CHAPTER 2
STORMWATER ILLICIT CONNECTIONS AND ILLEGAL DISCHARGES

9-2-1: PURPOSE AND INTENT:

A. Purpose: The purpose of this chapter is to provide for the health, safety, and general welfare of the citizens of Bettendorf through the regulation of non-stormwater discharges to the storm drainage system to the maximum extent practicable as required by federal and state law. This chapter establishes methods for controlling the introduction of pollutants into the municipal separate storm sewer system (MS4) in order to comply with requirements of the Nnational Ppollutant Ddischarge Eelimination Ssystem (NPDES) phase II permit process.

B. Objectives: The objectives of this chapter are:

1. To regulate the ~~contribution of~~ discharge of stormwater pollutants to the municipal separate storm sewer system (MS4) by stormwater discharges by any user;

2. To prohibit illicit connections and discharges to the municipal separate storm sewer system;

3. To establish legal authority to carry out all inspection, surveillance and monitoring procedures necessary to ensure compliance with this chapter. (2008 Code § 26.75-1)

4. To efficiently oversee pollution prevention programs without duplications of state and federal inspections and monitoring.

9-2-2: DEFINITIONS:

For the purposes of this chapter, the following shall mean:

AUTHORIZED ENFORCEMENT AGENCY:
Employees or designees of the city of Bettendorf public works department.

BEST MANAGEMENT PRACTICES (BMPs):
Schedules of activities, prohibitions of practices, general good housekeeping practices, pollution prevention and educational practices, maintenance procedures, and other management practices to prevent or reduce the discharge of pollutants directly or indirectly to stormwater, receiving waters, or stormwater conveyance systems. BMPs also include treatment practices, operating procedures, and practices to control site runoff, spillage or leaks, sludge or water disposal, or drainage from raw material storage.

CLEAN WATER ACT:
The federal water pollution control act (33 USC section 1251 et seq.), and any subsequent amendments thereto.

CONSTRUCTION ACTIVITIES:
Activities subject to NPDES construction permits. These include construction projects resulting in land disturbance of one acre or more. Such activities include, but are not limited to, clearing

and grubbing, grading, excavating, and demolition.

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

ILLEGAL DISCHARGE:
Any direct or indirect non-stormwater discharge to the storm drain system, except as exempted in this chapter.

ILLICIT CONNECTIONS:
An "illicit connection" is defined as either of the following:

A. Any drain or conveyance, whether on the surface or subsurface, which allows an illegal discharge to enter the storm drain system including, but not limited to, any conveyances which allow any non-stormwater discharge including sewage, process wastewater, and wash water to enter the storm drain system and any connections to the storm drain system from indoor drains and sinks, regardless of whether said drain or connection had been previously allowed, permitted, or approved by an authorized enforcement agency; or

B. Any drain or conveyance connected from a commercial or industrial land use to the storm drain system which has not been documented in plans, maps, or equivalent records and approved by an authorized enforcement agency.

INDUSTRIAL ACTIVITY:
Activities subject to NPDES industrial permits as defined in 40 CFR section 122.26(b)(14).

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) STORMWATER DISCHARGE PERMIT:
A permit issued by EPA (or by a state under authority delegated pursuant to 33 USC section 1342(b)) that authorizes the discharge of pollutants to waters of the United States, whether the permit is applicable on an individual, group, or general area wide basis.

NON-STORMWATER DISCHARGE:
Any discharge to the storm drain system that is not composed entirely of stormwater.

PERSON:
Any individual, association, organization, partnership, firm, corporation or other entity recognized by law and acting as either the owner or as the owner's agent.

POLLUTANT:
Anything that causes or contributes to pollution. Pollutants may include, but are not limited to: paints, varnishes, and solvents; oil and other automotive fluids; nonhazardous liquid and solid

wastes and yard wastes; refuse, rubbish, garbage, litter, or other discarded or abandoned objects, ordnances, and accumulations, so that same may cause or contribute to pollution; floatables; pesticides, herbicides, and fertilizers; hazardous substances and wastes; sewage, fecal coliform and pathogens; dissolved and particulate metals; animal wastes; wastes and residues that result from constructing a building or structure; and noxious or offensive matter of any kind.

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

STORM DRAINAGE SYSTEM:
Publicly or privately owned facilities by which stormwater is collected and/or conveyed, including, but not limited to, any roads with drainage systems, municipal streets, gutters, curbs, inlets, piped storm drains, pumping facilities, retention and detention basins, natural and human made or altered drainage channels, reservoirs, and other drainage structures.

STORMWATER:
Any surface flow, runoff, and drainage consisting entirely of water from any form of natural precipitation, and resulting from such precipitation.

STORMWATER POLLUTION PREVENTION PLAN:
A document which describes the best management practices and activities to be implemented by a person or business to identify sources of pollution or contamination at a site and the actions to eliminate or reduce pollutant discharges to stormwater, stormwater conveyance systems, and/or receiving waters to the maximum extent practicable.

WASTEWATER:
Any water or other liquid, other than uncontaminated stormwater, discharged from a facility. (2008 Code § 26.75-2)

9-2-3: APPLICABILITY:
This chapter shall apply to all water entering the storm drain system generated on any public or private developed and undeveloped lands unless explicitly exempted by an authorized enforcement agency. (2008 Code § 26.75-3)

9-2-4: RESPONSIBILITY FOR ADMINISTRATION:
The public works department, or its designated agent, shall administer, implement, and enforce the provisions of this chapter. Any powers granted or duties imposed upon the authorized enforcement agency may be delegated in writing by the city director of public works to persons or entities acting in the beneficial interest of or in the employ of the agency. (2008 Code § 26.75-4)

9-2-5: MINIMUM STANDARDS; ULTIMATE RESPONSIBILITY:
The standards set forth herein and promulgated pursuant to this chapter are minimum standards; therefore, this chapter does not intend nor imply that compliance by any person will ensure that

there will be no contamination, pollution, nor unauthorized discharge of pollutants. (2008 Code § 26.75-6)

9-2-6: DISCHARGE PROHIBITIONS:

A. Prohibition of Illegal Discharge: No person shall discharge or cause to be discharged into the municipal storm drain system or watercourses any materials, including, but not limited to, pollutants or waters containing any pollutants that cause or contribute to a violation of applicable water quality standards, other than stormwater. The commencement, conduct or continuance of any illegal discharge to the storm drain system is prohibited except as described as follows:

   1. The following discharges are exempt from discharge prohibitions established by this chapter: water line flushing or other potable water sources, landscape irrigation or lawn watering, diverted stream flows, rising groundwater, groundwater infiltration to storm drains, uncontaminated pumped groundwater, foundation or footing drains (not including active groundwater dewatering systems), crawl space pumps, air conditioning condensation, springs, noncommercial washing of vehicles, natural riparian habitat or wetland flows, swimming pools (if dechlorinated - typically less than 1 ppm chlorine), firefighting activities, and any other water source not containing pollutants.

   2. Discharges specified in writing by the authorized enforcement agency as being necessary to protect public health and safety.

   3. Dye testing is an allowable discharge, but requires a verbal notification to the authorized enforcement agency prior to the time of the test.

   4. The prohibition shall not apply to any non-stormwater discharge permitted under an NPDES permit, waiver, or waste discharge order issued to the discharger and administered under the authority of the Iowa D~~d~~department of N~~n~~atural R~~r~~esources; provided, that the discharger is in full compliance with all requirements of the permit, waiver, or order and other applicable laws and regulations; and provided, that written approval has been granted for any discharge to the storm drain system.

B. Prohibition Of Illicit Connections:

   1. The construction, use, maintenance or continued existence of illicit connections to the storm drain system is prohibited.

   2. This prohibition expressly includes, without limitation, illicit connections made in the past, regardless of whether the connection was permissible under law or practices applicable or prevailing at the time of connection.

   3. A person is considered to be in violation of this chapter if the person connects a line conveying sewage to the MS4, or allows such a connection to continue. (2008 Code § 26.75-7)

4. Improper connections in violation of this chapter must be disconnected and redirected, if necessary, to an approved onsite wastewater management system or the sanitary sewer system as directed by the public works department.

5. Any drain or conveyance that has not been documented in plans, maps or equivalent, and which may be connected to the storm sewer system, shall be located by the owner or occupant of that property upon receipt of written notice of violation from the public works department requiring that such locating be completed. Such notice will specify a reasonable time period, not to exceed twenty-one (21) days, within which the location of the drain or conveyance is to be determined, that the drain or conveyance be identified as storm sewer, sanitary sewer or other, and that the outfall location or point of connection to the storm sewer system, sanitary sewer system or other discharge point be identified. Results of these investigations are to be documented and provided to the public works department.

9-2-7: SUSPENSION OF MS4 ACCESS:

A. Suspension Due To Illicit Discharges In Emergency Situations: The public works department or its designated agent may, without prior notice, suspend MS4 discharge access to a person when such suspension is necessary to stop an actual or threatened discharge which presents or may present imminent and substantial danger to the environment, or to the health or welfare of persons, or to the MS4 or waters of the United States. If the violator fails to comply with a suspension order issued in an emergency, the authorized enforcement agency may take such steps as deemed necessary to prevent or minimize damage to the MS4 or waters of the United States, or to minimize danger to persons.

B. Suspension Due To Detection of Illicit Discharge: Any person discharging to the MS4 in violation of this chapter may have their MS4 access terminated if such termination would abate or reduce an illicit discharge. The authorized enforcement agency will notify a violator of the proposed termination of its MS4 access. The violator may petition the city council for a reconsideration and hearing.

C. Committing Offense: A person commits an offense if the person reinstates MS4 access to premises terminated pursuant to this section, without the prior approval of the authorized enforcement agency. (2008 Code § 26.75-8)

9-2-8: INDUSTRIAL OR CONSTRUCTION ACTIVITY DISCHARGES:

Any person subject to an industrial or construction activity NPDES stormwater discharge permit shall comply with all provisions of such permit. Proof of compliance with said permit may be required in a form acceptable to the public works department or its designated agent prior to the allowing of discharges to the MS4. (2008 Code § 26.75-9)

9-2-9: MONITORING OF DISCHARGES:

A. Applicability: This section applies to all facilities that have stormwater discharges associated with industrial activity, and construction activity.

B. Access To Facilities:

1. The public works department, or its designated agent, shall be permitted to enter and inspect facilities subject to regulation under this chapter as often as may be necessary to determine compliance with this chapter. If a discharger has security measures in force which require proper identification and clearance before entry into its premises, the discharger shall make the necessary arrangements to allow access to representatives of the authorized enforcement agency.

2. Facility operators shall allow the public works department, or its designated agent, ready access to all parts of the premises for the purposes of inspection, sampling, examination and copying of records that must be kept under the conditions of an NPDES permit to discharge stormwater, and the performance of any additional duties as defined by state and federal law.

3. The public works department, or its designated agent, shall have the right to set up on any permitted facility such devices as are necessary in the opinion of the authorized enforcement agency to conduct monitoring and/or sampling of the facility's stormwater discharge.

4. The public works department, or its designated agent, shall have the right to require the discharger to install monitoring equipment as necessary. The facility's sampling and monitoring equipment shall be maintained at all times in a safe and proper operating condition by the discharger at its own expense. All devices used to measure stormwater flow and quality shall be calibrated to ensure their accuracy.

5. Any temporary or permanent obstruction to safe and easy access to the facility to be inspected and/or sampled shall be promptly removed by the operator at the written or oral request of the public works department, or its designated agent, and shall not be replaced. The costs of clearing such access shall be borne by the operator.

6. Unreasonable delays in allowing the public works department, or its designated agent, access to a permitted facility is a violation of a stormwater discharge permit and of this chapter. A person who is the operator of a facility with an NPDES permit to discharge stormwater associated with industrial activity commits an offense if the person denies the authorized enforcement agency reasonable access to the permitted facility for the purpose of conducting any activity authorized or required by this chapter.

7. If the public works department, or its designated agent, has been refused access to any part of the premises from which stormwater is discharged, and he/she is able to demonstrate probable cause to believe that there may be a violation of this chapter, or that there is a need to inspect and/or sample as part of a routine inspection and sampling program designed to verify compliance with this chapter or any order issued hereunder, or to protect the overall public health, safety, and welfare of the community, then the authorized enforcement agency may seek issuance of a search warrant from any court of competent jurisdiction. (2008 Code § 26.75-10)

9-2-10: PREVENT POLLUTANTS; BEST MANAGEMENT PRACTICES:
The public works department will adopt requirements identifying best management practices (BMPs) for any activity, operation, or facility which may cause or contribute to pollution or contamination of stormwater, the storm drain system, or waters of the U.S. The owner or operator of a commercial or industrial establishment shall provide, at their own expense, reasonable protection from accidental discharge of prohibited materials or other wastes into the municipal storm drain system or watercourses through the use of these structural and nonstructural BMPs. Further, any person responsible for a property or premises which is, or may be, the source of an illicit discharge may be required to implement, at said person's expense, additional structural and nonstructural BMPs to prevent the further discharge of pollutants to the municipal separate storm sewer system. Compliance with all terms and conditions of a valid NPDES permit authorizing the discharge of stormwater associated with industrial activity, to the extent practicable, shall be deemed compliance with the provisions of this section. These BMPs shall be part of a stormwater pollution prevention plan (SWPPP) as necessary for compliance with requirements of the NPDES permit. (2008 Code § 26.75-11)

9-2-11: WATERCOURSE PROTECTION:
Every person owning property through which a watercourse passes, or such person's lessee, shall keep and maintain that part of the watercourse within the property free of trash, debris, and other deleterious materials that would pollute, contaminate, or significantly degrade the flow of water through the watercourse. In addition, the owner or lessee shall maintain existing privately owned structures within or adjacent to a watercourse, so that such structures will not become a hazard to the use, function, or physical integrity of the watercourse. (2008 Code § 26.75-12)

9-2-12: NOTIFICATION OF SPILLS OR RELEASES:
Notwithstanding other requirements of law, as soon as any person responsible for a facility or operation, or responsible for emergency responses for a facility or operation has information of any known or suspected release of materials which are resulting or may result in illegal discharges or pollutants discharging into stormwater, the storm drain system, or waters of the U.S., said person shall take all necessary steps to ensure the discovery, containment, and cleanup of such release. In the event of a release of hazardous materials, said person shall immediately notify emergency response agencies of the occurrence via emergency dispatch services. In the event of a release of nonhazardous materials, said person shall notify the authorized enforcement agency in person or by phone or facsimile no later than the next business day. Notifications in person or by phone shall be confirmed by written notice addressed and mailed to the public works department within five (5) business days of the phone notice. (2008 Code § 26.75-13)

9-2-13: VIOLATION; NOTICE; ORDER COMPLIANCE:
A. Notice of Violation: Whenever the public works department, or its designated agent, finds that an organization has violated a prohibition or failed to meet a requirement of this chapter, the authorized enforcement agency may order compliance by written notice of violation to the responsible person. Such notice may require, without limitation:
    1. The performance of monitoring, analyses, and reporting;
    2. The elimination of illicit connections or discharges;
    3. That violating discharges, practices, or operations shall cease and desist;

4. The abatement or remediation of stormwater pollution or contamination hazards and the restoration of any affected property;
5. Payment of a fine to cover administrative and remediation costs; and
6. The implementation of source control or treatment BMPs.

B. Abatement; Restoration: If abatement of a violation and/or restoration of affected property is required, the notice shall set forth a deadline within which such remediation or restoration must be completed. Said notice shall further advise that, should the violator fail to remediate or restore within the established deadline, the work will be done by a designated governmental agency or a contractor and the expense thereof shall be charged to the violator. (2008 Code § 26.75-14)

9-2-14: APPEAL OF NOTICE OF VIOLATION:
Any person receiving a notice of violation may appeal the determination of the authorized enforcement agency. The notice of appeal must be received within five (5) days from the date of the notice of violation. Hearing on the appeal before the city council shall take place within fifteen (15) days from the date of receipt of the notice of appeal or the next regularly scheduled city council meeting, whichever comes first. The decision of the city council shall be final. (2008 Code § 26.75-15)

9-2-15: ENFORCEMENT MEASURES AFTER APPEAL:
A. If the violation has not been corrected pursuant to the requirements set forth in the notice of violation, or, in the event of an appeal, within ten (10) days of the decision of the city council upholding the decision of the authorized enforcement agency, then representatives of the public works department may enter upon the subject private property and are authorized to take any and all measures necessary to abate the violation.

