

Stormwater Drainage Control Ordinance

of

Crawfordsville, Indiana

and

Contiguous Unincorporated Areas

**Chapter 53
Of the Municipal Code of the
City of Crawfordsville, Indiana**

Ordinance No. 20 – 2002

Date Adopted: August 12, 2002

Effective Date: August 12, 2002

Stormwater Drainage Control Ordinance
City of Crawfordsville

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1. POLICIES AND PROCEDURES

1.1 TITLE

This ordinance shall be known and may be cited and referred to as the “Stormwater Drainage Control Ordinance, City of Crawfordsville, Indiana” and shall hereafter be referred to as “this ordinance.”

1.2 PURPOSE

This ordinance establishes standards for the planning and design of drainage systems and storm water control facilities within the jurisdictional area of the City of Crawfordsville. The purpose of this Ordinance is to control storm water drainage facilities, grading, excavation, clearing, and other alterations of the land in order to limit the dangers of personal injury or property damage that may be caused by storm water runoff. In addition, these provisions are needed to secure the eligibility for flood insurance under Public Law 1016 and thereby promote the public health, safety, and general welfare of the citizens of Crawfordsville.

It is recognized that smaller streams and drainage channels serving the City of Crawfordsville may not have sufficient capacity to receive and convey storm water runoff, as land changes from agricultural or open use to a more urbanized use. It is further recognized that deposits of sediment from developments during and after construction activities can reduce capacities of storm sewer drainage systems and result in damages to the receiving of all new development, and redevelopment and other new construction in the City of Crawfordsville’s jurisdiction. The release rate of storm water from developed lands shall not exceed the release rate from the land area in its present land use, as further defined in Section 3, Hydrology and Hydraulics.

Because topography and the availability and adequacy of outlets for storm water run-off vary with almost every site, the requirements for storm water drainage tend to be an individual matter for any project. It is recommended that each proposed project be discussed with the Planning Director for the City of Crawfordsville at the earliest practical time in the planning stage.

1.3 APPLICABILITY

This ordinance shall apply to all development that requires City of Crawfordsville Permits (as hereinafter defined) and official review and approval of the Crawfordsville Planning Department. This Ordinance regulates:

- Storm water drainage improvements related to development or redevelopment of lands located within the jurisdiction of the City of Crawfordsville.

- Drainage control systems installed during new construction and guarding of lots and other parcels of land.
- Erosion and sediment control systems installed during new construction and grading of lots and other parcels of land.
- The design, construction, and maintenance of storm water drainage facilities and systems.

1.4 EXEMPTIONS

The following activities are exempt from this ordinance at this time:

Existing storm water drainage systems where the inclusion of improvements is not feasible.

New development and redevelopment projects which disturb less than one (1) acre of land and are not a part of a larger common plan of development that will ultimately disturb one (1) or more acres of land.

1.5 CONFLICTING ORDINANCES

The provisions of this Ordinance shall be deemed as additional requirements to minimum standards required by other City, State or Federal regulations. In the case of conflicting requirements, the most restrictive shall apply.

1.6 COMPLIANCE WITH OTHER ORDINANCES

In addition to the requirements of this ordinance, compliance with the requirements set forth in other applicable ordinances for submission and approval of preliminary and final subdivision plats, improvements plans, building permits, zoning approvals, and similar matters, and compliance with applicable State of Indiana statutes and regulations shall be required.

The following approvals, if applicable, and compliance with any other State or Federal laws or regulations, must be obtained before City approval on the Detailed Design Drainage Plan will be granted:

- **Permits for Construction in a Floodway**, from the State of Indiana, Department of Natural Resources.
- **Section 404 Permit**, from the U.S. Army Corps of Engineers.
- **Section 401 Water Quality Certification** from the State of Indiana, Department of Environmental Management.
- **Rule 13, NPDES general Permit**
- **Rule 5 Compliance, NPDES General Permit,**
- **Rule 6, NPDES General Permit,**

1.7 STORMWATER CONTROL POLICY

It is recognized that the streams and drainage channels serving the drainage needs of the City of Crawfordsville may not have sufficient capacity to receive and convey storm water runoff resulting from continued development. To address this condition, the storage and controlled release rate of excess storm water runoff shall be required for any development, redevelopment and/or new construction located within the City of Crawfordsville. All drainage in the developed area must be confined and maintained on site through perimeter structures or appurtenances including swales and inlets, detention or retention storage basins.

No permit will be issued by the City for construction or extension of any proposed or existing building until the required drainage plans have been approved in writing by the Plan Director, except for the following exemptions:

- Construction or extension of a single-family dwelling or an accessory use building thereto;
- Construction or extension of a duplex dwelling or an accessory use building thereto;
- Extension or replacement of any existing building that does not increase the existing rate of runoff.

The release rate of storm water from development, redevelopment, and new construction may not exceed a 2-year pre-developed rainfall event for a 10-year post developed storm, or a 10-year pre-developed outlet rate for a 100-year post developed storm.

The developer must submit to the City detailed computations of runoff before and after development, redevelopment, or new construction that demonstrates that runoff will not be increased. Hydrograph techniques and computer modeling methods used to determine storm water runoff shall be proven and accepted methods, and will be subject to approval of the Planning Director.

These computations must show that the peak runoff rate after development for the 100 year return period storm of critical duration must not exceed the 10 year return period predevelopment peak runoff rate. The critical duration storm is that storm duration that requires the greatest storm water storage. The top of the embankment must provide a two-foot freeboard above the elevation of the 100-year routed pool level. In addition, the emergency spillway must be designed so that it becomes operational at or above the elevation of the routed 100-year storm. The 100-year storm must be routed through the pond with the primary spillway inoperative.

1.8 DETERMINATION OF DRAINAGE IMPACT AREAS

The Planning Director is authorized, but is not required, to classify certain geographical areas as Drainage Impact Areas and to enact and promulgate regulations that are generally applied. In determining drainage impact areas, the Planning Director shall consider such factors as

topography, soil type, and carrying capacity of existing regulated drains and distance from adequate drainage facility. The following areas shall be designated as Drainage Impact Areas, unless good reason for not including them is presented to the Planning Director.

