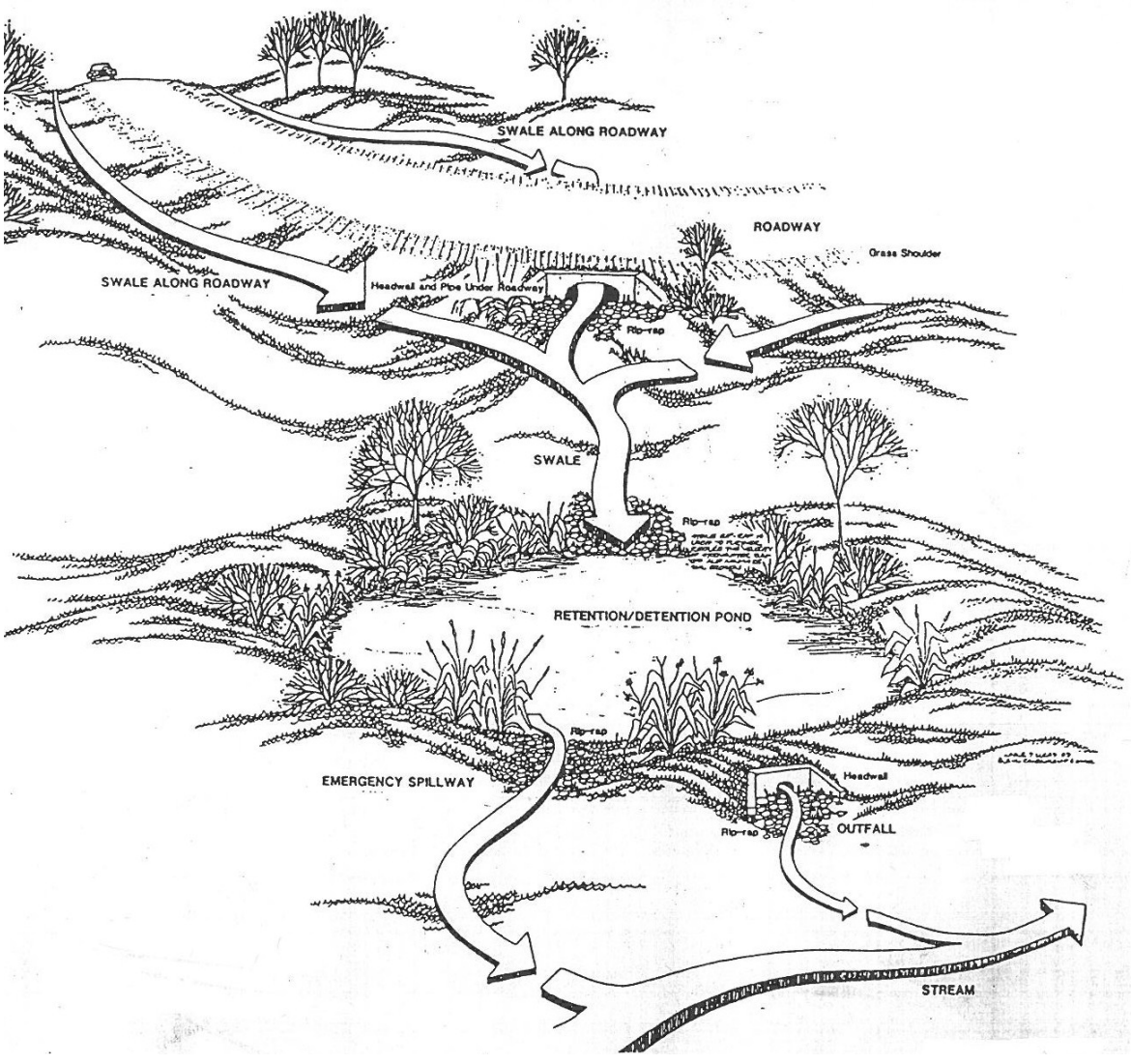
MARSHALL COUNTY STORM DRAINAGE AND SEDIMENT CONTROL ORDINANCE



MARSHALL COUNTY, INDIANA
STORM DRAINAGE AND SEDIMENT CONTROL ORDINANCE

An Ordinance applicable to the County Commissioner's jurisdiction or in jurisdictions not covered by a local ordinance.

As **Adopted: April 4, 2011**

Effective Date: April 4, 2011

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Storm Water Drainage Ordinance
Marshall County, Indiana

I. Purpose

It is recognized that smaller streams and drainage channels serving Marshall County may not have sufficient capacity to receive and convey storm water runoff, resulting when land use changes from open or agricultural use to a more urbanized use. It is further recognized that deposits of sediment from developments during and after construction can reduce capacities of storm sewers and drainage systems and result in damages to receiving lakes and streams.

Therefore, it shall be the policy of The Marshall County Commissioners that the storage and controlled release of storm water runoff shall be required of all new development, any redevelopment and other new construction in Marshall County. The release rate of storm water from developed, lands shall not exceed the release rate from the land area in its present land use.

Because topography and the availability and 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 recommended that each proposed project be discussed with the Marshall County Surveyor and Plan Director at the earliest practical time in the planning stage.

II. Conflicting Ordinances:

The provisions of this ordinance shall be deemed as additional requirements to minimum standards required by other ordinances of the County. In the case of conflicting requirements, the most restrictive shall apply.

III. Compliance with Other Ordinances:

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

IV. Definitions:

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

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.

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.

County Surveyor – The elected county official responsible for the regulated drain system and the Marshall County Storm Drainage and Sediment Control Ordinance.

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 flow of storm water to a prescribed maximum rate, and to detain concurrently the excess waters that accumulate behind the outlet.

Detention Storage - The temporary detaining or storage of storm water in storage basins, on rooftops, in streets, parking lots, school yards, parks, open spaces, or other areas under predetermined and controlled conditions, with the rate of drainage there from regulated by appropriately installed devices.

Drainage Area - The area from which water is carried off by a drainage system; a watershed or catchment area.

