

WABASH COUNTY STORM WATER CONTROL ORDINANCE



General Ordinance Number: 2020-85-17 .

An Ordinance Regulating Storm Water Control in
Wabash County, Indiana

BEFORE THE BOARD OF COMMISSIONERS OF WABASH COUNTY

ORDINANCE NO. 2020-85- 17

**AN ORDINANCE REPEALING AND REPLACING THE
WABASH COUNTY STORMWATER CONTROL ORDINANCE**

On or about March 2, 2007, the Board of Commissioners adopted General Ordinance Number 2007-85-02, entitled an Ordinance Regulating Storm Water Control in Wabash County, Indiana.

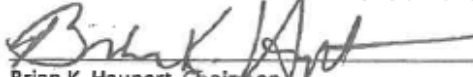
The Board of Commissioners believes that it would be in the best interests of the citizens of Wabash County, Indiana, to repeal General Ordinance Number 2007-85-02, and replace it with a new ordinance, attached hereto, entitled "Stormwater Drainage Ordinance."

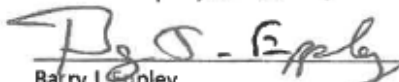
IT IS NOW ORDAINED:

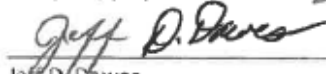
1. General Ordinance Number 2007-85-02 is now repealed.
2. The terms and provisions contained in the document attached hereto entitled "Stormwater Drainage Ordinance" is now adopted in its entirety.
3. This ordinance shall become effective upon publication of notice of its passage pursuant to Indiana law.

ADOPTED by the Board of Commissioners of Wabash County, Indiana, this 30 day of NOVEMBER, 2020.

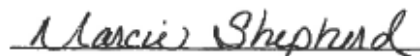
BOARD OF COMMISSIONERS OF WABASH COUNTY


Brian K. Haupert, Chairman


Barry J. Eppley


Jeff D. Dawes

ATTEST:


Marcie Shepherd, Wabash County Auditor

Wabash County, Indiana

Stormwater Drainage Ordinance

TABLE OF CONTENTS

SECTION 1 GENERAL PROVISIONS

Section 1.1	Scope and Purpose
Section 1.2	Authority
Section 1.3	Definitions
Section 1.4	Exemptions
Section 1.5	Conflicting Ordinances and Interpretation
Section 1.6	Disclaimer of Liability

SECTION 2 STORMWATER DRAINAGE PLANS

Section 2.1	Stormwater Control Policy
Section 2.2	Information Requirements
Section 2.3	Submittal and Consideration of Drainage Plans
Section 2.4	Open Drainage Board Meeting
Section 2.5	Approval

SECTION 3 PRINCIPLES AND STANDARDS OF DESIGN

Section 3.1	Determination of Runoff Questions
Section 3.2	Rational Method
Table 1	Urban Runoff Coefficients
Table 1A	Rural Runoff Coefficients
Table 2	Runoff Coefficients by Land Use
Figure 1	Nomograph for Time of Concentration
Section 3.3	Hydrograph Techniques (General)
Section 3.4	Hydrograph Techniques (TR-55)
Section 3.5	Hydrograph Techniques (Critical Duration Series, NOAA Atlas 14)
Section 3.6	Required Design Capacity of Stormwater Control Systems
Section 3.7	Storm Sewer Design Standards
Table 3	Typical Values of Manning's "n"
Section 3.8	Workmanship and Materials for Storm Sewers, Manholes and Inlets
Section 3.9	Open Channel Design Standards
Table 4	Maximum Permissible Velocities in Vegetation-Lined Channels and Watercourses
Section 3.10	Construction and Materials for Open Channels

Section 3.11	Stormwater Detention
Table 5	Point Precipitation Rainfall Depth (inches) for a given recurrence interval
Table 5A	Rainfall Intensity (inches per hour) for a given recurrence Interval
Table 6	Temporal Rainfall Distribution for TR-55 Hydrologic Modeling
Table 6A	Temporal Rainfall Distribution for Critical Duration Hydrologic Modeling (6-hours and less)
Table 6B	Temporal Rainfall Distribution for Critical Duration Hydrologic Modeling (greater than 6-hours and 12 hours or less)
Table 6C	Temporal Rainfall Distribution for Critical Duration Hydrologic Modeling (greater than 12-hours and 24 hours or less)

SECTION 4 CERTIFICATIONS REQUIRED

Section 4.1	Changes in Drainage Plans
Section 4.2	As-Built Documentation of Drainage Plans
Section 4.3	Certificates and Bonding of Improvements
Section 4.4	Determination of Impact Watersheds
Section 4.5	Floodplain Compensatory Storage
Section 4.6	Establishment of New Regulated Drains
Section 4.7	Establishment of Future Floodplains

SECTION 5 FEES AND PENALTIES

Section 5.1	Fees
Section 5.2	Violations and Penalties

SECTION 1

GENERAL PROVISIONS

Section 1.1

Scope and Purpose

This ordinance regulates all un-incorporated areas included within Wabash County, Indiana. This ordinance will also regulate all incorporated towns within Wabash County if adopted by their legislative body.

Smaller streams, storm sewers, culverts, and drainage channels serving Wabash County may not have sufficient capacity to receive and convey stormwater runoff when land use changes from open or agricultural use to a more urbanized use, or when redeveloped to a denser land use. Also, sediment from developments during and after construction can reduce capacities of storm sewers, culverts and drainage systems, and result in damage to receiving lakes and streams.

Any grading and other earthwork can alter the stormwater runoff for a site which can create increased concentrated flows outletting onto county road rights-of-way. These concentrated flows frequently result in damage to receiving roadside ditches and other road improvements, resulting in increased burden and costs for road maintenance.

The storage and controlled release of stormwater runoff shall be required of all new development, any redevelopment, and other new construction in Wabash County. The release rate of stormwater from developed lands shall not exceed the release rate from the land area in its present land use and controlled to no more than the rates listed in Section 2.1, Stormwater Control Policy.

Any grading or other earthwork that may result in a change or alternation to the stormwater runoff outletting onto a public road right-of-way, shall require review and approval from the Wabash County Drainage Board prior to conducting said activity. Any drainage facilities proposed within a public road right-of-way shall also be approved by the Board prior to installation or replacement.

Section 1.2

Authority

This Ordinance is adopted under the authority of I.C.36-9-28.5-3, I.C. 36-7-4, et. seq., and I.C. 36-9-27, et. seq.,

Section 1.3

Definitions

BOARD: The Drainage Board of Wabash County, Indiana, and any subordinate person to whom it shall specifically delegate a responsibility authorized by this Ordinance.

CAPACITY OF A STORM DRAINAGE FACILITY: The maximum flow that can be conveyed or stored by a stormwater drainage system without causing damage to public or private property.

CHANNEL: A natural or artificial watercourse which periodically or continuously contains moving/standing 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.

COMPENSATORY STORAGE: An artificial volume of storage within a floodplain used to offset loss of natural flood storage capacity when artificial fill or structures are placed within the floodplain.

CONDUIT: A device to convey water runoff or drainage flow.

CONTIGUOUS: Adjoining or in actual contact with.

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

DEPRESSIONAL STORAGE: An area or pond that does not have a direct gravity outlet. It may be an area in agricultural production that is drained by a tile, or that is drained via groundwater discharge.

DETENTION BASIN: A stormwater control system constructed or modified to restrict the flow of stormwater to a prescribed maximum rate, and to concurrently detain the excess waters resulting from development. This system has no permanent water pool during inter-storm periods.

DETENTION STORAGE: The temporary detaining or storage of stormwater in storage basins, underground chambers, streets, parking lots, school yards, parks, open spaces, or other areas under predetermined and controlled conditions, with the rate of drainage released therefrom regulated by appropriately installed devices.

DEVELOPMENT: Activity that results in a change of land use, or an area where a change to a more intensive land use has occurred, or migration from a less intense to more intense land use. This activity commonly results in increased runoff and peak flow.

DEVELOPMENT SITE: The parcel of land that contains the Development.

DRAINAGE AREA: See Watershed.

DURATION: The time period of a rainfall.

EROSION: Wearing away of the land by running water, waves, weather cycles, ice or wind.

FLOOD ELEVATION: The elevation delineating the maximum level of high waters for a flood of a given return period and rainfall duration.

FOOTING DRAIN: A drain pipe installed around the exterior of a building or basement wall foundation to relieve water pressure caused by high groundwater elevation.

GRADE/SLOPE: The inclination, or slope, of a channel, canal, conduit, etc., or natural ground surface usually expressed in terms of the percentage of the vertical rise (or fall) to the corresponding horizontal distance.