B. It shall be unlawful for any person, owner, agent or person in possession of any premises to refuse to allow the government agency or designated agent to enter upon the premises for the purposes set forth in subsection A of this section. (2008 Code § 26.75-16)

9-2-16: COST OF ABATEMENT OF VIOLATION:
Violations of this chapter are subject to civil fines and penalties as prescribed by the provision of the Iowa Code sections 364.3 and 364.12, as modified by the current city code. (2008 Code § 26.75-17)

9-2-17: VIOLATION DEEMED PUBLIC NUISANCE:
In addition to the enforcement processes and penalties provided, any condition caused or permitted to exist in violation of any of the provisions of this chapter is a threat to public health, safety, and welfare, and is declared and deemed a nuisance, and may be summarily abated or restored at the violator's expense, and/or a civil action to abate, enjoin, or otherwise compel the cessation of such nuisance may be taken. (2008 Code § 26.75-18)

9-2-18: REMEDIES NOT EXCLUSIVE:
The remedies listed in this chapter are not exclusive of any other remedies available under any applicable federal, state or local law and it is within the discretion of the authorized enforcement agency to seek cumulative remedies. (2008 Code § 26.75-19)

CHAPTER 4
POST CONSTRUCTION STORMWATER MANAGEMENT
(This is a complete re-write)

9-4-1: GENERAL PROVISIONS:
The U.S. E.P.A.'s National Pollutant Discharge Elimination System ("NPDES") permit program (Program) administered by the Iowa Department of Natural Resources ("IDNR") requires that cities meeting certain demographic and environmental impact criteria obtain from the IDNR an NPDES permit for the discharge of storm water from a Municipal Separate Storm Sewer System (MS4) (MS4 Permit). The City of Bettendorf is required to obtain and has been issued such a permit. The city's MS4 permit is on file at the office of the city clerk and is also available online at the city's website.

A. As a condition of the City's MS4 Permit, the City is obliged to develop, implement and enforce a program to address stormwater runoff from new construction and reconstruction projects for which stormwater permit coverage is required.

B. No state or federal funds have been made available to assist the City in administering and enforcing the Program. Accordingly, the City shall fund its inspection, monitoring and enforcement responsibilities entirely by fees imposed on the owners or developers of properties which are made subject to the Program by virtue of state and federal law, and/or other sources of funding established by a separate chapter.

C. Land development and associated increases in impervious cover alter the hydrologic response of local watersheds resulting in increased stormwater runoff rates and volumes, flooding, stream channel erosion, and sediment transport and deposition. This stormwater runoff contributes to increased quantities of water-borne pollutants. Stormwater runoff, soil erosion and nonpoint source pollution can be controlled and minimized through the regulation of stormwater runoff from development or re-development sites.

D. Therefore, City establishes this set of City stormwater requirements to provide reasonable guidance for the regulation of stormwater runoff for the purpose of protecting local water resources from degradation. It is determined that the regulation of stormwater runoff discharges from land development and other construction activities in order to control and minimize increases in stormwater runoff rates and volumes, soil erosion, stream channel erosion, and non-point source pollution associated with stormwater runoff, is in the public interest and will prevent threats to public health and safety.

E. The City's Design Standards Manual establishes Stormwater Management guidelines consisting of sizing criteria (water quality volume, channel protection storage volume and extreme flood protection), specifications, and best management practices (BMPs). The City hereby finds and declares the Design Standards Manual, and future editions and adopted modifications, are hereby adopted as the stormwater management standards of the City.

9-4-2: PURPOSE:
The purpose of this chapter is to adopt as City's standards the guidelines established in the Design Standards Manual (hereinafter collectively called the City's "stormwater requirements" or "standards") in order to protect and safeguard the general health, safety, and welfare of the public within this jurisdiction. This chapter seeks to meet that purpose through consideration of the following objectives:

A. Minimize increases in stormwater runoff from development within the city limits and fringe areas in order to reduce flooding, siltation, increases in stream temperature, and streambank erosion in order to maintain the integrity of stream channels;

B. Minimize mass grading of sites to preserve natural features and drainage ways as well as protect open space and impervious cover;

C. Minimize increases in non-point source pollution caused by stormwater runoff from development which would otherwise degrade local water quality;

D. Distribute and minimize runoff by utilizing vegetated areas for stormwater treatment (e.g. parking lot islands, vegetated areas along property boundaries, front and rear yards, and building landscaping). Encourage infiltration and soil storage of runoff through such practices as bio-swales, soil quality improvement with compaction reduction and compost amendments, bio-retention cells and rain gardens and other BMPs guided by the Iowa Stormwater Management Manual. Plant vegetation that does not require irrigation beyond natural rainfall and runoff from the site;

E. Reduce stormwater runoff rates and volumes, soil erosion and non-point source pollution, wherever possible, through establishment of appropriate minimum stormwater management standards and BMPs and to ensure that BMPs are properly maintained and pose no threat to public safety.

9-4-3: APPLICABILITY:
A. This chapter shall be applicable to all development and redevelopment applications meeting the minimum square foot applicability criteria in item B of this section, unless eligible for an exemption or granted a waiver by City under Section 9-4-7 of this chapter. The chapter also applies to land disturbance activities that are smaller than the minimum square foot applicability criteria specified in subsection B if such activities are part of a larger common plan of development that meets the minimum square foot applicability criteria of subsection B, even though multiple separate and distinct land development activities may take place at different times on different schedules.

B. City stormwater requirements must be met for development or redevelopment to be approved. City stormwater requirements apply to any development or redevelopment disturbing one (1) acre or more of land, or to any development disturbing less than one (1) acre if the amount of impervious cover created exceeds 10,000 square feet. New development includes any new residential, commercial, or industrial subdivision or individual site improvement requiring a site development plan. The following activities are exempt from this chapter:

1. Any agricultural activity.

2. Additions or modifications to existing single family property.

3. Repairs to any stormwater BMPs deemed necessary by City.

4. Areas deemed appropriate by the City Engineer.

C. City stormwater requirements shall apply to all development within the following districts:
   1. Greenway Creek and its tributaries.
   2. Stafford Creek and its tributaries upstream from a point two hundred feet (200') south of Middle Road.
   3. Halcyon Creek and its tributaries
   4. 44th Street Creek and its tributaries
   5. All areas north of the Mississippi River that drain to the river and do not contribute stromwater to Duck Creek, except that area south of U.S. Highway 67 and east of 35th Street. The exact boundaries shall be as determined by the City Engineer from contour maps maintained in that office.

9-4-4: COMPATIBILITY WITH OTHER CHAPTERS:

A. It is intended that this chapter be construed to be consistent with previously adopted City Code Chapter 9-2, Construction Site Erosion and Sediment Control and Chapter 9-3, Illicit Discharge to Storm Sewer System.

B. The requirements of this chapter should be considered minimum requirements, and where any provision of this chapter imposes restrictions different from those imposed by any other chapter, rule or regulation, or other provision of law, whichever provisions are more restrictive or impose higher protective standards for human health or the environment shall be considered to take precedence.

9-4-5: DEFINITIONS:

For the purposes of this chapter, the following shall mean:

APPLICANT:
Property owner or agent of a property owner who has filed an application for a stormwater management permit.

BEST MANAGEMENT PRACTICE (BMP):
Practice or series of practices used to manage stormwater and as further defined in the Iowa Stormwater Management Manual.

BUILDING:
Any structure, either temporary or permanent, used or intended for supporting or sheltering any use of occupancy more than one hundred forty four (144) square feet of area.

CHANNEL STORAGE PROTECTION VOLUME:
Providing for practices that will allow for extended detention of the runoff generated by a 1-year, 24-hour event. This means capturing the runoff volume from a storm of this nature, and slowly releasing it over a period of no less than 24-hours to reduce the rapid "bounce" effect common in many urban streams that leads to downcutting and streambank erosion.

CITY STORMWATER REQUIRMENTS OR STANDARDS:
The guidelines provided for in the City's Design Standards Manual for Stormwater Management.

COSESCO:
Construction Site Erosion and Sediment Control Chapter permit issue by the City of Bettendorf Public Works Department.

DEDICATION:
The deliberate appropriation of property by its owner for general public use.

DEVELOPER:
A person who undertakes land development activities.

DEVELOPMENT:
Land disturbance activity of one acre (43,560 square feet) or more on land previously vacant of buildings or largely free of previous land disturbance activity other than traditional agricultural activities.

DRAINAGE EASEMENT:
A legally recorded document which establishes a legal right granted by a landowner to a grantee allowing the use of private land for stormwater management purposes.

ENFORCEMENT OFFICER:
That person or persons designated by the City having responsibility for administration and enforcement of this chapter.

EXTREME FLOOD PROTECTION:
Managing the effects of large storm events (1% annual recurrence or expressed in the past as the 100-year recurrence intervals) on the stormwater management system, adjacent property, and downstream facilities and property. The impacts of these extreme events are accomplished using detention controls and/or floodplain management.

IMPERVIOUS SURFACE:
Surfaces (roads, sidewalks, driveways and parking lots) that are covered by impenetrable materials such as asphalt, concrete, brick, and stone, rooftops as well as soils compacted by urban development.

INFILTRATION BASED BMP'S:
Practices that promote the movement of stormwater runoff through the soil media to provide filtration and removal of pollutants.

LAND DISTURBANCE ACTIVITY:
Any activity which changes the volume or peak flow discharge rate of rainfall runoff from the land surface. This may include the grading, digging, cutting, scraping, or excavating of soil, placement of fill materials, paving, construction, substantial removal of vegetation, or any activity which bares soil or rock or involves the diversion or piping of any natural or man-made watercourse.

LANDOWNER:
The legal or beneficial owner of land, including those holding the right to purchase or lease the land, or any other person holding proprietary rights in the land.

MAINTENANCE AGREEMENT:
A legally recorded document that acts as a property deed restriction, and which provides for long-term maintenance of storm water BMPs.

NATIVE LANDSCAPING OR VEGETATION:
Vegetation originating naturally in this region of the state and does not contain noxious or invasive weeds. It is not to be confused with existing vegetation.

PREDEVELOPMENT CONDITION:
Pre-developed conditions are hydraulic and hydrologic site characteristics existing prior to development and shall include all the natural storage areas and drainage-ways plus existing farm drainage tiles and highway drainage structures. The City Engineer may require the pre-developed condition to be equal to an undeveloped condition if drainage problems are occurring downstream due to existing development at the proposed site or in the basin.

REDEVELOPMENT:
Land disturbance activity in areas where existing land use is commercial, industrial, institutional or multi-family residential.

STREAM:
Perennial and intermittent water sources identified through site inspection, and/or an approved city of Bettendorf map, and/or United States Geological Survey (USGS) 7.5 minute series topographical map.

STREAM BUFFER:
A vegetated strip of land which lies adjacent to a stream and provides such functions as protecting water quality, providing wildlife habitat and storing flood waters.

STORMWATER MANAGEMENT:
The use of BMPs that are designed in accordance with City stormwater requirements to reduce stormwater runoff pollutant loads, discharge volumes, peak flow discharge rates and detrimental changes in stream temperature that affect water quality and habitat.

STORMWATER POLLUTION PREVENTION PLAN (SWPPP):
A plan that is designed to minimize the accelerated erosion and sediment runoff at a site during construction activities and include provisions for additional pollution prevention.

SIZING CRITERIA:
An integrated approach to managing stormwater runoff quality and quantity by addressing the adverse impacts of stormwater runoff from development. The intent is to comprehensively manage stormwater to remove pollutants and improve water quality, prevent downstream streambank and channel erosion, and safely convey and reduce runoff from extreme storm events.

WATER QUALITY VOLUME:
The runoff resulting from a rainfall depth of 1.25" with 90% of the rainfall events in Iowa are of this depth or less. By managing these storms the vast majority of water volume will be treated and many of the "first flush" pollutants of concern will be effectively managed on-site.

9-4-6: PROCEDURES AND REQUIRMENTS:

A. No land owner or developer shall receive any of the building, grading or other land development permits required for land disturbance activities without first meeting the requirements of this chapter as well as any national, state and other local permits prior to commencing the proposed activity.

B. Unless otherwise exempted by this chapter, the Stormwater Management Plan and maintenance plan must be included with the site plan or subdivision preliminary plat and include the COSESCO permit application or approved COSESCO permit. All final plats submitted after January 1, 2016 will require a revised Stormwater Management Plan and maintenance plan per this chapter and may result in modifications to previously constructed BMPs.

C. The stormwater management plan and maintenance plan shall be prepared to meet the requirements of Section 9-4-6G of this ordinance, and fees shall be those established by the City as necessary by resolution.

D. Following submission and approval of Stormwater Management Plans to the City, all applicable state and federal environmental permits shall be obtained prior to issuance of local permits including floodplain permits.

E. If the stormwater management plan and maintenance plan are approved by the City, all appropriate local land development activity permits may be issued.

F. Approvals issued in connection with this chapter shall be valid from the date of issuance through the date City notifies the permit holder that all stormwater management BMPs have passed the final inspection required.

G. The stormwater management plan and maintenance plan shall be prepared to meet the following requirements:

1. Be prepared by a Licensed Professional Engineer (PE) or Professional Landscape Architect or credentialed in a manner acceptable to the City; and

2. Indicate whether stormwater will be managed on-site or off-site and, if on-site, the general location and type of BMPs; and

3. Include a signed and dated certification, under penalty of perjury by the preparer, of the stormwater management plan that it complies with all requirements of this ordinance and applicable sections of the Design Standards Manual, and is designed to achieve City stormwater requirements.

4. Contact Information, including but not limited to the name, address, and telephone number of all persons having a legal interest in the property and the tax reference number and parcel number of the property or properties affected.

5. Topographic Base Watershed Map, at a scale no greater than 1" = 100' which extends a minimum of 200’ beyond the limits of the proposed development and indicates existing surface water drainage including streams, ponds, culverts, field tiles, ditches, and wetlands; current land use including all existing structures; locations of utilities, roads, and easements; and significant natural and manmade features not otherwise shown. A minimum of 2’ contours shall be shown on-site and 2’ contours outside of the proposed property.

6. A written or graphic inventory of the natural resources at the site and immediate area as it exists prior to the commencement of the project and a description of the watershed and its relation to the project site. This description should include a discussion of existing pre-development soil conditions such as hydric soils and areas for infiltration-based BMPs, vegetative and forest cover, topography, wetlands, and other native vegetative areas on the site. Particular attention should be paid to environmentally sensitive resources that provide particular opportunities or constraints for development.

7. Provide a Drainage Report per the Design Standards Manual.

8. A soil management plan shall be provided that includes a site map that identifies areas where soils and vegetation will not be disturbed and shows where topsoil will be stripped and stockpiled. It shall include, if used, a description of soil health (quality) improvement methods such as tilling, ripping, and amending with materials such as compost and topsoil. It shall also include a technical assessment of soils that

identifies the soil series and the site limitations based on soils data provided in the Web Soil Survey for Scott County hosted by Natural Resources Conservation Service (NRCS). Soil borings shall be included when necessary to confirm suitable site conditions for placement of buildings with basements and related structures, especially in areas with hydric soils and shallow depth to groundwater. Existing soil conditions should be considered when designing the site layout. If a stormwater BMP depends on the properties of soils, the assessment shall include the necessary information such as, but not limited to: organic content and percolation/infiltration rates. The number and location of required soil borings and/or soil test sites shall be determined based on what is needed to determine the suitability and distribution of soil types present at the location of the BMP. This information shall be used to provide a summary of the associated risks and potential for adequate drainage related to infiltration practices, groundwater mounding and basement flooding.