A Floodway Fringe as designated on the Federal Emergency Management Agency's Floodway Maps as land within seventy-five (75) feet of the top of each bank of any regulated or legal drain.

In situations where there is not available land to provide an adequate outlet, taking into consideration the capacity and depth of the outlet, the location may be designated as a drainage impact area by approval of the Planning Director. Special requirements for development within and drainage impact area shall be included in the approval.

1.9 RIGHT OF ENTRY AND INSPECTION OF ANY

The Planning Director, inspector or other duly authorized employee of the City, upon reasonable notice to any person who is owner, tenant, or occupant of any real estate, is empowered to enter, upon presentation of proper credentials, upon or through any premises for the purposes of carrying out the objectives of this Ordinance. This right of entry shall include, but not be limited to, any equipment necessary to conduct such inspections. It shall be the duty of the person to provide all necessary clearance before entry and not to unnecessarily delay or hinder the inspector in carrying out the inspection. The right of entry shall exist at any time.

1.10 MAINTENANCE AND REPAIR OF STORM WATER DRAINAGE FACILITIES

The owner of real estate is responsible for all maintenance and repair of the property's storm water drainage facilities. The granting of an easement to the City does not alter the property owner's duty to maintain and repair the property's storm water drainage facilities.

2. DEFINITIONS

2.1 INTERPRETATION OF TERMS OR WORDS

For the purpose of this ordinance, certain terms or words are defined. The words and terms used shall be interpreted as follows:

The word "person" includes a firm, association, organization, partnership, trust, company, corporation, or legal entity, as well as an individual.

The present tense includes the future tense, the singular number includes the plural, and the plural number includes the singular.

The word “shall” is a mandatory requirement; the word “may” is a permissive requirement; the word “should” is a preferred requirement;

The word “lot” includes the words “tract, plot or parcel”; and

Any word or term not defined herein shall be given a meaning found in a standard English dictionary

2.2 DEFINITIONS

For the purpose of this ordinance, the following definitions shall apply:

Administrative Authority – Board of Public Works

Agricultural Land Use – Use of Land for the production of animal or plant life including, forestry, pasturing or yarding livestock and planting, growing, cultivating, and harvesting crops for human or livestock consumption.

Board – The Board of Public Works

Capacity of a storm drainage facility – The maximum flow that can be conveyed or stored by a storm drainage facility without causing damage to public or private property.

Channel – A natural or artificial watercourse which periodically or continuously contains moving water or which forms a connecting link between two bodies of water. It has a defined bed and banks which serve to confine the water.

Commercial land use – Use of land for the manufacturing, wholesale or retail sale of goods or services.

Compensatory storage – An artificial volume of storage within a floodplain used to balance the loss of natural flood storage capacity when artificial fill or structures are placed within the floodplain.

Contiguous – Adjoining or in actual contact with.

City staff or city plan commission staff – A representative from each of the following departments or other city departments not listed herein, shall make up the City Staff: **Planning, Street, Waste water, Engineering.**

Culvert – A closed conduit used for the passage of surface drainage water under a roadway, railroad, canal or other impediment.

Detention basin – A facility constructed or modified to restrict the runoff of storm water to a prescribed maximum rate, and to detain for a specified period of time the excess waters that accumulated upstream from the outlet.

Detention storage – A manhole having a vertical drop pipe connecting the inlet pipe to the elevation of the outlet pipe. The vertical drop pipe shall be located immediately outside the manhole.

Dry bottom detention basin – A basin designed to be completely dewatered after having provided its planned detention of runoff during a storm event.

Erosion – The detachment and movement of soil, sediment or rock fragments by water, wind, ice or gravity.

Erosion and sediment control plan – A written description and drawings of pertinent information concerning erosion and sediment control measure designed to meet the requirements of this ordinance.

Flood elevation - The maximum level of high waters for a flood of a given return period and rainfall duration.

Flood or floodwater – Water that overflows the banks of a lake or watercourse.

Flood hazard area – Any floodplain, floodway, floodway fringe, or any combination which is subject inundation by the regulatory flood or any floodplain as delineated by Zone A on the current Flood Hazard Boundary Map of the Federal Emergency Management Agency.

Floodplain – The area adjoining the river or stream which has been or may be covered by floodwaters. It consists of both the floodway and floodway fringe.

Floodway – See regulatory floodway.

Floodway fringe – That portion of the floodplain lying outside the floodway that is inundated by the regulatory flood.

Footing drain – A drainpipe installed around the exterior of a basement wall or foundation or located in a crawl space to prevent water from entering a basement or crawl space.

Gradient – The inclination or slope of a channel, conduit or natural ground surface expressed in a ratio of the vertical rise or fall to the corresponding horizontal distance.

Impact areas – Areas defined by the Board which are unlikely to be easily drained because of one or more factors including, but not limited to, any of the following; soil type, topography, land where there is not an adequate outlet, a floodway or floodplain, land within seventy –five feet from the centerline of any legal tile drain, or within recorded drainage easement of a legal drain.

Improvement location permit – A permit stating that the proposed erection, construction, enlargement or moving of a building or structure or the site preparation for the proposed construction complies with the provisions of the Ordinance.

Inlet – An opening into a storm sewer system for the entrance of surface storm water runoff, more completely described as a storm sewer inlet.

Junction chamber – Structure used to facilitate the flow from the one or more conduits into a main conduit.

Land disturbing activity or nonagricultural land disturbing activity – Any manmade change of the land surface including removing vegetative cover, excavating, filling, transporting, and grading. It included any activity requiring a Permit, but does not include agricultural land uses.

Manhole – Storm sewer structure through which a person may enter to gain access to a storm sewer or enclosed structure. A manhole may also be an inlet for the storm sewer system.

Outfall – The point or location where storm runoff discharges from a sewer, channel or detention facility.

