STORMWATER MANAGEMENT MANUAL

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INTRODUCTION

1.1 Background and Purpose

An ordinance for stormwater management and flood damage prevention was adopted by the Shelbyville City Council on December 9, 2004 which, together with the Flood Damage Prevention Ordinance, Title 11, Chapter 4, of the Shelbyville Municipal Code, establishes the legal framework for complying with the State of Tennessee NPDES permit for municipal separate stormwater sewer systems, and for reviewing building permits for stormwater management provisions and for requiring grading permits to control erosion and sedimentation problems. These regulations and technical guidelines were developed to implement the regulatory program established by the ordinances.

1.2 Authorization and Title

This manual shall be cited as the "City of Shelbyville Stormwater Management Manual." It comprises the rules and regulations promulgated under the authority of Shelbyville Municipal Code, Title 8, section 802. These regulations and technical guidelines became effective upon adoption by Shelbyville City Council on March 9, 2006. Changes to these regulations and guidelines are effective upon approval by the City Council.

1.3 Scope

The provisions of this manual shall replace any previous regulations and shall apply to all surface alteration and construction within the boundaries of the City of Shelbyville.

1.4 Language

1.4.1 Rules

The following rules shall apply to the text of these volumes:

1. The particular shall control the general.

2. In the case of any difference in meaning or implication between the text of these regulations and the text of an ordinance, the text of the ordinance shall control.

3. The words "shall" and "should" are always mandatory and not discretionary. The word "may" is permissive.

4. The word "permitted" or words "permitted as of right" mean permitted without meeting the requirements of these regulations.

5. Words used in the present tense include the future tense. The singular includes the plural, unless the context clearly indicates the contrary.

6. All public officials, bodies, and agencies to which reference is made are those of the City of Shelbyville, Tennessee, unless otherwise indicated.

7. The term “City” or “Department of Public Works” or “City Engineer” shall mean the area of jurisdiction of the City of Shelbyville.

8. Unless specifically or otherwise noted the term “development” shall include “redevelopment” and “significant redevelopment” as defined in appendix B. Significant redevelopment shall be required to follow the same stormwater quality requirements as new developments.

1.4.2 Definitions

In general, all words used in these regulations shall have their common dictionary definitions. Definitions for certain specific terms as applied to these regulations may be found in Appendix B of this volume.

1.5 Legal Considerations

1.5.1 Caveat

This manual neither replaces the need for professional engineering judgment nor precludes the use of information not presented in the 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.

1.5.2 Disclaimer of Liability

The degree of flood protection intended to be provided by the Stormwater Management and Flood Damage Prevention Ordinance, and Flood Damage Prevention Ordinance, Title 11, Chapter 4, of the Shelbyville Municipal Code, and these regulations 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, such as bridge openings restricted by debris. These ordinances and regulations do not imply that land outside the areas of special flood hazard or uses permitted within such areas will be free from flooding or flood damages. These regulations or ordinances shall not create a liability on the part of, or a cause of action against, the City of Shelbyville or any officer or employee thereof for any flood damages that result from reliance on these regulations or ordinances, or any administrative decision lawfully made thereunder.

1.5.3 Severability

If any section, subsection, sentence, clause, phrase, or portion of these regulations is for any reason held invalid or unconstitutional by any 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 these regulations.

1.5.4 Compatibility

If any provisions of these regulations and any other 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.

1.5.5 Saving Provision

These regulations do not abate any action now pending under prior existing regulations unless as expressly provided herein.

Chapter 2

STORMWATER MANAGEMENT POLICY

2.1 Objectives

The objectives of these regulations are:

1. To protect human life and health;

2. To minimize expenditure of public money for costly flood control projects;

3. To minimize the need for rescue and relief efforts associated with flooding;

4. To help maintain a stable tax base by providing for the sound use and development of flood-prone areas in such a manner as to maximize beneficial use without increasing flood hazard potential or diminishing the quality of the natural stormwater resources;

5. To ensure that potential homebuyers are notified that property is in a flood area and generally increase the public awareness of flooding potential;

6. To minimize prolonged business interruptions;

7. To minimize damage to public facilities and utilities such as water and gas mains; electric, telephone, and sewer lines; and streets and bridges located in flood plains;

8. To ensure a functional stormwater quantity and quality management system that will not result in excessive maintenance costs;

9. To encourage the use of natural and aesthetically pleasing design that maximizes preservation of natural areas;

10. To guide the construction of stormwater management facilities by developing comprehensive master plans to address stormwater quantity and quality;

11. To protect or enhance stormwater quality to a level of “designated use” and minimize the impacts from new development or areas of significant redevelopment through the use of low impact development BMPs and infiltration techniques when and where appropriate;

12. To encourage preservation of floodplains, floodways and open spaces to protect and preserve natural waterways; and,

13. To comply with all requirements of the current effective Tennessee NPDES permit issued to the City of Shelbyville.

2.2 Policy Statements

To implement the objectives presented above, the following general policy statements shall apply:

1. The City of Shelbyville Stormwater Management Program is intended to establish guidelines, criteria, and procedures for stormwater management activities within the City of Shelbyville. Key elements of the program include the Stormwater Management Manual, the ordinances related to stormwater management and flood damage prevention, and major watershed master plans.

2. If available, each individual project shall be evaluated for consistency with the master stormwater management plan for the major watershed or watersheds within which the project site is located. The individual project evaluation will determine if stormwater quantity and quality management practices can adequately serve the property and limit or reduce impacts to downstream public and private properties. The presence of a regional facility(s) will be considered in determining the extent to which quantity or quality controls will be necessary.

3. In the absence of such a stormwater quantity or quality master plan, a system of uniform requirements shall be applied to each individual project site. In general, these uniform requirements will be based on the criterion that post-development stormwater peak runoff and water quality must not differ significantly from pre-development conditions. Additional requirements will be based on volume control for sites tributary to sinkholes or “drainage” wells.

4. No construction, whether by private or public action, shall be performed in a manner that will negatively impact stormwater quantity or quality in its vicinity or in other areas whether by flow restrictions, increased runoff, or by diminishing channel or over-bank storage capacity.

5. New construction may not aggravate upstream or downstream flooding. Existing downstream or upstream problems may be required to be corrected in conjunction with new development.

6. Unwarranted acceleration of erosion due to various land development activities must be controlled.

7. New construction shall not be permitted until temporary or permanent erosion prevention and sedimentation control management practices have been placed or constructed and are operational to City’s satisfaction. City reserves the right to stop construction on properties that do not have adequate erosion prevention and sedimentation control measures.

8. New development will be required to minimize the impact to stormwater quality by applying structural or nonstructural management practices selected to address site-specific conditions.

9. The City reserves the right to require more stringent erosion prevention and sedimentation control practices and water quality BMPs on properties within sensitive (or impaired) watersheds proximate to “Waters of the State”.

10. For properties where stormwater quantity and quality management practices are either not feasible or are not necessary in lieu of regional stormwater quantity controls, the City reserves the right to require on-site controls for stormwater quantity or quality.

11. The City encourages regional stormwater quantity and quality management practices, serving 40 to 300 tributary acres, that may be consistently and efficiently managed and maintained. These types of practice will be encouraged in order to replace or reduce the implementation of on-site stormwater quantity or quality management practices, as appropriate and supported technically by a master plan.

12. Redevelopment of properties containing on-site stormwater management practices may be permitted by City of Shelbyville provided the property and downstream public and private properties, infrastructure, or "Waters of the State" are adequately protected by a regional facility or facilities from stormwater quantity or quality impacts.

13. Land disturbance activities will not be permitted within the floodway and a buffer. All development within floodplains should be done in a way that protects or enhances stormwater quality and promotes land and tree conservation, greenways, floodplain preservation and hazard mitigation. All development and significant redevelopment shall also be done in a way that protects or enhances stormwater quality and promotes land and tree conservation, greenways, floodplain preservation and hazard mitigation.

14. The City reserves the right to require maintenance or modification of stormwater management practices that are not operating properly, as determined by the Department of Environment and Conservation (TDEC) or City of Shelbyville, and to be on-site for inspection and enforcement of

    proper construction and maintenance of erosion prevention and sediment control management practices at a specific construction site.

2.3 Stormwater Management Systems

For the purposes of these regulations, stormwater management systems are considered to comprise two parts, the major and minor systems. A brief description of these two parts is presented below.

2.3.1 Minor Systems

The minor system of a stormwater management network is sometimes termed the "initial system" and may consist of a variety of stormwater management appurtenances ranging from inlets, manholes, street gutters, roadside ditches, and swales to small channels or pipes. This system collects the initial stormwater runoff and conveys it to the major system.

2.3.2 Major Systems

The major system primarily consists of natural waterways, "Waters of the State", large storm sewers, major culverts, bridges and large water impoundments, but it can also include less obvious flow paths such as overland relief swales and infrequent floodplain storage. The major system includes not only the trunk line conveyance that receives the water from the minor system, but also the natural flow path that functions in case of overflow from or failure of the

minor system. Properly designed overflow relief will not flood or damage homes, businesses, or other property. It must always be remembered that the major system is needed for small, medium, and large flood events. Eventually, it will fill with water and flow whether or not it has been planned and designed, and whether or not development is situated wisely with respect to it.

2.4 Stormwater Quantity and Quality Detention

Increased urbanization within City of Shelbyville has caused radical changes to the topography, ground cover, and minor stormwater management systems within each drainage basin. These changes have adverse effects on the environment, primarily through the subsequent increase in stormwater runoff quantity and non-point source pollution which impacts stormwater quality. In some areas, the combination of increased runoff and the location of property near a stream; causes frequent flooding (often several times per year). In these areas, upstream control of frequent as well as large flows may not provide adequate flood protection for residents and property downstream.

To minimize adverse stormwater quantity and quality impacts, onsite detention of stormwater is mandatory for all developments that are not served by an adequately sized regional stormwater management facility, subject to review by the City Engineer. Because detention in downstream areas of a large watershed can cause increased peak flows in downstream channels; the City reserves the right to alter the detention criteria and to eliminate it where it would cause adverse impacts. This decision shall be based on sound engineering judgment along with supporting data and studies. The City may also require or allow some type of in-stream mitigation measure in lieu of detention, where it can be shown that such measures are of equal or greater benefit. Nevertheless, in all cases where detention facilities are required, the location and design must comply with any stormwater master plans that may have been adopted.

This policy is primarily concerned with maintaining pre-development conditions, for stormwater quality, flood storage, flow and velocity; it should also be applied under certain conditions for the purpose of maintaining adequate capacity of an existing outfall or combining public and private efforts to correct existing deficiencies for flooding, erosion and stormwater quality. In some cases controlling the total volume of runoff to predevelopment levels may also be required, such as where area tributary to sink holes had provided volume storage.

2.5 Other Stormwater Quality Management Practices

The extent and type of management practices implemented must be proportionate to the land use, pollutant discharge potential and proximity to regional stormwater quality management practices. The City of Shelbyville encourages that a series of best management practices be implemented that optimize the use of required green and open spaces, especially along buildings and within or along parking lots. The stormwater controls must be designed to limit the discharge of stormwater pollutants offsite to pre- development levels to the extent allowable under state or local law. The TDEC Manuel, or if adopted, the City of Shelbyville Stormwater Best Management Practice (BMP) Manual, should be consulted for a guide to selecting stormwater controls best suited to the needs of specific sites. The manual contains specific guidelines and other suggestions for the applicability, construction and maintenance requirements for specific types of stormwater management practices.

2.6 Flood Plains

Areas of the flood plain available for development must be protected through the use of compacted fill, elevated structures, dikes, or floodwalls. Any use of these measures must be in accordance with the requirements in Chapter 5 of these regulations. Other flood-proofing measures are subject to the approval of the City Engineer.

2.7 Erosion and Sediment Control

All development shall be conducted in a manner which minimizes soil erosion and resulting sedimentation. Under no circumstances is construction to allow sediments to leave a construction site in a way that would be a violation of the site or City of Shelbyville's National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) permit. Site-specific variables such as topography, soil erodibility, stormwater management features, and vegetation shall be considered when developing an erosion control plan. The exposed area of any disturbed land shall be limited to the smallest practical area for the shortest possible period of time. New development and areas of significant redevelopment shall be required to fulfill the provisions in Section 6.10 of this volume. This includes the requirement that sediment detention traps shall be required at the fringes of clearing along with silt fences, berms or straw bales as appropriate. The detention shall be sized to control runoff and silt for the duration of the project.

Chapter 3

ADMINISTRATION

3.1 Overview

This chapter summarizes the division of responsibilities for administering stormwater management activities among different city departments and public agencies. The requirements for permitting and activities exempted from permit review by the City of Shelbyville are delineated. Procedures are established for enforcement of stormwater regulations and inspection of affected sites. As-built certification requirements for detention pond are also addressed.