9. The site shall be designed to provide vegetated buffers for water quality protection adjacent to receiving channels and waters. The area shall be defined within a recorded Outlot that includes a management plan. Buffer width are based on land use as follows:
    a) Residential- The total required stream buffer width is thirty (30) feet on each side perpendicular to the waterway measured from the "top of bank".
    b) Industrial- The total required stream buffer width is fifty (50) feet on each side perpendicular to the waterway measured from the "top of bank".
    c) Mid/ High Density Residential & Commercial- The total required stream buffer width is fifty (50) feet on each side perpendicular to the waterway measured from the "top of bank".

10. A Maintenance, Repair, and Landscaping Plan that is periodically updated for all structural and nonstructural stormwater BMPs including detailed routine maintenance as well as long-term maintenance of vegetation, and repair procedures to ensure their continued efficient function shall be provided to the Public Works Department. These plans will identify the parts or components of a stormwater BMP that need to be maintained and the equipment, skills or training necessary. The plan shall also indicate who will be responsible for the maintenance of vegetation at the site. Provisions for the periodic review and evaluation of the effectiveness of the maintenance program and the need for revisions or additional maintenance procedures shall be included in the plan. Native Iowa plants and trees shall be considered for use with stormwater BMPs.

11. Dedicating Drainage Easements: Any stormwater BMP outside of the public right-of-way shall be dedicated in a perpetual unobstructed easement with satisfactory access to a public way and from a public way to a natural watercourse or to other stormwater management measure. Any such easement shall be secured by the developer and dedicated to the City without cost to the City.

12. The property owners of residential, commercial and industrial properties are responsible for all maintenance (short-term and long-term) of all BMPs, water quality practices and water quantity (flood) control practices (e.g. detention basins) constructed as part their developments. Short term maintenance shall include but is not limited to mowing, weed control, and removal of volunteer trees. Long term maintenance shall include but is not limited to dredging of basins, reshaping of basins and outlet structure replacement.

13. Copies of all existing SWPPPs (as required by the City's COSESCO ordinance) current as of the date of submission of the stormwater management final plan for all construction activities related to implementing any on-site stormwater BMPs.

14. For lot development impacted by stormwater BMPs and conveyance features:
    a) The builder shall provide to the City Engineer, or designated City representative, an Elevation Certificate that is signed and sealed by a land surveyor, engineer, or architect authorized by law to certify elevation information.
    b) The Elevation Certificate shall certify that the protected level (lowest opening or protective flood barrier that achieves the same result) of all buildings shall be a minimum of 2 feet above the 100-year water surface elevation of stormwater BMPs.

15. Any required storm sewers including foundation drain collector lines shall be separate from any required sanitary sewers and shall be installed at the developer's expense and subject to requirements of the City and shall be adequate to serve all lots or parcels of land within the area to be subdivided.
    a) The storm sewer system shall be designed with due regard to the present and reasonably foreseeable needs of the area to be subdivided and to the location and capacity of existing storm sewers and other stormwater management measures available to serve existing and reasonably anticipated development or use of areas abutting the area to be subdivided.
    b) Upon determination by the City Engineer, such storm sewers may become the property of the City, upon determination of the City Engineer through the City's inspection, approval, and acceptance of such sewers, after the developer pays to the City any reasonable costs associated with supervision of their installation or other services provided by the City.

16. Accommodating Upstream Drainage Areas: Any necessary and appropriate stormwater BMPs shall be designed to accommodate runoff from any upstream area potentially draining into or through the area to be developed, whether such area is inside or outside the area to be developed. Such design shall assume that the upstream area upon development or redevelopment will be regulated such that volume of surface water runoff shall be equal to the runoff from the current land use condition.

17. Protecting Downstream Drainage Areas: Any development shall provide for mitigation of any overload condition reasonably anticipated on any existing downstream stormwater BMPs outside the area to be subdivided, provided that the development or use of the area to be subdivided creates or contributes to such condition

9-4-7: WAIVERS:

A. Every applicant shall provide for stormwater management as required by this chapter except in certain redevelopment situations when confronted with difficult site conditions that limit design of such BMPs listed in the Iowa Stormwater Management Manual. In such case, a written request must be filed to waive implementation of BMPs in part or in whole. Requests to waive implementation of BMPs in whole or in part shall be submitted to the City Engineer for approval.

B. Partial Waivers

1. Partial waivers of BMPs required by this chapter may be granted for redevelopment projects if the proposed development is not likely to impair attainment of the objectives of this chapter. At least one of the following conditions, in successive order, shall be established by applicant based on authoritative written evidence satisfactory to the City Engineer:
    a) Alternative minimum requirements for on-site management of stormwater have been established in a stormwater management plan that has been approved by the City Engineer and fully implemented. If the applicant is unable, for good cause shown, to meet the requirements of this subsection, the applicant shall meet the following condition:
    b) Provisions are made to manage stormwater by an off-site facility that has been approved by the Municipal Engineer. The off-site facility is required to be in place, to be designed and adequately sized to provide a level of stormwater control that is equal to or greater than that which would be afforded by on-site practices and there is a responsible entity legally obligated to monitor the performance of and maintain the efficiency of stormwater BMPs in accordance with an approved maintenance plan.

2. In instances where one of the above conditions is established, the applicant must further establish by authoritative written evidence satisfactory to the City Engineer that the partial waiver will not result in any of the following impacts to downstream waterways:
    a) deterioration of existing culverts, bridges, dams, and other structures;
    b) degradation of biological functions or habitat;
    c) accelerated streambank or streambed erosion or siltation;
    d) Increased threat of flood damage to public health, life, property.

9-4-8: CONSTRUCTION INSPECTION:

A. After construction is completed, applicants are required to submit actual “as-built” drawings satisfactory to the City for any stormwater BMPs located on-site. The drawings must show the final design specifications for all stormwater BMPs and must be certified by a

Professional Engineer, Landscape Architect or credentialed in a manner acceptable to the City.

B. Construction inspections will be conducted by the City or designated representative of the City at the conclusion of a development or redevelopment project after as-built survey and plans are submitted to ensure the stormwater BMPs have been built according to the stormwater management plan. An updated "as-built" survey plan with contours must be submitted to the City every five (5) years to ensure the facility continues to meet the approved design requirements.

9-4-9: MAINTENANCE AND REPAIR OF STORMWATER BMPs:

A. The applicant or owner of every site, or an assignee qualified, shall be responsible for maintaining as-built water quality BMPs in an effective state.

B. Prior to the issuance of a COSESCO permit that has a stormwater management BMP as one of its requirements of the permit, and part of receiving approval of the stormwater management plan, the applicant or owner of the site agree to provide for access to the BMP and the land it serves at reasonable times for periodic inspection by City or City's designee to ensure that the BMP is maintained in proper working condition to meet City stormwater requirements.

C. Maintenance of all stormwater management BMPs shall be ensured through the creation of a maintenance plan that must be approved by City at time of the stormwater management plan approval. As part of the plan, a schedule shall be developed for when and how often maintenance will occur to ensure proper function of the stormwater management BMPs. The plan shall also include plans for periodic inspections to ensure proper performance of the BMPs between scheduled cleanouts.

D. The owners of all stormwater management BMPs must undergo an annual inspection to document maintenance and repair needs and ensure compliance with the requirements of this chapter and accomplishment of its purposes. This annual inspection shall be performed by a Professional Engineer, Landscape Architect or individual credentialed in a manner acceptable to the City at the owner's expense. Any maintenance or repair needs detected must be corrected by the developer or entity responsible in a timely manner, as determined by City, and the inspection and maintenance requirement may be increased as deemed necessary to ensure proper functioning of the stormwater management BMPs.

E. Parties responsible for the operation and maintenance of stormwater management BMPs shall make records of the installation and of all maintenance and repairs, and shall retain the records for at least three (3) years. These records shall be made available to City during inspection of the facility and at other reasonable times upon request.

F. If a responsible party fails or refuses to meet the requirements of the approved plan or any provision of this chapter, the City, after reasonable notice, may correct a violation by performing all necessary work to place the BMP in proper working condition, or contract with others for such purpose, and charge all costs, including administration, to who the order

is directed. If the cost of remedying a condition is not paid within thirty (30) days after the mailing of a statement therefore from the director of public works, the cost shall be assessed against the property for collection in the same manner as a property tax. In the event the association fails or is unable to pay the costs associated with detention facility maintenance, these costs shall be assessed against those users of the facility based upon their percentage of use.

G. Owners of all existing detention basins constructed before January 1, 2016 will have until June 30, 2018 to complete any necessary maintenance on such basins and submit the required "as-built" survey. Failure to comply with this section will result in enforcement actions as outlined in this chapter.

9-4-10: ENFORCEMENT BY LEGAL OR ADMINISTRATION ACTION:

A. Violation of any provision of this chapter may be enforced by civil action including an action for injunctive relief. In any civil enforcement action, administrative or judicial, the City shall be entitled to recover its attorneys' fees and costs from a person who is determined by a court of competent jurisdiction to have violated this chapter.

B. Violation of any provision of this chapter may also be enforced as a municipal infraction within the meaning of Iowa Code Section §364.22, pursuant to the City's municipal infraction chapter.

C. Restoration of lands: Any violator may be required to restore land to its undisturbed condition. In the event that restoration is not undertaken within a reasonable time after notice, City may take necessary corrective action; the cost shall be assessed against the property for collection in the same manner as a property tax.

9-4-11: APPEALS:

Individuals or businesses who believe the provisions of this chapter have been applied in error may appeal as follows:

A. An appeal shall be filed, in writing, with the City Director of Public Works within five (5) business days of the decision or enforcement action. The appeal should include any information provided by competent authority with the requisite expertise to ascertain the nature of the offense alleged in the enforcement action.

B. Using the information provided by the department, the director shall immediately conduct a review of the conditions on the property and respond to the appeal in writing within five (5) workdays.

C. A decision of the director which is adverse to an appellant may be further appealed to the City Council. Notice of the appeal shall be served on the City Clerk by the appellant, within five (5) working days of receipt of the decision of the director, stating the reasons for appeal. The City Council shall hold a public hearing, giving the appellant and the director the

opportunity to provide any information deemed relevant. Thereafter, the council shall affirm, reverse, or modify the decision of the director.

D. There shall be no further appeal of the matter except as otherwise provided by law. (2008 Code § 28-116)

CHAPTER 3
CONSTRUCTION SITE EROSION AND SEDIMENT CONTROL ~~(ESC)~~

9-3-1: CITY AUTHORITY AND RESPONSIBILITY:

A. The U.S. EPA's N~~n~~ational P~~p~~ollutant D~~d~~ischarge E~~e~~limination S~~s~~ystem (NPDES) permit program administered by the Iowa D~~d~~epartment of N~~n~~atural R~~r~~esources (IDNR) requires that agencies meeting certain demographic and environmental criteria obtain from the IDNR an NPDES permit for the discharge of stormwater from a municipal separate storm sewer system (MS4) (MS4 Permit). The city is required to obtain and has been issued such a permit. The city's MS4 permit is on file at the office of the city clerk and is also available online at the city's website.

B. ~~The NPDES program requires individuals who desire to conduct earth disturbing activities related to construction on one acre of land or more, to submit an application to the IDNR for an NPDES general permit #2 for stormwater discharge associated with industrial activity for construction activities.~~

The NPDES program requires any person, firm, sole proprietorship, partnership, corporation, agency, or political entity required by law or administrative rule who is engaged in construction activities to submit an application to the IDNR for an NPDES General Permit #2 for stormwater discharge associated with industrial activity, and also to obtain from the City a Construction Site Erosion and Sediment Control (COSESCO) permit.

C. ~~As a condition of the city's permit, the city is obligated to undertake primary responsibility for administration and enforcement of the NPDES program by adopting a procedure to be followed by all general permit #2 applicants.~~

1. ~~Any person, firm, sole proprietorship, partnership, corporation, agency, or political entity required by law or administrative rule to apply to the IDNR for an NPDES general permit #2 shall also be required to obtain from the city a construction site erosion and sediment control (COSESCO) permit in addition to the NPDES general permit #2.~~

2. ~~The city shall have the primary responsibility for inspection, monitoring, and enforcement of both the NPDES general permit #2 and the COSESCO permit.~~

Notwithstanding any provision of this chapter, every applicant bears final and complete responsibility for compliance with a NPDES General Permit #2 and any other requirement of state or federal law or administrative rule

D. ~~No state or federal government funds have been made available to defray the costs of the city's administration and enforcement of the NPDES permit program. Pursuant to these governmental mandates, the city must fund the permit program. (2008 Code § 28-100)~~
The City shall have the primary responsibility for inspection, monitoring, and enforcement of both the NPDES General Permit #2 and the COSESCO permit.

E. No state or federal government funds have been made available to defray the costs of the city's administration and enforcement of the NPDES permit program. Pursuant to these governmental mandates, the city must fund the permit program. (2008 Code § 28-100)

F. Issuance of a COSESCO permit shall be a condition precedent for the issuance of a building permit for that site or development. (Moved from 9-3-3C)

9-3-2: APPLICATION FOR PERMIT; FEE:

A. Application: Applications for COSESCO permits shall be made on forms approved by the city and available at city hall, maintenance annex, and online at the city's website.

B. ~~Fee: Applicants will be charged a fee of fifty dollars ($50.00) for each permit for processing. (2008 Code § 28-110)~~

An applicant applying for a COSESCO permit shall pay fees as follows:

1. Before any COSECO permit application is issued by the Community Development Department, a plan review fee shall be paid by the applicant. If required materials are incomplete or changed so as to require additional review, an additional review fee shall be charged to the applicant for each review necessary.

2. A permit fee shall be due upon acceptance of an application based upon estimated amount of land disturbance, including areas to be dedicated to the City.

3. For each inspection required by this chapter, the applicant shall pay an inspection fee in the amount set from time to time by City Council resolution.

4. An annual permit renewal fee. *(Billing questions need to be addressed)*

Failure of the applicant to pay an inspection fee within thirty (30) days of billing shall constitute a violation of this chapter.

C. By submission of a COSESCO permit application, the applicant agrees to defend, indemnify and hold the City harmless from any and all claims, damages or suits arising directly or indirectly out of any act of commission or omission by the applicant, or any employee, agent, assign or contractor or subcontractor of the applicant, in connection with the applicant's State NPDES General Permit #2 and/or COSESCO permit.

9-3-3: SUPPORTING DOCUMENTATION:

A. An applicant who has applied for an NPDES general permit #2 through submittal of a notice of intent (NOI) to the IDNR shall subsequently submit to the city copies of the following materials as a basis for the city to issue a COSESCO permit:

1. Applicant's NPDES general permit #2 NOI and authorization letter.

2. The site specific stormwater pollution prevention plan (SWPPP) utilizing the city checklist for such plans available at the public works department.

3. Applicant's plans, specifications, and supporting data, if not already part of the NOI submittal, to include any information regarding concentrations of stormwater pollutants, if known, and not already required to be submitted.
4. Completed COSESCO permit application with applicable fees.

B. Every SWPPP submitted to the city in support of an application for a COSESCO permit shall have the following:

1. ~~A statement that the plan meets all current minimum mandatory requirements of the IDNR for SWPPPs in connection with the issuance of an NPDES general permit #2, as stated in the summary guidance for the permit~~.
A written document separate from engineered plans that comply with all current minimum mandatory requirements for SWPPP's promulgated by the IDNR in connection with issuance of a state NPDES General Permit #2.

2. A statement that the plan complies with the minimum mandatory requirements of the joint application form, "Protecting Iowa Waters", Iowa department of natural resources, and the U.S. army corps of engineers.

3. A certification ~~by the person preparing the SWPPP, that the plan complies with all other applicable state or federal permit requirements in existence at the time of application and all requirements of this chapter~~.
shall be prepared by a licensed professional engineer, landscape architect, or a certified professional in erosion and sediment control, credentialed in a manner acceptable to the City.