Peak flow – The maximum rate of flow of water at a given point in a channel or conduit resulting from a specified storm or flood of a given return period or duration.

Perimeter drain – A tile drain located around an absorption field in compliance with regulations.

Permit – Written permission by the City of Crawfordsville such as a building permit or an improvement location permit.

Rainfall intensity – The rate of rainfall expressed as the amount of rain occurring within a given duration, normally expressed in inches per hour.

Reach – A specified length of river, channel or conduit.

Regulated area – All of the land under the jurisdiction of the Board.

Regulatory flood – A flood with a peak having a probability of occurrence of one percent in any given year, which is commonly referred to as a one hundred year flood as calculated by a method and procedure that is acceptable to the Board. If a permit for constriction in floodway is required by the Indiana Department of Natural Resources, the regulatory peak discharge shall be calculated by the method and procedure acceptable to the Board and the Indiana Department of Natural Resources.

Regulatory floodway – The channel of a river or stream and those portion of the floodplain adjoining the channel which are reasonably required to carry and discharge the peak flow of the regulatory flood of any river or stream.

Release rate – The amount of water released from a storm water control facility per unit of time.

Return Period – The average interval of time within which a given rainfall event will be equaled or exceeded once. A flood having a return period of one hundred years has a one percent probability of being equaled or exceeded in any one year.

Runoff – The portion of precipitation from such sources as rainfall, snowmelt, or irrigation water that flows over or under the ground surface and arrives at the point of consideration as surface water.

Sediment – Material of soil and rock origin transported, carried, or deposited by water.

Siphon – A closed circuit, a portion of which lies above the hydraulic grade line resulting in a pressure less than atmospheric and requiring a vacuum within the conduit to start flow. An inverted siphon is used to carry flow under an obstruction.

Site – The entire area included in the legal description of the land on which the land disturbing activity is proposed in the permit application.

Spillway – A waterway in or about a hydraulic structure for the escape of excess water.

Silting Basin – A structure used to dissipate the energy and/or velocity of flowing water.

Storage Duration – The length of time that water may be stored in a storm water control facility.

Storm Sewer – A closed conduit for conveying storm water exclusively.

Storm water drainage system – All means, natural or man-made, used for conducting storm water to, through or from a drainage area.

Subsurface Drain – A tile drain installed for lowering the ground water table.

Urbanization – The development, change or improvement of any parcel of land consisting of one or more lots for residential, commercial, industrial, instructional, recreational or public utility purposes.

Watercourse – Any natural or man-made drainage way having a defined channel and banks and into which storm water runoff or floodwaters flow either regularly or intermittently.

Watershed – Drainage area.

Wet bottom detention basin/retention basin – A basin designed to retain a permanent pool of water plus capacity to detain and release excess runoff.

Wetlands – Those areas which have hydric soils, that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that, under normal circumstances, do support a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetland generally include swamps, marshes, bogs, and similar areas.

3. CITY REVIEW PROCESS

3.1 INFORMATION SUBMISSION

Applicants must submit drainage plans for review and approval prior to the initiation of any land alteration on the site. Local drainage review as part of the land alteration process shall typically be accomplished as a two-step process, in conjunction with the platting of land. A general drainage plan, including submittal of drainage calculations, and information for the entire parent tract shall be required with submittal of a primary plat. In addition to the information required by the platting process, other information shall be required, as noted in this section.

In the case where the site has already been platted, but development plan approval has not been granted, the drainage review process shall be completed in conjunction with the initial site development plan application. In addition to the information required by the development review process, other information shall be required, as noted in this section.

All preliminary and Final Drainage Plans must utilize the standards and methodology contained in the following sources, copies of which shall be on file with the City of Crawfordsville Planning Department, and must identify the sources utilized:

Christopher B. Burke and Thomas T. Burke, HERPICC County Storm Drainage Manual (West Lafayette: Purdue Research Foundation, 1994)

Indiana Department of Natural Resources, Indiana Handbook for Erosion Control In Development Areas (Indianapolis, 1992)

Indiana Department of Natural Resources Division of Water, Rainfall Frequency for Indiana (Indianapolis, 1994)

Indiana Department of Transportation, Standard Specifications (Indianapolis)

United States, Department of Agricultural, Soil Conservation Service Field Office Technical Guide (Washington)

United States, Department of Agricultural, Soil Conservation Service National Engineering Handbook (NEH-4) (Washington)

United States, Federal Highway Administration, Hydraulic Engineering Circular #19, Hydrology” (Washington)

3.2 PRE-SUBMITTAL MEETING

The Planning Director or the City Engineer can require a pre-submittal meeting.

3.3 GENERAL (PRELIMINARY) DRAINAGE PLAN

The applicant shall file in required form and numbers the application form, filing fee, and copies of the General Drainage Plan, in compliance with the applicable filing requirements set forth by the plan commission for the associated subdivision plat or development plan.

All submittals are subject to cursory review.

3.3.1 Additional information

The City Engineer shall be empowered to require additional information to evaluate and determine the adequacy of the proposed stormwater facility.

3.3.2 Certification Required

All drainage plans submitted to the City, as described under this section, must be prepared and certified by a registered professional engineer, licensed in the State of Indiana, and engaged in stormwater drainage design.

3.3.2 Certification Required

Return period – The average interval of time within which a given rainfall event will be equaled or exceeded once. A flood having a return period of one hundred years has a one percent probability of being equaled or exceeded in any one year.

Runoff – The portion of precipitation from such sources as rainfall, snow melt, or irrigation water that flows over or under the ground surface and arrives at the point of consideration as surface water.

Sediment – Material of soil and rock origin transported, carried, or deposited by water.

Siphon – A closed conduit, a portion of which lies above the hydraulic grade line resulting in a pressure less than atmospheric and requiring a vacuum within the conduit to start flow. An inverted siphon is used to carry flow under an obstruction.

Site – The entire area included in the legal description of the land on which the land disturbing activity is proposed in the permit application.