IMPACT AREAS: Areas defined, listed, and/or mapped by the Board which are unlikely to be easily drained because of one or more factors, including but not limited to, the following: soil type, topography, land with no adequate drainage outlet, a floodway or flood plain, land within 75 feet of the top of each bank of any regulated rain or within 75 feet from the centerline of any regulated storm sewer or tile drain.

IMPERVIOUS: Impossible to penetrate.

INLET: An opening into a storm sewer system for the entrance of surface water runoff, more appropriately described as a storm sewer inlet.

LATERAL STORM SEWER: A sewer that has inlets connected to it but has no other upstream storm sewer connected. Lateral storm sewers connect to a main storm sewer outlet.

MANHOLE: Storm sewer junction and maintenance structure through which a person or equipment may enter to gain access to an underground storm sewer or enclosed structure.

MAJOR DRAINAGE SYSTEM. A Drainage System having a Watershed of one or more square miles.

MINOR DRAINAGE SYSTEMS: Drainage systems having a Watershed of less than one square mile.

OFF-SITE: Not located within the Development Site.

ON-SITE: Located within the Development Site.

OUTFALL: The point or location where storm runoff discharges from a storm sewer or drain; also applies to the outfall sewer or channel which carries the storm runoff to its point of outfall.

PEAK FLOW: The maximum rate of flow of stormwater at a given point in a channel or conduit resulting from a particular storm or flood, commonly recorded in cubic feet per second.

RADIUS OF CURVATURE: Length of radius of circle used to define a curve.

RAINFALL INTENSITY: The cumulative depth of rainfall occurring over a given time period, normally expressed in inches per hour.

REACH: Any selected length of river, channel or storm sewer.

RELEASE RATE: The amount of stormwater released from a Stormwater Drainage System (typically a detention basin or retention pond) per unit of time. This term is normally expressed in cubic feet per second.

RETENTION POND: A Stormwater Drainage System designed to retain a permanent pool of water after having provided its planned detention of runoff during a storm event, or one that has no outlet and discharges into the soil with time.

RETURN PERIOD: The average interval of time within which a given rainfall will be equaled or exceeded one time. A flood having a return period of 100 years has a one percent probability of being equaled or exceeded in any one year.

RUNOFF COEFFICIENT: A decimal fraction relating the amount of rain which appears as runoff and reaches the Stormwater Drainage System to the total amount of rain falling. A coefficient of 0.5 implies that 50 percent of the rain falling on a given surface appears as stormwater runoff.

SEDIMENT: Material of soil and rock origin transported, carried and deposited by water.

SPILLWAY: A waterway in or about a hydraulic structure for the passage of flow of water. A portion of a stormwater control system designed for the passage or flow of water.

STILLING BASIN: A water-filled basin used to dissipate energy of flowing water.

STORAGE DURATION: The length of time that water may be stored in any Stormwater Drainage System, measured from the time water first begins to be stored until the end of the storage need.

STORM SEWER: A closed conduit for conveying collected stormwater.

STORMWATER: Rain, snow, and/or ice.

STORMWATER DRAINAGE SYSTEM: All means, natural or man-made, used for conducting Stormwater to, through or from a watershed to any of the following: conduits and appurtenant features, canals, channels, ditches, streams, culverts, streets and pumping stations.

STORMWATER RUNOFF: The water derived from rain, snow, and/or ice within a Watershed, flowing over the surface of the ground or collected in channels or conduits.

TRIBUTARY: Contributing stormwater from upstream land areas.

URBANIZATION: The development, re-development, change or improvement of any parcel of land consisting of one or more lots for residential, commercial, industrial, institutional, recreational, municipal, or public utility purposes.

WATERCOURSE: Any natural or man-made drainage system, river, stream, creek, brook, branch, etc., into which stormwater runoff or floodwaters flow, either regularly or intermittently.

WATERSHED: The area that contributes runoff to a point of interest, or design point, from Stormwater.

Section 1.4

Exemptions

1. Agricultural land disturbing activities that do not change natural drainage patterns.
2. Construction/Development where the total impervious area is less than 0.5 acres, and Single Family Homes that disturb less than 0.5 acres, except where flooding concerns have been identified.
3. The Surveyor, may recommend to the Board that a Development be exempted from the provisions of this Ordinance if they do not materially impact Stormwater Runoff.
4. An exemption may be granted only by the Board. The Board shall be authorized to grant exemptions from any and all requirement to this ordinance at its discretion.
5. Even if an exemption is granted, the applicant must comply with all other State, Federal, and local rules and regulations related to the Development

Section 1.5

Conflicting Ordinances and Interpretation

1. Conflict with Other Local Regulations. The requirements imposed by this Ordinance are in addition to the requirements of other ordinances and regulations, including, but not limited to, the Wabash County Floodplain Management Regulations, the Wabash County Master Plan, and the Wabash County Zoning Ordinance. If the provisions of this Ordinance are inconsistent with any of the provisions of the Wabash County Floodplain Management Regulations, the Wabash County Master Plan, or the Wabash County Zoning Ordinance, the more restrictive provisions shall control.
2. Conflict with State or Federal Regulations. The requirements imposed by this Ordinance are in addition to the requirements of any state and federal laws and regulations. If the provisions of this Ordinance are inconsistent with any of the provisions of any state or federal laws or regulations, the more restrictive provisions shall control.

Section 1.6

Disclaimer of Liability

The provisions of this Ordinance are reasonable for regulatory purposes and are based on historical records, engineering and scientific methods of study.

The Board assumes no responsibility, beyond its regulatory authority, for the planning, design, or construction of Stormwater Drainage Systems. It shall be the responsibility of the developer and contractor to assure that construction designs comply with this Ordinance and that construction will be completed accordingly. It shall also be the responsibility of the developer and contractor to assure that all other local, state and federal requirements are met in the completion of site development.

SECTION 2

STORMWATER DRAINAGE PLANS

Section 2.1

Stormwater Control Policy

Many streams and drainage channels serving Wabash County may not have sufficient capacity to receive and convey stormwater runoff resulting from existing and continued urbanization. Accordingly, the storage and controlled release rate of excess stormwater runoff shall be generally required for any development on real estate which lies within the jurisdiction of the Board. Drainage plans and calculations for the detention and controlled runoff for a specific development site shall comply with all provisions of this Ordinance and be submitted to the Board for approval prior to the issuance of an Improvement Location Permit.

The release rate of stormwater from development shall not exceed the stormwater runoff rate from the land area in its present condition and as further limited below. The developer must submit detailed computations of runoff before and after development that demonstrate that the runoff will not be increased.

These computations must show that the peak runoff release rate after development for the 100 year return period storm of critical duration must not exceed the 0.30 cfs per acre of development. The critical duration storm is that storm duration that requires maximum detention storage. Furthermore, the peak runoff rate after development for the 10 year return period storm of critical duration must not exceed 0.15 cfs per acre of development. Developed site allowable discharges shall be based on predevelopment watersheds.

Special cases may exist where the downstream limitations to drainage capacity and/or onsite depressional storage may be present in such a way that strict adherence to this policy may result in undue property damage. In these cases, the Board may further restrict the peak runoff release rate. As determined by the Board, the allowable release rate may be reduced so that additional detention shall be required to store that portion of the runoff exceeding the capacity of the receiving sewers or waterways.

Special cases may also exist where the detention of runoff from a development would be detrimental to the overall watershed and drainage outfall. In these cases, the Board may waive or reduce detention requirements.

The Board, after investigation and evaluation, may waive or reduce the requirement of controlled runoff for a specific development site if hydrologic modeling of the watershed and receiving stream prove that such reduction or waiver of controlled runoff is warranted. It shall be the responsibility of the developer to have such modeling prepared and submitted to the Board for approval under the same procedures and requirements outlined in this Ordinance for a drainage plan.

The primary function of roadside ditches is to provide drainage for road improvements. The drainage of adjacent private property is in most cases unavoidable and necessary, but should be considered secondary to maintenance and safety of the road. Accordingly, any grading or other earthwork proposed on a site that results in a change or alteration to the stormwater runoff within or outletting onto a public road right-of-way shall require prior approval from the Board.

Drainage plans and calculations for any proposed earthwork requiring the installation or modification of any storm sewers, culverts, control structures or other drainage facilities within a public road right-of-way shall comply with all provisions of this Ordinance and shall be submitted to the Board for approval prior to installation or modification.

Drainage plans for any proposed earthwork not requiring the installation or modification of public drainage facilities within a public road right-of-way, and not requiring the detention and controlled runoff for a specific development site, need not comply with Section 2.2 or Section 3 of this Ordinance, but shall substantially comply with all other applicable provisions of this Ordinance. Site sketches and descriptions adequately depicting the scope of proposed work shall be submitted to the Board for approval prior to starting work.