3.2 Organization

Administration of stormwater management activities is carried out by the City of Shelbyville , the Planning /Community development Department, the Department of Public Works, and the City Engineer. Other involved governmental agencies are shown in Table 3-1.

Table 3-1 Relevant Government Agencies		
Federal	***State***	***City***
Department of Agriculture Natural Resources Conservation Services (NRCS) 675 U.S. Courthouse 801 Broadway Nashville, Tennessee 37203 (615) 736-5477	TDEC – Tennessee Department of Water Pollution Control Columbia, Tennessee	City of Shelbyville Department of Public Works
Department of Army US Army Corps of Engineers Nashville District P.O. Box 1070 Nashville, Tennessee 37202-1070 (615) 736-5181	TDEC – Division of Water Supply	City of Shelbyville City Engineer
Department of the Interior US Geological Survey (USGS) 640 Grassmere Park, Suite 100 Nashville, Tennessee 37211 (615) 837-4700	Tennessee Wildlife Resources Agency (TWRA)	City of Shelbyville Codes Department
Federal Emergency Management Agency FEMA) Region IV Mitigation Division Kroger Center-Rutgers Building Atlanta, Georgia 30341 Maps: Toll free 1-877-fema-map General: 1-770-220-5200		

3.2.1 Administration Procedures and Responsibilities

Submission and Approval of Applications All applications or requests for building or grading permits shall be submitted to the Planning/Community Development Department. The Codes Department refers the submissions to the Planning /Community Development Administrator, who coordinates with the Public Works Director and the City Engineer, who reviews them for completeness and technical compliance with these regulations and other pertinent laws and regulations, and recommends approval or denial to the Codes Department.

Inspection for Compliance with Grading Permits Inspection for compliance with building and grading permits is the responsibility of the Codes Department. The City Engineer provides technical assistance for inspection and enforcement activities.

Inspection of Roadway Construction The Public Works Department is responsible for inspection of construction of roadways.

As-builts The Codes Department is responsible for obtaining as-built certifications, where required, by a registered professional engineer.

Inspection of Private Stormwater Systems The Public Works Department is responsible for inspection of private stormwater systems and stream alterations, and may order corrective action where necessary to maintain the proper functioning of such systems. The City Engineer provides technical assistance.

City Engineer Final Authority The City Engineer is the final authority on whether construction complies with approved plans.

3.3 Grading and Building Permit Requirements

Unless exempted by these regulations, all development of land in the City of Shelbyville requires a grading permit in conformance with the provisions of these regulations prior to the commencement of any development activities. Grading permits can be issued separately and at different times in the sequence of a project, or they can be issued jointly. Additional permits may be required by state or federal agencies.

Except for exempted activities (see Section 3.4), a building permit cannot be issued until required grading, drainage, and erosion control plans are submitted by a registered professional engineer and approved by the City Engineer. A Grading Permit (separate and apart from a building permit) is required when grading, stripping, excavating, filling, or any disturbance to the natural ground cover is planned for non-exempted activities not requiring a building permit. All development activity within a designated flood plain requires a grading permit. Even when development is exempt from obtaining a grading permit (see Section 3.4) or exempt from the City Engineer approval for a building permit (see Section 3.5), the City Engineer retains the authority to remove such exemption should development be found in violation of exemption criteria.

In addition, none of the following documents shall be issued or granted under applicable zoning regulations or other laws unless and until a grading, drainage, and erosion control plan has been approved by the City Engineer:

1. Final plat approval for a proposed subdivision;
2. Building permit issued by the Codes Department.

All grading permit applications shall include a grading, drainage, and erosion control plan prepared by a professional engineer, landscape architect, or land surveyor, as appropriate. Methods used shall be consistent with the acceptable engineering practices.

3.4 Grading Permit Exemptions

Specific activities that are exempt from obtaining a grading permit are identified in Sections 3.4.1 through
3.4.6. These exemptions shall not be construed as exempting the identified activities from onsite stormwater management improvements that may be required to conform to adopted building and construction codes.

In addition, the property owner or developer whose activities have been exempted from the

requirements for permits and approvals enumerated in this manual shall nevertheless be responsible for complying with the intent and provisions of these regulations.

The City reserves the right to revoke any of the following exemptions if the City Engineer determines that an individual site may impact stormwater quality or other related provisions in implementing its NPDES MS4 permit.

3.4.1 Exemption for Approved Subdivision or Grading Plans

No grading permit shall be required for any structure within a major subdivision for which there exists an approved grading, drainage, and erosion control plan. However, any alteration to the original plan may require submittal of an additional plan.

Any person disturbing the natural ground cover in an area for which there is an approved grading, drainage, and erosion control plan shall conform to the requirements of such plan without exception. In addition, subsequent development activities shall not impair existing stormwater management systems, constitute a potential erosion hazard, or act as a source of sedimentation to any adjacent land or watercourse.

3.4.2 Exemption for Finish Grading

Provided a site is outside of the 100-year floodplain and required buffer, no grading permit shall be required for finish grading or excavation below finished grade for the following structures:

1. Basements and footings of a single family or duplex residential structure.

2. Retaining walls.

3. Swimming pools.

4. Human or animal cemeteries.

5. Accessory structures related to single family residences or duplex structures authorized by a valid building permit, provided the disturbed material or fill is handled in such a manner as to conform to the approved erosion control plan for the area or, where no such erosion control plan is in effect, that such work is done in a manner which presents no significant erosion hazard.

3.4.3 Exemption for Excavation or Fill

No grading permit shall be required for an excavation or fill that satisfies all of the following criteria:

1. If the fill is not in the 100-year floodplain and is less than five (5) feet in vertical depth at its deepest point as measured from the natural ground.

2. Does not result in a total quantity of more than 100 cubic yards of material being removed from, deposited on, or disturbed on any lot, parcel, or subdivision thereof.

3. Does not impair existing surface stormwater management systems, constitute a potential erosion hazard, or act as a source of sedimentation to any adjacent land or

watercourse.

4. Has no final slopes steeper than one (1) foot vertical to three (3) feet horizontal (steeper slopes can be allowed if justified by calculations for appropriate stabilization measures).

5. Has proper vegetative cover re-established as soon as possible on all disturbed areas.

6. Does not contain hazardous substances.

7. Is not partially or totally in a watershed with primary outlet to a sinkhole or drainage well.

3.4.4 Exemption for Agricultural Practices

If the site is out of the 100-year floodplain, no grading permit shall be required for accepted agricultural land management practices such as plowing; cultivation; nursery operations such as the removal of or transplanting of cultivated sod and trees; tree cuttings at or above existing ground level; and logging operations leaving the stump, ground cover, and root mat intact.

3.4.5 Exemption for Maintenance Grading

No grading permit shall be required for grading as a maintenance measure, or for landscaping on existing developed lots or parcels, provided all of the following criteria are met:

1. The aggregate area affected or stripped at any one time does not exceed 10,000 square feet, and is not within a natural drainage way (e.g., designated floodplain).

2. The grade change does not exceed eighteen (18) inches at any point and does not alter the direction of the drainage flow path.

3. Proper vegetative cover is re-established as soon as possible on all disturbed areas.

4. The grading does not involve a quantity of material in excess of 250 cubic yards.

3.4.6 Exemption for Public Utilities

No grading permit shall be required for installation of lateral sewer lines, telephone lines, electricity lines, gas lines, or other public service facilities. Although exempt, public agencies are requested to submit documents to the Department of Codes Administration for consistency reviews and to allow coordination with other activities.

3.5 Enforcement

3.5.1 Right of Entry

The City, through any of its duly authorized representatives may enter upon the premises of any land within the City of Shelbyville for the purposes of inspecting the site before, during, and after construction to determine compliance with these regulations.

The City Engineer or the Director of the Department of Public Works, or any of their duly

authorized representatives, may enter upon the premises of any land and enter facilities within the City of Shelbyville for the purposes of inspecting potential impacts to stormwater quality or any activities that may violate the NPDES MS4 permit.

3.5.2 Revocation

The Director of the Codes Department may revoke any approval or permit issued under the provisions of these regulations when informed of any false statement or misrepresentation of facts in the application or plans on which the permit or approval was based.

3.5.3 Corrective Measures

Any non-permitted stormwater management system, or construction, or fill located within a floodplain shall, upon written notice from the City Engineer or Director of Department of Public Works be removed at the expense of the property owner.

3.5.4 Stop Work Order

When it is found that any provision of this regulation is being violated, the Directors of the Department of Public Works may issue a stop work order. The stop work order shall be in writing and shall be served upon the owner of the business or property violating the provision, the duly authorized agent, or the person responsible for such work; or posting of the stop work order at the site of the violation or noncompliance. The stop work order does not apply to those activities directed at cleaning up, abating discharge, and installing appropriate control measures.

The stop work order shall set forth the following:

1. The reasons why such work is being stopped;

2. The regulation or section of the City's Code that is being violated;

3. The conditions under which the order maybe removed and the work resumed; and

4. The right to an appeal before the City Manager.

A hearing to appeal the stop work order may be requested by anyone upon whom a stop work order has been served. An appeal must be requested in writing to the City Manager within ten (10) days of service of the stop work order. The City Manager shall conduct a hearing within ten (10) days of receipt of the appeal. The City Manager shall provide written notice of his decision within five (5) days of the hearing to the appealing party. The City Manager's decision is final.

If no appeal is requested within ten (10) days of service of the stop work order, the stop work order shall remain in effect until compliance with the appropriate regulation or code section can be demonstrated to the satisfaction of the issuing Codes Official. A compliance hearing to demonstrate that the business or work is in compliance with the relevant regulation or codes section maybe requested at any time after issuance of the stop work order. The issuing Codes Official shall schedule such a hearing within ten (10) business days of receiving the request.

3.5.5 Penalties and Injunctions

Any violation of these regulations shall be punishable by a civil penalty. Each day that a violation is not corrected shall be a separate offense.

In addition to all other remedies provided by law, the City of Shelbyville shall have the right to injunctive relief for any violation of these regulations. The enforcement response plan (ERP) describes responses to violations of the City's MS4 permit through progressive enforcement for repeat violations. The ERP can be found in Appendix D.

3.6 Inspections

The City Engineer, Director of the Department of Public Works may make or cause to be made the inspections required by this section. Reports by inspectors employed by recognized inspection services may be accepted provided that, after investigation, their qualifications and reliability prove satisfactory. No certificate called for by any provision of these regulations shall be based on such reports unless the same are in writing and certified by a responsible officer of such service.

Inspectors shall have access to and copy at reasonable times, any records that must be kept under the conditions of the Stormwater Management Manual and effective MS4 permit. The inspectors may at reasonable times inspect any facilities or equipment (including monitoring and control equipment), practices or operations regulated or required by the City's effective MS4 permit. The City may sample or monitor at reasonable times, for the purposes of assuring MS4 permit compliance or as otherwise authorized by the Clean Water Act, any substances or parameters at any location.

3.6.1 Permitting

Before the Department of Codes Administration issues a building permit, the City Engineer or Director of the Department of Public Works may examine or cause to be examined any tract of land for which an application has been received. The City Engineer or the Director of the Department of Public Works may also examine or cause to be examined any tract of land for which a grading permit application has been received.

3.6.2 Construction

The City Engineer, Director of the Department of Public Works shall inspect or cause to be inspected at various intervals all construction or grading for which a building permit or grading permit has been issued, and a final inspection or waiver thereof shall be made of the tract of land upon completion. Upon notification from the permittee or his agent, inspections of the tract of land shall be performed at the following times, as well as such other inspections as may be necessary:

1. Prior to the initiation of the project after temporary or permanent erosion prevention and sediment control practices have been installed;

2. After the completion of the rough grading and installation of stormwater management structures; and,

3. Upon completion of the project.

The Director of the Department of Public Works or there Designated Official shall either approve that portion of the construction or grading as completed or shall notify the permittee or his agent where violations are noted.

Work shall not be done on any part of the tract of land beyond the point indicated in each successive inspection without first obtaining approval from the Codes Official. In particular, construction may not proceed until the site has been inspected to ensure that adequately sized temporary or permanent erosion prevention and sediment control practices have been installed and are operational for grading activities.