Drop Manhole - A manhole having a vertical drop pipe connecting the inlet pipe to 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.

Duration - The time period of a rainfall event.

Erosion - Wearing away of the land by running water, waves, temperature changes, ice or wind.

Flood Elevation - The elevation at all locations delineating the maximum level of high waters for a flood of given return period and rainfall duration.

Flood or Flood Waters - The water of any watercourse which is above the banks of the watercourse. It also means the water of any lake which is above and outside the banks thereof.

Flood Hazard Area - Any flood plain, floodway, flood way fringe, or any combination thereof which is subject to inundation by the regulatory flood; or any flood plain as delineated by Zone A on a Flood Hazard Boundary Map.

Flood Plain - The area adjoining the river or stream which has been or may hereafter be covered by flood waters.

Flood Protection Grade - The elevation of the lowest floor of a building. If a basement is included, the basement floor is considered the lowest floor.

Floodway - See Regulatory Floodway.

Floodway Fringe - That portion of the flood plain lying outside the floodway, which is inundated by the regulatory flood.

Footing Drain - A drain pipe installed around the exterior of a basement wall foundation to relieve water pressure caused by high groundwater elevation.

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

Impact Areas - Areas defined and mapped by the Plan Commission 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 adequate outlet, a floodway or floodplain, land within 75 feet of each bank of any regulated drain or within 75 feet from the centerline of any regulated tile ditch.

Impervious - A term applied to material through which water cannot pass, or through which water passes with difficulty.

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 - A converging section of conduit, usually large enough for a person to enter, used to facilitate the flow from one or more conduits into a main conduit.

Lateral Storm Sewer - A sewer that has inlets connected to it but has no other storm sewer connected.

Manhole - Storm sewer structure through which a person may enter to gain access to an underground storm sewer or enclosed structure.

Major Drainage Systems - Drainage systems carrying runoff from an area of one or more square miles.

Minor Drainage Systems - Drainage systems having an area of less than one square mile.

Off-Site - Everything not on site.

On -Site - Located within the controlled area where runoff originates.

Outfall - The point or location where storm runoff discharges from a sewer or drain. Also applies to the outfall sewer or channel which carries the storm runoff to the point of outfall.

Peak Flow - The maximum rate of flow of water at a given point in a channel or conduit resulting from a particular storm or flood.

Plan Commission - The Marshall County Plan Commission.

Plan Director – The person appointed by and/or delegated the responsibility for the administration of the Zoning and Subdivision Control Ordinance regulations by the Marshall County Advisory Plan Commission, or the Plan Director's designees.

Radius of Curvature - Length of radius of a circle used to define a curve.

Rainfall Intensity - The cumulative depth of rainfall occurring over a given duration, normally expressed in inches per hour.

Reach - Any length of river, channel or storm sewer.

Regulated Area - All of the unincorporated land under the jurisdiction of the Marshall County Plan Commission. In addition, this will include major and minor residential subdivisions within the two-mile zoning jurisdictions of the towns of Argos and Bourbon, as well as the City of Plymouth" Indiana.

Regulatory Flood - That flood having a peak discharge which can be equaled or exceeded on the average of once in a one hundred (100) year period, as calculated by a method and procedure which is acceptable to the Plan Commission. If a permit from the National Resources Commission for construction in the floodway is required (see Section VI), then the regulatory flood peak discharge should be calculated by a method acceptable to the Board and the Natural Resources Commission. This regulatory flood is equivalent to a flood having a probability of occurrence of one percent (1%) in any given year.

Regulatory Floodway - The channel of a river or stream and those portions of the floodplains 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 storm water release 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 100 years has a one percent probability of being equaled or exceeded in anyone year.

Runoff Coefficient - A decimal fraction relating the amount of rain which appears as runoff and reaches the storm 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 storm water runoff.

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

Siphon - A closed conduit or 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. A siphon utilizes atmospheric pressure to effect or increase the flow of water through a conduit. An inverted siphon is used to carry storm water flow under an obstruction such as a sanitary sewer.

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

Stilling Basin - A basin used to slow water down or dissipate its energy.

Storage Duration - The length of time that water may be stored in any storm water control facility, computed from the time water first begins to be stored.

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 to any of the following: conduits and appurtenant features, canals, channels, ditches, streams, culverts, streets and pumping stations.

Storm Water Runoff - The water derived from rains falling within a tributary basin, flowing over the surface of the ground or collected in channels or conduits.

Technical Review Committee – A committee designated in the Marshall County Zoning Ordinance for the purpose of providing technical review of certain types of petitions and applications.

Tributary - Contributing storm water from upstream land areas.

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

Watercourse - Any river, stream, creek, brook, branch, natural or man-made drainage way in or into which storm water runoff or floodwaters flow either regularly or intermittently.

Watershed - See Drainage Area.

Wet Bottom Detention Basin - (Retention Basin) - A basin designed to retain a permanent pool of water after having provided its planned detention of runoff during a storm event.

V. Storm Water Control Policy:

It is recognized that the smaller streams and drainage channels serving Marshall County may not have sufficient capacity to receive and convey storm water runoff resulting from continued urbanization. Accordingly, the storage and controlled release rate of excess storm water runoff shall be required for any development, redevelopment and new construction located within Marshall County.

Possible exceptions to the requirement are minor subdivisions as described in the Marshall County Subdivision Ordinance. The county surveyor together with the Marshall County Plan Director, after thorough investigation and evaluation, may waive the requirement of controlled runoff for minor subdivisions.

The release rate of storm water from development, redevelopment, and new construction may not exceed the storm water runoff from the land area in its present state of development. The developer must submit to the Plan Commission detailed computations of runoff before and after development, redevelopment or new construction which demonstrates that runoff will not be increased.

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 pre-development peak runoff rate. The critical duration storm is that storm duration that requires the greatest detention storage.