The Board shall consider the impact of any proposed grading or other earthwork on adjacent road improvements, receiving streams and downstream drainage capacities. After thorough investigation and evaluation, the Board may waive requirements or impose additional restrictions as a condition of approval.

Section 2.2

Application

The owner of the Development Site shall make application to the Board on the form provided, and shall pay the application fee in full at the time the application is submitted. The application shall also be signed by the developer.

No improvement location permit may be issued until the application has been approved.

All the following information and data, prepared and certified by an Indiana licensed professional engineer or land surveyor engaged in storm drainage design, shall be submitted to the Board at the time the application is submitted.

The minimum sheet size of all maps and plats submitted in conjunction with the following shall be 11 inches by 17 inches; and the maximum sheet size shall be 24 inches by 36 inches.

A. Topographic and Soils Maps

A soils map of the proposed development and off-site contributing watersheds, indicating soil names and their hydrologic classification, must be provided. In addition, a topographic map of the land to be developed and such adjoining land whose topography may affect the layout or drainage of the development must be provided. The contour intervals shall be one foot when slopes are less than four percent, and shall be two feet when the slope exceeds four percent. On this map the following shall be shown:

1. The location of streams and other flood water runoff channels, the extent of the floodplains at the established 100-year flood elevation, and 500-year flood elevation where available (regulatory floodway), and limits of the floodway, all properly identified.

2. The normal shoreline of lakes, ponds, swamps and stormwater control systems, their floodplains, and points of inflow and outflow if any.
3. The location and elevation of regulated drains, farm drains, inlets and outfalls, if any of record.
4. Storm, sanitary, and combined sewers and outfalls, if any of record.
5. The location of domestic and commercial waste systems and outlets, if any of record, or as otherwise known to applicant.
6. Seeps, wetlands, springs, and wells, that are visible or of record.

B. Drainage Plan

A comprehensive plan designed to safely handle the stormwater runoff and to detain the increased stormwater runoff must be provided. The plan shall provide or be accompanied by maps or other descriptive materials, illustrating pre-development and proposed development conditions, indicating the feasibility of the drainage plan and showing the following:

1. The extent and area of each watershed affecting the design of detention facilities as shown on USGS Quadrangle Maps or other more detailed maps as required by the Board. Also provide a vicinity map that geographically locates the project area within the County.
2. The extent and area of each watershed tributary to the drainage channels in the development.
3. The street storm sewers and other storm drains to be built, the basis of their design, outfall and outlet locations and elevations, the receiving stream or channel and its 100-year and 500-year water elevations, and the functioning of the drains during high water conditions.
4. The parts of the proposed street system where pavements are planned to be depressed sufficiently to convey or temporarily store overflow from storm sewers and over the curb runoff resulting from the heavier rainstorms and the outlets for such overflow. This is also known as emergency flood routing.
5. Existing streams and floodplains to be maintained, and new channels to be constructed, their locations, cross sections and profiles.
6. Proposed culverts and bridges to be built, their materials, elevations, waterway openings and basis of their design.
7. Existing stormwater control systems to be maintained, enlarged, or otherwise altered and new basins or ponds to be built and the basis of their design.
8. The estimated location and percentage of impervious surfaces existing and expected to be constructed when the development is completed.
9. The slope, type and size of all sewers and other waterways.
10. For all detention and retention basins, a plot or tabulation of storage volumes with corresponding water surface elevations and a plot or tabulation of the basin outflow rates for those water surface elevations.
11. Proof that a Stormwater Pollution Prevention Plan for handling stormwater runoff associated with construction activity, in accordance with 327 IAC 15-5, has been filed with the Wabash County Soil and Water Conservation District.
12. Any existing and proposed easements and rights of access.
13. Identification and copies of any other State or Federal water quality permits that are required for construction activities associated with the owner's project site.

14. Party responsible for the permanent ownership and maintenance of the drainage system and a description of all maintenance requirements.

C. Valley Cross Section

One or more typical cross sections must be provided showing all existing and proposed channels or other open drainage facilities carried to a point above the 100-year high water elevation; showing the elevation of the existing land and the proposed changes thereto, together with the high water elevations expected from the 100-year and 500-year storms under the controlled conditions called for by this ordinance; and showing the relationship of structures, streets and other facilities.

D. Site Plan

A plan drawn to scale showing dimensions of the site with existing and proposed storm drainage systems must be provided.

Section 2.3

Submittal and Consideration of Drainage Plans

Three (3) sets of drainage plans shall be submitted to the Board at least thirty (30) calendar days before the desired date of the Drainage Board meeting of which plans are to be considered. All plans submitted shall be accompanied by a check or money order in the amount consistent with the current fee schedule.

Section 2.4

Open Drainage Board Meeting

Any matter before the Board shall not be conducted unless all required information is filed by the specified deadlines. At the board meeting for consideration of the drainage plan, the Board shall review all information submitted with the application and provided at the time of the meeting and shall hear any testimony from the applicant and interested parties. In considering information presented at the meeting, the Board, at its discretion, may elect to continue, approve or reject the matter.

Section 2.6

Approval

Upon concluding the meeting concerning the drainage plan, the Board shall state its findings, and determine the approval, disapproval or conditional approval of the plan. The Board will inform the applicant of its decision and any modifications or conditions upon which approval is contingent. The findings and decision of the Board will be entered in the official minutes of the meeting. The Board shall approve or conditionally approve all plans in compliance with the standards of this Ordinance, and good engineering practice standards. The Board shall stamp such approval on a copy of such plans and deliver the same to the applicant. Any Board approval shall be contingent on obtaining all necessary local, state and federal approvals or permits.

SECTION 3

PRINCIPLES AND STANDARDS OF DESIGN

Section 3.1

Determination of Runoff Quantities

Because topography and the availability of adequacy of outlets for storm runoff vary with almost every site, the requirements for storm drainage tend to be an individual matter for any project. It is required that each proposed project be discussed with the Wabash County Surveyor at the earliest practical time in the planning stage.

Runoff quantities shall be computed for the area of the parcel under development plus the area of the watershed flowing into or through the parcel under development. The quantity of runoff which is generated as the result of a given rainfall intensity must be calculated as follows:

1. For areas up to and including 20 acres, the Rational Method may be used to determine runoff quantities. The procedure is described in the Indiana LTAP Stormwater Drainage Manual. Other design methods as described below in subsection 2 may also be used.
2. For areas larger than 20 acres or with depressional storage, hydrograph techniques and/or computer drainage modeling methods must be used. The techniques or methods used shall be proven methods in the practice of hydrology, subject to approval of the Board. The Advanced Interconnect Pond and Channel Routing, SWMM, HEC-HMS, NRCS TR-20 (Project Formulation, hydrology), and NRCS TR-55 (Urban Hydrology for Small Watersheds) models are approved by the Board for appropriate use in analysis of the runoff and routing of stormwater.

Section 3.2

Rational Method

In the Rational Method, the peak rate of runoff, Q , in cubic feet per second is computed as:

$$Q = CIA$$

Where:

- C = runoff coefficient, representing the characteristics of the watershed and defined as the ration of runoff to rainfall.
- I = average intensity of rainfall in inches per hour for a duration equal to the time of concentration (t_c) for a selected rainfall frequency. The practical minimum time to be used is 5 minutes.
- A = tributary watershed in acres

Guidance to selection of the runoff coefficient " C " is provided by Table 1 and Table 1A, which show values for different types of surface and local soil characteristics. The composite " C " value used for a given watershed with various surface types shall be the weighted average for the total area calculated from a breakdown of individual areas having different surface types.

Table 2 provides runoff coefficients for different land use classifications. In the instance of undeveloped land situated in an upstream area, a coefficient or coefficients shall be used for this area in its present or existing state of development.

Rainfall intensity shall be determined from the rainfall frequency table shown in Table 5A. The time of concentration (t_c) to be used shall be the sum of the inlet time and flow time, or travel time, in the stormwater drainage system from the most hydraulically remote part of the watershed to the point under consideration.

Inlet time is the combined time required for the runoff to reach the inlet of a storm sewer. It includes overland flow time and flow time through established surface drainage channels such as swales, ditches and sheet flow across such areas as lawns, fields, and other graded surfaces.

The flow time, or travel time, in the storm sewers may be estimated by the distance in feet divided by full flow velocity in feet per second. The velocity shall be determined using Manning's Equation.