Spillway – A waterway in or about a hydraulic structure for the escape of excess water.

Silting Basin – A structure used to dissipate the energy and/or velocity of flowing water.

Storage Duration – The length of time that water may be stored in any storm water control facility.

Storm sewer – A closed conduit for conveying collected storm water.

Storm water drainage system – All means, natural or man-made, used for conducting storm water to, through or from a drainage area.

Subsurface drain – A tile drain installed for lowering the ground water table.

Urbanization – The development, change or improvement of any parcel of land consisting of one or more lots for residential, commercial, industrial, instructional, recreational or public utility purposes.

Watercourse – Any natural or man-made drainage way having a defined channel and banks and into which storm water runoff or floodwaters flow either regularly intermittently.

Watershed – Drainage Area

Wet bottom detention basin/ retention basin – A basin designed to retained a permanent pool of water plus capacity to detain and release excess runoff.

Wetlands - Those areas which have hydric soils, that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances, do support a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

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United States, Department of Agricultural, Soil Conservation Service Field Office Technical Guide (Washington)

United States, Department of Agricultural, Soil Conservation Service National Engineering Handbook (NEH-4) (Washington)

United States, Federal Highway Administration, Hydraulic Engineering Circular #19, "Hydrology" (Washington)

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All submittals are subject to cursory review.

3.3.1 Additional Information

The City Engineer shall be empowered to require additional information to evaluate and determine the adequacy of the proposed stormwater facility.

3.3.2 Certification Required

All drainage plans submitted to the City, as described under this section, must be prepared and certified by a registered professional engineer, licensed in the State of Indiana, and engaged in stormwater drainage design.

3.4 DETAILED DESIGN (FINAL) DRAINAGE PLAN

The detailed drainage plan shall be incorporated into the secondary plat, as part of the construction drawings, or with a final site development plan. That submittal should be a finalized version of the earlier Preliminary Drainage Plan.

- All final development and construction plans shall be submitted under the seal and signature of a Professional Engineer licensed to practice in the State of Indiana.

3.4.1 Standard Plans

City of Crawfordsville Construction Standard Plans as adopted by the City of Crawfordsville Board of Public Works shall be included as part of the submittal.

3.4.2 Required Information

The City Engineer shall be empowered to require additional information to evaluate and determine the adequacy of the proposed stormwater facility.

3.4.3 Certification Required

All drainage plans submitted to the City, as described under this section, must be prepared by a registered professional engineer, licensed in the State of Indiana, and engaged in storm drainage design.

3.5 DEVIATIONS FROM APPROVED PLANS

Substantial deviations from approved plans and specifications shall not be made after the Planning Director grants formal plan approval. Written application for deviation (s) from approved plans shall be filed in duplicate with the City Engineer and approved by the Planning Director, prior to implementation of the revision or change (s). Copies of the revisions or changes, if approved, shall be attached to the original plans and specifications.

3.6 PERFORMANCE AND MAINTENANCE GUARANTEES

The City of Crawfordsville shall require financial guarantees such as performance bonds, or maintenance bonds, irrevocable letters to credit to be submitted. These performance bonds, irrevocable letters of credit, or other accepted financial guarantees may be part of the financial guarantee package required by the Planning Director for subdivisions, development plans, etc.

RECORD DRAWINGS

- As part of the final acceptance process, record drawings of the drainage facilities must be submitted to the City Engineer, as set forth herein, for all platted subdivisions. A Professional Engineer, licensed to practice in the State of Indiana shall certify drawings. Structure inverts, pipe inverts, top-of-castings.
- Horizontal alignment of storm drain pipes, culverts, streets and storm drain structures, to minimum accuracy of two (2) feet.
- The horizontal location and/or bank cross-sections for all wet-bottom or dry-bottom storage facilities or other information sufficient to verify that the constructed stormwater storage facility provides the required minimum runoff storage volume.
- Certified statement on plans stating the completed storm drainage system substantially complies with construction plans as approved by the Board.
- Other information that may be requested by the City Engineer.

Final record drawings shall not be accepted until the Board of Public Works accepts the improvements. Record drawings shall be initially submitted as paper copies, while final record drawings shall be submitted in format approved by the City Engineer.

IMPROVEMENT LOCATION PERMIT

An Improvement Location Permit to begin site development shall not be granted by the Planning Department office until the detailed design drainage plan and construction plans have been approved by the City Engineer, in addition to the execution of required performance guarantees, inspection agreements, etc.

HYDROLOGY AND HYDRAULICS

4.1 AMOUNT OF RUNOFF TO BE ACCOMMODATED

Various parts of a drainage facility must accommodate runoff water as follows:

4.2.1 Street Drainage

The street drainage system, such as inlets, catch basin, street gutters, swales, sewers and small channels that collect storm water must accommodate peak runoff from a 10 year return period storm.

- The allowable spread of water on Collector and Arterial Streets is limited to maintaining two clear ten (10) foot moving lanes of traffic. One lane is to be maintained on Local Streets.

- Open channels carrying peak flows greater than thirty (30) cubic feet per second shall be capable of accommodating peak runoff for a 50 year return period storm within the drainage easement.
- Culverts shall be designed to carry, without overtopping the roadway, the 25, 50, and 100 year storms for Local, Collector, and Arterial Streets, respectively.
- Culverts shall be capable of accommodating a peak runoff from a 50 year return period storm when crossing under a road that is classified as an arterial or collector. In no case shall a new culvert be designed to carry less than the existing capacity of the channel.

4.2.2 Overall Drainage System

The overall drainage system shall be designed in accordance with the most current Indiana Department of Natural Resources standards. Storm sewers and swales/ditches shall be designed for a 10 year storm.

4.2.2.1 Pre- developed runoff rates

Pre-developed runoff rates shall be based on the existing land use at the time the new development is being planned.

4.2.2.2 General Drainage System Design Standards

The drainage system shall be constructed and installed in accordance with plans and specifications approved by the Board of Public Works. All streets shall have a storm drainage system consisting of curbs, gutters and storm sewers, unless a waiver is granted to the applicant.