Computations for areas up to and including 200 acres may be based on the Rational Method; typical runoff coefficients are listed herein. For areas larger than 200 acres, hydrograph techniques and/or computer drainage modeling methods may be used. Hydrograph techniques and computer modeling methods used to determine storm water runoff shall be proven methods, subject to approval of the Plan Director, County Surveyor or if appropriate the Technical Review Committee.

In the event the natural downstream channel or storm sewer is inadequate to accommodate the release rate provided above, then the allowable release rate shall be reduced to that rate permitted by the capacity of the receiving downstream channel or storm sewer system. Additional detention as determined by the Marshall County's Surveyor's Office may be required to store that portion of the runoff exceeding the capacity of the receiving sewers or waterways.

VI. **Information** Requirements:

The following information and data provided by an Indiana licensed professional engineer, architect or land surveyor engaged in storm drainage design shall be submitted to the Plan Commission Office at the time of application for a building permit for any development, redevelopment or new construction on real estate which meets the criteria of project size and type that is regulated under this ordinance.

A. Topographic and Soils Maps:

A soils map of the proposed development indicating soils names and their hydrologic classification must be provided when Natural Resources Conservation Service (NRCS) hydrologic methods are used. In addition, a topographic map of the land to be· subdivided and such adjoining land whose topography may affect the layout or drainage of the development must be provided. The contour intervals shall be no greater than two (2) foot. 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 where available (regulatory floodway), and the limits of the floodway, all properly identified.

(2) The normal shoreline of lakes, ponds, swamps and detention basins, their floodplains, and lines of inflow and outflow if any.

(3) The location 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) Septic tank systems and outlets, if any of record.

(6) Seeps, springs, flowing and other wells, that are visible or of record.

(7). Soil names and their hydrologic classification for the proposed development when hydrologic methods requiring soils information are used.

B. Preliminary Drainage Plan:

A comprehensive plan, in preliminary form (or in combined preliminary and final form), designed to handle safely the storm water runoff and to detain the increased storm water runoff must be provided. The plan shall provide or be accompanied by maps or other descriptive materials 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 Plan Commission Office.

(2) The preliminary layout and design of proposed storm sewers, the outfall and outlet locations and approximate elevations, the receiving stream or channel and its 100 year return period water elevation.

(3) The location and design of the proposed street system, especially including depressed pavements used to conveyor temporarily store overflow from the heavier rainstorms, and the outlets for such overflow .

(4) The locations, cross sections and profiles of existing streams and floodplains to be maintained, and new channels to be constructed.

(5) The materials, elevations, waterway openings, and the basis for design of proposed culverts and bridges.

(6) Existing ponds and basins to be maintained, enlarged, or otherwise altered and new ponds or basins to be built and the basis of their design.

(7) The estimated depth and amount of storage required **in** the new ponds or basins.

(8) The estimated location and percentage of impervious surfaces existing and expected to be constructed when the development is completed.

(9) Any interim plan which is to be incorporated into the development pending completion of the development and the final drainage plan.

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 storm 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 facilities must be provided.

E. Final Drainage Plans:

Upon review of the preliminary drainage plans by the Plan Director and County Surveyor, final drainage plans shall be submitted to the Plan Commission Office. The final plans shall provide or be accompanied by calculations, maps and/or other descriptive material showing the following:

(1) The extent and area of each watershed tributary to the drainage channels in the development.

(2) 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 high water elevation, and the functioning of the drains during high water conditions.

(3) The parts of the proposed street system where pavements are planned to be depressed sufficiently to conveyor temporarily store overflow from storm sewers and over the curb runoff resulting from the heavier rainstorms and the outlets for such overflow.

(4) Existing streams and floodplains to be maintained, and new channels to be constructed, their locations, cross sections and profiles.

(5) Proposed culverts and bridges to be built, their materials, elevations, waterway openings and basis of their design.

(6) Existing detention basins and ponds to be maintained, enlarged, or otherwise altered and new basins or ponds to be built and the basis of their design.

(7) The estimated location and percentage of impervious surfaces existing and expected to be constructed when the development is completed.

(8) The slope, type and size of all sewers and other waterways.

(9) For all detention 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.

F. Submittal and Consideration of Plans:

Preliminary and final drainage plans and/or construction plans shall be submitted to the Plan Commission Office at least twenty one (21) days prior to their regularly scheduled meeting. All preliminary plans, final plans and/or construction plans in compliance with the standards of this ordinance must be approved by the Plan Commission Office. The Plan Commission Office shall stamp such approval on a copy of such plans and deliver the same to the applicant. The Plan Commission Office shall approve or disapprove any preliminary plans, final plans and/or construction plans within sixty (60) days of submission unless the applicant consents to a continuance or extension. All approvals and disapprovals with written reasons shall be incorporated into the Plan Commission minutes.

The Marshall County Plan Director and Surveyor is authorized to review engineering summaries of projects and based upon the same, grant exemptions from any and all requirements of this ordinance and/or waive any requirements of this ordinance. Any applicant may appeal the decision of the Plan Director or County Surveyor to the Plan Commission which shall also be authorized to grant exemptions from any and all requirements of this ordinance and/or waive any requirements of this ordinance at its discretion.

VII. Determination of Runoff Quantities:

A. Development sites less than or equal to 5 acres in size, with a drainage area less than or equal to 50 acres and no depressional storage.

The Rational Method may be used for sites meeting the stated criteria. In the Rational Method, the peak rate of runoff, Q, in cubic feet per second (cfs) is computed as:

$$\mathbf{Q = CIA}$$

Where: C = Runoff coefficient, representing the characteristics of the drainage area and defined as the ratio 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.

A = Tributary drainage area 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 surfaces and local soil characteristics. The composite "C" value used for a given drainage

area with various surface types shall be the weighted average value for the total area calculated from a breakdown of individual areas having different surface types

Table 2 provides runoff coefficients and inlet times 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.