3.6.3 Owner /Operator Inspections

Owners and operators of facilities that have permanent stormwater management facilities are required to perform the following inspections:

a. Perform routine inspections to ensure that stormwater management facilities are properly functioning. These inspections shall be conducted on an annual basis, at a minimum. These inspections shall be conducted by a person familiar with control measures implemented at the site. The owners and operators shall maintain documentation of these inspections.
b. Perform comprehensive inspections of all stormwater management facilities and practices. These inspections shall be conducted once every five years, at a minimum. Such inspections must be conducted by either a professional engineer or landscape architect. The inspection reports for the five year inspections shall include:
c. Facility type;
d. Name and telephone number of person with TDEC Level 1 Certification;
e. Inspection date;
f. Latitude and longitude and nearest street address;
g. Stormwater management facility owner (e.g. name, address, phone number, fax, and email);
h. Description of the stormwater management facility condition including: vegetation and soils; inlet and outlet channels and structures; embankments, slopes and safety benches; spillways, weirs, and other control structures; and any sediment and debris accumulation;
i. Photographic documentation of stormwater management facility; and
j. Specific maintenance items or violations that need to be corrected by the stormwater management facility owner along with deadlines and re-inspection dates.

Owners and operators of the stormwater management systems shall maintain documentation of all inspections. The City may require submittal of the inspection documentation.

3.7 As-Built Certifications

Prior to the issuance of a use and occupancy permit for any structure in a development, unless exempted by section 3.4, a Tennessee registered engineer shall submit to the Codes Official certification that the stormwater management system (both public and private) and the public road system is complete and functional in accordance with the plans approved by the City Engineer and the Director of the Department of Public Works. Any deviations from the approved plans shall be noted. To ensure the adequacy of stormwater quantity detention facilities and stormwater quality management practices, this certification shall, at a minimum, include as-built

drawings showing final topographic features of all these facilities. This shall include invert elevations of outlet control structures. Hydrologic and hydraulic calculations may be required for as-built conditions.

Prior to the issuance of a use and occupancy permit for any new or substantially improved structure subject to minimum floor elevation requirements, a registered engineer and/or registered land surveyor shall submit to the Codes Official certification of the elevation (in relation to mean sea level) of the lowest floor (including basement); or if the structure has been flood proofed, the elevation (in relation to mean sea level) to which the structure was flood proofed. This information must be provided on a FEMA Elevation Certificate. To ensure that floodplain cut and fill balances have been achieved, as-built plans, cross-sections, and related calculations must be submitted for all floodplain manipulations.

Chapter 4 PERMITTING PROCEDURES

4.1 Overview

This chapter explains the procedure for applying for a permit for grading or building where grading plans are required and the process by which the City Engineer reviews permits. Responsibilities of the applicant for posting permits, maintaining compliance with regulations, meeting time limits, and obtaining other required federal and state permits are also discussed.

4.2 Application Preparation

4.2.1 Pre-application Conference

All applicants shall schedule a pre-application conference with the City Engineer and Director of the Planning/Community Development Department to discuss their proposed project. A pre-application conference is strongly encouraged to assure timely permit application preparation and review. This conference should be used to determine if a proposed project qualifies for exemption and to determine how technical guidelines and criteria should be applied.

4.2.2 Required Information and Checklist

Each application for a grading permit for property of a size requiring a permit shall be accompanied by a certification that a Notice of Intent (NOI) has been submitted to TDEC for a Tennessee General Storm Water Permit or certification that a permit is not required. The review of the plans will proceed if the certification indicates that the applicant will submit the permit number at a later date. If the site requires a Tennessee General Storm Water Permit, the permit number must be submitted to City Engineer before a grading permit is issued. This certification is included in Appendix A.

Each application for a grading permit or a building permit submitted to the Planning/Community Development Department, unless exempt, shall contain site preparation plans certified by a registered engineer, landscape architect, or land surveyor, as appropriate. The plans shall indicate whether or not the tract will be developed in stages and timing schedules shall be included when appropriate. In particular, site preparation plans shall include grading, drainage, and erosion control plans with appropriate plan and profile sheets for proposed streets or roads and details and calculations for the stormwater quantity and quality management systems.

An application checklist is provided in Appendix A to assist the applicant to prepare a complete application package and thereby ensure a timely review. The applicant shall attach a signed copy of the checklist with the application to certify that a complete package is being submitted. The checklist includes a requirement that the applicant be aware that certain land disturbance activities that will impact “Waters of the State”, “Wetlands”, or “Sinkholes” may be required to meet certain State and Federal regulations. It is the responsibility of the applicant to seek out and obtain any applicable State and Federal permits, prior to the initiation of any land disturbance activities.

Some requirements of the checklist will not be applicable to all projects, depending on the permit being requested. These should be checked as not applicable. Omission of any required items shall render the plans incomplete, and they shall be returned to the applicant, or his engineer, for

additional information.

4.2.3 Grading, Drainage, and Erosion Control Plans

The grading, drainage, and erosion control plan shall be of quality suitable for reproduction by electronic scanning or microfilm, and shall include as a minimum all of the following:

1. A complete plan of the proposed development at a scale no less than 1" (one inch) = 100' (one hundred feet). This plan is to include existing and proposed contours at intervals no greater than 2' (two feet) (NGVD to be used exclusively). Contours shall extend to the centerline of all roads bordering the site. Where a stormwater management system ultimately enters the groundwater via a sinkhole or drainage well, the sinkhole or drainage well tributary area shall be delineated. At a minimum, the tributary area shall be delineated on a USGS 1:24000 quadrangle map to show basin wide contours. Preferably, the City of Shelbyville's **GIS** base map data will be used to delineate and present the tributary area;

2. Existing and proposed buildings on the property;

3. Existing and proposed impervious surfaces, including calculations of directly connected impervious area (DCIA) versus non-DCIA;

4. Proposed and existing stormwater management structures, including inlets, catch basins, quantity indicated;

5. Hydrologic, hydraulic, and stormwater quality calculations for appropriate design conditions and facilities, as follows:
    a. storm sewer – 10 year design;
    b. detention pond design – post to pre-development 2,5,10, check 100; More stringent requirements possible where current flooding exists.

6. Stormwater quantity detention pond control structure details, including multiple stages;

7. Any proposed swales, ditches, or proposed modifications to existing ditches, with typical sections and limits of changes indicated;

8. Calculations and details for sizing construction site and stormwater quality management practices including, but not limited to detention, bio-infiltration, infiltration, pretreatment swales and other appropriate practices are presented in the latest edition of the Tennessee Erosion and Sediment Control Practices (found on the TDEC website, at http://tennessee.gov/environment/wpc/sed_ero_controlhandbook) *and latest edition of the Tennessee Guide to the Selection and Design of Stormwater Best Management practices (BMPs) (found on the Tennessee Water Resources Research Center website at http://eerc.ra.utk.edu/divisions/wrrc/BMP/bmp.htm;*

9. Any high water or flood lines, either calculated or observed in the vicinity of the proposed development, and the source of said line or elevation indicated;

10. All fill areas indicated as such, with the limits and elevation indicated;

11. At least one benchmark located, with the proper elevation indicated (**NGVD to be used exclusively**);

12. The location, size and capacity of the two stormwater management structures immediately downstream of the proposed development in every direction that will receive runoff. This may be shown on a vicinity map with a scale no less than 1" (one inch) = 2000' (two thousand feet). Exception may be granted on a site-by-site basis by the City Engineer;

13. Arrows indicating the existing and proposed direction of runoff throughout the plan;

14. Invert and top of grate elevations on all catch basins and inlets in addition to flow line elevations, stations, and percent grades of all cross drains and pipe between inlets and catch basins. Inlets should be sized to match pipe capacity;

15. Flood plain areas require the following information: existing and proposed flood plain and floodway boundaries along with flood plain elevations and lowest floor elevations for buildings in the flood plain. Hydraulic calculations should be submitted, as appropriate;

16. Temporary erosion and sediment control measures to be implemented during construction including but not limited to temporary sediment basins, outlet protection devices, temporary seeding, mulching, geotextiles, straw bales, silt fence, etc.;

17. Final stabilization measures proposed for all disturbed areas on the property. Areas with slopes 3:1 or greater shall be stabilized with soil bioengineering techniques, “green” engineering techniques or by other methods approved by the City Engineer. Riprap may be used provided calculations are presented to City Engineer that illustrate that soil bioengineering or “green” engineering techniques are either not cost-effective for the site or not feasible. Show stabilization for each ditch;

18. Plans shall include the maintenance activities and expected minimum frequency required for each type of temporary erosion prevention and sediment control management practice. The details shall present information to indicate when the management practices need to be maintained or replaced without the need to be notified by City Engineer, Public Works Director.

19. Where special structures such as box culverts, bridges, or junction boxes are proposed, detailed plans showing dimensions, reinforcement, spacing, sections, elevations, and other pertinent information shall be submitted;

20. Delineation of wetlands, stream buffer zones, or other environmentally sensitive areas; and,

21. Plans and calculations shall be signed and sealed by a registered engineer, landscape architect, or land surveyor, if application is for a grading permit. If application is for a building permit, they shall be signed and sealed by a registered engineer. All plans requiring engineering calculations (e.g., subsurface storm water management design) shall be signed and sealed by a registered engineer.

Omission of any of the above requirements for detailed plans and calculations shall render the application incomplete and it will be returned to the applicant or his engineer, for additional information.

4.2.4 *Street Plan and Profile Sheets*

Streets shall be designed in accordance with the current edition of the Subdivision Regulations for the City of Shelbyville. Street plan and profile sheets shall include as a minimum all of the following:

1. Detail plans plotted on plan and profile sheets to a minimum scale of 1" (one inch) = 100' (one hundred feet) horizontal, and 1" (one inch) = 10' (ten feet) vertical;

2. Plan section including the street and right of way plotted to the proper scale with stationing shown, which should match that of the profile section as nearly as possible;

3. Where ditch section roadways are used, the type of stabilization required for the roadside ditches;

4. Typical roadway sections including pavement design details, as appropriate;

5. Profile section plotted to the same scale as identified above and including the proposed centerline finish-grade profile, in addition to the existing centerline profile;

6. Existing ground profiles at the center line;

7. All vertical control points on or pertaining to the proposed centerline profile such as P.V.C., P.V.I., and P.V.T.; all low points and street intersections as to station and elevation;

8. All percent grades and vertical curve data; both balanced and unbalanced;

9. Centerline finished grade elevations every 50' (fifty feet) to the nearest hundredth of a foot, at the bottom of the profile sheet;

10. Delineation of wetlands, stream buffer zones, or other environmentally sensitive areas;

11. Plan and profile sheets shall be signed and sealed by a registered engineer;

12. Inlets and curb type shall be specified; and,

13. Vertical and horizontal curve data shall give design speed based off of TDOT Design Manual.

4.2.5 Sinkhole and Drainage Well Information

Because of the many stormwater management problems commonly associated with sinkholes and drainage wells, the applicant must provide the following information prior to the alteration of the natural flow patterns for watersheds discharging to such features:

1. Proposed onsite and offsite stormwater management channels that are tributary to a sinkhole throat or drainage well inlet shall be delineated, along with appropriate hydraulic calculations to define the existing and altered (if appropriate) 100-year flood plain and to confirm that offsite flooding will not be increased. Such plans and hydraulic calculations are to be certified by a registered engineer.

2. Proposed stormwater quality management practices to be implemented above and beyond those that would be implemented on less sensitive sites. The details and accompanying calculations shall illustrate temporary and/or permanent controls.

3. Detailed contours are to be shown for all sinkholes that are to receive stormwater runoff from the site. These contours are to have a maximum interval of 2 feet and are to be verified by field surveys.

4. A geologic investigation of all sinkholes receiving stormwater runoff from the site shall be performed. The report from this investigation shall be certified by a registered engineer experienced in geology and groundwater hydrology and shall contain the following:

    a. Location and nature of underground aquifers.
    b. Direction of flow for the subsurface drainage associated with the sinkhole or drainage well.
    c. Estimated safe discharge from sinkhole to aquifers. Include information on method of sinkhole discharge estimation.
    d. Potential for siltation problems.
    e. Foundation problems that may be expected around sinkhole.
    f. Details of stormwater management structures to be built in sinkholes.
    g. Any other factors relevant to the design of conveyance from sinkholes.
    h. Plans showing the current and altered (if appropriate) 100-year flood plain.
    i. Details of plan for grading and clearing of vegetation within the 100-year flood plain.

5. Compliance with any and all conditions that may be required by the federal government or the State of Tennessee shall be documented. The TDEC Division of Water Supply is the primary regulatory agency for drainage wells. Discharge into a sinkhole may require a permit for a Class V well under rules for Underground Injection Control (UIC).