4.2.3 Storm Sewer Design Standards

All public storm sewers shall conform to the design standards and other requirements contained in this ordinance and peer the standard detail sheets as approved by the Board of Public Works.

4.2.3.1 Manning Equation

The hydraulic capacity of storm sewers shall be determined using Manning's Equations:

$$V=(1.486/n) R^{2/3} S^{1/2} \text{ where,}$$

V= mean velocity of flow in feet per second

R= the hydraulic radius in feet

S= the slope of the energy grade line in feet per foot

n= roughness coefficient

The hydraulic radius, R is defined as the cross sectional area of flow divided by the wetted flow surface or wetted perimeter. Typical “n” values are listed in Table 4.

Roughness coefficient (n) values for other sewer materials can be found in standard hydraulics texts and references.

TABLE 4 TYPICAL ROUGHNESS COEFFICIENTS (MANNING’S N VALUE)

Type	Range
Concrete Pipe	0.010-0.016
Corrugated Metal Pipe	0.019-0.025
HDPE Pipe	0.011-0.015
PVC Pipe	0.011-0.015

- 4.2.3.2 Velocity
The minimum pipe flow should not be less than two and one half (2.5) feet per second. The maximum pipe velocity is to be fifteen (15) feet per second. However, outlet velocities in excess of five (5) feet per second will necessitate energy dissipation measures, as approved by the City Engineer.
- 4.2.3.3 Minimum Pipe Size
The minimum pipe size of all storm sewers shall be twelve (12) inch diameter. An orifice plate, weir, or other devices, subject to approval of the City Engineer shall control the rate of release for stormwater, where the pond’s primary spillway pipe will not limit the required rate of release.
- 4.2.3.4 Grade
Storm sewer grade shall be such that, in general, a minimum of two (2) feet of cover is maintained over the top of the pipe. Pipe cover less than the minimum may be used only upon approval of the City Engineer. Uniform slopes shall be maintained between inlets, manholes, and inlets to manholes. Final grade shall be set with full consideration of the capacity required, sedimentation problems, and other design parameters. Minimum and maximum allowable slopes shall be those capable of producing velocities of two and one-half (2.5) and five (5) feet per second, respectively, when the storm sewer is flowing full.
- 4.2.3.5 Alignment
Storm Sewers shall be straight between manholes, insofar as possible. Where long radius curves are necessary to conform to street layout, the minimum radius of curvature shall be no less than one hundred (100) feet for sewers forty two (42) inches and larger in diameter, Deflection of pipe sections shall not exceed the maximum deflection shall be uniform and finished installation shall follow a smooth curve.
- 4.2.3.6 Manholes

Manholes shall be installed to provide access to continuous underground storm sewers for the purpose of inspection and maintenance. Manholes shall be provided at the following locations:

- Where two or more storm sewers converge;
- At the point of beginning or at the end of a curve, and at the point of reverse curvature (PC, PT, PRC).
- Where an abrupt change in alignment occurs;
- Where a change in grade occurs;
- At suitable intervals in straight sections of the storm sewer. The maximum distance between storm sewer manholes shall be three hundred (300) feet for pipe twelve (12) inches through forty-two (42) inches, and five hundred (500) feet for pipes larger than forty-two (42) inches.

4.2.3.7 Inlets

Inlets or drainage structures shall be utilized to collect surface water through grated openings and convey it to storm sewers, channels or culverts. Inlet design and spacing shall be in accordance with INDOT's Road Design Manual or other appropriate design procedures, but in no case may be spaced more than five hundred (500) feet apart.

Inlets shall be sized and each individual inlet shown on plans. The inlet grate opening provided must be adequate to pass the design 10 year flow with fifty (50%) percent of the sag inlet areas clogged. An overload channel from sag inlets, so that the maximum depth of water that might be ponded in the street sag shall not exceed six (6) inches.

4.2.3.8 Protection of Embankment

Erosion protection shall be provided for the primary outlet and emergency spillway so that the stormwater facility embankment will be adequately protected. The location of the emergency spillway shall be in undisturbed material, unless otherwise approved by the City Engineer.

4.2.3.9 Outlet Conduit

The minimum allowable size for the primary outlet conduit, from the stormwater facility, shall be twelve (12) inches. If further restriction of the outlet conduit is required, the restriction shall be made to the inlet end of the conduit.

4.2.3.10 Outlet Velocity

In those instances where the discharge velocity from the primary outlet or emergency spillway is excessive in the opinion of the City Engineer, energy dissipation may be required. In general, outlet velocities in excess of five (5) per second in earth/grassed channels are considered excessive.

4.3 INDIVIDUAL SITE DRAINAGE

All drainage in a developed area must be confined and maintained on site through perimeter structure including swales and inlets, and shall be channeled through the storm water storage area.

4.4 OPEN CHANNEL DESIGN STANDARDS

4.4.1 Manning Equation

Open channel design shall be based on the Manning Equation. See Section 3.2.3.1 for an Explanation of Manning equation.

4.4.2 Minimum Size

The required channel cross-section and grade are determined by the design capacity, the material in which the channel is to be constructed, and the requirements for maintenance. A minimum depth may be required to provide adequate outlets for subsurface drains, tributary ditches or streams. The channel grade shall be such that the velocity in the channel is high enough to prevent siltation but low enough to prevent erosion. Velocities less than one and one half (1.5) feet per second should be avoided because siltation will take place and ultimately reduce the channel cross-section. Developments through which the channel is to be constructed must be considered in design of the channel section.

4.4.3 Side Slopes

Side slopes for grass-lined channels shall be no steeper than three (3) to one (1). Side slopes for rock riprap-lined channels shall be no steeper than one and one half (1.5) to one (1). Channels with vertical walls may be constructed, with approval of the City Engineer.