TABLE 1

Urban Runoff Coefficients

Urban Runoff Coefficients	
Hard Surfaces	
Asphalt	0.82
Concrete	0.85
Roof	0.85
Lawns (Sandy)	
Flat (0-2% Slope)	0.07
Rolling (2-7% Slope)	0.12
Steep(Greater than 7% Slope)	0.17
Lawns (Clay)	
Flat (0-2% Slope)	0.16
Rolling (2-7% Slope)	0.21
Steep (Greater than 7% Slope)	0.30

Source: HERPICC Stormwater Drainage Manual, July 1994.

The coefficients of this tabulation are applicable to storms of 5 to 10 year frequencies. Coefficients for less frequent higher intensity storms shall be modified as follows:

Return Period (yrs)	Multiply "C" by
25	1.1
50	1.2
100	1. 25

TABLE 1A

Rural Runoff Coefficients

Rural Runoff Coefficients	
Woodland (Sandy)	
Flat (0-5% Slope)	0.10
Rolling (5-10% Slope)	0.25
Steep (Greater than 10% Slope)	0.30
Woodland (Clay)	
Flat (0-5% Slope)	0.30
Rolling (5-10% Slope)	0.35
Steep (Greater than 10% Slope)	0.50
Pasture (Sandy)	
Flat (0-5% Slope)	0.10
Rolling (5-10% Slope)	0.16
Steep (Greater than 10% Slope)	0.22
Pasture (Clay)	
Flat (0-5% Slope)	0.30
Rolling (5-10% Slope)	0.36
Steep (Greater than 10% Slope)	0.42
Cultivated (Sandy)	
Flat (0-5% Slope)	0.30
Rolling (5-10% Slope)	0.40
Steep (Greater than 10% Slope)	0.52
Cultivated (Clay)	
Flat (0-5% Slope)	0.50
Rolling (5-10% Slope)	0.60
Steep (Greater Than 10% Slope)	0.72

Source: HERPICC Stormwater Drainage Manual, July 1994.

The coefficients of this tabulation are applicable to storms of 5 to 10 year frequencies. Coefficients for less frequent higher intensity storms shall be modified as follows:

Return Period (Yrs)	Multiply "C" by
25	1.1
50	1.2
100	1. 25

TABLE 2

Runnoff Coefficients "C" By Land Use and Typical Inlet Times				
Land Use	***Runoff Coefficients***			**Inlet Times (Minutes) (4)**
	Flat (1)	**Rolling (2)**	**Steep (3)**	
Commercial(CBD)	**0.75**	**0.83**	**0.91**	**5**
Commercial *(Neighborhood)*	**0.54**	**0.60**	**0.66**	**5-10**
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**	**10-15**
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**	**To Be Computed**

(1) Flat terrain involves slopes of 0-2%.
(2) Rolling terrain involves slopes of 2-7%.
(3) Steep terrain involves slopes greater than 7%.
(4) Interpolation, extrapolation and adjustment for local conditions shall be based on engineering experience and judgment.
(5) The coefficients of this tabulation are applicable to storms of 5 to 10 year frequencies. Coefficients for less frequent higher intensity storms shall be modified as follows:

Return Period	Multiply "C" by
25	1.1
50	1. 2
100	1.25

Rainfall intensity shall be determined from the rainfall frequency curves shown in Tables 5A and B. The time of concentration (tc) to be used shall be the sum of the inlet time and flow time in the drainage facility from the most remote part of the drainage area to the point under consideration. The flow time in the storm sewers may be estimated by the distance in feet divided by velocity of flow in feet per second. The velocity shall be determined by the Manning Formula.

Inlet time is the combined time required for the runoff to reach the inlet of the 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. It may be computed by using Figure 1.