4. A signed and dated certification by the person preparing the SWPPP, that the plan complies with all other applicable state or federal permit requirements in existence at the time of application and all requirements of this chapter.

C. ~~Issuance of a COSESCO permit shall be a condition precedent for the issuance of a building permit for that site or development~~. (Moved to 9-3-1F)
In addition to the SWPPP requirements stated above which constitute minimum mandatory requirements imposed by the Program, every SWPPP submitted to the city in support of an application for a COSESCO Permit shall comply with the Statewide Urban and Design Specifications Design Manual for design, location, and phased implementation of effective, practicable stormwater pollution prevention measures, and shall also:

1. Assure that stockpiled soil or other materials subject to erosion by wind or water are covered, vegetated, or otherwise effectively protected from erosion and sedimentation in accordance with the amount of time the material will be on site and the manner of its proposed use; no stockpiling is allowed in the street.

2. Identify measures and procedures to reasonably minimize site soil compaction.

3. Assure that all temporary erosion and sediment control measures shall not be removed until the site has been permanently stabilized.

4. Assure that all disturbed sites be permanently stabilized with 70% perennial cover as defined by the US EPA NPDES General Permit.

5. Identify methods to prevent sediment damage to adjacent properties and sensitive environmental areas.

6. Provide for design and construction methods to stabilize steep or long continuous slopes.

7. Protect storm sewer infrastructure from sediment loading/plugging.

8. Specify precautions to be taken to contain sediment when working in or crossing water bodies and streets.

9. Provide for proper disposal of collected sediment and floating debris.

D. For the duration of the time that the construction site is subject to the NPDES general permit #2 and the COSESCO permit, the applicant shall provide to the city, and keep current, the following:
   1. The name, address, and telephone number of the person designated by the applicant ~~to~~ who is knowledgeable and experienced in erosion and sediment control and who will oversee compliance with the NPDES general permit #2 and the COSESCO permit.

   2. The name, address, and telephone number of the individual or firm responsible for the installation and maintenance of each ~~ESC measure delineated~~ erosion and sediment control measure identified in the SWPPP.

   3. Applicant's failure to provide current information shall constitute a violation of this ordinance.

E. If the applicant for the NPDES general permit #2 and the COSESCO permit is not the same individual as the owner/builder on the site, then the applicant has the option to include the owner/builder as a co-permittee. Co-permittees have the same obligations and responsibilities as the original applicant. Absent written confirmation of transfer of responsibility signed by both the parties and provided to the city at the office of the enforcement official, the original applicant remains obligated and responsible for permit compliance on any parcel of the site, whether the parcel has been sold or not. (2008 Code § 28-111)

F. Upon receipt of an application for a COSESCO permit, the City shall either find that the application complies with this chapter and issue a City COSESCO Permit in accordance with

this chapter, or that the application fails to comply with this chapter, in which case the City shall provide a written report identifying non-compliant elements of the application.

9-3-4: PERMIT TERM

A. A COSESCO permit shall be valid for three hundred sixty-five (365) calendar days from its date of issuance and must be renewed annually.

B. A COSESCO permit shall be considered expired one hundred eighty (180) calendar days after the date of issuance if permitted work has not commenced.

9-3-45: INSPECTIONS FOR PERMITS:

A. All inspections required under this chapter will be conducted by a designated person from the public works department, herein referred to as the "enforcement official".

B. The applicant will notify the enforcement official in writing when all measures required by the applicant's SWPPP have been accomplished, whereupon, the enforcement official shall conduct an inspection for verification. The enforcement official shall provide the applicant with a written response indicating compliance with the SWPPP or a list of conditions of noncompliance. This response shall be provided within ~~one workweek~~ five (5) business days of receipt of the applicant's notification to the city. Upon receipt of the conditions of noncompliance, the applicant will take immediate action to correct items of concern and shall complete actions within forty eight (48) hours.

C. Construction shall not occur on the site at any time when the city has identified conditions of noncompliance.

D. The city shall not be responsible for the direct or indirect consequences to the applicant, or any third parties, for any noncompliant conditions undetected by the inspection process, nor shall the inspection be deemed any guarantee by the city that the work performed is in conformance with the requirements of city, state, or federal law. (2008 Code § 28-112)

9-3-~~5~~6: MONITORING PROCEDURES FOR PERMITS:

A. Upon the issuance of a COSESCO permit, the applicant has an absolute duty to monitor site conditions and report to the enforcement official any change in circumstances or site conditions the applicant knows, or should know, pose a risk of stormwater discharge in a manner inconsistent with the applicant's SWPPP, NPDES general permit #2, or COSESCO permit.

   1. Such report shall be made by the applicant immediately, but in any event within twenty four (24) hours of the change of circumstances or site conditions.

   2. Failure to make a timely report shall constitute a violation of this ordinance.

B. ~~The site condition report shall be made by the applicant to the enforcement official immediately upon knowledge of site condition changes, but no later than twenty four (24) hours after the changed condition~~.

Any third party may also report to the City site conditions which the third party reasonably believes pose a risk of stormwater discharge in a manner inconsistent with the permittee's SWPPP, General Permit #2 and/or COSESCO Permit.

C. Upon receiving a changed conditions report, the enforcement official shall ~~will~~ conduct an inspection of the site as soon as reasonably possible and will provide the applicant a list of items not meeting compliance. The applicant shall immediately commence corrective actions. Items needing correction must be completed within forty eight (48) hours. The enforcement official may extend the deadline for correction based upon good cause.

D. Unless a report is made to the enforcement official pursuant to the previous sections of this chapter, the official will conduct at least one unannounced inspection of the site during the construction process. As with subsection C of this section, the applicant has the same duty to correct any deficiencies noted during the inspection. (2008 Code § 28-113)

E. The City shall not be responsible for the direct or indirect consequences to the permittee or to third-parties for non-compliant conditions undetected by inspection or monitoring.

F. Inspection Access. The city employee authorized to enforce this section shall be permitted to enter and inspect facilities subject to regulation under this section as often as necessary to determine compliance with this section. If a discharger has security measures that require identification and clearance before entry to its premises, the discharger shall make the necessary arrangements to allow access to the city employee authorized to enforce this section.

9-3-~~6~~7: TERMINATION OF PERMIT:

A. Within thirty (30) days after final stabilization at the construction site, as defined by the IDNR in its NPDES general permit #2, the owner (permittee) shall submit a notice of termination to the enforcement official of the Public Works Department. The notice shall contain the following information:

1. The name and address of the owner (permittee) to whom the permit was issued.

2. The permit authorization number.

3. The date the construction site reached final stabilization.

4. ~~A certification that the disturbed soils have been finally stabilized and temporary sediment control devices will be removed at an appropriate time. The permittee will acknowledge that he/she is no longer authorized to discharge stormwater associated with construction at this site. (2008 Code § 28-114~~)
A statement certifying that the permittee shall minimize soil compaction and, unless infeasible, preserve topsoil as defined by the IDNR in the General Permit #2, and the disturbed soils have been finally stabilized and temporary sediment control devices will be removed at an appropriate time. The permittee will also acknowledge that

he/she is no longer authorized to discharge stormwater associated with construction at this site. (2008 Code § 28-114)

B. Upon receipt of the Notice of Termination, the enforcement officer shall conduct a final inspection of the site for the purpose of verifying final stabilization. Within a reasonable time thereafter, the enforcement officer will report to the applicant that either final stabilization is achieved, or that final stabilization has not been achieved before COSESCO termination is accepted.

9-3-~~7~~8: VIOLATION; ENFORCEMENT:

A. Violation of any provision of this chapter may be enforced by civil action including an action for injunctive relief. In any civil enforcement action, administrative or judicial, the city shall be entitled to recover its legal fees and costs from a person who is determined by a court of competent jurisdiction to have violated this chapter.

B. Violation of any provision of this chapter may also be enforced as a municipal infraction within the meaning of Iowa Code section 364.22. The schedule of fines follows the provisions of section 1-4-2 of this code, except as shown herein:

1. Schedule of violations

Type I:	First offense	$100
	Second offense	$250
	Third and subsequent offense	$500
Type II:	First offense	$250
	Second and subsequent offense	$500

2. Definition of offenses

Type I:

a) Failure to control off site tracking of soils, silt, sediment, or mud.
b) Failure to implement stormwater pollution prevention controls as designated in the SWPPP.
c) Failure to maintain stormwater pollution prevention controls.
d) Failure to document any stormwater discharge that is a violation of water quality standards or in a manner in-consistent with the applicants SWPPP, General Permit #2 and/or COSESCO Permit.

Type II:

a) Operating without a COSESCO permit.
b) Discharging ~~excessive amounts of sediment~~ silt/ sediment to the City of Bettendorf's storm or sanitary sewers.
c) Failure to comply with a written directive issued by the city engineer, director of public works, or the enforcement official designated by the city.

C. Enforcement pursuant to this section shall be undertaken by the enforcement official upon the advice and consent of the city attorney. (2008 Code § 28-115)

9-3-9: STOP WORK ORDER:

A. In the event any person holding a COSESCO Permit pursuant to this ordinance violates the requirements of the permit as is described herein or carries on-site development in such a manner so as to materially adversely affect the health, welfare, environment, or safety of persons residing or working in the neighborhood of the development site or so as to be materially detrimental to the public welfare or injurious to property or improvements in the neighborhood, the enforcement official shall suspend or revoke the COSESCO Permit.

B. The suspension of a COSESCO Permit shall be a written stop work order issued by the enforcement officer to the permittee or his agent or the person performing the work. The stop work order shall be effective immediately, shall state the specific violations cited, and the conditions under which the work may be resumed. A stop work order shall remain in effect until the enforcement officer has approved corrective measures.

C. Any person who shall continue any work after having been served with a stop work order, except such work as the person is directed to perform to remove a violation, shall be subject to penalties as stated in this chapter.

9-3-~~8~~10: APPEALS:

Individuals or businesses who believe the provisions of this chapter have been applied in error may appeal as follows:

A. An appeal shall be filed, in writing, with the city director of public works within five (5) business days of the decision or enforcement action. The appeal should include any information provided by competent authority with the requisite expertise to ascertain the nature of the offense alleged in the enforcement action.

B. Using the information provided by the department, the director shall immediately conduct a review of the conditions on the property and respond to the appeal in writing within five (5) workdays.

C. A decision of the director which is adverse to an appellant may be further appealed to the city council. Notice of the appeal shall be served on the city clerk by the appellant, within five (5) working days of receipt of the decision of the director, stating the reasons for appeal. The city council shall hold a public hearing, giving the appellant and the director the opportunity to provide any information deemed relevant. Thereafter, the council shall affirm, reverse, or modify the decision of the director.

D. There shall be no further appeal of the matter except as otherwise provided by law. (2008 Code § 28-116)

Design Standards Manual

Table of Contents

CHAPTER 1 – STORMWATER MANAGEMENT

Section 1: General Information

1.1 Concept

This section contains storm water management criteria. Emphasis should be placed on detention and storage of rainfall to mitigate increased runoff due to development. This should result in a reduction of increased development runoff and related damage to downstream properties.

1.2 Conditions

1. The design provided by the Project Engineer should demonstrate:

    A. The streets function as part of the storm water system. The computed amount of runoff in streets should not exceed the requirements set forth herein.

    B. Gutters and intakes are adequately designed to prevent excessive flooding of streets and parking.

    C. Culverts and storm pipes are designed to accommodate the design storm.

    D. Adequate overland relief is present for storms larger than the design storm. Channels and respective easements are adequately sized.

    E. Street grades are coordinated with lot drainage. Lot drainage slopes should not be less than 1.5 percent.

        1) Where such slopes are not possible in rear and side yards, spot elevations and flow arrows should be included at each rear lot corner and at the midpoint of the side yard line. Plans should note the builder will grade rear and side yard swales to drain to the right-of-way.

    F. The storm drainage system design should consider surface and subsurface sources. The discharge from subdrain systems should not flow over sidewalks or onto streets.

2. The Project Engineer should evaluate storm water management alternatives and select a design to best balance initial capital costs, maintenance costs, safety, and environmental protection.

3. Runoff analysis should be based upon proposed (including future where applicable) land use and consider contributing runoff from offsite areas.

4. The Project Engineer should consider the future land use of all undeveloped land tributary to the study area and develop assumptions for runoff and stormwater management.

    A. The probable future flow pattern in the undeveloped areas should be based on existing natural topographic features (existing slopes, drainage ways, etc.)

    B. Average land slopes in both developed and undeveloped areas may be used in computing runoff. Known and proposed drainage patterns and slopes should be utilized where possible.

5. Flows and velocities which may occur when the upstream area is fully developed should be considered. Drainage facilities should be designed to prevent erosion damage.

6. The preservation of natural drainageways is recommended and encouraged whenever possible, in accordance with City of Bettendorf code. The changing of natural drainageway locations may not be approved unless shown to be without unreasonable hazard and liability, substantiated by thorough analysis and investigation. Deteriorated drainageways may be required to be stabilized as determined by the City Engineer.

7. Drainage and stormwater detention easements may be required for the protection and maintenance of drainage swales and detention areas. The Project Engineer should show that natural and constructed channels will have no adverse effect on adjacent properties and downstream areas.

8. Grading of the project site should take advantage of existing contours and minimize soil disturbance. Steep slopes (>3:1) should be avoided. If steep slopes are necessary, an attempt should be made to save natural grasses, shrubs and trees on these slopes and reestablish ground cover and permanent erosion control measures as soon as possible.

9. During construction grading, temporary diversions, contour furrows, terraces and other remedial conservation practices should be used to reduce erosion and excessive water drainage to downstream adjacent properties. Sediment traps and basins should be used and maintained at the lower end of the drainage ways.

10. Plan and design drainage systems so erosion and/or flooding problems are not transferred from one property to another.

11. Floodplain and floodway information will be required on drainage plans when known, and should include the area inundated by the major storm headwater.

12. Where a master drainage plan for a City is available, the flow routing for both the minor storm and major storm runoff should conform to this plan. Drainage easements conforming to the master plan will be required and should be designated on drainage plans and subdivision plats.

13. The design for storm water management facilities shall conform to this Manual and applicable regulations of the Iowa Department of Natural Resources and US Environmental Protection Agency. In case of a conflict between the design criteria, the more restrictive requirement shall apply.

14. Construction standards shall be the City of Bettendorf Standard Specifications for Public Improvements.

15. Possible wetland areas shall be investigated and identified as appropriate.

Section 2: Drainage Report

2.1 Purpose

The purpose of the drainage report is to estimate and propose solutions for increased runoff due to proposed development. The report must include adequate analysis and discussion of off-site drainage and the capacity of downstream drainage systems to determine their ability to convey the developed discharge.

The drainage report and plan shall be reviewed and accepted by the City Engineer prior to approval of improvement plans. The Project Engineer may be required to submit a drainage report, plan, and permit application to the Iowa Department of Natural Resources and/or Corps of Engineers. The drainage report shall be certified by a Professional Engineer licensed to practice in the State of Iowa.

2.2 Instructions for Preparing the Drainage Report

1. Include a cover sheet with project name and location, name of firm or agency preparing the report, Professional Engineer's signed and sealed certification, and table of contents. Number each page of the report.

2. All analyses shall be performed according to the intent of professionally recognized methods. Any modifications to these methods shall be supported by well-documented and industry accepted research.

3. It is the designer's responsibility to provide all data requested. If the method of analysis (for example, a computer program) does not provide the required information, then the designer shall select alternate or supplemental methods to ensure the drainage report is complete and accurate.

4. Acceptance of a drainage report implies the City concurs with the project's overall stormwater management concept. This does not constitute a full approval of the improvement plans, alignments, and grades, since constructability issues may arise in plan review.

5. The report format is shown in Appendix A. Use all headings listed in the order given. A complete report will include all the information requested in this format. If a heading listed does not apply, include the heading and briefly explain why it does not apply. Include additional information and headings as required to develop the report.