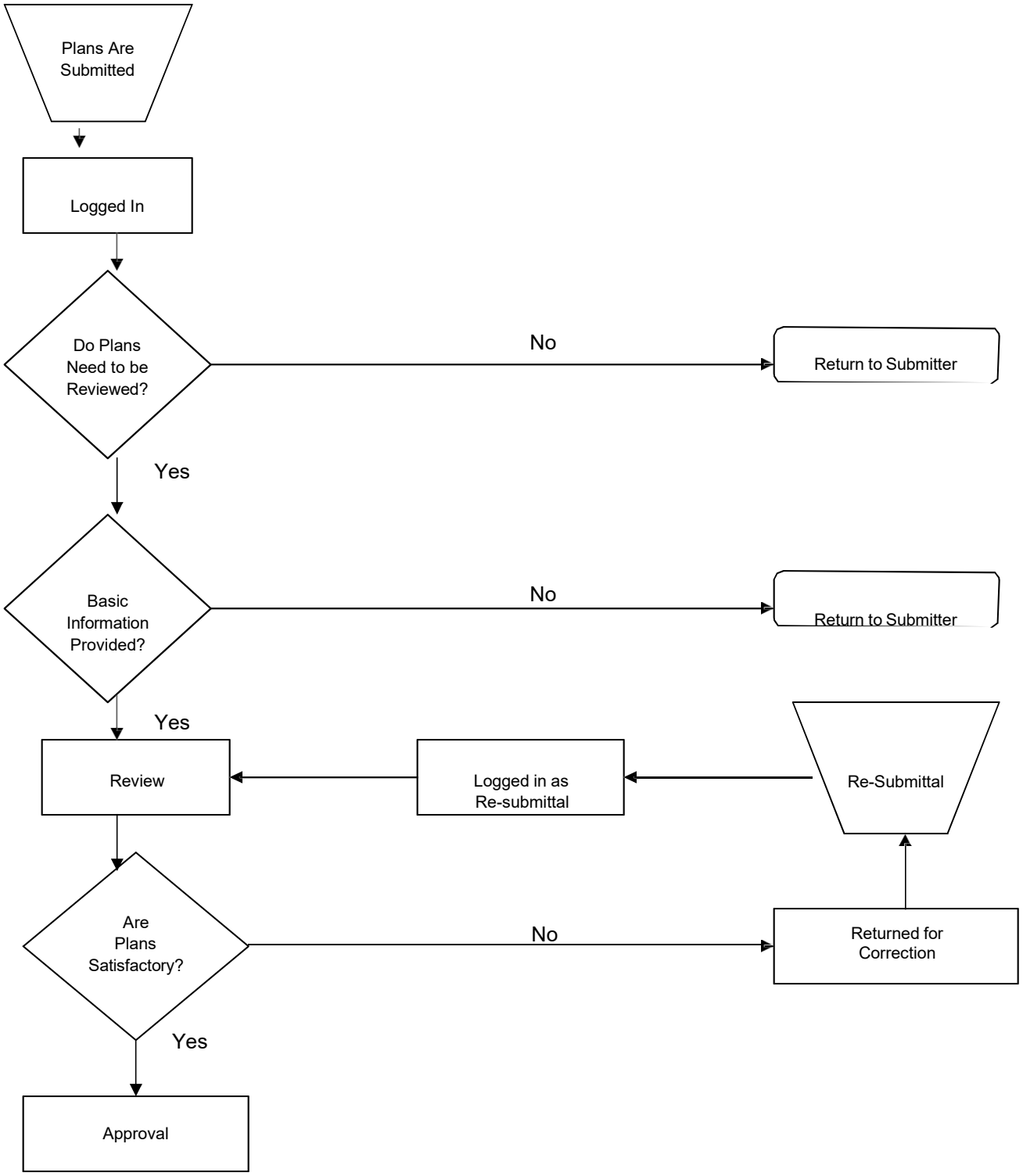
6. Demonstration that development will not occur within the area flooded by the 100-year flood. The 100-year elevation may be lowered by construction of a drainage well or detention pond. Calculations that document a lowering of the 100-year flood elevation shall be based on the 100- year, 24-hour storm using an appropriate safety factor for discharge into the sinkhole.

Multiple residential developments must be designed assuming total sinkhole or drainage well blockage. A surface outlet may be provided to prevent stormwater from rising above the 100-year flood elevation. No development will be allowed within the basin of a sinkhole if such development will lead to any additional increase in flood levels within that or adjacent basins. Special care will be required during construction to prevent eroded soil or debris from being washed into the sinkhole.

4.3 Application Processing

Applications for building permits and grading are made to the Planning/Community Development Department. A flow chart for processing of applications by the Planning/Community Development Department is presented in **Figure 4-1**.

Figure 4-1
Grading, Stormwater Management and Erosion Control Plan Review Flow Chart



4.3.1 Initial Receipt and Resubmittals

When referred to Planning/Community Development Department, permit applications are logged in by date and assigned a tracking number. A basic project information sheet must be completed in its entirety. Failure by the applicant to complete the basic information sheet on initial submission or include the tracking number in re-submittals may result in a delay in the review of the proposed plans. The basic information sheet, called the Plans Submittal Information Form, is included in Appendix A.

4.3.2 Staff Review

The Planning/Community Development Director first conducts a sufficiency review of the permit application to determine if all basic information has been included. A sufficiency review checklist similar to the application checklist presented in Appendix A will be used for this purpose. Should the permit application be determined to be incomplete, the application will be returned to the applicant along with a request for any additional information and the tracking number to accompany the re-submittal.

When all basic information has been supplied, The Planning/Community Development Director will log in the plans and forward the plans to the City Engineer to conduct a technical evaluation of the permit application. This technical evaluation will be based on acceptable engineer practices.

4.3.3 Staff Recommendation

If in the opinion of staff, the work described in the permit application, including drawings, conforms to the requirements of these regulations and other pertinent laws and ordinances, a grading permit shall be issued and a recommendation for approval shall be given to the Codes Official who may then issue a building permit.

However, if in the opinion of staff, the application, including the drawings, describes work that does not conform to the requirements of these regulations or other pertinent laws or ordinances, staff shall not approve the application. The plans shall be stamped “returned for correction”, shall be accompanied by written reasons, and returned to the applicant with the tracking number. The opinion of the City Engineer/Planning Director shall be based on the results of the sufficiency review and the technical evaluation.

4.3.4 Revisions to Approved Plans

Should prior to or during construction, changes be anticipated that would constitute a revision of the plans already approved by the City Engineer, the approved plans shall be revised and resubmitted in triplicate by a registered engineer. The resubmission shall include a letter stating why such changes are believed necessary for the approved plans, the grading permit number and the completed basic project information form presented in Appendix A. The City Engineer may waive this requirement or re-review the entire set of plans in the light of requested changes.

4.4 Construction Procedures

A person, firm, or corporation required to obtain a grading permit in compliance with these regulations must do so prior to commencing any work pertaining to the permit. Corrective measures including but not limited to stop work orders, penalties, and injunctions may be taken as required to enforce the terms of

this requirement.

4.4.1 Posting of Permit

Work requiring a grading permit shall not be commenced until the permit holder or his agent shall have posted the grading permit card in a conspicuous place on the front of the premises. The permit shall be protected from the weather and be placed to allow easy access for recording entries. The permit card shall remain posted by the permit holder until the use and occupancy permit has been issued by the Codes Official.

4.4.2 Effect of Permit

A grading permit issued pursuant to this section shall be construed to be a license to proceed with the work and shall not be construed as authority to violate, cancel, alter, or set aside any of the provisions of these regulations, nor shall issuance of a permit prevent the City Engineer or the Planning/Community Development Director from thereafter requiring a correction of errors in plans or in construction or of violations of these regulations.

4.4.3 Time Limits on Permit

Unless the work authorized by a grading permit is commenced within six (6) months after the date the permit was issued, the grading permit shall become invalid and a new permit shall be required. If the work authorized by such permit is not completed in accordance with approved timing schedules, or twelve (12) months from the date of issuance the permit shall be invalid. However, for just and reasonable cause, one or more extensions for periods not exceeding thirty (30) days each may be allowed. Requests for such extensions shall be submitted in writing to the Planning/Community Development Director.

4.5 Federal and State Permits

Approval by City of Shelbyville does not relieve the applicant of responsibility for obtaining any permits required by the U.S. Army Corps of Engineers, Tennessee Division of Water Pollution Control, Tennessee Division of Ground Water Protection, Region IV of the U.S. Environmental Protection Agency, or by any other federal or state agencies. See Table 3-1 in Chapter 3 for selected agency addresses and phone numbers.

4.5.1 U.S. Army Corps of Engineers

Section 301 of the Clean Water Act prohibits the discharge of dredged or fill material into waters of the United States unless the work has been previously authorized by a permit pursuant to Section 404 of the same Act. Placement of dredged or fill material below ordinary high water of any water in conjunction with stormwater management improvements (e.g., channel realignments, concrete slope paving) will require a DA permit prior to construction.

The placement of dredged or fill material or any grading activities within a wetland must also be in compliance with section 404.

If a permit is required, approximately 60 days would normally be required for permit processing. Depending on the nature and location of the work, it is possible that the work has been previously

approved under authority of the Nationwide Permit and individual processing would not be required.

4.5.2 Tennessee Division of Water Pollution Control

In accordance with the Tennessee Water Quality Control Act, T.C.A. 69-3-108, any activity which alters the course or physical character of a stream, defined by a blue line on a 7 1/2 minute U.S.G.S. (United States Geological Survey) quadrangle, requires an Aquatic Resource Alteration Permit (ARAP). This permit is required for activities such as stream channelization, stream enlargement, dredging, and diversions in box culverts.

Section 405 of the Water Quality Act of 1987 (WCA) added section 402(p) of the Clean Water Act (CWA) to require the Environmental Protection Agency (EPA) to establish regulations setting forth National Pollutant Discharge Elimination (NPDES) permit application requirements. Projects must be designed with sensitivity to stormwater quality issues and must comply with Section 405 as administered by the Tennessee Division of Water Pollution Control.

Chapter 5
FLOOD PLAIN REQUIREMENTS

5.1 Zoning Ordinance

Uses permitted within the flood plain shall be in accordance with this chapter. The regulations and controls set forth shall be applied within the areas designated on the zoning map or on special overlays that are made a part of the Zoning Ordinance and may be viewed upon request at the office of the Planning/Community Development Department. Nothing contained herein shall prohibit application of this Chapter 5 to lands that can be shown by competent engineering survey, using the adopted profiles from which the flood protection elevation is derived, to lie within any flood plain. Any lands within the areas designated as flood plains on the zoning map or special overlays shall be subject to the regulations on controls pertaining to flood plains as set forth in this manual.

5.2 Base Flood and Floodway Data

All applications for proposed projects within areas of special flood hazard shall provide base flood elevations and floodway data to establish flood plain easements and lowest floor and fill elevations. Areas of special flood hazard along with base flood elevation and floodway data for many streams in the county are available from the Flood Insurance Rate Map (FIRM), Codes Official's map revision files, and the ongoing work to develop plans for selected watersheds. All proposed developments near streams included in these studies must be designed in accordance with the provisions of these regulations.

If a project is located in an unnumbered A zone, the applicant shall provide base flood elevation and floodway data as documented in a Flood Plain Report when the project is greater than the lesser of 50 lots or 5 acres. In addition, a Flood Plain Report shall be required for areas outside unnumbered A zones, when the stream has a tributary area of one square mile or greater. Approximate methods for flood level determination may be used if prior approval is granted by the City Engineer.

The Flood Plain Report shall consist of plan and profile data and water surface elevation calculations. The plan view shall show the flood plain water surface limits, flood plain easement lines, base line, cross section stations, and adjacent boundaries. The profile should show stream invert, cross section stations, and computed water surface elevations. The report should also show the topographic divides on the plan and the ultimate zoning categories used.

Base flood elevation and floodway data submitted by the applicant for areas previously without such data or for areas not studied by FEMA, shall be reviewed by the City Engineer and if acceptable, shall be processed for adoption as part of the official flood plain management data for these regulations. When the base flood elevation and floodway data submitted by the applicant results in a deviation from the data developed by FEMA; such deviations shall become official following review and approval by both City Engineer and FEMA. Acceptable methods and models are on the FEMA Website.