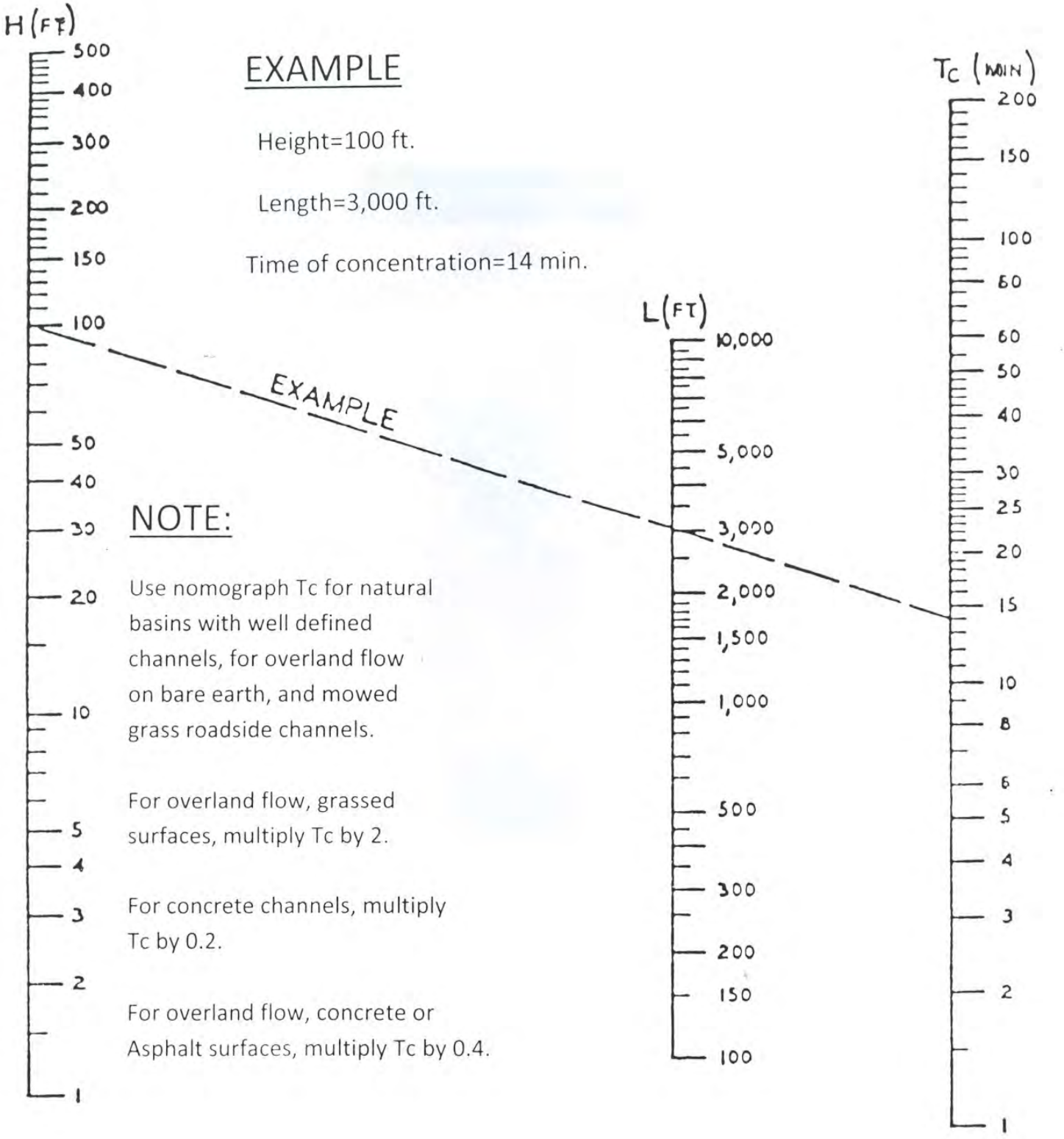

Figure 1 Nomograph for Determining Time of Concentration (developed from the Kirpirh Equation).

B. The runoff rate for areas in excess of 200 acres shall be determined by methods described in Section XIII, subsection F.

VIII. Amount of Runoff to be Accommodated by Various Parts of Drainage Facility:

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

A. The minor drainage system such as inlets, catch basins, street gutters, swales, sewers and small channels which collect storm water must accommodate peak runoff from a lO-year return period storm. Rainfall duration shall be equal to the time of concentration or one hour if the time of concentration is less than one hour. A first quartile storm distribution shall be used for computer modeling. These minimum requirements must be satisfied:

(1) The allowable spread of water on Collector Streets is limited to maintaining two clear 10 foot moving lanes of traffic. One lane is to be maintained on Local Roads, while Places can have a water spread equal to one-half of their width.

(2) 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.

(3) Culverts shall be capable of accommodating peak runoff from a 50-year return period storm when crossing under a road which is part of the Indiana Department of Highways rural functional classification system and are classified as principal or minor arterial, major or minor collector roads.

B. Major drainage systems are defined in Section IV.

IX. Storm Sewer Design Standards:

All storm sewers, whether private or public, and whether constructed on private or public property shall conform to the design standards and other requirements contained herein.

A. Manning's Equation

The hydraulic capacity of storm sewers shall be determined using the Manning's Equation to determine velocity, where:

$$V = \left(\frac{1.486}{n}\right)\left(R\frac{2}{3}\right)\left(S\frac{1}{2}\right)$$

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 = Manning's "n" or 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 tests and references.

B. Minimum Size:

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

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 approval of the Plan Commission Office. 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 and 15 feet per second, respectively, when the sewer is flowing full.

Typical Values of Manning's "n"		
Material	*Manning's "n"*	*Maximum Velocities (feet/second)*
◆ **Closed Conduits**		
Concrete	0.013	15
Vitrified Clay	0.013	15
HDPE	0.012	15
PVC	0.011	15
◆ **Circular CMP, Annular Corrugations, 2 2/3 x ½ inch**		
Unpaved	0.024	7
25% Paved	0.021	7
50% Paved	0.018	7
100% Paved	0.013	7
Concrete Culverts	0.013	15
HDPE or PVC	0.012	10
◆ **Open Channels**		
Concrete, Trowel Finish	0.013	15
Concrete, Broom Finish	0.015	15
Gunite	0.018	15
Riprap Placed	0.030	10
Riprap Dumped	0.035	10
Gabion	0.028	10
New Earth **(1)**	0.025	3-5
Existing Earth **(2)**	0.030	3-5
Dense Growth of Weeds	0.040	3-5
Dense Weeds and Brush	0.040	3-5
Swale with Grass	0.035	3-5

Source: HERPICC Stormwater Drainage Manual, July 1994.

(1) New earth (uniform, sodded, clay soil)
(2) Existing earth (fairly uniform, with some weeds)

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.

E. 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:

1. Where two or more storm sewers converge.

2. Where pipe size changes.

3. Where a change in horizontal alignment occurs.

4. Where a change in grade occurs.

5. At intervals in straight sections of sewer, not to exceed the maximum allowed.

The maximum distance between storm sewer manholes shall be as follows:

Size of Pipe (Inches)	Maximum Distance (Feet)
12 through 42	400
48 and larger	600

F. 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 Section 7-400 of the Indiana Department of Highways' Road Design Manual - Volume I or other approved design procedure. The inlet grate opening provided must be adequate to pass the design 10 year flow with 50% of the sag inlet areas clogged. An overload channel from sag inlets to the overflow channel or basin shall be provided at sag inlets, so that the maximum depth of water that might be ponded in the street sag shall not exceed 7 inches.

X. Workmanship and Materials:

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 Highways' "Standard Specifications"; additionally, ductile iron pipe shall be laid in accordance with American Water Works Association (A WW A) C-600 and clay pipe shall be laid in accordance with American Society of Testing Materials (ASTM) C-12.

B. Materials:

Storm sewer manholes and inlets shall be constructed of masonry, cast in place concrete or precast reinforced concrete. Material and construction shall conform to Indiana Department of Highways' "Standard Specifications", Section 720.

Pipe and fittings used in storm sewer construction shall be extra strength clay pipe (ASTM C-700), ductile iron pipe (A WW A C-151), or concrete pipe (ASTM C-76). Other pipe and fittings not specified herein may be used only when specifically authorized by the Plan Commission. Pipe joints shall be flexible and watertight and shall conform to the requirements of Section 715.02 - Materials, of the latest edition of the Indiana Department of Highways' "Standard Specifications".