4.4.4 Drainage of Vegetated Waterways

Vegetated waterways that have less than one and one half (1 ½ %) percent slope, are subject to low flows of long duration or where wet conditions prevail shall be drained with an underdrain or low flow structure. Lines may be outletted through a drop structure at the end of the waterway, or through a standard tile outlet.

4.4.5 Longitudinal Slopes

Longitudinal slopes shall be grass-lined and, for channel length of four hundred (400) feet or less, the minimum standard longitudinal slope shall be one and three-tenths (1.3 %) percent. If the slope is less than one and three-tenths (1.3%) percent but at least one (1%) percent, then an underdrain is required. If the slope is less than one (1%) percent, a paved concrete swale as approved by the City Engineer shall be required. For channel length greater than four hundred (400) feet, the minimum standard longitudinal slope shall be one (1%) percent. For slopes between one (1%) and one three-tenths (1.3%), an underdrain is required.

4.4.6 Alternative swale/ditch treatments

Alternative open channel treatments shall be subject to approval of the City Engineer.

4.4.7 Channel Stability

All swales shall be blanketed or fiber mulched, so erosion control extends completely to the top of the bank.

4.4.8 Effects of Channel Improvements

The effect of channel improvements

on existing culverts, bridges, buried cables, pipelines and inlet structures for surface and subsurface drainage on the channel being improved and laterals there to shall be evaluated to determine the need for modification or replacement. Culverts and bridges which are modified or added as part of channel improvement projects shall meet reasonable standards for the type of structure, and shall have a minimum capacity equal to the design discharge or governmental agency design requirements, whichever is greater.

4.4.9 Disposition of Spoil

Spoil material resulting from clearing, grubbing and channel excavation shall not stay on the site unless it is to be used as part of the approved grading plan. In no case shall spoil be deposited in the floodway. Excavated materials, when stored temporarily on-site, must be handled in accordance with the Rule 5 Erosion Control Plan and the erosion control measures included in the construction plans.

4.5 CONSTRUCTION AND MATERIALS

4.5.1 Construction

Specifications shall be in keeping with the current standards on file with the City of Crawfordsville, and shall describe the requirements for proper installation of the project to achieve its intended purpose.

4.5.2 Street Drainage

Street drainage shall be divided to drain on both sides of the street, and shall comply with the City's approved standard details, as adopted by the Board of Public Works.

4.5.3 Materials

4.5.3.1 Storm Sewers

Pipes shall comply with the City's approved standard detail.
End treatments shall be slope walls reinforced concrete.

4.5.3.2 Open Channels

Materials acceptable for use as channel lining are grass, revetment rip-rap, concrete, hand-laid rip-rap, pre-cast cement concrete rip-rap, grouted rip-rap, and gabions. Lining materials shall receive specific approval of the City Engineer. Materials shall comply with the latest edition of INDOT's Standard Specifications.

4.5.4 Special Hydraulic Structures

Special hydraulic structures, including junction chambers, drop manholes, inverted siphons, stilling basins, energy dissipation structures, etc. shall be used only if they match one of the City's approved standard details or if approved by the City Engineer.

4.6 STORM WATER STORAGE

The following shall govern the design of any improvement with respect to the temporary storage of storm water runoff.

4.6.1 Acceptable Storage Methods

Increased storm water runoff resulting from a proposed development should be detained on-site by the provision of appropriate storm water storage ponds. Storage of storm water shall not be allowed to occur within any swales unless such storage is part of a plan approved by the Planning Director.

4.6.2 Design Storm

Design of storm water facilities shall be based on a return period of once in 100 years. The storage volume and outflow rate shall be sufficient to handle storm water runoff from a critical duration storm, as defined in this Ordinance.

- Drainage System Overflow Design – Drainage systems shall have adequate capacity to convey the storm water runoff from all upstream tributary areas through the development under consideration for a storm of 100- year design return period calculated on the basis of the upstream land in its present state of development.
- The City Engineer may approve, upon review of evidence submitted by the developer, an allowance, equivalent to the reduction of flow rate provided, for upstream storage, when such upstream storage and release rates have previously been approved by the Board and evidence of its construction can be shown. This requires flow restriction at the discharge end.
- Determination of Storage Volume – Hydrograph Method – For developments requiring that storm water storage be provided, the hydrograph methods shall be used to determine the required volume of storm water storage.

4.7 GENERAL STORM WATER BASIN DESIGN REQUIREMENTS

Basin shall be constructed to detain temporarily the storm water runoff that exceeds the maximum peak flow rate authorized by this Ordinance. The volume of storage provided in these basins shall be sufficient to control excess runoff from the 100 – year storm.

- For on-site watershed, the 100 – year, 24 –hour hydrograph for the tributary drainage area, representing fully developed conditions of the watershed, and corresponding runoff coefficients and travel times, shall be routed through the storm water basin.
- Runoff for upstream off-site development will flow through the site. The 100 – year run-off under existing upstream conditions shall be determined, and this shall be used in sizing the emergency spillway for the pond.
- The routing shall determine the maximum 100-year pool elevation; the maximum routed discharge, and the maximum pond storage requirement for the design storm. The maximum routed discharge shall be equal to or less than the 10-year frequency peak discharge from the watershed under pre-developed conditions.
- The 10-year 24 –hour hydrograph for the fully developed watershed must be routed through the storm water pond and have a routed peak discharge rate not to exceed the pre-developed 2-year peak discharge rate.
- The lip of the emergency spillway shall be established at or above the routed 100-year pool elevation. The pond embankment shall have a minimum freeboard of two feet between the maximum routed 100-year pool elevation and the top of the facility embankment.