Table 1 – Urban Runoff Coefficients

Type of Surface	Runoff Coefficient "C"
Asphalt	0.82
Concrete	0.85
Roof	0.85
Compacted Gravel / Crushed Stone	0.65
Lawns (Sandy)	
Flat (0-2%)	0.07
Rolling (2-7%)	0.12
Steep (greater than 7%)	0.17
Lawns (Clay)	
Flat (0-2%)	0.16
Rolling (2-%)	0.21
Steep (greater than 7%)	0.30

Table 1A – Rural Runoff Coefficients

Land Use	Runoff Coefficient "C"
Woodland (Sandy)	
Flat 0-5% slope)	0.10
Rolling (5-10% slope)	0.25
Steep (greater than 10%)	0.30
Woodlands (Clay)	
Flat	0.30
Rolling	0.35
Steep	0.50
Pasture (Sandy)	
Flat	0.10
Rolling	0.16
Steep	0.22
Pasture (Clay)	
Flat	0.30
Rolling	0.36
Steep	0.42
Cultivated (Sandy)	
Flat	0.30
Rolling	0.40
Steep	0.52
Cultivated (Clay)	
Flat	0.50
Rolling	0.60
Steep	0.72

TABLE 2 – RUNOFF COEFFICIENTS BY LAND USE

Land Use	Runoff Coefficients "C"		
	Flat	Rolling	Steep
Commercial	0.75	0.83	0.91
Commercial (Neighborhood)	0.54	0.60	0.66
Industrial	0.63	0.70	0.77
Garden Apartments	0.54	0.60	0.66
Churches	0.54	0.60	0.66
Schools	0.31	0.35	0.39
Semi Detached Residential	0.45	0.50	0.55
Detached Residential	0.40	0.45	0.50
Quarter Acre Lots	0.36	0.40	0.44
Half Acre Lots	0.31	0.35	0.39
Parkland	0.18	0.20	0.22

General Notes:

Flat terrain 0-2% Slopes

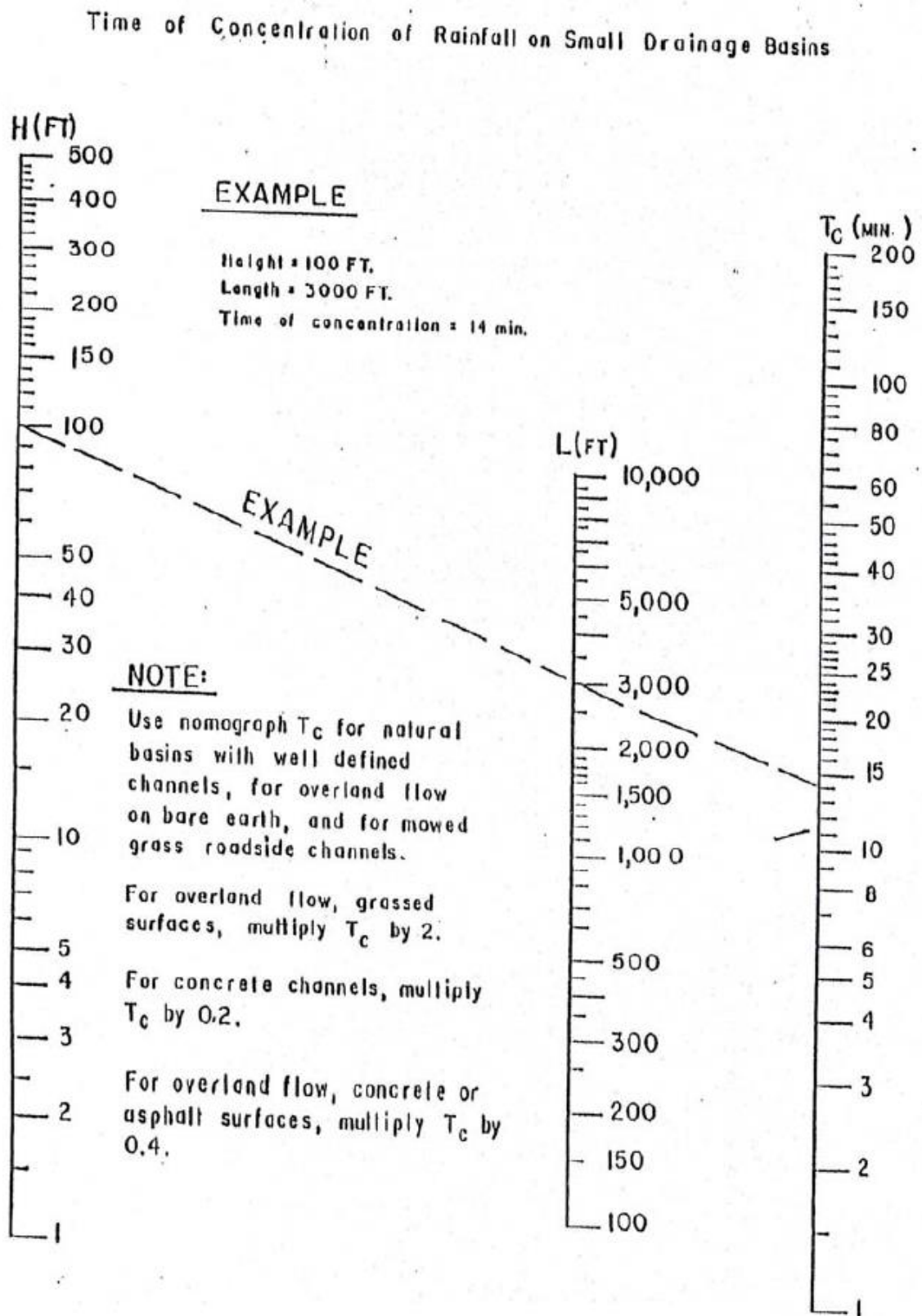
Rolling terrain 2-7% Slopes

Steep terrain greater than 7%

Slopes.

Interpolation, extrapolation and adjustment for local conditions shall
be based on engineering experience and judgement

FIGURE 1 – NOMOGRAPH FOR DETERMINING TIME OF CONCENTRATION



Section 3.3

Hydrograph Techniques (General)

When required by Section 3.1 of this ordinance stormwater storage shall be computed using a computer model that can generate hydrographs based on the NRCS TR-55 time of concentration and runoff curve number calculation methodologies.

- A. For post developed sites, runoff curve number calculations shall utilize the next less infiltrating Hydrologic Soil Group (HSG) category. For example, A to B, B to C, and C to D.
- B. Undisturbed offsite areas may utilize the HSG referenced by the USDA soil survey mapping.
- C. Offsite areas must be routed through the site.
 - 1. They do not need to be stored unless depressional storage is present in existing conditions.
 - 2. The discharge rate comparison shall be completed by utilizing only onsite routings.
 - 3. Capacities of infrastructure such as inlets, pipes, culverts shall be determined utilizing both onsite and offsite areas.
 - 4. High water or base flood elevations for channels, pipes, culverts and detention areas, shall be calculated using the entire contributing watershed.
 - 5. Offsite areas may be diverted around the development but must discharge the site from at the same point as predevelopment conditions.

Section 3.4

Hydrograph Techniques (TR-55)

To lessen the calculation burden TR-55 methods may be used to calculate hydrographs for developments. When utilizing TR-55 for hydrograph techniques only (1) storm event needs to be ran. That storm event shall be the 24-hour duration storm. Rainfall depths for various return frequencies are shown in Table 5. NRCS Type 2 storm temporal distribution shall be used and is shown in Table 6.

Section 3.5

Hydrograph Techniques (Critical Duration Series, NOAA Atlas 14)

An alternative methodology for calculating hydrographs is a critical duration series analysis. This methodology uses multiple storm durations to calculate the peak flow and / or routed elevations. These peaks are then utilized for design plans.

- A. Storm events from 0.5 hours to 24 hours shall be analyzed.
- B. Rainfall depths for various return frequencies and storm durations are shown in Table 5A.
- C. NOAA Atlas 14, 50% risk of exceedance, first quartile temporal distributions shall be utilized for the analysis.
 - a. For storm events equal to or less than 6 hours, temporal distribution Table 6A shall be used.
 - b. For storm events greater than 6 hours, but equal to or less than 12 hours, temporal distribution Table 6B shall be used.
 - c. For storm event great than 12 hours, but equal to or less than 24 hours, temporal distribution Table 6C shall be used.