6. This Design Standards Manual does not preclude the utilization of methods other than those referenced nor does it relieve the designer of responsibility for analysis of issues not specifically mentioned.

Section 3: Rainfall and Runoff Analysis

Updated to NOAA Atlas 14 Rainfall Data January 2015 (Use NOAA Atlas Data provided in table). Preferred Design Assumptions

Bettendorf is located within Climate Section 6 as shown in Figure 1 of ISWMM Section 2C-2. Rainfall values used for stormwater design analysis should be taken from values from NOAA Atlas 14 Rainfall Data. It is recommended to interpolate as needed to obtain rainfall amounts for storm durations which are not listed within this table.

**Generally, rainfall intensities are used for the Rational Method and rainfall depths are used for NRCS TR-20 and TR-55.*

Rainfall Depth and Intensity for Various Return Periods

	Return Period															
	1 year		*2 year*		*5 year*		*10 year*		*25 year*		*50 year*		*100 year*		*500 year*	
Duration	***D***	***I***	***D***	***I***	***D***	***I***	***D***	***I***	***D***	***I***	***D***	***I***	***D***	***I***	***D***	***I***
5 min	0.38	4.56	0.44	5.30	0.54	6.56	0.63	7.65	0.76	9.18	0.86	10.3	0.97	11.6	1.23	14.8
10 min	0.55	3.33	0.64	3.87	0.8	4.8	0.93	5.58	1.11	6.70	1.26	7.60	1.42	8.54	1.80	10.8
15 min	0.67	2.70	0.78	3.14	0.97	3.88	1.13	4.53	1.36	5.45	1.54	6.18	1.73	6.94	2.20	8.81
30 min	0.95	1.90	1.11	2.22	1.38	2.76	1.61	3.22	1.94	3.88	2.20	4.40	2.47	4.95	3.14	6.29
1 hr	1.23	1.23	1.44	1.44	1.80	1.80	2.11	2.11	2.58	2.58	2.96	2.96	3.36	3.36	4.37	4.37
2 hr	1.51	0.75	1.77	0.88	2.22	1.11	2.62	1.31	3.22	1.61	3.71	1.85	4.24	2.12	5.60	2.80
3 hr	1.68	0.56	1.96	0.65	2.47	0.82	2.93	0.97	3.63	1.21	4.22	1.40	4.85	1.61	6.50	2.16
6 hr	1.97	0.32	2.30	0.38	2.89	0.48	3.45	0.57	4.3	0.71	5.02	0.83	5.8	0.96	7.87	1.31
12 hr	2.28	0.19	2.65	0.22	3.31	0.27	3.93	0.32	4.88	0.40	5.68	0.47	6.56	0.54	8.87	0.73
24 hr	2.60	0.10	3.01	0.12	3.75	0.15	4.42	0.18	5.44	0.22	6.29	0.26	7.22	0.30	9.64	0.40
48 hr	2.98	0.06	3.43	0.07	4.22	0.08	4.93	0.10	6.01	0.12	6.90	0.14	7.86	0.16	10.3	0.21
3 day	3.28	0.04	3.72	0.05	4.51	0.06	5.24	0.07	6.32	0.08	7.22	0.10	8.19	0.11	10.7	0.14
4 day	3.53	0.03	3.98	0.04	4.78	0.04	5.50	0.05	6.58	0.06	7.49	0.07	8.46	0.08	10.9	0.11
7 day	4.17	0.02	4.67	0.02	5.53	0.03	6.29	0.03	7.39	0.04	8.30	0.04	9.25	0.05	11.6	0.06
10 day	4.75	0.01	5.30	0.02	6.24	0.02	7.04	0.02	8.20	0.03	9.12	0.03	10.0	0.04	12.4	0.05

D= Total depth of rainfall for given storm duration (inches)
I= Rainfall intensity for given storm duration (inches/hour)

Addressing Small Storm Hydrology:
Note per the table above, 90% of the rainfall events that typically occur in Central Iowa have been of 1.25" depth or less. Without proper planning and installation of appropriate best management practices (BMPs) that address these types of events, runoff from these storms will go largely unmanaged, leading to more frequent storm discharges and greater runoff volumes being released to urban stream corridors.

Section 4: Time of Concentration

Reference: Section 2C-3 of the Iowa Stormwater Management Manual (ISWMM)

4.1 Preferred Design Assumptions

The following values and methods are recommended for use in completing calculations for time of concentration within the City of Bettendorf.

1. *Design calculations shall include a detailed explanation and evidence supporting any variation from these recommended methods or values.*

4.2 Existing conditions analysis for areas of undeveloped agricultural lands:

To better reflect the retention of rainfall on large areas of undeveloped landscapes, use the NRCS lag method.

1. *Note that the value for "Y" in the equation given is average watershed land slope, not slope along the stream length. Slope data from county soil surveys or LIDAR topographic information can often be used to compute this value.*

2. *Be aware of the limitations of this method as listed in note 2d of ISWMM Section 2C-3.*

4.3 Existing and proposed conditions near or within urbanized areas:

Use Manning's Kinematic Solution Method.

Apply the following additional information:

1. **Sheet flow.** Sheet flow is very shallow, uniform flow that usually occurs along the upper edges of a watershed. It only occurs until water reaches a point where flow will concentrate in a small depression or swale.

   **Sheet flow should never be measured past the point where contours indicate flow will begin to funnel to a common path. Follow the following guidelines for sheet flow calculation:*

2. **Flow Length (maximum values – stop at point of concentration for each sub-area)**
   A. **Pre-development conditions:** No greater than 100 feet.

   B. **Post-development conditions:** No greater than 50 feet of lawn, grass or wooded area unless specific practices are installed that encourage sheet flow conditions (level spreader, etc.) Total including paved surfaces no greater than 100 feet.

3. **Roughness coefficient.** Use values listed in the table below.

   **Note that these values for "n" are different than those to be used for Manning's equation used for open channel flow.*

Surface Description	Manning's "n"
Smooth Surfaces (Pavement)	0.011
Cultivated agriculture	0.17
Prairie grasses	0.15
Turf grass lawns	0.24
Woods	0.40

4. **Shallow concentrated flow.** Use the following equation to calculate flow velocity (from FHWA Hydraulic Engineering Circular No.22, Third Edition, September 2009):

$V = Ku * k * \sqrt{Sp}$ (From equation 3-4, page 3-9 of HEC-22)
Where Ku = 3.28 (for English units)
V = Velocity (ft/s)
k = Intercept coefficient (from Table)
Sp = Slope along flow path (%, i.e. 2% = 2)

Intercept Coefficients from Equation 3-4 (from Table 3-3 of HEC-22)

Land Cover	k
Forest with Heavy ground liter, hay meadow	0.076
Trash fallow or minimum tillage cultivation; contour or stripped cropped; woodland	0.152
Short pasture grass	0.213
Cultivated straight row	0.274
Nearly bare and untilled	0.305
Grassed waterway	0.457
Unpaved	0.491
Paved areas; small upland gullies	0.619

5. **Open Channel flow.** Use Manning's equation for open channel flow – Equation 4 (ISWMM Section 2C-3, page 6) based on channel cross-section properties and surface conditions.

   A. Refer to Table 2 for values of "n" for this equation (ISWMM Section 2C-3, page 12).

   B. Include with submitted calculations details on the assumed cross-section of the channel and surface conditions used to select value of "n".

      Note that these values for "n" are different than those to be used for sheet flow discussed earlier.

   C. *Caution: Improper calculation of time of concentration can dramatically affect calculated peak flow rates, especially when the Rational Method is being used. To a lesser extent, it will affect the shape and peak of hydrographs developed using the NRCS TR-20 or TR-55 methods.*

   D. Note: NRCS WinTR-55 may be utilized to determine time of concentration. Parameters set forth previously in this section shall be used as inputs when using WinTR-55.

Section 5: Storm Sewer System Design

5.1 Minor and Major Storms

Every urban area has two distinct drainage systems. One is the minor system corresponding to the minor storm event having a return frequency of 10 years. The other is the major system corresponding to the major storm event having a return frequency of 100 years. Since the effects and routing of the major storm runoff may not be the same for the minor storm, storm drainage plans submitted should include the routing path and effects of both the minor and major storm.

Table 5.1 Chance of a Storm Equaling or Exceeding A Given Frequency for a Given Time Period

Frequency (years)	Time Period (years) 1	10	25	50	100
5	20%	89%	99.9%	99.9%	99.9%
10	10%	65%	94%	99.9%	99.9%
25	4%	34%	64%	87%	98%
50	2%	16%	40%	60%	86%
100	1%	9.6%	22%	39%	64%

1. Minor Storm Provisions
   The minor storm drainage system should be designed to protect against regularly recurring damage, reduce street maintenance costs, and provide an orderly urban drainage system and to provide public convenience. Storm sewer systems consisting of underground piping, natural drainageways and other required conveyance should be considered part of the minor storm drainage system.

2. Major Storm Provisions
   The major storm drainage system should be designed to prevent major property damage or loss of life from storm runoff expected from the major storm. The effects of the major storm on the minor drainage system should be noted in the drainage report.

5.2 Location of Storm Sewer

1. Storm Sewers in Public Right-of-Way:
   A. Storm Sewers parallel to the street and in the right-of-way should be placed behind the back of curbs, as close as practical to fit specific manhole or intake connections and to avoid conflicts with other utilities.

   B. Storm sewers perpendicular to the street are to connect at each end by intakes or manholes.

2. Storm Sewer and/or Drainage Easements:
   A. Easements must be exclusively for the City.

   B. Width of permanent easements for storm sewer pipe shall be required based on depth of invert, size of pipe, soil types, construction limits required to remove and replace pipe, and overflow conveyance requirements. At a minimum, the easement shall be twenty feet (20') wide. The pipe should be located in the center of the easement.

   C. No permanent structures, fencing or landscaping shall be placed in any drainage easement.

   D. Storm sewers at intersection corners may require additional corner easements.

5.3 Pipe Material:

Pipe material and pipe strength for sewers within the public right-of-way shall conform to the City of Bettendorf Standard Specifications for Public Improvements.

5.4 Physical Requirements:

1. Recommended minimum cover on storm sewers outside of pavement is 2'-0". Recommended minimum cover under six inch (6") local street pavement for cross runs is 1'-6" from top of pavement. For greater pavement thickness or street classification other than local, provide structural calculations for minimum cover.

2. Minimum cover on subdrain within public right-of-way is 3'-0".

3. Minimum and maximum cover based on structural calculations and manufacturers' recommendations.

4. Minimum pipe size for public storm sewers – 15" diameter.

5. Minimum pipe grades:
   A. Storm Sewer Mains: Minimum grade is set by the required velocity for storm sewers and footing drain sewers- 3 fps for the design storm.

   B. Cross Runs: Minimum grade of 1%. Desired minimum velocity of 3 fps for the design storm.

   C. Building Storm Sewer Stubs: Minimum grade of 1%.

   D. Subdrains: Minimum grade of 0.5%.

5.5 Separation of Water Mains from Sewer Mains:

The following comply with the Iowa Department of Natural Resources (IDNR) separation requirements.

1. Horizontal Separation of Gravity Sewers from Water Mains:

   Separate gravity storm sewer mains from water mains by a horizontal distance of at least ten feet (10') unless:

   A. The top of a sewer main is at least eighteen inches (18") below the bottom of the water main, and,

   B. The sewer is placed in a separate trench or in the same trench on a bench of undisturbed earth at a minimum horizontal separation of three feet (3') from the water main.

      When it is impossible to obtain the required horizontal clearance of three feet (3') and a vertical clearance of eighteen inches (18") between sewers and water mains, the sewers must be constructed of water main materials meeting the requirements of the City of Bettendorf Standard Specifications for Public Improvements. However, provide a linear separation of at least two feet (2').

2. Separation of Sewer Force Mains from Water Mains:

   Separate storm sewer force mains and water mains by a horizontal distance of at least ten feet (10') unless:

   A. The force main is constructed of water main materials meeting a minimum pressure rating of 150 psi and the requirements of City of Bettendorf Standard Specifications for Public Improvements, and

   B. The sewer force main is laid at least four (4) linear feet from the water main.

3. Separation of Sewer and Water Main Crossovers:

   Vertical separation of storm sewers crossing under any water main should be at least eighteen inches (18") when measured from the top of the sewer to the bottom of the water main. If physical conditions prohibit the separation, the sewer may be placed not closer than six inches (6") below a water main or

eighteen inches (18") above a water main. Maintain the maximum feasible separation distance in all cases. The sewer and water pipes must be adequately supported and have watertight joints. Use a low permeability soil for backfill material within ten feet (10') of the point of crossing.

Where the storm sewer crosses over or less than eighteen inches (18") below a water main, the entire length of sewer pipe from structure to structure shall be constructed of water main material or reinforced concrete pipe (RCP) with flexible O-ring gasketed joints.

5.6 Horizontal Alignment:

Sewer should be laid with a straight alignment between manholes structures at all times.

5.7 Outlets:

1. Where a storm sewer discharges to a receiving channel, an outlet structure should be provided that will blend the storm sewer discharge into the natural channel flow in a manner to prevent erosion of the bed or banks of the channel. All storm sewer pipe outlets will require flared end sections with curtain walls per the City of Bettendorf Standard Drawings.

2. When the discharge velocity is greater than outlined in Tables 5.2 & 5.3, prevention of erosion of the natural channel bed or banks in the vicinity of the outlet will require an energy dissipating structure, such as riprap, concrete baffles, gabions, or stilling basin. Refer to Section 6, Outlet Revetment Protection.

3. Storm Sewer along a side property line shall run the length of the property line and outlet past the rear property line to a receiving drainageway.

4. Outlets shall drain to a receiving drainageway or connect to an existing storm sewer. Outlets will not drain directly to streets. Outlets shall not be located on slopes without adequate erosion protection and means of conveyance between the outlet and receiving drainageway or storm sewer. Erosion protection on slope only at the outlet is often inadequate, as runoff velocity will increase down grade of the outlet.

5.8 Storm Sewer Structures

1. Location:
   Manholes or intakes will be required whenever there is a change in size, direction, elevation, grade or a junction of two or more storm sewers. When feasible, access structures should be installed at street intersections. Manholes should be located in areas to allow direct access by maintenance vehicles. Structures will be spaced at distances not greater than four hundred feet (400'), regardless of gutter capacity. The most upstream structure of a storm sewer run shall be located a maximum four hundred feet (400') from a street high point to minimize gutter spread. Intakes near intersections should be located at least ten feet (10') from pedestrian ramps, as measured between near edge of flume and near edge of ramp, to avoid ponding water at the ramps.

2. Invert Drop
   When there is a change in pipe size at a structure, the invert of the smaller sewer must be raised to maintain the same energy gradient. An approximate method of doing this is to place the 0.8 depth point of both sewers at the same elevation. When there is a change in alignment between storm sewer of 45° or greater the suggested minimum manhole drop is 0.10'.

5.9 Hydraulic Design

Storm sewers should be designed to convey the 10-year storm peak runoff without surcharging the sewer. Where surcharging is a concern, the hydraulic grade line may be calculated by accounting for energy losses. Total hydraulic losses will include friction, expansion, contraction, bend and junction losses. The design method shall generally follow procedures in FHWA Hydraulic Engineering Circular No. 22, "Urban Drainage Design Manual", or as approved by the City.

1. Pipe Friction Losses
   The Manning's "n" values to be used in the calculation of storm sewer capacity and velocity are shown as follows:

Type of Pipe	Manning's "n"
PVC/HDPE Pipe (Smooth Interior Wall)	0.011
Concrete Pipe	0.013
PVC/HDPE Pipe (Corrugated Single Wall)	0.020

   *Values for materials other than listed above shall be approved by the City Engineer.