- The emergency spillway shall be designed by routing the 100-year, 24 –hour hydrograph through the pond assuming that the primary spillway is not operating. This storm should be routed through the basin with the maximum pool level below the top of the embankment.
- All storm water storage facilities shall be separated by a minimum of twenty-five (25) feet from any primary building or structure to be occupied. A twenty (20) feet wide easement around the perimeter of the pond, measured from the top of bank shall be required. Off-site easements may be required by the City, based on the location of primary and emergency pond spillways, and their proximity to adjacent property. No permanent structure may be constructed in the easement. The removal of any structure from the easement shall be at the owner’s expense.
- Outlet control structures shall be designed to operate as simply as possible and shall require little or no maintenance and/or attention for proper operation. They shall limit discharges into existing or planned downstream channels or conduits so as not to exceed the predetermined maximum authorized peak flow rate. This facility should be designed to allow easy access from the embankment to remove trash and debris from the outlet structure.
- Emergency overflow facilities such as a weir or spillway shall be provided for the release of exceptional storm runoffs or in emergency conditions should the primary spillway become completely or partially inoperative. The overflow facility shall be of such design that its operation is automatic and does not require manual attention. All storm water storage facilities shall be provided with an emergency spillway.
- Sod or other vegetative cover acceptable to the City Engineer shall be provided throughout the entire basin area. Grass should be cut regularly at approximately monthly intervals during the growing season or as required unless designated as a wildflower or prairie area.
- Debris and trash removal and other necessary maintenance shall be performed regularly by the designated body (e.g., developer or homeowner’s association) to assure continued in conformance to design.
- A report shall be submitted to the Office of the City Engineer describing the proposed development, the current land-use conditions, the method of hydraulic and hydrologic analysis used (including any assumptions or special conditions), the results of the analysis, and the recommended drainage control facilities. Hydraulic and hydrologic calculations, including input and output files, shall be included as appendices to the report.
- Drainage easement- All storm water storage facility should be located in a drainage/utility easement so that the City can access the facility under emergency conditions.

4.8 DRY-BOTTOM BASIN DESIGN REQUIREMENTS

Storm water storage facilities, which are designed to have dry bottoms, must be designed to include under drains, to drain the bottom of the storm water storage facility, so that the facility can be maintained. In addition, the bottom of the facility shall be designed to have a longitudinal slope of one and three-tenths (1.3%) percent and traverse grade to the outlet, so that the facility will empty, leaving no ponded water. Detention basins with less than one (1%) percent must be provided with subsurface drainage or paved gutters. Recreation facilities, aesthetic qualities, open space or secondary use shall be considered in planning in detention facilities. Max planned depth of storm water stored without a permanent pool shall not exceed four feet.

4.9 WET-BOTTOM BASIN DESIGN REQUIREMENTS

Where part of a storm water basin will contain a permanent pool of water, all the items required for storm water storage shall apply except that the system of drains with a positive gravity outlet required to maintain a dry-bottom basin will not be required. A controlled positive outlet will be required to maintain the design water level in the wet-bottom basin and provide required temporary storage above the design water level (permanent pool). However, the following additional conditions shall apply:

- Storm water basins shall be designed in compliance with the City of Crawfordsville's Standard Detail.
- In the case of valley storage, natural slopes may be considered stable.
- A safety ledge shall be provided per the City's standard detail must be installed in all ponds.
- There shall be two (2) feet of freeboard from the routed 100-year pool to the top of bank.
- There shall be a minimum easement width around the pond of twenty (20) feet, with an additional easement area adjacent to the pond large enough to serve as a staging area for maintenance equipment such as dredges and dump trucks.
- Periodic maintenance is required in ponds to control weed and larval growth. The pond shall also be provide for the easy removal of sediment that will accumulate during periods of pond operation. A means of maintaining the designed water level of the pond during prolonged periods of dry weather is also required.
- Aeration facilities to enhance and maintain pond water quality shall be provided for all ponds with a surface area of less than one acre.
- Design calculations to substantiate the effectiveness of these aeration facilities shall be submitted with final engineering plans. Agreements for the perpetual operation and maintenance of aeration facilities shall be prepared to the satisfaction of the Board.
- If fish are to be maintained in the pond, a minimum depth of approximately ten (10) feet shall be maintained over at least twenty (25%) percent of the pond area. The remaining pond areas shall have no extensive shallow areas.
- If fish are not to be maintained, the minimum depth shall be with eight (8) feet over at least twenty-five (25%) percent of the pond at permanent water level, or where a limiting layer prevents excavation to that depth, a minimum of six (6) feet over at least fifty (50%) percent of the area shall be required.
- In excavated ponds, the underwater side slopes in the pond shall be stable. In the case of valley storage, natural slopes may be considered stable.
- A safety ledge a minimum of six (6) feet in width and a ten to one (10:1) slope is required and must be installed in all ponds approximately thirty (30) inches below the permanent water level.
- Erosion control measures must be installed to prevent erosion from wave action and wet-dry cycles.

4.10 FACILITY FINANCIAL RESPONSIBILITY

The construction cost of the storm water control systems and facilities as required by this ordinance shall be accepted, as part of the cost of land development, and the developer shall be responsible for all costs.

4.11 FACILITY MAINTENANCE RESPONSIBILITIES

Maintenance of storm water facilities during construction and thereafter shall be the responsibility of the land developer/property owner. Assignment of responsibility for maintenance of drainage facilities serving more than one lot shall be part of appropriate covenants to property deeds. The City shall not be responsible for maintenance of drainage facilities unless the Board of Public Works formally agrees to accept responsibility for maintenance.

4.12 JOINT DEVELOPMENT OF CONTROL SYSTEMS

Storm water control systems may be planned and constructed jointly by two or more developers as long as compliance with this Ordinance is maintained.

4.13 INSTALLATION OF EROSION CONTROL SYSTEMS

Runoff and erosion control systems shall be installed as soon as possible during the course of site development. Perimeter and entrance/exit erosion facilities are required prior to the start of any site work. Basins should be designed to collect sediment and debris in specific locations so that removal costs are kept to a minimum.

4.14 STORM WATER STORAGE FACILITIES IN FLOODWAY

No storage facilities shall be accepted in the floodway.

4.15 OFF-SITE DRAINAGE PROVISIONS

When the allowable runoff is released in an area that is susceptible to flooding, the developer may be required to construct appropriate storm drains through such area to avert increased flood hazard, caused by the concentration of allowable runoff at one point, instead of the natural overland distribution. The requirement of off-site drains shall be at the discretion of the City Engineer.