Section 3.6

Required Design Capacity of Stormwater Control Systems

Various parts of a stormwater drainage system must accommodate runoff waters as follows:

- A. The minor drainage system such as inlets, catch basins, steel gutters, swales, sewers and small channels, which collect stormwater, must accommodate peak runoff from a 10 year return period storm. Rainfall duration shall be equal to the time of concentration or ten minutes if the time of concentration is less than ten minutes.
 - 1. Open channels carrying peak flows greater than 30 cubic feet per second shall be capable of accommodating peak runoff for a 50 year return period storm within the drainage easement.
 - 2. Culverts shall be capable of accommodating peak runoff from a 50 year return period storm when crossing under a County road. The minimum culvert size shall be 15 inches.
 - 3. Temporary water storage will not be permitted on any local street or road, except by special exception of the Board.
- B. Major drainage systems are defined in Section 1.3 and shall be designed in accordance with Indiana Department of Natural Resources standards.

Section 3.7

Storm Sewer Design Standards

All storm sewers subject to this Ordinance whether private or public, and whether constructed on private or public property, shall conform to the design standards and other requirements contained herein. The hydraulic capacity of storm sewers shall be determined using Manning's Equation:

- A. Manning's Equation

$$Q = (A) (V)$$

$$\text{Where; } V = \frac{1.486}{n} R^{(2/3)} S^{(1/2)}$$

A = Waterway area of conduit in square feet

Q = Discharge in cubic feet per second (cfs)

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 and maximum permissible velocities for storm sewer materials are listed in Table 3. Roughness coefficient “ n ” values for other sewer materials can be found in standard hydraulics texts and references.

B. Minimum Size

The minimum size of all storm sewers shall be 12 inches. Where a 12 inch pipe will not limit the rate of release as required, the rate of release for detention storage shall be controlled by an orifice plate or other devices, subject to approval of the Board.

C. Grade

Sewer grade shall be such that, in general, a minimum of two feet of cover is maintained over the top of the pipe. Pipe cover less than the minimum may be used only upon the approval of the Board. Uniform slopes shall be maintained between inlets, manholes and inlets to manholes. Final grade shall be set with full consideration of capacity required, sedimentation and other design parameters. Minimum and maximum allowable slopes shall be those capable of producing velocities of two and one-half and 15 feet per second, respectively when the sewer is flowing full. Velocity more than 7 feet per second shall require the use of water-tight joints to reduce soil infiltration potential.

D. 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 100 feet for sewers 42 inches and larger in diameter. Deflection of pipe sections shall not exceed the maximum deflection recommended by the pipe manufacturer. The deflection shall be uniform and finished installation shall follow a smooth curve. Storm sewers smaller than 42 inches in diameter shall not be curved.

E. Manholes

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

1. Where two or more storm sewers converge.
2. At the point of beginning or at the end of a curve, and at the point of reverse curvature (PC, PT, PRC).
3. Where pipe size changes.
4. Where an abrupt change in alignment occurs.
5. Where a change in grade occurs.
6. At suitable intervals in straight sections of sewer (400' maximum distance).

F. Gutterspread and Inlets

Calculations for roadway gutterspread and storm inlets spacing shall be performed. Inlet design and spacing shall be in accordance with the most recent version of the Indiana Department of Transportation Design Manual Hydrology and Hydraulics Section. Gutterspread and inlets shall be adequate to pass the design 10 year flow. The County Highway Engineer, Superintendent or duly appointed representative appointed by the County Commissioners should be consulted for open moving lanes. At a minimum (1) 10 foot moving lane shall be available during the 10-year storm for all local and feeder roads. Secondary and Primary roads should have (2) moving lanes available during the 10-year storm. The Wabash County Commissioners has the authority to enforce more stringent requirements.

Additionally, a channel or basin shall be provided at sag inlets, so the maximum depth of water that might be ponded in the street sag or gutter shall not exceed 10 inches above the gutter elevation under a completely clogged scenario.

Table 3 – Typical Values of Manning’s “n”

Material	Manning's "n"	Desirable Maximum Velocities*
Closed Conduits		
Concrete	0.013	15 f.p.s.
Vitrified	0.013	15 f.p.s.
Brick	0.015	15 f.p.s.
Cast Iron	0.013	15 f.p.s.
Circular Corrugated Metal Pipe, Annular Corrugations, 2-2/3 x 1/2 in.		
Unpaved	0.024	10 f.p.s. ¹
25% Paved	0.021	10 f.p.s. ¹
50% Paved	0.018	10 f.p.s. ¹
100% Paved	0.013	10 f.p.s. ¹
Circular Corrugated Metal Pipe. Helical, 2-2/3 x 1/2 in. Unpaved Corrugations		
12"	0.011	10 f.p.s. ¹
18"	0.013	10 f.p.s. ¹
24"	0.015	10 f.p.s. ¹
36"	0.018	10 f.p.s. ¹
48"	0.020	10 f.p.s. ¹
60" or larger	0.021	10 f.p.s. ¹
Corrugated Polyethylene Smooth Interior Pipe (HDPE)	0.012	15 f.p.s. ¹
Open Channels		
Concrete, Trowel Finish	0.013	
Concrete, Broom or Float Finish	0.013	
Guniting	0.018	
Riprap Hand Placed	0.030	
Riprap Dumped	0.035	
Gabion	0.028	
New Earth (Uniform, Sodded, Clay)	0.025	
Existing Earth (Fairly Uniform, with Some Weeds)	0.030	
Dense Growth of Weeds	0.040	
Dense Weeds and Light Brush	0.040	
Dense Weeds and Heavy Brush	0.060	
Swale with Grass	0.035	

* Velocity more than 7 f.p.s. require the use of water tight joints.

Values shown are for materials in good condition.

Values may increase as materials age or are damaged.

Section 3.8

Workmanship and Materials for Storm Sewers, Manholes and Inlets

A. Workmanship

The Specifications for the construction of storm sewers shall not be less stringent than those set forth in the latest edition of the Indiana Department of Transportation "Standard Specifications"; additionally, ductile iron pipe shall be laid in accordance with American Society of Testing Materials (ASTM) C-12.8.

B. Materials

Storm sewer manholes and inlets shall be constructed of masonry, cast in place concrete, or precast reinforced concrete, or other material approved by the Board. Material and construction shall conform to the current Indiana Department of Transportation "Standard Specifications" unless otherwise approved in advance of installation by the Board.

Pipe and fittings used in storm sewer construction shall be: (1) PVC meeting the requirements of ASTM D-3034 SDR 35 with joints meeting the requirements of ASTM D-3212; 2) High density polyethylene (HDPE) meeting the requirements of AASHTO 294 and ASTM D-1248 with joints meeting the requirements of ASTM D-3212, or 3) concrete pipe (ASTM C-76). Other pipe and fittings not specified herein may be used only when specifically authorized by the Board. Pipe joints shall be flexible, watertight and shall conform to the requirements of the Materials of the latest edition of the Indiana Department of Transportation "Standard Specifications". The Board reserves the right to select pipe/fitting materials for selected uses in all drainage projects involving public rights-of-way in Wabash County. Approval shall be subject to the review and concurrence of the municipal engineering heads of the cities and towns.

C. Special Hydraulic Structures

Special hydraulic structures required to control the flow of water in storm runoff drainage systems include junction chambers, drop manholes, inverted siphons, stilling basins, and other special structures. The use of these structures shall be limited to those locations justified by prudent planning and by careful and thorough hydraulic engineering analysis.

Section 3.9

Open Channel Design Standards

All open channels subject to this Ordinance whether private or public, and whether constructed on private or public land, shall conform to the design standards and other requirements contained herein. The waterway for channels shall be determined using Manning's Equation.

A. Manning's Equation

$$Q = (A) (V)$$

$$\text{Where; } V = \frac{1.486}{n} R^{(2/3)} S^{(1/2)}$$

A = Waterway area of channel in square feet

Q = Discharge in cubic feet per second (cfs)

V = Mean velocity of flow in feet per second

R = The hydraulic radius in feet

S = Slope of the Energy Grade Line in feet per foot
(approximated by channel bottom slope in most cases)

n = Roughness coefficient

B. Channel Cross Section and Grade

The required channel cross section and grade are determined by the design capacity, site topographical conditions, 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/lateral 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 1.5 feet per second should be avoided, where possible, because sedimentation will take place and ultimately reduce the channel cross section resulting in more frequent maintenance required. The maximum permissible velocities in vegetation-lined channels are shown in Table 4. Developments through which the channel is to be constructed must be considered in design of the channel section. The proposed channel may increase sediment load, peak flow and velocity in downstream reaches.

C. Side Slopes

Earthen channel side slopes shall be no steeper than 2 to 1 and shall be dependent on existing soil conditions. Flatter slopes may be required to prevent sloughing or erosion and for ease of maintenance. It is desirable to have slopes that are easily mowed to control vegetation and the growth of brush. Where channels will be lined, side slopes shall be no steeper than 1-1/2 to 1 with adequate provision made for bank drainage. Side slopes steeper than 1-1/2 to 1 may be used for lined channels provided that the side lining and structural retaining wall are designed and constructed with provisions for live and dead load surcharge. Maximum allowable side slopes for road side ditches is 4:1.