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.

XI. Open Channel Design Standards:

All open channels, whether private of public, and whether constructed on private or public land, shall conform to the design standards and other design requirements contained herein.

A. Manning Equation:

The waterway for channels shall be determined using Manning's Equation.

$$Q = \left(\frac{1.486}{n}\right)(A)\left(R\frac{2}{3}\right)\left(S\frac{1}{2}\right)$$

Where:

A= Waterway area of channel in square feet

Q= Discharge in cubic feet per second (cfs)

A=Waterway area of channel I square feet

V, R, S & n are explained in Paragraph XA.

B. Channel Cross Section and Grade

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 1.5 feet per second should be avoided because siltation will take place and ultimately reduce the channel cross section. The maximum permissible velocities in vegetal-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.

C. Side Slopes:

Earthen channel side slopes shall be no steeper than 3 to 1. Flatter slopes may be required to prevent erosion and for ease of maintenance. Where channels will be lined, side slopes shall be no steeper than 1-1/2 to 1 with adequate provisions made for weep holes .

TABLE 4

Maximum Permissible Velocities in Vegetal-Lined Channels (1)

Cover	*Side Slope Range (Percent)* **(3)**	*Permissible Velocity* **(2)**	
		Erosion Resistant Soils (ft. per sec.) **(4)**	*Easily Eroded Soils (ft. per sec.)* **(4)**
Bermuda Grass	0-5 5-10 Over 10	8 7 6	6 5 4
Bahia Buffalo Grass Kentucky Bluegrass Smooth Brome Blue Grama	0-5 5-10 Over 10	7 6 5	5 4 3
Grass Mixture Reed Canary Grass	**(3)** 0-5 5-10	5 4	4 3
Lespedeza Sericea Weeping Lovegrass Yellow Bluestem Redtop Alfalfa Red Fescue	**(4)** 0-5 5-10	3.4	2.5
Common Lespedeza **(5)** Sudangrass **(5)**	**(6)** 0-5	3.5	2.5

(1) From Soil Conservation Service, SCS-TP-61, Handbook of Channel Design for Soil & Water Conservation

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

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

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

(5) Annua1s--use on mild slopes or as temporary protection until permanent covers are established.

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

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.

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 elsewhere.
(e) Gullies do not form or enlarge due to the entry of uncontrolled surface flow to the channel.

(2) Channel stability 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 "n" values for various channel linings as shown in Table 3. In no case is it necessary to check channel stability for discharges greater than that from a 100year return period storm.

(3) Channel stability must 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 on the watershed, or the bank full flow, whichever is smaller. The "n" value for newly constructed channels in fine-grained soils and sands may be determined in accordance with the National Engineering Handbook 5, Supplement B, Soil Conservation Service and shall not exceed 0.025. 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.

E. Drainage of Waterways:

Vegetated waterways 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. Tile lines may be outletted through a drop structure at the end of the waterway or through a standard tile outlet.

F. Establishment of New Regulated Drain:

The Marshall County Drainage Board may mandate that storm drains and detention basins in residential subdivisions become regulated drains to insure the proper maintenance of the system. If the Board mandates the establishment of a new Regulated Drain, each developer must provide the necessary information and meet the requirements of the 1965, Indiana Drainage Code, 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.

G. Appurtenant Structures:

The design of channels will provide all structures required for the proper functioning of the channel and the laterals thereto and travelways for operation and maintenance. Recessed inlets and structures needed for entry of surface and subsurface flow into channels without significant erosion or degradation shall be included in the design of channel improvements. The design is also to provide the necessary flood gates, water level control devices, and any other appurtenance affecting the functioning of the channels and the attainment of the purpose for which they are built.

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 thereto 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.

H. Disposition of Spoil:

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

(1) Minimize overbank wash.
(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 hinder the development of travelways for maintenance. (4) Leave the right-of-way in the best condition feasible, consistent with the project purposes, for productive use by the owner.
(5) Improve the aesthetic appearance of the site to the extent feasible.
(6) Be approved by the IDNR or US Army Corps of Engineers (whichever is applicable), if deposited in the floodway.

XII. Construction and Materials:

A. Construction:

Specifications shall be in keeping with the current standards of engineering practice and shall describe the requirements for proper installation of the project to achieve its intended purpose.

B. Materials:

Materials acceptable for use as channel lining are:

1. Grass
2. Revetment Riprap
3. Concrete
4. Hand-laid Riprap
5. Precast Cement Concrete Riprap
6. Grouted Riprap
7. Gabions

Other lining materials shall receive specific approval of the Plan Commission. Materials shall comply with the latest edition of the Indiana Department of Highways' "Standard Specifications"

XIII. Storm Water Detention:

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

A. Acceptable Detention Methods:

The increased storm water runoff resulting from a proposed development should be detained on-site by the provisions of appropriate wet or dry bottom reservoirs, by storage on flat roofs, parking lots, streets, lawns, or other acceptable techniques. Measures which retard the rate of overland flow and the velocity in runoff channels shall also be used to control the runoff rate partially. Detention basins shall be sized to store excess flows from storms with a one hundred (100) year return period. Control devices shall limit the discharge to a rate no greater than that prescribed by this ordinance (see Sections XIIIE and XIIIF).

B. Design Storm:

Design of storm water detention 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 Sections XIVE and XIVF. Rainfall intensity-duration-frequency relationships shall be those given in Tables 5.

C. Allowable Release Rate:

The allowable release rate of storm water originating from a proposed development shall not exceed the amount specified in Section V - Storm Water Control Policy, and as described in Sections XIIIE and XIIIF.

In the event the natural downstream channel or storm sewer system is inadequate to accommodate the release rate provided above, then the allowable release rate shall be reduced to that rate permitted by the capacity of the receiving downstream channel or storm sewer system, and additional detention as determined by the Plan Commission shall be required to store that portion of the runoff exceeding the capacity of the receiving sewers or waterways.