5.3 General Standards

In all areas of Special Flood Hazard, the following provisions are required:

1. New construction and substantial improvements shall be anchored to prevent flotation, collapse, or

lateral movement of the structure;

2. Manufactured homes shall be anchored to prevent flotation, collapse, or lateral movement. Methods of anchoring may include, but are not limited to, use of over-the-top or frame ties to ground anchors. This standard shall be in addition to and consistent with applicable state requirements for resisting wind forces;

3. New construction and substantial improvements shall be constructed with materials and utility equipment resistant to flood damage;

4. New construction or substantial improvements shall be constructed by methods and practices that minimize flood damage;

5. Electrical, heating, ventilation, plumbing, air conditioning equipment, and other service facilities shall be designed and/or located so as to prevent water from entering or accumulating within the components during conditions of flooding;

6. New and replacement water supply systems shall be designed to minimize or eliminate infiltration of floodwaters into the system;

7. New and replacement sanitary sewage systems shall be designed to minimize or eliminate infiltration of flood-waters into the systems and discharges from the systems into floodwaters;

8. Onsite waste disposal systems shall be located and constructed to avoid impairment to them or contamination from them during flooding;

9. Any alteration, repair, reconstruction, or improvements to a structure that is in compliance with the provisions of these regulations shall meet the requirements of "new construction" as contained in these regulations; and,

10. Any alteration, repair, reconstruction or improvements to a structure that is not in compliance with the provisions of these regulations shall be undertaken only if said non-conformity is not furthered, extended or replaced.

5.4 Specific Standards

In all areas of special flood hazard where base flood elevation data have been provided, the provisions detailed below are required. It is the intent of the City that all construction, whether within or adjacent to delineated flood plains, shall be subject to the provisions of these regulations. As an example, all residential construction shall be elevated such that the lowest floor is no lower than 4 feet above the base flood elevation. Exceptions to this standard may be granted by the City Engineer (by letter) based on a demonstration that the regulatory elevation is so conservative as to place an unreasonable burden upon developers or property owners.

5.4.1 Residential Construction

New construction or substantial improvement of any residential structure (or manufactured home) shall have the lowest floor, including basement, elevated no lower than 4 feet above the base flood elevation.

Should solid foundation perimeter walls be used to elevate a structure, openings sufficient to facilitate the unimpeded movements of floodwaters shall be provided in accordance with standards.

5.4.2 Standards for Manufactured Homes and Recreational Vehicles

Manufactured homes and recreational vehicles shall meet the following provisions:

1. All manufactured homes placed, or substantially improved, on individual lots or parcels, in expansions to existing manufactured home parks or subdivisions, or in substantially improved manufactured home parks or subdivisions, must meet all the requirements for new construction, including elevation and anchoring;

2. All manufactured homes placed or substantially improved in an existing manufactured home park or subdivision must be elevated so that:

    a. The lowest floor of the manufactured home is elevated no lower than 4 feet above the base flood elevation;

    b. The manufactured home chassis is supported by reinforced piers or other foundation elements of at least an equivalent strength, of no less than 36 inches in height above grade;

    c. The manufactured home must be securely anchored to the adequately anchored foundation system to resist floatation, collapse and lateral movement; and,

    d. In an existing manufactured home park or subdivision on which a manufactured home has incurred "substantial damage" as the result of a flood, any manufactured home placed or substantially improved must meet the standards for elevation and anchoring listed above.

3. All recreational vehicles placed on sites must either:

    a. Be fully licensed and ready for highway use, that is, it must be on its wheels or jacking system, is attached to the site only by quick disconnect type utilities and security devices and has no permanently attached structures; or,

    b. The recreational vehicle must meet all the requirements for new construction, including elevation and anchoring in items 1 and 2 above.

5.4.3 Non-Residential Construction

New construction or substantial improvement of any commercial, industrial, or non-residential structure (including manufactured structures) shall have the lowest floor, including basement, at least one foot above the level of the base flood elevation. Structures located in A and AE zones may be flood proofed in lieu of being elevated, provided that all areas of the structure below the required elevation are watertight, with walls substantially impermeable to the passage of water, and use structural components having the capability of resisting hydrostatic and hydrodynamic loads and the effect of buoyancy. A registered engineer or architect shall certify that these standards are satisfied.

5.4.4 Elevated Buildings

New construction or substantial improvements of elevated buildings that include fully enclosed areas formed by foundation and other exterior walls below the base flood elevation shall be designed to preclude finished living space. Design shall also allow for the entry and exit of floodwaters to automatically equalize hydrostatic flood forces on exterior walls. Designs for complying with this requirement must either be certified by a registered engineer or architect, or meet the following minimum criteria:

1. A minimum of two openings having a total net area of not less than one square inch shall be provided for every square foot of enclosed area subject to flooding;

2. The bottom of all openings shall be no higher than one foot above grade; and,

3. Openings may be equipped with screens, louvers, valves, or other coverings or devices provided they permit the automatic flow of floodwaters in both directions.

Electrical, plumbing, and other utility connections are prohibited below the base flood elevation. Access to the enclosed area shall be the minimum necessary to allow for parking of vehicles (garage door) or limited storage of maintenance equipment used in connection with the premises devices, roadways, and bridges, (standard exterior door) or entry to the living area (stairway or elevator). The interior portion of such enclosed area shall not be partitioned or finished into separate rooms.

5.4.5 Floodways

Areas designated as floodways are located within areas of special flood hazard. The floodway is an extremely hazardous area because of the velocity of floodwaters, which can carry debris and potential projectiles and have erosion potential. Floodways are also used as a base in determining the width of the required stream buffer as described in Section 5.9. Thus, the following provisions shall apply:

1. Encroachments, including fill, excavation, clearing, new construction, and other developments, are prohibited unless certification (with supporting technical data) by a registered engineer is provided demonstrating that encroachments shall not result in any increase in flood levels during occurrence of the base flood discharge;

2. If Item 1 above is satisfied, all new construction shall comply with all applicable flood hazard reduction provisions of these regulations; and,

3. The placement of manufactured homes is prohibited except in an existing manufactured home park or subdivision. A replacement manufactured home may be placed on a lot in an existing manufactured home park or subdivision provided the anchoring, elevation, and encroachment standards of these regulations are met.

The open space uses listed below shall be permitted within the floodway to the extent that they are not prohibited in a particular area by any base zoning ordinance and all applicable flood hazard reduction provisions of these regulations are met.

1. Agricultural uses such as general farming, pasture, truck farming, forestry, sod farming, and wild

crop harvesting;

2. Public and private recreational uses not requiring "permanent or temporary structures" designed for human habitation; some examples are parks, greenways, swimming areas, golf courses, driving ranges, picnic grounds, wildlife and nature preserves, game and skeet ranges, and hunting, fishing, and hiking areas. Temporary structures placed on a site for less than 180 consecutive days and are not considered to be improved property; and,

3. Utility facilities such as flowage areas, transmission lines, pipelines, water monitoring.

5.4.6 Flood Plain Alterations

All dredged or cut areas shall be stabilized immediately to prevent erosion. Areas to be filled must be cleared of standing trees, stumps, brush, down timber, and all objects including structures on and above the ground surface. Topsoil shall be removed and stockpiled, while all other spoil materials must be disposed of offsite. Fill material obtained offsite shall not be stockpiled onsite before grading cuts are completed. Fill material shall be placed in compacted layers and the minimum distance from the perimeter of any proposed building to the top of the slope shall be either 25 feet or twice the depth of fill at that point, whichever is greater. The fill material must not have slopes equal to or greater than 3:1 unless stabilization measures approved by the City Engineer are installed. All slopes shall be stabilized.

No alterations can be made to flood plain land and stormwater management channels without the written approval of the City Engineer. All applicable requirements of Ordinances No. xx- xxx and, in addition, the following specific conditions must be met before such approval will be granted:

1. The construction of a levee, earth fill, building, or other structure that alters a flood plain area shall only be permitted based on a plan prepared by a registered engineer, showing existing and proposed elevations, existing and proposed stormwater management channels, and existing and proposed structures. The plan shall be approved by the City Engineer certifying that the alteration and construction as proposed are in compliance with all applicable flood hazard reduction provisions of these regulations;

2. The proposed excavation, filling, or change of alignment of any existing channel under the jurisdiction of the U.S. Army Corps of Engineers shall be approved by same; and,

3. The plan shall be approved by the State Planner. Any duly approved alteration of the flood plain will be so noted on the official zoning map as a matter of information. This notation will be made upon certification by the Codes Official or City Engineer that such alteration has been completed in accordance with the approved plan.

5.4.7 Flood-proofing

Flood-proofing measures such as those identified below are acceptable provided they are certified by a registered engineer or architect as being consistent with the base flood conditions for the particular area and flood-proofing criteria for non-residential construction in Section 5.4.2 are met.

1. Anchoring to resist flotation and lateral movement;

2. Installation of watertight doors, bulkheads, and shutters;

3. Reinforcement of walls to resist water pressures;

4. Use of paints, membranes, or mortars to reduce seepage of water through walls;

5. Addition of mass or weight to structures to resist flotation;

6. Installation of pumps to lower water levels in structures;

7. Construction of water supply and waste treatment systems to prevent the entrance of floodwaters;

8. Pumping facilities for subsurface stormwater management systems for buildings to relieve external foundation wall and basement floor pressures;

9. Construction to resist rupture or collapse caused by water pressure or flotation debris; and,

10. Cutoff valves on sewer lines or the elimination of gravity flow basement drains.

5.5 Standards for Streams Without Established Base Flood Elevations and/or Floodways

It is the intent of the City that all construction whether within or adjacent to delineated flood plains, shall be subject to the provisions of these regulations. As an example, all residential construction shall be elevated such that the lowest floor is no lower than 4 feet above the base flood elevation. Exceptions to this standard may be granted on appeal to the City Engineer based on a demonstration that the regulatory elevation is so conservative as to place an unreasonable burden upon developers or property owners.

For proposed developments located near small streams but where no base flood data or floodways have been provided or required under the Federal Flood Insurance Program or by Section 5.2 of these regulations, the following provisions apply:

1. No encroachments, including fill material and structures, shall be located within a minimum distance of 25 feet from the top of the stream bank on each side or 30 feet from the centerline of a stream channel, whichever is greater, unless certification by a registered engineer is provided demonstrating that such encroachments shall not result in any increase in flood levels during the occurrence of the base flood discharge;

2. New construction or substantial improvements of residential structures shall have the lowest floor, including basement, elevated at least four (4) feet above the base flood elevation as determined by an appropriate approximate method; and,

3. New construction and substantial improvements of non-residential structures shall have the lowest floor, including basement, elevated at least 2 feet above the highest adjacent grade; or, together with attendant utility and sanitary facilities, be completely flood proofed to or above that

level so that any space below that level is watertight, with walls substantially impermeable to the passage of water, and with structural components having the capability of resisting hydrostatic and hydrodynamic loads and the effect of buoyancy.

5.6 Subdivision Standards

All subdivision projects shall meet the following provisions:

1. Design shall be consistent with the need to minimize flood damage;

2. Public utilities and facilities such as sewer, gas, electrical, and water systems shall be located and constructed to minimize flood damage;

3. Stormwater management facilities shall be provided to reduce exposure to flood hazards; and,

4. Base flood elevation and floodway data shall be provided as required in Section 4.2.

5.7 Nonconforming Uses

The existing lawful use of a structure or premise that is not in conformity with the flood plain requirements of this manual may be continued subject to the following conditions:

1. No such use shall be expanded or enlarged except in conformity with the provisions of this manual;

2. No structural alterations, additions to, or repairs to any nonconforming structure over the life of the structure shall exceed 50 percent of its assessed value at the time of its becoming a nonconforming use unless permanently changed;

3. If such use is discontinued for 12 consecutive months, any future use of the building and premises shall conform to the provisions of this manual;

4. Uses or adjuncts; thereof, which are nuisances shall not be permitted to continue as nonconforming uses; and,

5. Any alteration, addition to or repair to any nonconforming structure permitted shall be protected by flood-proofing measures pursuant to Section 5.4.6.

5.8 Dikes and Floodwalls

The design of dikes and floodwalls for flood protection purposes should consider several factors, including alternate compensating storage, possible surcharge in flood heights, overtopping, and failure.

Dikes are generally earth embankments that can extend around sections of a building. Fill material used in their construction should be dredged from the flood plain to aid in providing compensating storage. The fill material shall be placed on cleared ground, compacted in layers, and protected from seepage. Buildings shall have a minimum setback from the base of the dike of 20 feet or twice the height of the embankment, whichever is greater.

Floodwalls are preferred for locations with limited space and can be constructed as cantilever I-type steel piles, cellular walls, buttress walls, or gravity walls. They shall be well founded with cutoffs installed to prevent seepage. Areas located behind a dike or floodwall should be drained by conduits installed with automatic flap gates to prevent backflow, or by manually operated valves that are closed during flooding, or by a combination of these methods.

5.9 Buffers

New development and significant redevelopment in or adjacent to the floodplain and floodway shall include buffers in the proposed plans. The buffer along waterways will be an area where the surface is left in a natural state and is not disturbed by construction activity.