D. Channel Stability

1. Characteristics of a stable channel are:

- a. It neither aggrades nor degrades beyond tolerable limits.
- b. The channel banks do not erode to the extent that the channel cross section is changed appreciably.
- c. Excessive sediment bars do not develop.

- d. Excessive erosion does not occur around culverts, bridges or other channel structures.
 - e. Gullies do not form or enlarge due to the entry of uncontrolled surface flow to the channel.
- 2. Channel capacity shall be determined for an aged condition and the velocity shall be based on the design flow or the bank full flow, whichever is greater, using roughness coefficient “n” values for various channel linings as shown in Table 3.
 - 3. Channel stability must also be checked for conditions immediately after construction. For this stability analysis, the velocity shall be calculated for the expected flow from a ten-year return period storm from the watershed, or the bank full flow, whichever is smaller. The roughness coefficient “n” value for newly constructed channels shall be as shown in Table 3. The allowable velocity in the newly constructed channel may be increased by a maximum of 20 percent to reflect the effects of vegetation to be established under the following conditions:
 - a. The soil and site in which the channel is to be constructed are suitable for rapid establishment and support of erosion controlling vegetation;
 - b. Species of erosion controlling vegetation adapted to the area, and proven methods of establishment are shown;
 - c. The channel design includes detailed plans for establishment of vegetation on the channel side slopes, and a maintenance plan is in place to ensure vegetation is established.

E. Drainage of Waterways

Vegetated waterways (swales) that are subject to low flows of long duration, or where wet conditions prevail, shall be drained with a tile system or by other means such as paved gutters. Any vegetated swale 0.50% slope or less should have a tile underdrain. Tile lines should be a minimum of 6 inches in size, be offset from the centerline, and may be outlet through a drop structure at the end of the waterway or through a standard tile outlet.



Spoil material resulting from clearing, grubbing and channel excavation shall be disposed in such a manner which will:

1. Minimize overbank wash. Maintain a minimum 15-foot wide berm between the top and bank and beginning of spoil toe.
2. Provide for the free flow of water between the channel and floodplain unless the valley routing and water surface profile are based on continuous dikes being installed.
3. Not limit the development of travel ways along the ditch for maintenance purposes.
4. Leave the right-of-way in as good of condition or better than existed prior to construction; or in the best condition feasible for productive use by the owner, consistent with the project purposes.
5. Improve the aesthetic appearance of the site to the extent feasible.
6. Be approved by the Indiana Department of Natural Resources, Indiana Department of Environmental Management, and US Army Corps of Engineers (as applicable) if deposited in the floodway.
7. Comply with 327 IAC 15-5, "Rule 5", erosion and sediment control requirements.

H. Brush and Trees

Brush and trees may be disposed of by removing from the site, burying, or burning in accordance with local and state regulations.

Table 4
Maximum Permissible Velocities in Vegetation-Lined Channels
And Watercourses ⁽⁶⁾

Cover	Permissible Velocity ⁽¹⁾		
	Slope Range (% percent)	Erosion Resistant Soils (ft. per sec.)	Easily Eroded Soils (ft. per sec.)
Bermudagrass	0-5	8	6
	5-10	7	5
	over 10	6	4
Kentucky Bluegrass	0-5	7	5
Smooth Brome	5-10	6	4
Blue Grass (other turf grasses)	Over 10	5	3
Grass Mixtures	0-5 ⁽²⁾	5	4
Lespedeza Sericea	0-5 ⁽³⁾	5	4
Reed Canary Grass	5-10	4	3
Redtop	0-5	3.5	2.5
Alfalfa	0-5	3.5	2.5
Red Fescue	0-5	3.5	2.5
Common Lespedeza ⁽⁴⁾	0-5 ⁽⁵⁾	3.5	2.5
Sudan Grass ⁽⁴⁾	0-5	3.5	2.5

⁽¹⁾ Use velocities exceeding 5 feet per second only where good cover and proper maintenance can be obtained.

⁽²⁾ Do not use on slopes steeper than 10 percent except for vegetated side slopes in combination with stone, concrete, or highly resistant vegetative center section.

⁽³⁾ Do not use on slopes steeper than 5 percent except for vegetated side slopes in combination with stone, concrete, or highly resistant

⁽⁴⁾ Annuals - use on mild slopes or as temporary protection until permanent covers are established.

⁽⁵⁾ Use on slopes steeper than 5 percent is not recommended.

⁽⁶⁾ Adapted from Natural Resources Conservation Services, SCS-TP-61, Handbook of Channel Design for Soil & Water Conservation, 1949.

Section 3.10

Construction and Materials for Open Channels

A. Construction

Specifications shall be in keeping with the current standards of engineering and construction practice and shall describe the requirements for proper installation of the project to achieve its intended purpose without damage to either on or off-site facilities.

B. Materials

Materials acceptable for use as channel slope protection are:

1. Vegetation
2. Revetment Riprap or other gradations as appropriate
3. Concrete formed and poured
4. Hand-laid Riprap
5. Precast Cement Concrete Riprap / Slope Paving Materials
6. Grouted Riprap
7. Gabions

Other lining materials shall receive special approval of the Board. Materials shall comply with the latest edition of the Indiana Department of Transportation "Standard Specifications", and shall have no detrimental effects on stormwater flow, the environment, or fish and wildlife. Refuse materials such as bricks, blocks, broken concrete and other rubble shall not be used as lining materials unless specifically approved by the Board.

Section 3.11

Stormwater Detention

The following shall govern the design of any improvement with respect to the detention of stormwater runoff.

A. Acceptable Detention Methods

The increased stormwater runoff resulting from a proposed development shall be detained on-site by the provisions of appropriate detention or retention basins, underground storage, parking lots, streets, lawns, or other acceptable techniques. Measures, which further retard the rate of overland flow and the velocity in runoff channels may also be required to partially control the runoff rate.

B. Design Storm

Design of stormwater detention systems shall be based on a return period of once in 100 year and once is 10 year storm events. The storage volume and outflow rate shall be sufficient to handle stormwater runoff as outlined in Sections 3.1 through 3.5 at the discharge rates specified in Section 2.1. Rainfall depth-duration-frequency relationships and intensity-duration-frequency relationships used shall be those given in Tables 5 and 5A.

Table 5
Point Precipitation Rainfall Depth (inches) for a given recurrence interval

Duration	2-year	5-year	10-year	25-year	50-year	100-year
0.50-hour	0.954	1.39	1.59	1.84	2.04	2.24
1-hour	1.17	1.74	2.03	2.39	2.69	2.99
2-hour	1.39	2.08	2.44	2.90	3.29	3.69
3-hour	1.48	2.21	2.60	3.11	3.54	3.98
6-hour	1.74	2.59	3.04	3.65	4.16	4.70
12-hour	2.01	2.96	3.47	4.14	4.71	5.31
24-hour	2.32	3.47	4.02	4.80	5.43	6.10

Reference: NOAA Atlas 14, Volume 2, Version 3, Wabash Station 12-9138

Table 5A
Rainfall Intensity (inches per hour) for a given recurrence Interval

Duration	2-year	5-year	10-year	25-year	50-year	100-year
5 min	5.388	6.372	7.248	8.28	9.132	9.948
10 min	4.206	4.95	5.592	6.36	6.9	7.5
15 min	3.428	4.04	4.6	5.2	5.72	6.2
30 min	2.3	2.78	3.18	3.68	4.08	4.48
1 hour	1.17	1.74	2.03	2.39	2.69	2.99
2 hour	0.835	1.04	1.22	1.45	1.645	1.845
3 hour	0.593	0.737	0.867	1.037	1.18	1.327
6 hour	0.348	0.432	0.507	0.608	0.693	0.783
12 hour	0.2	0.247	0.289	0.345	0.393	0.443
24 hour	0.116	0.145	0.168	0.2	0.226	0.254

Reference: NOAA Atlas 14, Volume 2, Version 3, Wabash Station 12-9138

Table 6
Temporal Rainfall Distribution for TR-55 Hydrologic Modeling
(Temporal Distribution: 24-Hour Duration)
(NRCS Type II)