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

TABLE 5

Precipitation Intensity Estimates in inches per hour

Precipitation Intensity Estimates (in/hr)																		
ARI* (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	4.46	3.47	2.84	1.88	1.15	0.67	0.48	0.29	0.17	0.10	0.06	0.03	0.02	0.02	0.01	0.01	0.01	0.01
2	5.34	4.16	3.40	2.27	1.39	0.82	0.59	0.35	0.20	0.12	0.07	0.04	0.03	0.02	0.01	0.01	0.01	0.01
5	6.41	4.98	4.08	2.79	1.75	1.05	0.75	0.45	0.25	0.15	0.08	0.05	0.03	0.02	0.02	0.01	0.01	0.01
10	7.25	5.59	4.59	3.18	2.03	1.23	0.88	0.52	0.30	0.17	0.10	0.05	0.03	0.03	0.02	0.01	0.01	0.01
25	8.33	6.37	5.24	3.70	2.40	1.48	1.07	0.64	0.36	0.21	0.11	0.06	0.04	0.03	0.02	0.02	0.01	0.01
50	9.17	6.94	5.73	4.10	2.70	1.69	1.22	0.73	0.41	0.23	0.13	0.07	0.04	0.03	0.02	0.02	0.01	0.01
100	9.98	7.52	6.22	4.49	3.00	1.90	1.38	0.83	0.47	0.26	0.14	0.08	0.05	0.04	0.02	0.02	0.02	0.01
200	10.84	8.09	6.71	4.90	3.32	2.13	1.55	0.94	0.53	0.29	0.16	0.08	0.05	0.04	0.03	0.02	0.02	0.01
500	11.99	8.81	7.33	5.43	3.76	2.45	1.80	1.09	0.62	0.34	0.18	0.09	0.06	0.05	0.03	0.02	0.02	0.01
1000	12.85	9.36	7.80	5.84	4.10	2.72	2.00	1.22	0.69	0.37	0.20	0.10	0.06	0.05	0.03	0.02	0.02	0.02

* These precipitation frequency estimates are based on a partial duration series. **ARI** is the Average Recurrence Interval.
Please refer to NOAA Atlas 14 Document for more information. NOTE: Formatting forces estimates near zero to appear as zero.

Table 5A. Precipitation Frequency estimates in inches for Plymouth, IN.

Precipitation Frequency Estimates (inches)																		
ARI* (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	0.37	0.58	0.71	0.94	1.15	1.35	1.46	1.73	2.01	2.35	2.71	3.06	3.62	4.10	5.54	6.92	8.75	10.55
2	0.45	0.69	0.85	1.14	1.39	1.65	1.77	2.10	2.43	2.84	3.26	3.65	4.30	4.86	6.53	8.13	10.25	12.33
5	0.53	0.83	1.02	1.40	1.75	2.10	2.26	2.67	3.07	3.55	4.02	4.44	5.17	5.78	7.66	9.41	11.72	14.00
10	0.60	0.93	1.15	1.59	2.03	2.46	2.65	3.14	3.60	4.13	4.64	5.07	5.85	6.52	8.56	10.39	12.84	15.27
25	0.69	1.06	1.31	1.85	2.40	2.96	3.21	3.81	4.36	4.94	5.50	5.94	6.77	7.52	9.77	11.66	14.28	16.86
50	0.76	1.16	1.43	2.05	2.70	3.37	3.66	4.36	4.99	5.62	6.20	6.64	7.50	8.31	10.71	12.62	15.35	18.02
100	0.83	1.25	1.56	2.25	3.00	3.81	4.14	4.96	5.67	6.32	6.92	7.35	8.23	9.11	11.64	13.55	16.36	19.12
200	0.90	1.35	1.68	2.45	3.32	4.26	4.66	5.61	6.40	7.07	7.68	8.09	8.98	9.92	12.58	14.45	17.33	20.14
500	1.00	1.47	1.83	2.72	3.76	4.91	5.40	6.55	7.47	8.12	8.75	9.10	9.99	11.01	13.82	15.60	18.54	21.39
1000	1.07	1.56	1.95	2.92	4.10	5.44	6.01	7.33	8.35	8.98	9.59	9.90	10.78	11.84	14.77	16.44	19.41	22.27

* These precipitation frequency estimates are based on a partial duration series. **ARI** is the Average Recurrence Interval.
Please refer to NOAA Atlas 14 Document for more information. NOTE: Formatting forces estimates near zero to appear as zero.

D. 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. An allowance, equivalent to the reduction in flow rate provided, shall be made for upstream detention when such upstream detention and release rate have previously been approved by the Board and evidence of its construction can be shown.

E. Determination of Storage Volume - Rational Method:

For areas of two hundred (200) acres or less, the Rational Method may be used to determine the required volume of storm water storage. The following eleven step procedure may be used to determine the required volume of storage. Other design methods may also be used, subject to, approval of the Board, and as described in Section XIVF.

Steps Procedure

1. Determine total drainage area in acres "A".
2. Determine composite runoff coefficient "C_u" based on existing land use (undeveloped).
3. Determine time of concentration "tc" in minutes based on existing conditions.
4. Determine rainfall intensity "I_u" in inches per hour, based on time of concentration and using Figure **1** or from data given in Table 5 for the ten (10) year return period.
5. Compute runoff based on existing land use (undeveloped), and ten (10) year return period:

$$Q_u = C_u I_u A$$

6. Determine composite runoff coefficient "Cd" based on developed conditions and a one hundred (100) year return period.
7. Determine the one hundred (100) year return period rainfall intensity "Id" for various storm durations "td" up through the time of concentration for the developed area using Table 5.
8. Determine developed inflow rates "*Qd*" for various storm durations "td", measured in hours.
9. Compute a storage rate "Std" for various storm durations "tct" up through the time of concentration of the developed area.

$$S(Td) = (Qd) - (Qu)$$

10. Compute required storage volume "SR" in acre-feet for each storm duration "td'" . This assumes a triangular hydro graph of duration (2*td) hours with the peak flow of Std at tct hours.

$$SR = S(td)t\left(\frac{d}{12}\right)$$

11. Select the largest storage volume computed in step 10 for detention basin design.

F. Determination of Storage Volume - Other Methods

Methods other than the rational method for determining runoff and routing of storm water may be used to determine the storage volume required to control storm water runoff. The procedures or methods used must receive the prior approval of the Plan Director and County Surveyor. The TR-20 and TR-55 models are approved for the appropriate use in analysis of the runoff and routing of storm water. The use of these models or other approved procedures can be defined in a seven step procedure to determine the required storage volume of the detention basin.