5.9.1 Buffer Areas Defined

The buffer shall be defined as follows:

1. In areas where a floodplain and floodway have not been determined and accepted by the City Engineer or Codes Official, that contain a “blue line” or intermittent “blue line” stream denoted on the United States Geological Survey Quadrangle maps or serves a significant tributary area, of 40 or more acres, the buffer shall be at least 15 feet perpendicular from each side of the stream bank, creek or unnamed waterway under “bank full” conditions; and,

2. In areas where a floodplain and floodway have not been determined and accepted by the City of Shelbyville or the Federal Emergency Management Agency and it does not contain a “blue line” or intermittent “blue line” stream denoted on the United States Geological Survey Quadrangle maps or serves a significant tributary area, of 100 or more acres, a buffer is not required.

5.9.2 Performance Criteria

The following additional performance criteria shall apply:

1. In order to maintain the functional value of the buffer area, indigenous vegetation may be removed only to provide for reasonable sight lines, access paths, general woodlot management, and storm water quality BMPs, as follows:

    a. Tree pruning or removal be minimized, but permitted as necessary to provide for sight lines and vistas, provided that where removed they shall be replaced with other vegetation that is equally effective in retarding runoff, preventing erosion, and filtering non-point source pollution from runoff;

    b. Any path, for public or private use, shall be constructed and surfaced so as to effectively control erosion and minimize increases in excess storm water runoff volume and velocity; and,

    c. Dead, diseased, or dying trees or shrubbery may be removed at the discretion of the landowner.

2. When the application of the buffer area would result in the extreme loss of buildable area, as

defined by a 50% or greater loss on a lot or parcel, modifications to the width of the buffer area may be allowed by the City Engineer at his discretion.

Chapter 6
TECHNICAL GUIDELINES AND CRITERIA

6.0 Adequate Stormwater Management Systems

Adequate stormwater management systems shall have the hydraulic capacity to accommodate the maximum expected stormwater discharge for a specified tributary area and precipitation duration and intensity.

Adequate stormwater management systems shall be designed to accomplish the following:

1. Account for both offsite and onsite stormwater;

2. Maintain natural topographic divides;

3. Convey stormwater to a stream, natural channel, or other existing facility;

4. Discharge stormwater into the natural channel by connecting the channel at natural elevations, or by discharging the stormwater into an existing facility of sufficient capacity to receive it, or by discharging into an approved drainage well; and,

5. Limit or control stormwater quality leaving the site to predevelopment levels through the use of appropriate stormwater quality BMP's.

Determination of the size and capacity of an adequate stormwater management system shall take into account the future development in the watershed or affected portions thereof. The design must not adversely affect adjacent or neighboring properties.

It is the responsibility of the developer or property owner to pick up or acceptably handle the quantity of runoff as it flows onto their property from the watershed above, and conduct it through the property to an adequate outfall at the lower property line or beyond. The outfall must be sufficient to receive the runoff without deterioration of the downstream channel.

The stormwater management system for new developments shall be designed to enhance stormwater quality for runoff, or a portion thereof, entering the property from the above watershed. New developments and areas of significant redevelopment are required to control stormwater quality for runoff from their site to predevelopment levels through the use of BMPs. If a downstream regional stormwater quality facility serves the runoff from the site then the developer may, with approval from City Engineer, limit the extent to which runoff quality is controlled. Alternatively, if it is unfeasible to implement an on-site stormwater quality BMP then the developer may, with approval from City Engineer, design a system that controls quality for an equivalent portion of runoff entering from the watershed above.

6.0.1 Minor Systems

The design of the minor stormwater management system shall be based on a storm frequency of 10 years. This criterion shall be applied to both closed conduit and open channel systems. However, if the 10-year design flow for an open channel system is greater than 100 cubic feet per second (cfs), then the open or

closed system shall be capable of passing the 100-year design flow within the drainage easement. Systems relying on sinkholes or drainage wells for discharge shall be capable of passing the 100-year design flow within the drainage easement.

In residential subdivision developments where the average lot size is less than 20,000 square feet, the following general guidelines shall be observed in the design of the minor system:

1. Design surface runoff across lots shall not have erosive velocities (see Volume 2);

2. Quantities of surface runoff greater than 1 cfs that flow through lots shall be collected and conveyed in a system of open channels, closed conduits, or a combination of both; and,

3. Lots should generally be graded in such a manner that surface runoff does not cross more than three lots before it is collected in a system of open channels, closed conduits, or a combination of both. However, runoff will be permitted to cross more than three lots before it is collected if the system is designed to achieve stormwater quality benefit and does not pose a risk of erosion of other damage to public or private property. This may only be performed with approval from City Engineer.

Design flows may be determined by acceptable engineering practices with all assumptions stated.

6.0.2. Major Systems

Wherever possible, natural waterways serving the major system should remain undisturbed, with proposed development situated wisely accordingly. Detention may be required to avoid discharges that exceed the capacity of natural waterways. Channelization and other related modifications to the natural waterways are discouraged. Improvements to natural open channels that are to function primarily as the major system shall be designed to pass the 100-year design flow without damage to the channel. Man- made channels designed to function as the major system (trunk line system) shall be capable of carrying a 100-year design flow. Where man-made channels are necessary, the channels should be located as far away from buildings or structures as possible and preferably in established greenways or other conservation corridors.

The onsite major stormwater management system for most developments is the natural backup system and consists of the less obvious drainage ways. Ideally, this major system should provide relief such that no building will be flooded with a 100-year design flow even if the minor system capacity is exceeded.
The 100-year frequency storm shall be used to compute runoff for the design of the onsite major stormwater management system. This system shall be designed to provide relief for flow in excess of the 10-year design flow.

The following guidelines pertain to design of the onsite major stormwater management system:

1. Areas should be graded in such a manner or buildings located or constructed in such a manner that if the capacity of the minor system is exceeded, no building will be flooded by the design flow;

2. Critical areas to consider are sumps, relatively flat areas, and areas where buildings are located below streets or parking lots;

3. The 100-year frequency storm for the duration equivalent to the time of concentration shall be used to compute runoff for the major stormwater management system;

4. For the first trial, the same time of concentration values shall be used that were used in designing the minor stormwater management system and the minor system assumed to be completely inoperable. If no building will be flooded based on these assumptions, then the analysis can be considered complete;

5. If buildings will be flooded based on the assumptions used in the preceding item, more precise hydrologic and hydraulic computations are required. The minor system, overland relief swales, or surface storage should be designed so that no building will be damaged by flooding; and,

6. In general, the minor stormwater management system should not be oversized as a basis for providing major system capacity. The major stormwater management system should be in the form of area grading or the location and construction of buildings in such a manner that overland relief swales or surface storage will provide adequate flood protection.

The major stormwater management system should be evident on the drainage plan, including overland relief swales and areas that may be affected by surface storage for a 100-year design storm. Calculations performed for major system design should be submitted with the drainage plan.

6.1 HYDROLOGY SYNOPSIS

Hydrologic studies are required to develop appropriate input data for hydraulic calculations to evaluate the impact of land development. Current conditions must be compared to predictions for post-construction conditions to assess the impact of the construction. This chapter describes techniques for estimating peak flood discharges and flood hydrographs recommended for use in the City of Shelbyville.

The objectives of this chapter may generally be met using a systematic approach to arrive at the required results. The organization of this chapter is designed to facilitate such an approach and is outlined as follows:

1. Based on requirements (e.g., peak flow only, peak flow and runoff volume, or complete runoff hydrograph) and watershed characteristics (e.g., area, length, slope, and ground cover), select an appropriate hydrologic procedure from Section A;

2. Identify rainfall data requirements for appropriate design storm conditions from Section A.1. If required for hydrograph generation, develop a rainfall hyetograph for the design storm event using the method described in Section A.2;

3. Estimate rainfall excess using Rational Method runoff coefficients or Soil Conservation Service (SCS) curve numbers as outlined in Section A.3;

4. Compute the watershed time of concentration using the procedures in Section A.4;

5. Compute the peak runoff rate using methods described in Section A.5, as appropriate for the procedure selected in Step 1. If required, generate a complete runoff hydrograph using one of the methods from Section A.6; and,

6. Based on watershed characteristics such as detention storage, open channel flow path length and slope, and channel roughness, determine if detention storage or channel routing is required. If

appropriate, conduct hydrologic routing using methods described in Section 2.7.

A.1 PROCEDURE SELECTION

The guidelines discussed in this section and summarized in Table A-1 are recommended for selecting hydrologic procedures. A consideration of peak runoff rates for design conditions is generally adequate for conveyance systems such as storm sewers or open channels. However, if the design must include flood routing (e.g., storage basins or complex conveyance networks and timing of peak runoff), a flood hydrograph is usually required.

Because stream flow measurements for determining peak runoff rates for pre-project conditions are generally not available, accepted practice is to perform flood hydrology calculations using several methods. Results can then be compared (not averaged), and the method that best reflects project conditions selected and documents. When stream flow data are available, they should be obtained and analyzed before a hydrologic method is selected.

The Rational Method (see Section A.5.2) is subject to the following limitations:

1. Only peak design flows can be estimated;

2. Time of concentration, t_c, is greater than or equal to 5 minutes and less than or equal to 30 minutes (5 minutes $\leq t_c \leq$ 30 minutes); and,

3. Drainage area, DA $\leq$ 100 acres.

Beyond these limits, results should be compared using other methods, and approval by MDPW is required.

The SCS TR-55 (1986) graphical method (see Section A.5.4) is subject to the following limitations:

1. Estimates of peak design flows only;

2. Design storm = SCS Type II 24-hour distribution;

3. Time of concentration, t_c, of 0.1 hour $\leq t_c \leq$ 10 hours;

4. The method was developed from results of computer analyses performed using TR-20 (USDA, SCS, 1983) for a 1-square-mile homogeneous (describable by one CN value) watershed;

5. Curve number, CN, of 40 $\leq$ CN $\leq$ 98;

6. Ratio of initial abstraction to precipitation, I_a/P, of 0.1 $\leq I_a/P \leq$ 0.5;

7. Unit hydrograph shape factor of 484;

8. Only one main stream channel in the watershed or, if more than one exists, nearly equal times of concentration for the branches;

9. Use of the 1986 version of TR-55 in place of the 1975 procedures; and,

10. No consideration of hydrologic channel routing.

The SCS TR-55 (1986) tabular method (see Section A.6.4) can be used to estimate flood hydrographs and to approximate the effects of hydrologic channel routing, subject to the following limitations:

1. Design storm = SCS Type II 24-hour distribution;

2. Time of concentration, t_c, of 0.1 hour ≤ t_c ≤ 2 hours;

3. DAs of individual sub-areas that do not differ by a factor of 5 or more. The procedure was developed for a DA of 1 square mile;

4. Curve number, CN, 40 ≤ CN ≤ 98;

5. Ratio of initial abstraction to precipitation, I_a/P, of 0.1 ≤ I_a/P ≤ 0.5;

6. Unit hydrograph shape factor of 484;

7. Reach travel time, t_T, of 0 to 3 hours; and,

8. Use of the 1986 version of TR-55 in place of the 1975 procedures.

U.S. Geological Survey (USGS) regional regression equations (see Section 2.5.3) have been prepared for Nashville and Davidson County for small, ungaged, rural and urban watersheds. These regression equations are subject to the following limitations:

1. Estimates of peak flows only;

2. DAs from 0.15 to 850 square miles for rural equations and from 0.15 to 30 square miles for urban equations;

3. Imperviousness less than or equal to 20 percent for rural equations and ranging from 20 to 80 percent for urban equations; and,

4. No extensive drainage improvements that alter the basin lag time incorporated into the watershed.

Because a statistical estimate of expected error in predicted peak discharge is available for these regression equations, they are very useful for comparing results from other hydrologic methods. The statistical error estimates do not apply to watersheds that are outside the ranges of area and imperviousness listed above, however, and, as a result, should not be used for predicting peak discharge from such watersheds.

Unit hydrograph theory (see Section 2.6.1) provides a generally applicable procedure for developing flood hydrographs using a basin-specific unit hydrograph and an appropriate rainfall hyetograph. Many computer models use unit hydrograph theory. With careful development of a basin-specific unit hydrograph, this versatile method can be adapted to a wide range of conditions.

Inman's dimensionless hydrograph (see Section A.6.2) can be used to develop flood hydrographs with

peak runoff rates and a basin lag time from other hydrologic methods. Lag time as used in Inman's dimensionless hydrograph is defined as the difference between the center of mass of rainfall excess and the center of mass of runoff. Inman's hydrograph is applicable to both rural and urban watersheds, subject to the following limitations:

1. Rural watershed drainage areas between 0.17 and 481 square miles, inclusive, and imperviousness less than 4 percent; and,

2. Urban watershed drainage areas between 0.47 and 64 square miles, inclusive, and imperviousness between 4 and 48 percent, inclusive.