% Storm Time	% Storm Rainfall Depth Total	% Storm Time	% Storm Rainfall Depth Total
0	0	52	73
4	1	53	75
10	2.5	54	77
15	4	55	78
20	6	56	80
25	8	57	81
30	10	58	82
33	12	60	83.5
35	13	63	86
38	15	65	87
40	16.5	67	88
42	19	70	89.5
43	20	72	91
44	21	75	92
45	22	77	93
46	23	80	94
47	26	83	95
48	30	85	96
48.5	34	87	97
48.7	37	90	98
49	50	95	99
50	64	100	100
51	71		

Table 6A
Temporal Rainfall Distribution for Critical Duration Hydrologic Modeling
(Temporal Distribution: 6-Hours and less)
(1st Quartile Distribution – 50% Exceedance Probability)

% Storm Time	% Storm Rainfall Depth Total
0	0
8.3	18.2
16.7	36.1
25	53.9
33	69.1
41.7	78.4
50	84
58.3	88.6
66.7	92.4
75	95.4
83.3	97.7
91.7	99.1
100	100

Note: Use for 0.5 hour, 1-hour, 2-hour, 3-hour and 6-hour duration storm events

Reference: NOAA Atlas 14, Volume 2, Version 3

Table 6B
Temporal Rainfall Distribution for Critical Duration Hydrologic Modeling
(Temporal Distribution: Greater than 6-Hours and 12 hours or less)
(1st Quartile Distribution – 50% Exceedance Probability)

% Storm Time	% Storm Rainfall Depth Total
0	0
8.3	18
16.7	40.3
25	59.6
33	72.2
41.7	80.4
50	86.4
58.3	91.2
66.7	94.8
75	97.4
83.3	99
91.7	99.8
100	100

Note: Use for 12-hour duration storm event

Reference: NOAA Atlas 14, Volume 2, Version 3

Table 6C
Temporal Rainfall Distribution for Critical Duration Hydrologic Modeling
(Temporal Distribution: Greater than 12-Hours and 24 hours or less)
(1st Quartile Distribution – 50% Exceedance Probability)

% Storm Time	% Storm Rainfall Depth Total
0	0
8.3	21.8
16.7	43.5
25	60.9
33	72
41.7	79.1
50	84.7
58.3	89.7
66.7	93.9
75	96.9
83.3	98.9
91.7	99.8
100	100

Note: Use for 24-hour duration storm event

Reference: NOAA Atlas 14, Volume 2, Version 3

C. Allowable Release Rate

The allowable release rate of stormwater from development, redevelopment, and new construction shall not exceed the stormwater runoff rate from the land area in its present condition as described in Section 2.1.

If more than one detention basin is involved in the development of the area upstream of the limiting restriction, the allowable release rate from any one detention basin shall be in direct proportion to the ratio of its watershed to the watershed of the entire watershed upstream of the restriction.

D. Drainage System Overflow Design

The drainage system shall have adequate capacity to safely and adequately convey the stormwater runoff from all upstream tributary areas through the development under consideration for a storm of 100 year design return period calculated based on the upstream land in its present state of development. This conveyance shall be accomplished without damage to structures and improvements. An allowance, equivalent to the reduction in flow rate provided, shall be made for existing detention basins in upstream tributary areas, provided evidence of its construction can be shown.

E. General Detention/Retention Basin Design Requirements

Basins shall be constructed to temporarily detain the stormwater runoff which exceeds the maximum peak flow rate authorized by this Ordinance. The volume of storage provided in these basins, together with such storage as may be contained in other on-site systems, shall be sufficient to control excess runoff from the one hundred (100) year storm.

The following design principles shall be observed.

1. The maximum volume of water stored and subsequently released at the design release rate shall not result in storage duration more than 48 hours unless additional storms occur within the period.
2. The maximum planned depth of stormwater stored should generally not exceed five feet.
3. All earthen stormwater detention systems shall be separated by not less than 50 feet from any building, structure to be occupied, or road right of way.
4. Debris and safety screens having a maximum opening of 6 inches shall be provided for any pipe or opening to prevent children or large animals from crawling into the structures.
5. Earthen dams that are a component of stormwater systems shall be designed and constructed according to sound engineering and construction principals. Dams shall not be designed to overtop in a 100-year storm, unless approved by the Board.
6. Warning signs shall be mounted at appropriate locations to warn of deep water and possible flooding conditions during storm periods or other dangers that exist. Fencing shall be required if deemed necessary by the Board.

7. 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 at maximum storage levels.
8. The smallest allowable outlet orifice is 5 inches. Drainage calculations for developments requiring smaller orifices shall provide the calculated amount of storage required in the development but utilize a 5 inch opening for the discharge structure.
9. Emergency overflow systems such as a weir or emergency spillway shall be provided for the release of exceptional storm runoff or in emergency conditions should the normal discharge devices become inoperative. The overflow system shall be of such design that its operation is automatic and does not require manual attention. It shall be designed to be stable and resist erosion in exceptional storm runoffs. It shall direct all flows to the receiving outlet without passing through any off-site property or be contained in an easement.
10. Grass or other suitable vegetative cover shall be provided throughout the entire earthen basin area. Grass shall be maintained in healthy condition and should be cut regularly at approximately monthly intervals during the growing season or as required.
11. Debris and trash removal and other necessary maintenance shall be performed on a regular basis to assure continued operation in conformance to design.
12. A report shall be submitted to the Board describing
 - a) The proposed development;
 - b) The current land use conditions;
 - c) The method of hydraulic and hydrologic analysis used, including input and output files;
 - d) A maintenance plan clearly outlining the party responsible for the permanent ownership and maintenance of the drainage system and all periodic maintenance requirements.

F. Detention Basin Design Requirements

Provisions shall be incorporated to facilitate complete interior drainage of detention basins, to include the provisions of natural grades to outlet structures, longitudinal and transverse grades to perimeter drainage systems, paved gutters, or the installation of subsurface drains.

G. Retention Basin Design Requirements

The following additional design principals shall be observed:

1. Basins designed with permanent pools or containing permanent ponds shall have a water area of at least one-half acre. If fish are to be maintained in the pond, a minimum depth of approximately 10 feet shall be maintained over at least 25 percent of the pond area. The remaining pond area shall have not extensive shallow areas, except as required by subsection (3) below.
2. In excavated ponds, the underwater side slopes in the pond shall be stable with a maximum slope of 3 to 1. In the case of valley storage, natural slopes may be considered to be stable.

3. A safety ledge four to six feet in width is required and must be installed in all ponds approximately 18 inches below the permanent water level. The slope above the safety ledge shall be stable, with a maximum slope of 5 to 1, and of a material such as stone or riprap which will prevent erosion due to wave action.
4. Periodic maintenance is required in ponds to control weed growth. The pond shall also be designed to provide for the easy removal of sediment, which will accumulate during periods of pond operation.
5. For emergency use, basin cleaning or shoreline maintenance, systems shall be provided, or consideration given for auxiliary equipment to permit emptying and drainage.
6. Dry fire hydrants and drafting basins for fire protection may be requested for installation in areas where fire protection water supplies are not available.

H. Parking Lot Storage

Paved parking lots may be designed to provide temporary detention storage of stormwater on all or a portion of their surfaces. Depth of storage must be limited to a maximum depth of six (6) inches to prevent damage to parked vehicles and so that access to parked vehicles is not impaired. Ponding should, in general, be confined to those positions of the parking lots farthest from the area served.

I. System Financial Responsibilities

The construction and maintenance cost of stormwater control systems and systems as required by this Ordinance shall be accepted as part of the cost of land development. If public use of the system can be demonstrated, negotiations for public participation in the cost of such developments may be considered.

J. Maintenance and Ownership Responsibilities

System maintenance responsibility and permanent ownership of detention/retention systems during construction and thereafter shall be the responsibility of the land developer/owner, unless such responsibility and ownership is formally dedicated to and accepted by a public body. Assignment of responsibility for maintaining systems serving more than one lot or holding shall be documented by appropriate covenants to property deeds and shall be determined before the drainage plans are approved.

Stormwater detention and retention basins may be dedicated to the County or other unit of local government for permanent ownership and maintenance providing:

1. The County or governmental unit is willing to accept responsibility.
2. The system has been designed and constructed according to all applicable provisions of this ordinance.
3. All improvements have been constructed, approved and accepted by the County for the land area served by the drainage basin.
4. Dry detention basins shall have all slopes, bottom of the basin and area above the high water line seeded and stabilized; and shall have the high water line not closer than 50 feet to any development boundary.

5. The Board has accepted as-built documentation and all conditions of any permits have been met.

K. Inspections

All public and privately owned detention and retention storage systems must be made available for inspection by representatives of the Board as necessary. If the Board determines that maintenance is needed or that the original objectives are not being realized, a certified inspection report covering the physical conditions, available storage capacity and operational condition of key system elements will be required from the owner. The certified inspection report shall be completed by a licensed professional surveyor or engineer. If a report is not provided within 60 days penalties may be applied.