2. Velocity within Storm Sewer Pipe:
   A. Minimum flow (1/2 full pipe) for 10-year design storm flow = 3 fps
   B. Maximum for 10-year design storm flow = 15 fps

3. Velocity at Outlet of Pipe:
   A. Energy dissipation is required when discharge velocities exceed those allowed for downstream channel. (See Tables 5.2 & 5.3)
   B. Max. with flared end section = 5 fps
   C. Max. with flared end section and rip-rap = 10 fps
   D. Max. with energy dissipation device = 20 fps

Table 5.2- Permissible Velocities for Channels Lined With Erodible Linings, Based on Uniform Flow in Continuously Wet, Aged Channels

Soil Type or Lining (earth; no vegetation)	Maximum Permissible Velocities for the following		
	Clean Water (fps)	Water Carrying Fine Silts (fps)	Water Carrying Sand and Gravel (fps)
Fine sand (non-colloidal)	1.5	2.5	1.5
Sandy loam (non-colloidal)	1.7	2.5	2.0
Silt loam (non-colloidal)	2.0	3.0	2.0
Ordinary firm loam	2.5	3.5	2.2
Volcanic ash	2.5	3.5	2.0
Fine gravel	2.5	5.0	3.7
Stiff clay	3.7	5.0	3.0
Graded, loam to cobbles (non-colloidal)	3.7	5.0	5.0
Graded, silt to cobbles (colloidal)	4.0	5.5	5.0
Alluvial silts (non-colloidal)	2.0	3.5	2.0
Alluvial silts (colloidal)	3.7	5.0	3.0
Coarse gravel (non-colloidal)	4.0	6.0	6.5
Cobbles and shingles	5.0	5.5	6.5
Shales and hard pans	6.0	6.0	5.0
Fabric and excelsior mat	7.0	7.0	7.0
Dry rip-rap/ gabions	10.0	10.0	10.0
Concrete pilot channel	Use grass permissible velocity- Table 5.3		

Table 5.3- Permissible Velocities for Channels Lined With Uniform Stands of Various Grass Covers, Well Maintained[1]

Cover	Slope Range (%)	Permissible Velocity on…	
		Erosion Resistant Soils (fps)	Easily Eroded Soils (fps)
Bermuda grass	0 to 5	8	6
	5 to 10	7	5
	Over 10	6	4
Buffalo grass	0 to 5	7	5
Kentucky Bluegrass	5 to 10	6	4
Smooth brome			
Blue grama	Over 10	5	3
Grass mixture	0 to 5	5	4
	5 to 10	4	3
Lespedeza sericea	0 to 5	3.5	2.5
Weeping lovegrass			
Yellow bluestem			
Kudzu			
Alfalfa			
Crabgrass			
Common lespedeza[2]	0 to 5	3.5	2.5
Sudangrass[3]			

[1]Use velocities of 5 fps only where good covers and proper maintenance can be obtained.
[2]Annuals, used on mild slopes or as temporary protection until permanent covers are established.
[3]Use on slopes steeper than 5% is not recommended

Section 6: Storm Sewer Intakes

6.1 Introduction

1. A storm intake is an opening into a storm sewer system to collect surface storm runoff. There are three (3) basic types of intakes:

   A. Curb-grate opening

   B. Open Throat (Iowa DOT SW intake)

   C. Area Intake

2. Intakes are further classified as being at grade or at a low point. The term "at grade" refers to an intake located on the street grade with continuous slope, where ponding does not occur at the intake. The sump or low point condition exists whenever water is restricted to the inlet area because the intake is located at a low point. A low point condition can occur at a sag vertical curve or due to the crown slope of a cross street when the intake is located at an intersection.

6.2 Definitions

1. Design flow is the calculated quantity of storm runoff at a given point. For gutter applications, design flow shall include bypass flow from upstream intakes.

2. Bypass flow is gutter flow not intercepted by a given upstream intake. Bypass flow is calculated by subtracting the allowable capacity of the given intake from the design flow assigned to that intake. Bypass flow shall be added to the design storm runoff for the next downstream intake. As a minimum, intakes at a low point shall have design capacity to intercept all storm runoff including upstream bypass flows.

6.3 Intercepting Flows

Storm sewer intakes shall be designed to intercept design flow with the following allowable bypass from the system:

1. Streets on Continuous Grade – The final downstream intake or intakes shall be designed to intercept no less than 50% of the design flow.

2. Temporary Dead-End Streets on Down Grade – Unless otherwise approved by the City Engineer, intakes shall be designed to intercept no less than 100% of the design flow.

3. Cul-de-sac Streets on Down Grade and Low Points – Intakes shall be designed to intercept no less than 100% of the design flow. Depending on downstream conditions, the City Engineer may require oversized or additional flanker intakes at low points to account for potential plugging or blockage.

4. Intersections – Intakes shall be placed at end of intersection returns to intercept design flow for reduced gutter spread at pedestrian ramp locations.

5. Emergency overflow flow paths shall be provided to safely pass the 100 year storm event overland without causing damage to the surroundings.

6.4 Street Capacity

Storm sewers shall be designed for a 100-year storm in such a manner that the flooded street width shall not exceed:

Street Width (ft) (BOC to BOC)	Allowable Flooded Width Each Side (ft)	Required non-flooded Lanes
27	8	1- 10’ Lane
29	9	1- 10’ Lane
31	10	1- 10’ Lane
45	11	2- 11’ Lanes
49 & wider	12	2- 12’ Lanes

Section 7: Culvert Design

7.1 Limitation of Culvert Use:
Culverts with outlet control will only be allowed by approval of the City Engineer.

7.2 Culvert Capacity:
100-year flood headwater at culverts shall not overtop roadways or encroach beyond prescribed drainage easements.

7.3 Culvert Material:
1. RCP- Minimum strength Class 3 under all streets and entrance pavement and Class 5 under railroad crossings.

2. Multi-plate, PVC, and HPDE are to be approved by the City Engineer. CMP material will not be allowed in the City of Bettendorf.

7.4 Physical Requirements:
1. Minimum grade shall be one percent (1%) for inlet control.

2. Maximum length shall be two hundred feet (200') for inlet control.

3. Fencing typically required around headwalls.

4. Headwalls located to avoid steep slopes (>3:1) between headwall and top of bank.

5. The minimum culvert size will be determined by design and not less than fifteen inch (15") inside diameter.

7.5 Erosion Control at Inlet and Outlet:
Energy dissipation shall be required for velocities higher than those outlined in table- "Permissible Flow Velocity for Channels" (Tables 5.2 and 5.3)

7.6 Design Method:
The design method shall be FHWA Hydraulic Design Series No. 5, "Hydraulic Design of Highway Culverts", or other method approved by the City Engineer.

Section 8: Outlet Rip Rap Protection

Reference: Chapter 7, Section 7E-10 “Rip Rap” of the Iowa Statewide Urban Design and Specifications (SUDAS) Design Manual.

The information in this section should be considered as a general overview only of the rip rap design process. Chapter 7 of the SUDAS Design Manual provides comprehensive guidance on the design of rip rap basins and aprons and should be followed for all project submittals.

8.1 Introduction

The most common method of protecting a channel at an outlet is to place a layer of crushed stone along the bottom and sides of the channel. The purpose of the stone is to protect the channel until the outlet flow loses sufficient velocity and energy, so that erosion will not occur in the downstream channel. Rip rap is provided by constructing a blanket of crushed stone, to a specified depth at the outlet.

8.2 Sizing

1. Most crushed stone used for outlet protection is specified by weight, not by diameter. The following table lists the standard SUDAS and Iowa DOT revetment and erosion stone weights and corresponding d50 diameters. These gradations are also shown on Figures 7E-10.03 and 7E- 10.04 in SUDAS. Alternative gradations may be selected and specified if available from local aggregate suppliers.

Table 8.1- Standard Revetment and Erosion Stone Properties

Standard Classification	d_{50} Weight (lbs)	Average d_{50} Diameter[1] (feet)	Maximum Weight (lbs)	Avg. Max. Diameter[1] (feet)
Class A Revetment Stone	125 [2]	1.1 [2]	400	1.7
Class B Revetment Stone	275	1.5	650	2
Class D & E Revetment Stone	90	1	250	1.4
Erosion Stone	---	0.5	---	0.8

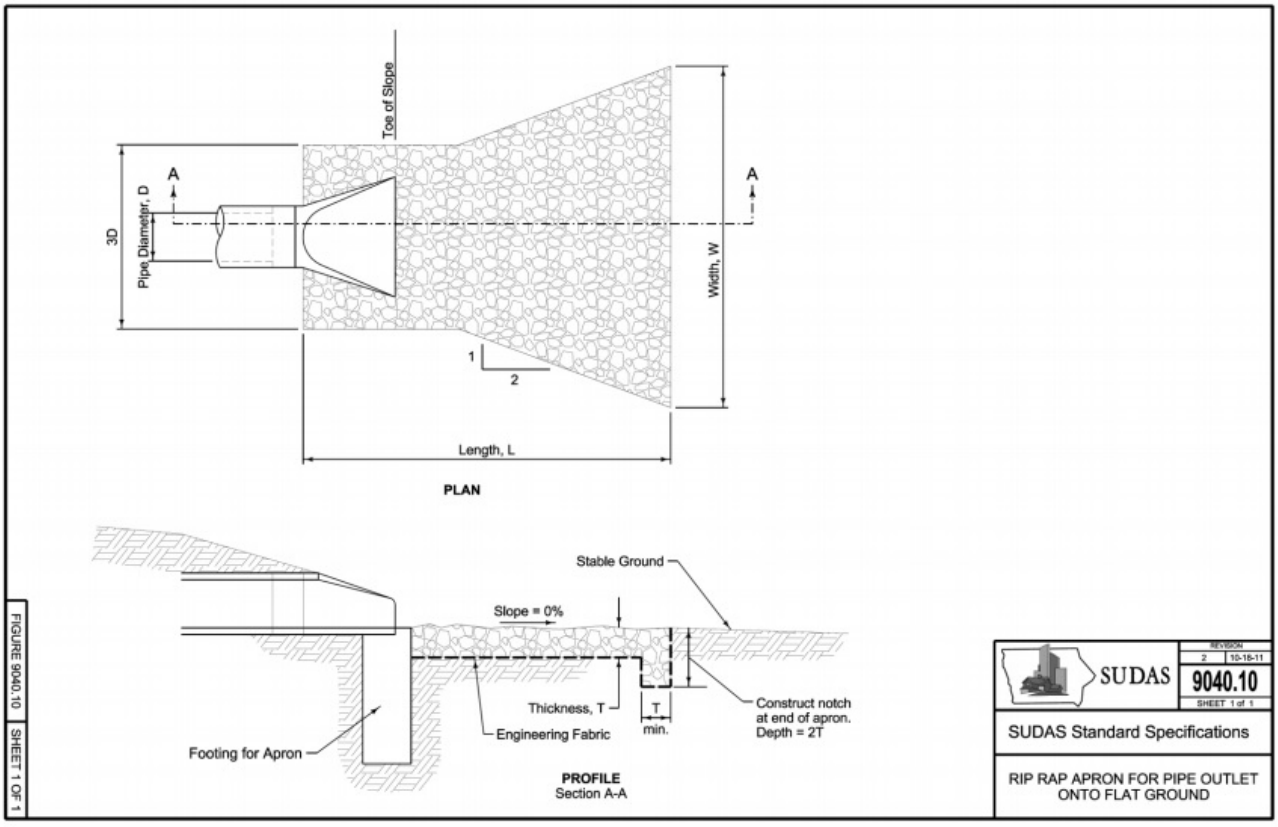
[1] Diameters based upon assumed specific gravity of 2.65
[2] Approximate values for design purposes. Actual d_{50} value is not specified (d_{75} = 75 lbs)

2. **Apron Length**:
   A sufficient length of protection must be provided in order to reduce the velocity and energy of the flow to the level anticipated in the downstream channel. This length is dependent on the volume and velocity of the flow at the discharge point. It is also dependent on the tailwater condition of the downstream channel. The length, La , is found from Figure 7E-10.03 or 7E-10.04 (SUDAS) for the appropriate tailwater condition. From the intersection of discharge and pipe diameter, or for velocity and flow depth found in the previous step, a vertical line is projected to the appropriate discharge depth/pipe diameter in the upper set of curves. From this intersection, a horizontal line is projected to the left to determine the minimum length of rock protection required.

3. **Apron Width:**
   For pipes that discharge into a well-defined channel, the width of the apron should extend to the top of the bank, or at least 1-foot above the maximum tailwater depth, whichever is less, along the entire length of the apron. For outlets that discharge onto flat areas, the width of the apron at the upstream end of the culvert should be three times the diameter of the pipe, or equal to the width of the concrete pipe apron if one is provided. The width of the apron at the downstream end should be equal to the length of the apron, La , plus the diameter of the pipe, D.

4. **Apron Depth:**
   The depth of the apron should be equal to one and one-half times the maximum stone diameter (see Table 7E-10.01 (SUDAS) for maximum diameter). The channel downstream of the rock apron must be analyzed to ensure that existing or proposed channel liner is sufficient and that it will not be eroded under the anticipated flow depths. Methods for analyzing channel liners can be found in Section 7E-23.

5. Shape the revetment to generally comply with the following figure (SUDAS 9040.10)



Section 9: Subdrain System Design

9.1 Subdrain Design Criteria

1. All roadways shall be provided with a subsurface drainage system to drain roadway subgrade.

2. Down spouts from buildings or yard surface drainage are not allowed to be directly connected to the subdrain or tiled to the sump pump pit.

3. Subdrain shall be installed to the same grade as the roadway.

4. Increased flow into the storm sewer from subdrains will not be considered in the design of storm sewers.

5. Subdrains shall be located according to the City of Bettendorf Standard Drawings.

9.2 Subdrain Standards

1. Subdrain pipe shall be a minimum 4 inch diameter perforated PVC or polyethylene pipe meeting the City of Bettendorf Standard Specifications for Public Improvements.

2. Where required, a separate sump pump collection system shall be provided which includes provisions for connection of private sump hoses. A 4-inch diameter plastic pipe shall be connected and extended to 10 feet beyond the right-of-way at each property line. The property end shall be capped until the building sump hose is installed.

3. Subdrain shall have access from manholes, storm sewer intakes, open channels or cleanouts. The upstream end of subdrain extending into storm sewer intakes shall be capped to prevent conveyance of surface storm drainage through the tile system. Maximum spacing of access is 400 feet.

Section 10: Stormwater Detention Practices

Reference: Iowa Stormwater Management Manual, Section 2B-1, for further guidance.

10.1 Introduction

Standards set by the City are intended to ensure compliance with the City's Post-Construction Stormwater Management Ordinance. The sizing criteria included in this manual is an integrated approach to managing stormwater runoff quality and quantity by addressing the adverse impacts of stormwater runoff from development.

The intent is to comprehensively manage stormwater to remove pollutants and improve water quality, prevent downstream streambank and channel erosion, reduce downstream overbank flooding and safely convey and reduce runoff from extreme storm events.

10.2 Definitions

1. Excess storm runoff shall be judged in comparison to the site in its predevelopment condition and shall include all increases in stormwater resulting from any of the following:

    A. An increase in the impervious surface of the site, including all additions of buildings, roads, parking lots and wet pond surfaces.

    B. Changes in soil absorption caused by compaction during development.

    C. Grade changes including the filling or draining of depression areas, alterations of drainageways or regrading of slopes.

    D. Clearing woodlands.

    E. Installation of storm sewer to intercept street flows or to replace existing drainageways.

    F. Alteration of subsurface flows, including any groundwater dewatering or diversion practices such as curtain drains.

2. Pre-developed conditions are hydraulic and hydrologic site characteristics existing prior to development and shall include all the natural storage areas and drainageways plus existing farm drainage tiles and highway drainage structures. The City Engineer may require the pre-developed condition to be equal to an undeveloped condition if drainage problems are occurring downstream due to existing development at the proposed site or in the basin.

3. Developed conditions are hydraulic and hydrologic site characteristics that occur following the completion of the proposed development.