Computer modeling is appropriate when limitations of simpler methods are exceeded, complex situations are being studied, or more detailed information is required. HEC-1 (U.S. Army Corps of Engineers, 1981), calibrated to basin-specific data, is the recommended model.

A.2 RAINFALL DATA

Rainfall data required for hydrologic studies include total rainfall depth and area and time distribution for design or historical storm conditions. Data developed specifically for Metro Nashville include intensity-duration-frequency (IDF) curves and depth-duration-frequency data, which are required for predicting peak discharge rates and for developing runoff hydrographs.

A.2.1 INTENSITY-DURATION-FREQUENCY RELATIONSHIPS

MDPW has developed IDF curves for use in Nashville and Davidson County based on National Weather Service (NWS) data that replace previous data and precipitation records from the Metro Nashville Airport. IDF curves for durations up to 100 minutes are presented in Figure A-1 for return periods of 2, 5, 10, 25, 50, and 100 years. Corresponding depth-duration-frequency data for durations up to 25 hours are included in Figure A-1.

The rainfall intensities and depths shown in Figure A-1 are representative for any single point in Davidson County; however, as the drainage area increases, the intensity of precipitation should be reduced as recommended by the NWS. Aerial reduction curves from TP-40 (Hershfield, 1961), which are appropriate for use with all recurrence intervals, are shown in Figure 2-2.

A.2.2 RAINFALL HYETOGRAPHS

The rainfall data presented in Section A.2.1 identify average depth or intensity over specific durations. To develop a flood hydrograph, however, a time variable distribution (hyetograph) is required.

The balanced storm approach was used to develop hyetographs for Metro Nashville for a 24-hour storm duration. A dimensionless hyetograph for a 24-hour storm is shown in Figure A-3. Tabular data for the dimensionless hyetograph, along with the 2-, 10-, 25-, and 100-year return frequency hyetographs, are presented in Table A-2. A hyetograph can be developed for any return frequency by multiplying the ratio from the dimensionless hyetograph by the total 24-hour duration rainfall (see Figure A-1) for the return frequency in question (see Example A-1).

The tabular hyetographs in Table A-2 are for 15-minute time intervals. If smaller time intervals are

required, additional data points may be obtained from the dimensionless hyetograph curve in Figure A-3 or interpolated directly from the tabular data.

6.2 Open Channels

6.2.1 Channel Capacity

Open channel capacity shall be determined by Manning's equation. Appropriate Manning's values shall be utilized for design and are subject to approval from the City Engineer.

6.2.2 Lined Channels

Open channels may be designed as hard-armored, geo-synthetic or soil bioengineering lined channels. Acceptable lining materials must be placed in accordance with product vendor specifications applicable subdivision regulations. Approval of lining materials is subject to review by the City Engineer.

Channel lining shall be required when the design velocity is scouring, non-erosive velocity for a given channel reach and no other erosion control measures provide adequate protection. Allowable, non-erosive velocities for various soil types are presented in below.

6.2.3 Grassed Channels

The design of grassed channels shall consider the variable degree of retardance generated by different types of cover.

Temporary erosion control shall be utilized during non- growing seasons and during grass cover establishment. The engineer shall note on the drawings or in the specifications that "All grassed channels must be in a well-stabilized condition and show no sign of erosion at the time of final acceptance by the City Engineer/Public Works' Director."

6.2.4 Easement Width

All open channels shall be located within the right-of-way of a public utility and drainage easement. Minimum easement width shall be determined from Table 6-1.

Table 6-1
Minimum Easement Width for Open Channels

Top Width of Channel	Easement Width
Less than 5 feet	10 feet
5 – 20 feet	10 feet greater than top width of channel, with minimum of 5 feet on one side
Greater than 20 feet	15 feet greater than top width of channel, with minimum of 5 feet on one side.

6.3 Stormwater Quantity Detention

6.3.1 Conduit Capacity

Closed conduits shall be designed for the total flow intercepted by the inlets during the design storm event.

6.3.2 Pressure Flow

Storm drain systems should generally be designed as non-pressure systems. However, pressure flow systems if coordinated with the CITY ENGINEER/DEPARTMENT OF PUBLIC WORKS during the preliminary design phase, may be allowed.

The hydraulic gradient for pressure flow systems shall not exceed the following criteria:

1. An elevation greater than one foot below the established ground surface, or

2. More than five feet above the crown of the conduit.

6.3.3 Easement Width

Minimum allowable easement width for stormwater pipes and culverts shall be determined from Table 6-2.

Table 6-2
Minimum Easement Width for Storm Drains

Conduit Size	Easement Width
15 – 18 inches	10 feet
21 – 33 inches	15 feet
36 – 48 Inches	20 feet
54 – 72 inches	25 feet

6.3.4 Inlets

Inlets shall be designed to convey the 10-year frequency, time of concentration storm event.

6.3.5 Culverts

The design flow for culverts shall be based on the following return frequencies:

1. 100-year for residential collector and commercial road crossings; and,

2. 10-year for residential roads and crossings.

In addition, building elevations shall be checked for flooding caused by the 100-year, 24-hour storm.

6.4 Outlet Protection

The design discharge at the outlet of stormwater management systems shall not result in velocities that equal or exceed the erosive velocity of the receiving channel, unless energy dissipation and permanent erosion protection measures are placed at the outlet. Energy dissipation and erosion control devices shall have no over-fall at the terminal end and shall discharge onto a stable section. The terminal section shall be considered stable if the terminal section design velocity is less than the erosive velocity.

6.5 Bridges

All bridges shall be designed for the 100-year, 24-hour storm event. The design flow shall consider runoff from the total tributary area and will require stream channel routing, as appropriate.

6.6 Stormwater Quantity Detention

6.6.1 Release Rate

The release rate from any detention facility should approximate that of the site prior to the proposed development for the 2-year through 10-year storms, with emergency overflow capable of handling at least the 100-year discharge except where waived or altered by the City Engineer. Detention systems must be constructed during the first phase of major developments to eliminate damage to adjacent properties during construction. In this regard, the detention systems shall be designed to function as sediment traps and cleaned out to proper volumes before completion. If siltation has occurred, detention systems must be restored to their design dimensions after construction is complete and certified as part of the as-built submittal (see Section 3.9).

6.6.2 Detention Volume

The required detention volume shall be that volume necessary to attenuate the post- development peak discharge to a level not to exceed the pre-development peak discharge. This volume may be minimized by careful attention to outlet structure design.

6.6.3 Drawdown

Detention storage volume shall be drained within 72 hours. This requirement includes that volume above any permanent pool. Drawdown may be accomplished by a V-notch weir, perforated standpipe, small orifice, or complex geometry weir. Other methods may be approved subject to City Engineer's review.

6.7 Post Development Performance Standards

Stormwater quality management practices are to be applied to all new development. They are intended to benefit stormwater quality by controlling frequent storm event flooding, erosion and non-point pollutant loading. While detention practices are not required on all sites, due to land use, contributing area and other factors, they will most likely be necessary on larger sites.

The stormwater quality systems are to be designed to "treat" the small frequent stormwater quality events and be designed to bypass all larger storm (flood) events, unless the facility is designed to serve as both

a stormwater quantity and quality management practice.

The post development requirements (BMPs) apply to new development and redevelopment projects that disturb greater than or equal to one acre, including projects less than one acre that are part of a larger common plan of development or sale, that discharges into the City's MS4. The post development BMPs will result in minimizing water quality impacts resulting from the development and redevelopment projects and are appropriate for the City.

6.7.1 Retention

Supportive data must be submitted to justify the type of detention facility selected. If the facility is designed to retain (volume control) all or a significant portion of runoff, then appropriate soils analyses findings shall be submitted to City Engineer. This submission shall also discuss the impacts the facility will have on local karst topography as found through a geological investigation of the site. The facility may be designed to infiltrate runoff to groundwater rather than transmit it downstream under conditions up to a 10-year storm event. It must be able to bypass all other storms up to a 100-year event with a discharge rate equivalent to or less than pre-development conditions without negatively impacting the 100-year floodplain above or below the site. If data are not supportive that the facility can retain a significant portion of the runoff then the facility must be sized to detain runoff.

6.7.2 Dry and Wet Detention Design Criteria

All stormwater quality dry or wet detention facilities designs shall consider the following criteria:

1. Bleed down or "live" storage volume of the first 0.5 to 1.0 inches of runoff and residence time of 12 to 24 hours for dry ponds and 24 to 60 hours for wet ponds;

2. Permanent pond volume hydraulic residence time of 2 to 4 weeks;

3. Sediment forebay, baffle boxes or equivalent pretreatment device with high flow (10-year storm frequency or greater) bypass;

4. Length to width ration of at least 4:1;

5. Energy dissipating inlet structures;

6. Safe side slopes;

7. Oil and grease traps or floatable debris skimmers (not used at this time);

8. Maximum permanent pool depth of no more than 12 feet unless re-circulated with an aerator or fountain;

9. For wet ponds, a littoral zone of 10-30 percent pond coverage within 3 years of planting; and,

10. City Engineer strongly encourages that major stormwater quality controls, especially detention facilities, be designed as off-line devices.

6.7.3 Emergency Overflow

The release rate from any stormwater quality detention facility should be as described above with emergency overflow capable of handling the 100-year discharge except where waived or altered by the City Engineer. An adequate alternate stormwater management system must be provided to accommodate major storm flows. Major stormwater quality controls must be constructed during the first phase of developments to eliminate damage to adjacent properties during construction. The construction of an emergency overflow shall be of a non-erodable surface

6.7.4 Post Construction Detention Volume

The required detention volume shall be that volume necessary such that post-development hydrology does not exceed the pre-development hydrology of the site. If siltation occurs during construction, the detention system must be restored to the original design dimensions after site construction is completed and certified as part of the as-built submittal. (See Section 3.9)

6.7.5 Post Development Requirements

The following minimum requirements shall be met for all new development and redevelopment projects except those projects that are exempt as defined in Section 3.4.

1. Stormwater discharges and volumes must be managed such that post-development hydrology does not exceed the pre-development hydrology at the site.

2. Permanent stormwater BMPs shall at a minimum infiltrate, evapo-transpire, harvest and/or use, at a minimum, the first inch of every rainfall event preceded by 72 hours of no measurable precipitation. The first inch of rainfall must be managed without any stormwater runoff being discharged to surface waters; if appropriate for the site; there is not a potential for introducing pollutants into the groundwater, unless pretreatment is provided; pre-existing soil contamination in areas subject to contact with infiltrated runoff; and sinkholes or other karst features are not present. Permanent stormwater BMP design must take into account infiltrative capacity of soils at the site.

3. For projects and sites that cannot meet 100 percent of the requirements 6.7.5.2, the remaining portion of the one inch of rainfall must be treated with structural or non-structural BMPs reasonably expected to remove 80 percent of the total suspended solids (TSS). The BMPs must be designed, installed, and maintained to continue to meet this performance standard.

6.8 Permanent Stormwater BMP Maintenance

Care must be taken to ensure that any required detention facilities do not become nuisances or health hazards. Stormwater quality management practices generally require more maintenance than stormwater quantity management practices. Detention facilities should be designed to require minimal maintenance, and maintenance responsibility must be clearly stated on the plans. Detention facilities may be designed to serve multiple purposes whereby runoff may be detained under wet-weather conditions, but also serve as common or recreational areas during dry-weather conditions. Where multi-purpose facilities are provided, or where flat grades or poorly draining soils encountered, provisions for adequate low flow stormwater management system may be required. Where the retention/ detention facility is planned to be used as a lake, pond or stormwater quality management practice with a permanent pool, water budget calculations shall be performed and submitted to demonstrate that an adequate pool is expected during dry summer months.

All detention facilities located in residential developments shall be within public utility and drainage easements and shall be maintained by the property owner. Detention facilities located in condominium developments, apartment or townhouse complexes, single family PUDs, industrial, commercial, or institutional developments shall be within public utility and drainage easements and maintained by the property owner or homeowners association. A maintenance agreement must be executed before the development plan is approved, which shall provide, among other things, that the Department of Public Works may, upon the failure of the property owner to do so, take corrective action an assess the costs thereof to the property owner. The maintenance agreement shall be referenced in the final plat.

All stormwater management facilities (BMPs) must be maintained in perpetuity. Owners or operators of any site that have BMPs covered under the City's effective MS4 permit must have a maintenance agreement addressing maintenance requirements for any BMPs, including off-site mitigation. The maintenance agreement allows the City, or its designee, to conduct inspections in accordance with Section 3.6. The maintenance agreement transfers responsibility to the new owner or operator if the site is sold or leased to a new owner or operator. The maintenance agreement must be executed before the development plan is approved, which shall provide, among other things, that the Department of Public Works may, upon failure of the property owner to do so, take corrective action and assess the costs thereof to the property owner. The maintenance agreement shall be referenced in the final plat.