4.16 STANDARD DETAILS

Standard detail plans are adopted by the City of Crawfordsville Board of Public Works, which has the authority to enforce the regulations.

5. ENFORCEMENT AND VIOLATIONS

5.1 CIVIL STORM WATER DRAINAGE AND SEDIMENT CONTROL VIOLATIONS

Any person who is in violation of the Storm water Drainage and Sediment Control Ordinance of Crawfordsville shall be deemed to have committed a civil storm water drainage and sediment control violation and may be issued a citation by the designated enforcement entity. Each day a violation remains uncorrected is a distinct and separate civil storm water drainage and sediment control violation subject to an additional citation and fine in the amount prescribed below, provided a warning ticket has first been issued pursuant to subsection 5.2.

The monetary fine for each civil storm water drainage and sediment control violation shall be \$250.00, except that for a repeated storm water drainage and sediment control violation, the following fines shall apply:

- Second Citation \$500.00
- Each Citation in Excess of Two \$1000.00

All fines prescribed by this section for civil storm water drainage and sediment control violations shall be paid within 72 hours to the City of Crawfordsville Clerk-Treasurer, who shall render to the person making the payment a receipt stating the amount and purpose for which the fine has been paid, and duplicate of which shall be made a part of the records of the Planning Department.

5.2

CITATION FOR CIVIL STORM WATER DRAINAGE AND SEDIMENT CONTROL VIOLATIONS

The Planning Director and/or his duly authorized designees may issue a civil storm water drainage and sediment control violation to a person who commits a civil storm water drainage and sediment control violation to the legal owner, the contract vendee, or any person or entity with a possessory interest in the real estate upon which the violation occurs. The citation may be served by personal service, by certified mail, or by a placement in a conspicuous place on the property where the violation occurs and shall serve as notice to a person that he or she has committed a civil storm water drainage and sediment control ordinance violation.

No citation shall be issued for the first offense unless the person who commits a civil storm water drainage and sediment control violation, or the legal owner, the contract vendee, or any person or entity with a possessory interest in the real estate upon which the violation occurs has been issued a warning ticket before the issuance of the citation to allow said person to correct the violation to come into compliance with the prescribed storm water drainage and sediment control ordinance or regulations.

A person who receives a warning ticket or a citation may either choose to abate the violation or file a petition for a drainage plan, a Storm Water Drainage and Sediment Control Ordinance waiver, or other means provided by this Chapter to correct the violation, as prescribed below. A person who elects to file such a petition shall indicate this intent in writing to the issuing agency. A person shall have ten (10) working days after issuance of the warning ticket to file the petition, and additional monetary fines as prescribed in subsection 5.1 of this Section shall be stayed upon the filing of such petition, as long as the violation does not continue at the real estate. A person who files the petition within said time period shall pursue the petition in an expeditious fashion. If the petition is denied, withdrawn, or dismissed for want of prosecution, and the civil storm water drainage and sediment control violation continues at the real estate, then a lawsuit will be commenced by the designated enforcement entity in a court of competent jurisdiction in Montgomery County, Indiana.

If the violation is determined by the Planning Director to be a threat to public health or safety, the Planning Director may order the land use or activity to cease and desist immediately, regardless of whether a warning ticket or citation has been issued.

5.3 TRIAL FOR CIVIL STORM WATER DRAINAGE AND SEDIMENT CONTROL VIOLATIONS

A person who receives a citation may elect to stand trial for the offense by indication on the citation his intent to stand trial and returning a copy of the citation to the Planning Director. The returned copy of the citation shall serve as notice of the person's intent to stand trial, and additional monetary fines prescribed in Section 5.1 shall be stayed upon receipt of the notice. On receipt of the notice of intention to stand trial, a lawsuit will be commenced by the city attorney in a court of competent jurisdiction in Montgomery County, Indiana.

If a person who receives a citation fails to pay the assessed fine within 72 hours and fails to give notice of his intention to either file a petition as prescribed in subsection 5.2, or stand trial as prescribed above, the city attorney may file a civil lawsuit as prescribed by applicable laws and ordinance, and seek penalties as prescribed in this section.

A person adjudged to have committed a violation of this Ordinance is liable for the court costs and fees. No costs shall be assessed against the enforcement agency in any such action. Any person who violates this ordinance or fails to comply with any of its requirements shall, upon conviction, thereof be fined up to two thousand five hundred dollars (\$2,500.00) and, in addition shall pay all costs and expenses involved in the case, including but not limited to mediation costs, court costs, coverage or reasonable attorney fees, short-term and long-term mitigation of damages, and restoration and restitution. Each day such violation continues shall constitute a separate offense.

6. IMPLEMENTATION OF ORDINANCE

6.1 DISCLAIMER OF LIABILITY

The degree of protection required by this Ordinance is considered reasonable for regulatory purposes and is based on historical records, engineering and scientific methods of study. Larger storms may occur or storm water runoff depths may be increased by man-made or natural causes. This Ordinance does not imply the land uses permitted will be free from storm water damage. This Ordinance shall not create liability on the part of the City of Crawfordsville or any officer or employees thereof for any damages that may result from reliance on this Ordinance or on any administrative decision lawfully made there under.

6.2 CORRECTIVE ACTION

Nothing herein contained shall prevent the City of Crawfordsville from taking such other lawful action as may be necessary to prevent or remedy any violation. All costs connected therewith shall accrue to the person or persons responsible.

6.3 WHEN EFFECTIVE

This Ordinance shall become effective upon its final passage and approval in accordance with Indiana Law.

6.4 EXEMPT PROJECTS

Any subdivision or construction project that has had a final drainage plan approved by the City Engineer prior to the effective date of this Ordinance shall be considered legally non-conforming. As such, the plan may be implemented as approved. If, however, the project is expanded or otherwise altered, these regulations shall apply.