4. Post-developed peak runoff is expected to exceed pre-developed runoff from a similar storm event. Even if calculated time of concentration or curve number tables suggest lower post-developed runoff, developed sites generally have more impervious areas, compacted soils, change in soil horizon, and differing vegetation from undeveloped conditions. There may be exceptions, but careful consideration of the hydrologic method and sufficient engineering judgment are necessary to ensure calculated results meet reasonable expectations.

10.3 Limitation of Storm Runoff

1. No development shall cause downstream properties, channels or conduits to receive stormwater runoff from the proposed development site at a higher peak flow rate, or at higher velocities than would have resulted from the same storm event occurring over the site in its pre-developed condition.

2. The City shall determine if construction of storm detention facilities are required as a condition for approval of the development. Factors considered in making a determination include but are not limited to:

A. The drainage report as outlined in Section 2.

B. Historical or potential drainage or flood problems adjacent to the site.

C. Historical or potential area wide drainage or flooding problems in the watershed.

D. Location of the site relative to existing drainageways and/or stormwater conveyances.

E. Extent of proposed site increase in impervious surface area.

3. Anticipated future development of the drainage basin.

4. Existing site features that may facilitate or impede detention design and/or construction.

5. City's stormwater management ordinance.

6. City's water quality standard, as applicable.

7. Parcels of land, of which only part will be initially developed but are contained in the same drainage area, will be evaluated for stormwater facilities, including detention, for the entire drainage area.

10.4 Stormwater Detention Requirements

If stormwater detention is required, the site owner shall construct stormwater detention facilities, designed by a professional engineer licensed in the State of Iowa, which meet the criteria of this section.

Detention basins with 18 acre feet or more of storage require a permit from the Iowa Department of Natural Resources (IDNR).

1. Design Storm

   The design storm is the rainfall event having a return frequency of 100 years unless higher frequencies are required by the IDNR or City. Design storm duration is the critical duration of rainfall requiring the greatest detention volume.

2. Release Requirements
   A. For rainfall events having an expected return frequency of five (5) years to one hundred (100) years, inclusive, the rate of runoff from the developed site shall not exceed the existing, pre-developed peak runoff from a five (5)-year frequency storm of the same duration unless if limited by downstream conveyance.

      Example #1
      A ten-acre site has a peak rate of runoff from a 5-year, 6-hour storm before development of 12 cfs. Discharge from detention during the 100-year, 50-year, 25-year, or 10-year 6-hour storm after development shall not exceed 12 cfs.

   B. Release of runoff generated off-site and routed through the detention basin should not increase the combined off-site and on-site release rate.

   C. Release of stormwater runoff from the detention basins shall not damage private or public properties.

10.5 Detention Facilities Requirements

1. Basin Construction:
   A. Side slopes shall be at least 4:1 or flatter and should have temporary and permanent erosion control stabilization.

   B. Detention bottom cross-slopes to the main detention channel will be 2% minimum.

C. Subsurface drains from basin inlets to outlets may be required by the City Engineer.

D. The embankment top shall be at least 6 ft. wide. Smaller widths may be approved by the City Engineer but shall not be less than 3 feet.

E. Freeboard shall be minimum of 1 ft. above the 100-year water surface elevation.

F. The embankment shall be protected from catastrophic failure due to overtopping following IDNR requirements where applicable. Overtopping can occur when the pond outlet becomes obstructed or when a larger than 100-year storm occurs. Failure protection for the embankment may be provided in the form of a buried, heavy rip rap layer on the entire downstream face of the embankment or a separate emergency spillway having a minimum capacity of the developed inflow rate for the 100-year storm from contributing on-site and off-site areas. The spillway is also needed to control the release point of the overflows. Structures shall not be permitted in the path of the emergency spillway or overflow. The invert of the emergency spillway should be set equal to or above the 100- year water surface elevation.

G. The outlet structure shall be protected by a debris rack. Debris will block most outlet structures at some point, and a well-designed debris rack can help ensure the outlet functions even under a heavy trash load. Debris racks vary in design and include for example, welded wire and hinged metal plates over low-flow orifices, a hinged gate over an outfall culvert, or rack placed over a standpipe. On larger structures, debris racks are locked to prevent children and animals from entering the structure.

2. Parking Lot Storage:
   A. Paved parking lots may be designed to provide stormwater detention on a portion of their surfaces not to exceed fifty percent (50%) of the parking lot area.

   B. Outlets shall be designed to drain slowly and storage depth must be limited to nine inches (9") to minimize damage to parked vehicles. The minimum pipe size for the outlet is 12" diameter where a drop inlet is used to discharge to a storm sewer or drainageway. Where a weir and a small diameter outlet through a curb are used, the size and shape are dependent on the discharge/storage requirements. A minimum pipe size of 4" diameter is recommended.

   C. Maintenance access shall be provided. The potential for pavement overlays shall be considered in the calculated detention.

3. Multipurpose Basins
   A. Dry bottom basins may be designed to serve secondary purposes for recreation, open space or other use which will not be adversely affected by intermittent flooding.

   B. Retention basins with potential to improve water quality may be approved by the City Engineer.

4. Underground Storage
   A. Detention systems utilizing chambers and aggregate storage, vaults or other underground methods may be approved by the City Engineer.

5. Acceptance of Storm Detention:
   A. The City shall not guarantee the accuracy of certified engineering calculations and improvement plans, or the performance of the constructed facilities. Acceptance of stormwater detention plans and issuance of any permit should not be interpreted as alleviating the Project Engineer of responsibility for the accuracy and performance of the design and plans.

10.6 Discouraged Design Practices

1. **Passive detention systems.**
   These systems direct captured runoff through a storm sewer network to the outlet from the site. At that point, a restriction is placed, such as an orifice plate, which causes water to surcharge and back up out of an intake into a surface depression for temporary storage during large storm events. This

design method allows runoff from smaller storm events to leave the site directly, without the opportunity to remove suspended pollutants and debris.

2. **Low flow flumes and directly connected impervious areas.**
   These systems prevent infiltration of storm water runoff and reduce or eliminate the possibility of providing water quality treatment or small storm management. Virtually any storm event will direct surface runoff from paved areas to the receiving storm sewer system or stream.

3. **Flow path shortcutting.**
   When runoff enters a basin or treatment practices at nearly the same point where it outlets from the practice, the opportunity for absorption, infiltration or treatment of storm water runoff is severely reduced. For this reason, it is recommended that storm water runoff enter a basin or other treatment practice as far from the outlet as possible. Pipe outlets, flumes or other points of concentrated stormwater flows should enter a treatment practice or basin at a distance from the outlet of no less than twice the width of the practice (a pipe entering a 15' wide bioretention cell should be located no closer than 30' from the point where water would leave the treatment area).

10.7 Water Quality Volume and Channel Protection Design Standard

1. **Capture and treat the Water Quality Volume [WQv]**, or the runoff that is expected to be generated from a given site after development from a 1.25" rainfall event. Approximately 90% of the rainfall which falls in Eastern Iowa is from storm events which are less than this amount. Using BMPs to properly manage runoff from these events could potentially eliminate direct surface runoff from a given site during most rainfall events, effectively managing many of the "first flush" pollutants of concern on-site.

2. **Provide extended detention of the 1-year, 24-hour storm event or Channel Protection Volume [CPv]** (with a drawdown time of 24- to 48-hours) to reduce rapid fluctuations of flows in urban stream corridors that lead to erosive velocities and unstable stream conditions. In Bettendorf, the rainfall depth for such an event is 2.60 inches. Practices which address this criteria will capture this volume of runoff and slowly release it over a period of no less than 24 hours.

10.8 Description of Water Quality Practices

1. This section describes typical water quality practices and provides general guidelines for their use.

   A. **Infiltration trench/French drain** – A rock-filled trench with no outlet that receives storm water runoff. Storm water runoff passes through some combination of pretreatment measures, such as a swale into the trench. Runoff is stored in the void space between the aggregate and infiltrates into the surrounding soil. The desired infiltration time is 24 hours. The primary pollutant removal mechanism of this practice is filtering through the soil. Infiltration trenches have select applications due to concerns such as potential ground water contamination, soils, and clogging. Infiltration trenches generally can be applied to relatively small sites less than 5 acres, with relatively high impervious cover. Application to larger sites generally causes clogging, resulting in high maintenance. A French drain is a rock-filled trench with subdrain for overflow.

   B. **Dry well** – A subsurface storage facility that receives and temporarily stores roof runoff. This runoff is discharged trough infiltration to the surrounding soil. A dry well may be either a structure and/or excavated pit filled with aggregate. A dry well is not considered for pollutant removal due to relatively low level of expectant pollutants in roof runoff. Runoff should drain within 72 hours. The maximum drainage area to a dry well is 1 acre and dry wells should be applied to relatively small sites.

   C. **Porous pavement** – A permeable pavement surface with an underlying stone reservoir to temporarily store surface runoff before it infiltrates into the subsoil. This porous surface replaces traditional pavement, allowing parking lot storm water to infiltrate directly and receive water quality treatment. Porous pavement options include porous asphalt, and pervious concrete. Porous asphalt and pervious concrete appear to be the same as traditional pavement from the surface, but are manufactured without "fine" materials, and incorporate void spaces to allow infiltration. The ideal application for porous pavement is for low-traffic or overflow parking areas.

The base of the stone reservoir should be below the frost line to reduce the risk of frost heave. Porous pavement cannot be used where sand is applied because sand will clog the surface of the material. Care must also be taken when applying salt to a porous pavement surface as chlorides from road salt may migrate into the ground water.

D. **Vegetated filter strip** – Treats sheet flow from adjacent surfaces. Filter strips function by slowing runoff velocities and filtering out sediment and other pollutants, and by providing some infiltration into underlying soils. With proper design and maintenance, filter strips can provide relatively high pollutant removal. However, it is difficult to maintain sheet flow, so the practice may be "short circuited" by concentrated flows, receiving little or no treatment. In some situations filter strips may consume a large amount of space relative to other practices. Filter strips are best suited to treating runoff from streets, roof downspouts, small parking lots, and pervious surfaces. Typically, filter strips are used to treat very small drainage areas. The limiting design factor, however, is not the drainage area but the length of flow leading to it. As storm water runoff flows over the ground's surface, it changes from sheet flow to concentrated flow. When flow concentrates, it moves too rapidly to be effectively treated by a grassed filter strip. As a rule, flow concentrates within a maximum of 75 feet for impervious surfaces, and 150 feet for pervious surfaces. Using this rule, a filter strip can treat one acre of impervious surface per 580-foot length.

E. **Vegetated swale** – Vegetated, open channel management practices designed specifically to treat and attenuate storm water runoff. As storm water runoff flows through these channels, it is treated through filtering by the vegetation in the channel, filtering through a subsoil matrix, and/or infiltration into the underlying soils. Variations of the grassed swale include the grassed channel, dry swale, and wet swale. The specific design features and methods of treatment differ in each of these designs, but all are improvements on the traditional drainage ditch. Swales are well suited for treating street runoff. Vegetated swales should generally treat small drainage areas of less than 5 acres. If the practices are used to treat larger areas, the flows and volumes through the swale become too large to design the practice to treat storm water runoff through infiltration and filtering.

F. **Bioretention** – Landscaping features adapted to provide on-site storm water treatment. They are commonly located in parking lot islands or within small pockets of residential land. Surface runoff is directed into shallow, landscaped depressions. These depressions are designed to incorporate many of the pollutant removal mechanisms that operate in forested ecosystems. During storms, runoff ponds above the mulch and soil in the system. Runoff from larger storms is generally diverted past the facility to the storm sewer system. The remaining runoff filters through the mulch and prepared soil mix. Typically, the filtered runoff is collected in a perforated subdrain and returned to the storm sewer system. Bioretention should be used on small sites of 5 acres or less. When used to treat larger areas, they tend to clog. In addition, it is difficult to convey flow from a large area to a bioretention area.

G. **Wet pond (a.k.a. storm water pond, retention pond, wet extended detention pond) -** Constructed basins that have a permanent pool of water. Ponds treat incoming storm water runoff by settling and algal uptake. The primary removal mechanism is settling as storm water runoff resides in this pool, and pollutant uptake, particularly of nutrients, also occurs through biological activity in the pond. Wet ponds are among the most cost-effective and widely used storm water practices. While there are several different versions of the wet pond design, the most common modification is the extended detention wet pond, where storage is provided above the permanent pool in order to detain storm water runoff to provide settling. Wet ponds need sufficient drainage area to maintain the permanent pool, typically about 25 acres.

H. **Level Spreader** – An outlet constructed at zero grade consisting of a vegetated or rock-surfaced structure, used to disperse or “spread” concentrated flow thinly over a receiving area. The purpose is to spread runoff over a wide area to prevent erosion of the receiving area. Additional benefits of infiltration and filtration may also occur. This practice applies where concentrated flow is dispersed within wooded areas adjacent to bodies of water and in areas requiring a filter strip to treat water. Its use should also be limited to drainage areas less than ten acres and where

receiving areas have relatively flat slopes of four percent or less; 1 to 2 percent slope is recommended.

I. **Soil amendment** – Material added to a soil to improve its physical properties, such as water retention, permeability, infiltration, drainage, aeration and structure. Soil amendments increase the spacing between soil particles so that the soil can absorb and hold more moisture. This in turn reduces runoff. The amendment of soils changes physical, chemical and biological characteristics so the soils become more effective in maintaining water quality. Compared to compacted, un-amended soils, amended soils provide greater infiltration and subsurface storage and thereby help to reduce a site's overall runoff volume, helping to maintain the predevelopment peak discharge rate and timing. The volume of runoff that needs to be controlled to replicate natural watershed conditions changes with each site based on the development's impact on the site's curve number (CN). Organic amendments include peat, wood chips, grass clippings, straw, compost, manure, biosolids, and sawdust.

Section 11: Channel and Storage (Reservoir) Routing

11.1 Introduction

Given the variety of available software packages capable of performing calculations consistent with the routing methods described within this section, it is assumed that designers will rarely use techniques to manually perform these calculations as described within this section. The designer should be familiar with the basis of such calculations, and the following information should be clearly indicated in storm water drainage reports:

11.2 Channel Routing:

1. Clearly identify the **channel length, slope** (along channel length) **and Manning roughness coefficient** (n) used for design. Document surface conditions considered for selection of "n" and identify length and elevation used for slope calculation on drainage map.

2. Provide a **sketch showing the assumed cross-section of the channel** (triangular, rectangular, trapezoidal, etc.) with bottom width and side slopes clearly labeled.

11.3 Reservoir Routing:

For detention design analysis, a stage-storage hydrograph routing is required for the 1-, 5-, 10-, and 100-year events to verify that after development, a given site does not violate peak release rate restriction requirements for these storms.

**Additional routing of the WQv event may be required if selected practices intended to meet the Water Quality Volume requirements for a given area have inadequate capacity to capture and infiltrate the required volume and therefore use extended detention (slow release through a surface inlet) to allow settling of suspended pollutants and treatment to occur.*

1. **Inflow hydrograph** (numeric or graphic) through the duration of the storm event. Maximum time steps of 0.1 hour or 6-minutes (2-minutes preferred).

2. **Stage-storage volume relationship** of the reservoir area. No less than one foot intervals.

3. **Stage-discharge relationship of basin outlet.** Calculations should identify all stages of outflow design (riser pipe, orifice, weir, discharge pipe, etc.) and include characteristics of each (elevation, size, etc.) that match plan dimensions. Calculations should include either detailed calculations of flow through each outlet stage, or graphical representation of stage-discharge relationship from calculation output from used software package.

4. **Energy loss coefficients** for weir and orifice conditions.

5. **Target peak discharge allowed** from the reservoir (for each event to be considered).

6. **Outflow hydrograph** from routing output identifying flow rate (in cfs) versus time, the peak flow rate, time of occurrence in relation to the rainfall event. For analyses involving the design events identified in this report provide a numeric or graphic representation of the entire outlet hydrograph through the duration of the storm event.