L. Corrective Measures

If the Board finds deficiencies, the person or entity responsible for the stormwater control systems will be required to take the necessary measures to correct such deficiencies. If the person or entity responsible fails to do so, the Board will undertake the work and collect from the responsible party.

M. Joint Development of Control Systems

Stormwater control systems may be planned and constructed jointly and by two or more developers if compliance with this Ordinance is adhered to and future operation, maintenance and ownership are assured.

N. Installation of Control Systems

Runoff and erosion control facilities shall be installed as soon as possible during site development. Detention/retention basins shall be designed with an additional (six) percent of available capacity to allow for sediment accumulation resulting from development and to permit the basin to function for reasonable periods between cleanings. Basins should be designed to collect sediment and debris in specific locations so that removal costs are kept to a minimum.

O. Off-Site Drainage Provisions

When the allowable runoff is released into 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. The requirement of off-site drains shall be at the discretion of the Board.

SECTION 4

CERTIFICATIONS REQUIRED

Section 4.1

Changes in Drainage Plans

Any revisions, significant change or deviation in the detailed plans and specifications, after formal approval by the Board, shall be filed in duplicate with and approved by the Board prior to implementing, installing or constructing the revision or change. After approval, copies of the revisions or changes shall be attached to the original plans and specifications and shown on as-built plans to be filed after completion of construction.

Section 4.2

As-Built Documentation of Drainage Plans

A record drainage plan, prepared and certified by a licensed engineer or surveyor, detailing the as-built elevations and dimensions of the plan components, shall be submitted to the Board within 30 calendar days of completion of construction. The Board shall accept no portions of the drainage system to be maintained by the Board or other public entity for ownership or maintenance responsibility prior to approval of the record plans. As-Built plans may use the approved drainage plan drawings as a base.

These plans shall include all pertinent data relevant to the completed storm drainage system and shall include:

1. Pipe sizes and pipe materials.
2. Invert elevations.
3. Top rim elevations
4. Lengths of all pipe structures.
5. Data and calculations showing detention basin storage volume.
6. Written certification that all dedicated public improvements were installed in conformance with the Principles and Standards and Design outlined in this Ordinance, and with the approved drainage plan on file with the Board.

All such submitted plans shall be reviewed for compliance within 30 calendar days after submission to the Board. If notice of noncompliance is not given within 30 calendar days of submission of the plans, the plans shall be construed as approved and accepted.

Section 4.3

Certificates and Bonding of Improvements

- A. Upon the completion of any dedicated public improvements and installations, and prior to the acceptance thereof for public maintenance by the applicable government entity, the applicant shall provide:
 1. Up to a three (3) year maintenance bond as directed by the Drainage Board which shall:
 - a) Run to the applicable government entity having a legal responsibility for the maintenance of said public improvements and installations.
 - b) Be in an amount equal to 20% of the cost of said public improvements and installations, or an amount determined by the Board.

- c) Be with surety satisfactory to the Board.
- d) Warrant the workmanship and all materials used in the construction, installation and completion of said public improvements and installations to be of good quality and have been constructed and completed in a workmanlike manner in compliance with the Principles and Standards of Design outlined in this Ordinance and the satisfactory plans and specifications thereof.
- e) Provide that for the period designated after said public improvements and installation have been accepted for public maintenance by any governmental unit or agency thereof, the subdivider will at his/her own expense make all repairs to said improvements and installations, or the foundations thereof, which may become necessary by reason of improper workmanship or materials; however, such repairs are not to include any damage to said improvements and installations resulting from forces or circumstances beyond the control of said subdivider.

Section 4.4

Determination of Impact Watersheds

The Board is authorized, but is not required, to classify certain geographical areas as Impact and to enact and promulgate regulations, which are generally applied thereto. In determining Impact Watersheds, the Board shall consider such factors as topography, soil type, and capacity of existing regulated drains and distance from adequate drainage facility. The following areas shall be designated as Impact Watersheds, unless good reason for not including them is presented to and approved by the Board:

1. A floodway or floodplain as designated by the Indiana Department of Natural Resources.
2. Land within 75 feet of each bank of any regulated drain, ditch or channel.
3. Land within 75 feet of the centerline of any regulated drain tile.

Land where there is not an adequate outlet, taking into consideration the capacity and depth of the outlet, may be designated as an Impact Watershed by resolution of the Board. Special requirements for development within any Impact Watershed shall be included in the resolution.

Section 4.5

Floodplain Compensatory Storage

Compensatory storage at a ratio of 3:1 shall be provided for fill within a floodplain. The ratio shall be considered based on cross-sections provided by the developer and at the 100-year base flood elevation. If no base flood elevation is present, the developer shall provide one for all areas with a watershed area greater than or equal to 200 acres.

For areas with a watershed of 640 acres or more, compensatory storage shall be completed at the rate listed above through the 500-year flood elevation. If the Indiana Department of Natural Resources (IDNR) does not have a 500-year flood elevation, the developer shall request one from IDNR or provide evidence of calculations approved by IDNR.

Section 4.6

Establishment of New Regulated Drains

When the Board determines it is necessary to establish a new Regulated Drain, each developer must provide the necessary information and meet the requirements of the Indiana Drainage Code IC 36-9-27, as amended, for the establishment of a new Regulated Drain. The Board shall determine the necessary easements for adequate maintenance of any new Regulated Drain if greater than statutory easements are needed.

The Board has the authority to require a new regulated drain with a development brought before the board. These new regulated drains may include outlets for the development and/or the internal drainage system for a development. The costs to construct the new regulated drain will be bore by the developer. At the time of the hearing an annual maintenance fee will be placed on the developed lots as the Board determines is appropriate.

Section 4.7

Establishment of Future Floodplain

For areas with a watershed of 640 acres or more, the 500-year flood elevation is considered the future 100-year floodplain. All developments adjacent to these floodplains shall meet elevation and freeboard requirements as noted in the Floodplain Management Ordinance but apply the freeboard to the 500-year elevation. If the Indiana Department of Natural Resources (IDNR) does not have a 500-year flood elevation, the developer shall request one from IDNR or provide evidence of calculations approved by IDNR.

SECTION 5

FEES AND PENALTIES

Section 5.1

Fees

- A. No fee shall be required for the filing or any application required by this Ordinance.
- B. The Board may require, however, the owner of the Development Site to reimburse the Board for the actual costs and expenses incurred in obtaining an independent review and analysis of a proposed drainage plan.
- C. Reimbursement of such costs and expenses shall be made within thirty (30) days of receipt of an invoice.
- D. The Board's findings and recommendations shall not be transmitted to the Plan Commission until reimbursement of all costs and expenses has been made.

Section 5.2

Violations and Penalties

- A. Whenever a violation of this Ordinance occurs, or is alleged to have occurred, any person may file a written complaint with the Board. The Board shall properly record such complaint and immediately investigate. If acts elicited by such investigation are sufficient to establish a reasonable belief that a violation has occurred, the Board shall provide written notice to any alleged violator and thereafter may file or cause to be filed a complaint against such person as provided by this Ordinance and in accordance with law.
- B. Any buildings erected, raised or converted, or land or premises used in violation of this Ordinance or regulation thereof are hereby declared to be a common nuisance and the owner and/or the developer shall be jointly and severally liable for maintaining a common nuisance, which may be restrained or enjoined or abated in any appropriate action or proceeding.
- C. The owner or tenant of any building, structure, premises or part thereof, and any architect, builder, contractor, realtor, agent or other person who commits, participates in, assists in or maintains such violation may each be found guilty of a separate offense and suffer the penalties herein provided.
- D. The Board may institute a complaint for injunctive relief in the Circuit or Superior Court of the County to restrain any person from violating this Ordinance. If the Board prevails, the respondent shall bear the costs of the action, including reasonable attorney's fees.
- E. The Board may institute a complaint for injunctive relief in the Circuit or Superior Court of the County seeking an order of removal of a structure or system erected in violation of this Ordinance, or to require modification of said structure or

system to comply with its terms. If the Board prevails, the respondent shall bear the costs of the action, including reasonable attorney's fees.

- F. Nothing herein shall prevent the County or other unit of local government from taking such other lawful action as is necessary to prevent or remedy any violation.
- G. In addition to all other remedies that are available herein, any person who violates this ordinance or fails to comply with any of its provisions may be fined by the Wabash County Drainage Board the sum of up to One Hundred Dollars (\$100.00) per day for each day that such violation or failure continues unabated.

M:\dswan\Wabash County\Drainage board\Wabash_Co Stormwater drainage Ord_07_2020_.docx