If inadequacies are discovered during an inspection the City will notify the BMP owner or operator of any deficiencies. The BMP owner or operator must initiate corrective action within 30 days of the notice and complete the corrective action as soon as practical. Depending on the nature of the violation, the City can require immediate action which may include design and timeline for remediation of the inadequacy. The maintenance agreement allows the City, or its designee, to perform necessary maintenance or corrective actions if the owner or operator does not initiate the corrective actions within 30 days of being notified or fails to complete the corrective actions as soon as practical. The City will recoup costs from the owner or operator for work performed by the City or its designee. The City will conduct a subsequent inspection (or obtain written or photographic evidence) to ensure completion of all required repairs.

Owners or operators of any site that have BMPs covered under the City's effective MS4 permit must provide verification of maintenance for any approved BMPs used to meet requirements of the effective MS4 permit. The verification of maintenance must include one of the following options.

a. The owner or operator's signed statement accepting responsibility for maintenance of BMPs with a provision for transferring maintenance responsibility if the property is legally transferred to another party; and/or
b. Written conditions in the sales or lease agreement that require the recipient to assume responsibility for maintenance; and/or
c. Written project conditions, covenants and restrictions for residential properties assigning maintenance responsibilities to a homeowner's association, or other appropriate group, for maintenance of runoff reduction and pollutant reduction stormwater BMPs; and/or
d. Any other legal enforceable agreement that assigns permanent responsibility for maintenance of runoff reduction and pollutant reduction stormwater BMPs.

6.9 Sinkholes and Drainage Wells

All stormwater management systems discharging to sinkholes or drainage wells shall be designed using the 100-year storm for the critical duration of the watershed tributary to the sinkhole or drainage well. A geologic investigation and report as described in Section 4.2.5 is required, along with a demonstration that development will not occur within the area flooded by the 100-year storm and that all state and

federal permitting requirements are complied with.

6.10 Erosion Control Plans

An erosion control plan shall identify the erosion control practices and sediment trapping facilities which are appropriate for the actual site conditions. In addition, the appropriate schedule of implementation shall be identified. Particular attention is required for concentrated stormwater flows. Either concentrated stormwater flows shall be avoided or the conveyance system shall be protected sufficiently to prevent significant erosion. Sediment trapping devices are required at all points where stormwater leaves a site laden with sediment. The plan shall identify provisions including but not limited to the following:

1. Erosion prevention on denuded areas ;

2. Non-structural management practices to be implemented;

3. Perimeter controls;

4. Permanent stormwater conveyance structures;

5. Final stabilized conditions of the site;

6. Provision for removing temporary control measures;

7. Stabilization of the site where temporary measures are removed;

8. Maintenance requirements for temporary management practices including minimum inspection requirements; and,

9. Maintenance requirements for any permanent measures.

Additional guidance, for selecting, designing and implementing appropriate erosion prevention and sediment control practices, is presented in Tennessee Department of Environment and Conservation

6.10.1 Stabilization of Denuded Areas and Soil Stockpiles

Permanent or temporary soil stabilization shall be applied to denuded areas within 15 days after final grade is reached on any portion of the site. Soil stabilization shall also be applied within 15 days to any portion of denuded areas which may not be at final grade, but will remain dormant (undisturbed) for longer than 60 days.

Soil stabilization refers to measures that protect soil from the erosive forces of raindrop impact and flowing water. Applicable practices include but are not limited to vegetative establishment, mulching, and the early application of gravel base on areas to be paved. Selected soil stabilization measures should be appropriate for the time of year, site conditions, and estimated duration of use.

Soil stockpiles shall be stabilized if left undisturbed for 15 or more days. They shall be protected with sediment trapping measures that may include sediment traps or detention ponds to prevent soil loss from the project site throughout the life of the soil stockpiling practice.

6.10.2 Establishment of Permanent Vegetation

A permanent vegetative cover shall be established on denuded areas not otherwise permanently stabilized. Permanent vegetation shall not be considered established until a ground cover is achieved which, in the opinion of the City Engineer, Public Works Director or his designee is mature enough to control soil erosion satisfactorily and to survive severe weather conditions.

6.10.3 Protection of Adjacent Properties

Properties adjacent to the site of a land disturbance shall be protected from sediment deposition. This may be accomplished by preserving a well-vegetated buffer strip around the lower perimeter of the land disturbance; by installing perimeter controls such as sediment barriers, filters, diversion berms, or sediment basins; or by a combination of such measures.

Vegetated buffer strips may be used alone only where runoff in sheet flow is expected. Buffer strips should be at least 25 feet in width. If at any time it is found that a vegetated buffer strip alone is ineffective in stopping sediment movement onto adjacent property, additional perimeter controls shall be required.

6.10.4 Timing and Stabilization of Sediment Trapping Measures

Sediment basins and traps, perimeter diversion berms, sediment barriers and other measures intended to trap sediment onsite shall be constructed as a first step in grading, and be made functional before upslope land disturbance takes place. All sediment control practices at hydraulic outlets from the site must be installed before additional construction may take place. See Section 3.6.2 of this volume. Earthen structures such as dams, dikes, and diversions shall be seeded and mulched within 15 days of installation.

6.10.5 Sediment Basins

Stormwater runoff from tributary areas with 5 acres or greater disturbed area shall pass through a sediment basin or other suitable sediment trapping facility.

6.10.6 Cut and Fill Slopes

Cut and fill slopes shall be designed and constructed in a manner which will minimize erosion. Consideration must be given to the length and steepness of the slope, the soil type, upslope tributary area, groundwater conditions, and other applicable factors. As a minimum, all slopes at 3 to 1 or greater shall be stabilized with rock riprap, geosynthetic material, or other method approved by the City Engineer or geotechnical recommendations.

6.10.7 Construction Exits

A stabilized stone pad shall be placed at any point where traffic will be leaving a construction site to a public right-of-way, street, alley, sidewalk, or parking lot. Stone pads shall contain ASTM-1 stone, six (6) inches thick and be a minimum of one hundred (100) feet long. Detailed requirements for construction exits are presented in the Stormwater BMP Manual (the Tennessee Erosion and Sediment Control Handbook).

6.10.8 Deficient Performance

If at any time it is determined by the appropriate City's official, the property owner or designated construction site inspector/manager that the erosion prevention and sediment control practices as originally designed are not capable of preventing sediment from leaving the site under storm conditions then additional controls shall be implemented. Additional controls shall be implemented to a level and until a time in which the City Engineer is satisfied that the controls are adequate. If the appropriate City official's inspectors determine that adequate inspections and maintenance procedures are not being implemented or the controls as designed are not meeting performance objectives presented in this chapter then the appropriate City's official may issue a Stop Work Order, rescind a grading permit or take other appropriate legal actions. See Section 3.7 of this Volume.

6.11 GUTTER AND INLET HYDRAULICS

SYNOPSIS

The level of service of facilities that provide drainage of roadway surfaces should be consistent with the level of service of the roadway. Guidelines are given for evaluating roadway features and design criteria as they relate to gutter and inlet hydraulics. Procedures for performing gutter flow calculations are based on a modification of Manning's Equation. Inlet capacity calculations for grated and combination inlets are based on information contained in HEC-12 (USDOT, FHWA).

DESIGN CRITERIA

The following design criteria are typically important for gutter and inlet capacity calculations:

1. Return period
2. Spread
3. Inlet types and spacing
4. Manning's "n" values
5. Grade
6. Cross-slope
7. Curb and gutter sections
8. Roadside and median ditches
9. Bridge decks

6.11.1 RETURN PERIOD

The design storm return period for pavement drainage should be consistent with the frequency selected for other components of the drainage system.

6.11.2 SPREAD

For multi-laned curb and gutter or guttered roadways with no parking, it is not practical to avoid travel lane flooding when grades are flat (1.0 percent). However, flooding should never exceed the lane adjacent to the gutter (or shoulder) for design conditions. Standard practice in Shelbyville is to limit maximum stormwater spread to 8 feet, measured from the face of the curb. Municipal bridges with curb and gutter should also use this criterion. For single-lane roadways, at least 8 feet of roadway should remain unflooded for design conditions.

6.11.3 INLET TYPES AND SPACING

Inlet types shall be selected from Standard Drawings of the Shelbyville Subdivision Specifications for Streets and Roads. Inlets shall be located or spaced in such a manner that the design curb flow does not exceed the spread criterion of 8 feet.

An allowance of 0.1 cfs will only be allowed to cross intersecting streets unless the City Engineer dictates no flow for area of high traffic hazard. In addition, curb and gutter inlets should not be built in curb returns.

6.11.4 GRADE

Curb and gutter grades that are equal to pavement slopes shall not exceed 13 percent or fall below 1 percent without approval from the City Engineer. A minimum longitudinal gradient is more important for curbed pavements which are susceptible to stormwater spread. Flat gradients on uncurbed pavements can lead to a spread problem if vegetation is allowed to build up along the pavement edge.

6.11.5 CROSS SLOPE

The design of pavement cross slope is often a compromise between the need for reasonably steep cross slopes for drainage and relatively flat cross slopes for driver comfort. In most Shelbyville design situations, cross slopes will be defined by the standard pavement sections given on the Standard Drawings of the Shelbyville Subdivision Specifications for Streets and Roads. The standard Shelbyville cross slope is a 4-inch crown over the edge of the pavement.

When three or more lanes are inclined in the same direction on multi-lane pavements, it is desirable for each successive pair of lanes, or the portion thereof outward from the first two lanes from the crown line, to have an increased slope. The two lanes adjacent to the crown line should be pitched at the normal slope, and successive lane pairs, or portions thereof outward, should be increased by about 0.5 to 1.0 percent. Where three or more lanes are provided in each direction, the maximum pavement cross slope should be limited to 4 percent.

6.11.6 CURB AND GUTTER SECTIONS

Curbing at the outside edge of pavement is normal practice for low-speed, urban highway facilities. Curb and curb and gutter details are presented in Standard Drawing Subdivision Specifications for Streets and Roads. Standard gutter width is 18 inches. Gutters are on the same cross slope as the pavement on the high side and depressed with a steeper cross slope on the low side, usually 1 inch per foot. Typical practice is to place curbs at the outside edge of shoulders or parking lanes on low speed facilities.

Standard Drawing_____also shows a typical cross-section for a curb without the gutter section.

6.11.7 ROADSIDE AND MEDIAN DITCHES

Roadside ditches are commonly used with uncurbed roadway sections to convey pavement runoff and up-gradient area runoff that drains toward the pavement. Right-of-way limitations prevent use of roadside ditches in densely developed urban areas. They can be used in cut sections, depressed sections, and other locations where sufficient right-of-way is available and driveways or intersections are infrequent and the area tributary to the gutter section should be kept to a minimum to reduce the hazard from water on

the pavement. Where practicable, the flow from major areas draining toward curbed highway pavements should be intercepted by ditches as appropriate.

It is preferable to slope median areas and inside shoulders to a center swale to prevent drainage from the median area from running across the pavement. This is particularly important for high-speed facilities and for facilities with more than two lanes of traffic in each direction.

6.11.8 BRIDGE DECKS

Drainage of bridge decks is similar to other curbed roadway sections. It is often less efficient because cross slopes are flatter, parapets collect large amounts of debris, and small drainage inlets on scuppers have a higher potential for clogging by debris. Bridge deck constructability usually requires a constant cross slope, so the guidelines in Section 1.5 do not apply. Because of the difficulties in providing and maintaining adequate deck drainage systems, gutter flow from roadways should be intercepted before it reaches a bridge. In many cases, deck drainage must be carried several spans to the bridge end for disposal.

Zero gradients and sag vertical curves should be avoided on bridges. The minimum desirable grade for bridge deck drainage should be 1.0 percent. When bridges are placed at a vertical curve and the grade is less than 1.0 percent, the gutter spread should be checked to ensure a safe, reasonable design.

Scuppers are the recommended method of deck drainage because they can reduce the problems of transporting a relatively large concentration of runoff in an area of generally limited right-of-way. They also have a low initial cost and are relatively easy to maintain. However, the use of scuppers should be evaluated for site-specific concerns. Scuppers should not be located over embankments, slope pavement, slope protection, navigation channels, driving lanes, or railroad tracks. Runoff collected and transported to the end of the bridge should generally be collected by inlets and down drains, although sod flumes may be used for extremely minor flows in some areas.