7. **A graph of storage volume or elevation versus time** for the key design events. Review drawdown for extended detention of small storms. (minimum 24-hour drawdown after storm event)

8. **Identify maximum storage volume and water surface elevation for each event reviewed.**

Section 12: Inlet Sediment Forebays

12.1 Introduction

Sediment forebays are essential to long-term maintenance and performance of proposed stormwater management BMPs. A forebay is an area near a concentrated point of discharge to a certain BMP, where stormwater flows can be slowed to an extent where heavier sediments and debris can be captured before they enter the BMP itself.

These should be located in areas where they can be accessed for maintenance and sediment (and debris) removal. This helps reduce the amount of heavy pollutants that enter a proposed treatment practice (pollutants that could clog or otherwise negatively affect the performance or appearance of those practices).

12.2 Key design considerations:

1. Sediment forebays should be sized for 0.10 – 0.25 inches of runoff per impervious acre within the watershed upstream of the forebay. A typical sizing criterion is 10% of the WQv to be treated.

2. Forebays are often separated from the BMP they protect by a physical barrier of some type (berm, spillway, gabion or revetment stone wall, etc.) that forces water entering the BMP to pool temporarily near the entrance to the facility, reducing velocities and allowing suspended materials to settle out.

3. Forebays should be located where they can be directly accessed for maintenance. Provide clear paths from adjacent streets to the facility that can accommodate expected maintenance equipment (trucks, small excavators, etc.). In some cases this may require a hard surface access path.

4. A hardened bottom surface should be considered to help avoid over-excavation during cleanout operations.

5. Plan for sediment cleanout at least every 3-5 years (for stabilized watershed), or when 6-12 inches of sediment has accumulated, whichever is first.

Appendix A: Drainage Report Format

1. Executive Summary

Summarize report results with a narrative and tabular data. Provide tabular data for peak discharge, detention pond characteristics, and release rates according to the format below:

Table 1: Runoff Summary

	Onsite		Contributing Offsite	
Runoff Recurrence Interval	Pre-Developed Peak Discharge (cfs)	Post-Developed Peak Discharge (cfs)	Existing Discharge (cfs)	Developed Discharge (cfs)
5 yr				
10 yr				
25 yr				
50 yr				
100 yr				

Table 2: Detention Basin Characteristics

Stage (ft)	Storage (acre-feet)	Inflow (cfs)	Outflow (cfs)
Max. (1 foot Intervals)			

Table 3: Allowable Release Rate

Allowable Release Rate (cfs)		On Site Pre-Developed Peak Discharge Rate - 5 yr		Contributing Off Site Pre-Developed Peak Discharge Rate - 100 yr (1)		Onsite Post-Development By-Pass Peak Discharge Rate - 100 yr
	=		+		-	

Table 4: Overflow Release Rate

Overflow Release Rate (cfs)		On Site Post-Developed Peak Discharge Rate - 100 yr		Contributing Off Site Post-Developed Peak Discharge - 100 yr (2)
	=		+	

(1) From offsite areas that are routed through the basin.

(2) This value is the larger of either the existing peak discharge or developed peak discharge.

(3) Post-developed peak discharge may be reduced with water quality best-management practices. Any proposed reduction must be adequately justified in the drainage report with narrative and calculations.

2. Site Characteristics

A. **Pre-Developed Conditions**

Describe pre-developed land use, topography, drainage patterns including overland conveyance of the 100-year storm event, natural and man-made features. Describe ground coverage, soil type, and physical properties, such as hydrologic soil group and infiltration. If a geotechnical study of the site is available, provide boring logs and locations in the appendix of the Drainage Report. If a soil survey was used, cite it in Section VIII, References.

B. **Post-Development Conditions**

Describe post-developed land use and proposed grading, change in percent of impervious area, and change in drainage patterns. Note if an existing drainage way is filled, the runoff otherwise stored by the drainage way shall be mitigated with storm water detention, in addition to the post-development runoff.

C. **Contributing Off-Site Drainage**

Describe contributing off-site drainage patterns, land use, and storm water conveyance. Identify undeveloped contributing areas with development potential and list assumptions about future development runoff contributed to the site.

D. **Identify areas of the site located within the floodway or floodplain boundaries** as delineated on Flood Insurance Rate Maps, or as determined by other engineering analysis. Identify wetland areas on the site, as delineated by the National Wetlands Inventory, or as determined by a specific wetland study.

3. Pre-Development Runoff Analysis

A. **Watershed Area**

Describe overall watershed area and relationship between other watersheds or sub-areas. Include a pre-development watershed map in the report appendix.

B. **Time of Concentration**

Describe method used to calculate the time of concentration. Describe runoff paths and travel times through sub-areas. Show and label the runoff paths on the pre-development watershed map.

C. **Precipitation Model**

Describe the precipitation model and rainfall duration used for the design storm. Typical models may include one or more of the following:

1. SCS Type-II Distribution
2. Huff Rainfall Distribution. Select the appropriate distribution based on rainfall duration.
3. Frequency-Based Hypothetical Storm.
4. Rainfall Intensity Duration Frequency (IDF) Curve.
5. User-defined model based on collected precipitation data, subject to City Engineer's approval. Total rainfall amounts for given frequency and duration shall be obtained from NOAA Atlas 14.

D. **Rainfall Loss Method**

List runoff coefficients or curve numbers applied to the drainage area.

E. **Runoff Model**

Describe method used to project runoff and peak discharge. Typical models are as follows:

1) Rational Method – for drainage areas up to 20 acres. Often used in storm sewer design.

2) For drainage areas larger than 20 acres and flow routing is required, use one of the following methods:
   a. TR-20 Model
   b. TR-55 Tabular Hydrograph Method
   c. Routines contained in HEC-1 or HEC-HMS computer models

d. Regression Equations and other hydrologic models approved by the City.

F. **Summary of Pre-Development Runoff**
Provide table(s) including drainage area, time of concentration, frequency, duration, and peak discharge.

4. Post-Development Runoff Analysis

A. **Watershed Area**
Describe overall watershed area and sub-areas. Discuss if the post-development drainage area differs from the pre-development drainage area. Include a post-development watershed map in the report appendix.

B. **Time of Concentration**
The method used will be the same as used in the pre-development analysis. Describe change in times of concentration due to development (i.e. change in drainage patterns). Show and label the runoff paths on the post-development watershed map.

C. **Precipitation Model**
Storm event, total rainfall, and total storm duration will be the same as used for the pre-development model. If IDF curves are used, describe the change in design rainfall intensity.

D. **Rainfall Loss Method**
Method will be the same as pre-development analysis. Describe the change in rainfall loss due to development.

E. **Runoff Model**
The runoff method will be the same as used in the pre-development analysis, except for variables changed to account for the developed conditions.

F. **Summary of Post-Development Runoff**

1) Provide table(s) including drainage area, time of concentration, frequency, duration, and peak discharge. Summarize in narrative form the change in hydrologic conditions due to the development. Provide a runoff summary table in Section I, Executive Summary.

2) Post-developed discharge should take into account any upstream offsite detention basins and undeveloped offsite areas assumed to be developed in the future with storm water detention.

3) Calculate the allowable release rate from the site. This equals the onsite 5-year pre-developed peak discharge plus the contributing offsite 100-year pre-developed peak discharge minus the onsite 100 year post-development by-pass peak discharge. Include this calculation in Section I, Executive Summary.

5. Stormwater Detention Design

A. **All stormwater detention facilities shall be designed according to the City of Bettendorf Design Standards Manual at a minimum.** The following references may provide helpful design information for stormwater detention and water quality issues:

1) Federal Highway Administration (1996) Urban Drainage Design Manual. Hydraulic Engineering Circular No. 22, Washington D.C.

2) American Society of Civil Engineers (1985) Final report of the Task Committee on Stormwater Detention Outlet Control Structures. Am. Soc. Civ. Eng., New York, N.Y.

3) American Society of Civil Engineers (1992) Design and Construction of Urban Stormwater Management Systems. Manual of Practice No.77, New York, N.Y.

4) American Society of Civil Engineers (1998) Urban Runoff Quality Management. Manual of Practice No. 87, New York, N.Y.

5) Stahre, P and Urbonas, B (1990) Stormwater Detention for Drainage, Water Quality, and CSO Management. Prentice-Hall, Englewood Cliffs, N.J.

6) American Public Works Association (1991) Water Quality Runoff Solutions. Special Report No. 61, Chicago, IL.

B. **Detention Basin Location**
Describe basin site. Discuss existing topography and relationship to basin grading. Determine if construction will be affected by rock deposits. Also determine if a high water table precludes basin storage. Floodplain locations should be avoided.

C. **Detention Basin Performance**
1) For rainfall events having an expected return frequency of 10 years to 100 years inclusive, the rate of runoff from the developed site will not exceed the existing, pre-developed peak runoff from the 5-year frequency storm of the same duration unless if limited by downstream conveyance. Provide a table summarizing these release rates. Also provide a stage-storage discharge table. These tables are also to be shown in Section I, Executive Summary. State the minimum freeboard provided, and at what recurrence interval the basin overtops.

2) Discuss the effects on the overall storm water system by detention basins in contributing offsite areas. If contributing offsite areas are presently undeveloped, discuss assumptions about future development and storm water detention.

3) Calculate the basin overflow release rate. This equals the onsite 100-year post-developed peak discharge plus the contributing offsite 100-year post developed peak discharge. Include this calculation in Section I, Executive Summary.

D. **Detention Basin Outlet**
1) The single-stage outlet (i.e. one culvert pipe) is not recommended because of its inability to detain post-developed runoff from storms less than the 5- year interval. In many cases, runoff from storm events less than the 5-year recurrence interval has created erosion and sedimentation problems downstream of the detention basin.

2) A more desirable outlet has two or more stages. An orifice structure serves to detain runoff for water quality purposes and release runoff for low-flow events less than the 5-year storm. Greater storm events are usually discharged by a separate outlet.

3) Discuss the basin outlet design in terms of performance during low- and high-flows, downstream impact (discuss in Section V), and improvement of water quality (discuss in Section VI. G).

4) State whether the detention basin volume is controlled by the required flood control volume or the water quality volume.

E. **Spillway and Embankment Protection**
1) Design the spillway for high flows using weir and/or spillway design methods. The steady-state open channel flow equation is not intended for use in spillway design.

2) Describe methods to protect the basin during overtopping flow.

F. **Note the TR-55 method** of sizing detention basins may result in storage errors of 25%, and shall not be used in final design unless approved by the City Engineer. The detention basin size in final design shall be based upon actual hydrograph routing.

6. Stormwater Conveyance Design

A. **All stormwater conveyances shall be designed according to the City of Bettendorf Design Standards Manual at a minimum.** The following references may be used for supplemental design information:

1) Federal Highway Administration (1996) Urban Drainage Design Manual. Hydraulic Engineering Circular No. 22, Washington D.C.

2) Federal Highway Administration (1988) Design of Roadside Channels with Flexible Linings. Hydraulic Engineering Circular No. 15, Washington D.C.
3) Federal Highway Administration (1985) Hydraulic Design of Highway Culverts. Hydrologic Design Series Number 5, Washington D.C.

4) US Geological Survey (1968) Measurement of Peak Discharge at Culverts by Indirect Methods. Book 3, Applications of Hydraulics, Washington D.C.

5) American Society of Civil Engineers (1986) Design and Construction of Sanitary and Storm Sewers. Manual of Practice No. 37, New York, N.Y.

B. **Storm Sewer**
1) List design criteria, including storm event and runoff model. Describe the hydraulic grade line and whether pressure flow or surcharging is possible. Provide a graphic of the hydraulic grade line.
2) List design criteria for intake size and spacing. Describe the anticipated gutter flow and spread at intakes.
3) List any special considerations for sub-drainage design, such as high water tables.
4) Provide tables of storm sewer and intake design data.

C. **Culverts**
1) Describe culvert capacity, inlet or outlet control conditions, estimated tailwater and headwater. Determine if 100-year or lesser storm event will flood roadway over culvert.

2) Sketch a contour of the 100-year headwater elevation on a topographic map and/or grading plan. This delineated 100-year flood elevation is used to determine drainage easement and site grading requirements.

D. **Open Channel Flow – Swales and Ditches**
1) Describe swale and ditch design. State the assumed Manning's roughness coefficients. State the anticipated flow velocity, and whether it exceeds the permissible velocity based on soil types and/or ground coverage. If the permissible velocity is exceeded, describe channel lining or energy dissipation.

2) Discuss design calculations. Depending on the complexity of the design, these may range from a single steady-state equation (i.e. Manning's) to a step calculation including several channel cross-sections, culverts and bridges.

3) Discuss the overall grading plan in terms of controlling runoff along lot lines and preventing runoff from adversely flowing onto adjacent lots.

E. **Storm Drainage Outlets and Downstream Analysis**
1) Discuss soil types, permissible and calculated velocity at outlets, energy dissipator design, and drainage impacts on downstream lands. Provide calculations for the energy dissipator dimensions, size, and thickness of riprap revetment (or other material) and filter layer.

2) Include a plan and cross-sections of the drainage way downstream of the outlet, indicating the flow line slope and bank side-slopes. Identify soil types on the plan.

3) Downstream Analysis The downstream analysis will show what impacts, if any, a project will have on the drainage systems downstream of the project site. The analysis consists of three elements: review of resources, inspection of the affected area, and analysis of downstream effects.
   a. During the review of resources, review any existing data concerning drainage of the project area. This data will commonly include area maps, floodplain maps, wetland inventories, stream surveys, habitat surveys, engineering reports concerning the entire drainage basin, known drainage problems, and previously completed downstream analyses.

b. Physically inspect the drainage system at the project site and downstream of it. During the inspection, investigate any problems or areas of concern that were noted during the review of resources. Identify any existing or potential capacity problems in the drainage system, flood-prone areas, areas of channel destruction, erosion and sediment problems, or areas of significant destruction of natural habitat.

c. Analyze the information gathered during the review of resources and field inspection, to determine if the project will create any drainage problems downstream or will make any existing problems worse. Note there are situations that even when minimum design standards are met the project will still have negative downstream impacts. Whenever this situation occurs, mitigation measures must be included in the project to correct for the impacts.

F. **Hydraulic Model**

If the design warrants hydraulic modeling, state the method used. Typical modeling programs include:

1) HEC-RAS - River Analysis Systems
2) HEC-2 - Water Surface Profiles
3) SWMM - Storm Water Management Model
4) WSPRO - Water Surface Profiles
5) HY-8 – Hydraulic Design of Highway Culverts
6) Other commercial or public domain programs approved by the City.

7. Permits

Indicate what permits have been applied for and received. Submit IDNR approval letter and report for sites affecting unnumbered A-zones, as delineated on Flood Insurance Rate Maps.

8. References

Provide a list of all references cited

9. Appendix

A. Provide the following exhibits and calculations in the Appendix:

1) Exhibits
   a. Pre- and post-developed drainage area maps, including all contributing areas, both on-site and off-site. Also label flow patterns used to determine times of concentration.
   b. Soils map or geotechnical information.
   c. Drainage schematics - Indicate flow routings through drainage areas and detention basins.
   d. IDF Curves
   e. List rainfall totals and distributions in tabular format
   f. Delineated 100-year flood elevation as warranted by culvert or bridge analysis, or special drainage considerations (i.e. existing roadway with history of flooding).
   g. Grading plan
   h. Map showing extents of downstream analysis.
   i. Wetlands report as applicable.

2) Calculations
   a. Determine runoff coefficients and curve numbers

b. Determine times of concentration

c. Calculations for intake capacity, sewer design, and culvert design

d. Peak discharge calculations – Show results in tabular format and pre- and post-developed hydrographs

e. Detention basin design – Show tabular stage-storage-discharge results and inflow/outflow hydrographs

f. Detention basin outlet design

g. Open channel flow calculations

h. Erosion protection design

3) Computer Calculations
Attach computer-generated reports and output if software was used. Underline and label results, such as the peak discharge.