Step Procedure:

1. Calibrate the hydrologic/hydraulic model that is to be used for prediction of runoff and routing of storm water.
2. For each storm duration listed in Table 5, perform steps three through six.
3. Determine the ten (10) year, undeveloped peak flow. Denote this flow by Q_u^{10}.
4. Determine the one hundred (100) year runoff hydrograph (H_d^{100}) for developed conditions.
5. Determine the hydrograph that must be stored (H_s^{100}) by subtracting a flow up to Q_u^{10} from the hydro graph (H_d^{100}) found in step 4.
6. Determine the volume of water (V_s) to be stored by calculating the area under the hydrograph H_s100.
7. The detention basin must be designed to store the largest volume (V_s) found for any storm duration analyzed in step 6.

G. General Detention Basin Design Requirements:

Basins shall be constructed to detain temporarily the storm water 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 authorized in other on-site facilities 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 a storage duration in excess of 48 hours unless additional storms occur within the period.

(2) The maximum planned depth of storm water stored (without a permanent pool) shall not exceed four feet.

(3) All storm water detention facilities shall be separated by not less than 75 feet from any building or structure to be occupied.

(4) All excavated excess spoil may be spread so as to provide for aesthetic and recreational features such as sliding hills, sports fields, etc. Slopes no steeper than 6 horizontal to I vertical for safety, erosion control, stability and ease of maintenance shall be permitted.

(5) Safety screens having a maximum opening of 4 inches shall be provided for any pipe or opening to prevent children or large animals from crawling into the structures .

(6) Danger signs shall be mounted at appropriate locations to warn of deep water, possible flooding conditions during storm periods and other dangers that exist. Fencing shall be provided 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.

(8) 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 normal discharge devices become totally or partially inoperative. The overflow facility shall be of such design that its operation is automatic and does not require manual attention.

(9) Grass or other suitable vegetative cover shall be provided throughout the entire basin area. Grass should be cut regularly at approximately monthly intervals during the growing season or as required.

(10) Debris and trash removal and other necessary maintenance shall be performed on a regular basis to assure continued operation in conformance to design.

(11) A report shall be submitted to the Plan Commission describing (a) the proposed development; (b) the current land use conditions; (c) the method of hydraulic and hydrologic analysis used, including any assumptions or special conditions; (d) the results of the analysis; and (e) the recommended drainage control facilities. Hydraulic and hydrologic. calculations, including input and output files, shall be included as appendices to the report.

H. Dry Bottom Basin Design Requirements:

Detention basins which will not contain a permanent pool of water shall comply with the following requirements:

(1) Provisions shall be incorporated to facilitate complete interior drainage of dry bottom basins, to include the provisions of natural grades to outlet structures, longitudinal and transverse grades to perimeter drainage facilities, paved gutters, or the installation of subsurface drains.

(2) The detention basin shall, whenever possible, be designed to serve a secondary or multipurpose function. Recreational facilities, aesthetic qualities (open spaces) or other types of use shall be considered in planning the detention facility.

I. Wet Bottom Basin Design Requirements:

Where part of a detention basin will contain a permanent pool of water, all the items required for detention 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 detention storage above the design water level. However, the following additional conditions shall apply:

(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 no extensive shallow areas, except as required by subsection (3) below.

(2) In excavated ponds, the underwater side slopes in the pond shall be stable. 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 30 to 36 inches below the permanent water level. In addition, a similar maintenance ledge 12 to 18 inches above the permanent water line shall be provided. The slope between the two ledges shall be stable and of a material such as stone or riprap which will prevent erosion due to wave action.

(4) A safety ramp exit from the pond is required in all cases and shall have a minimum width of 20 feet and exit slope to 6 horizontal to I vertical. The ramp shall be of a material that will prevent its deterioration due to vehicle use and/or wave action.

(5) Periodic maintenance is required in ponds to control weed and larval growth. The pond shall also be designed to provide for the easy removal of sediment which 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.

(6) For emergency use, basin cleaning or shoreline maintenance, facilities shall be provided or plans prepared for auxiliary equipment to permit emptying and drainage.

(7) Facilities to enhance and maintain pond water quality shall be provided, if required to meet applicable water quality standards. 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 Plan Commission.

J. Roof Top Storage:

Detention storage requirements may be met in total or in part by detention on flat roofs. Details of such designs are to be included in the building permit application and shall include the depth and volume of storage, details of outlet devices and down drains, elevations of emergency overflow provisions and certification of the structural portion of the building design plans by a structural engineer. This type of storage is allowable but should only be utilized as a last resort if no other options are available.

K. Parking Lot Storage:

Paved parking lots may be designed to provide temporary detention storage of storm waters on all or a portion of their surfaces. Outlets will be designed so as to empty the stored waters slowly. Depths of storage must be limited to a maximum depth of 7 inches so as 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.

L. Facility Financial Responsibilities:

The construction cost of storm water control systems and facilities as required by this ordinance shall be accepted as part of the cost of land development. If general public use of the facility can be demonstrated, negotiations for public participation in the cost of such development may be considered.

M. Facility Maintenance Responsibility:

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

Storm water detention, and retention basins may be donated to the County or other unit of government designated by the County, for ownership and permanent maintenance providing:

(1) The County or other governmental unit is willing to accept responsibility.

(2) The facility 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) Retention ponds containing a permanent pool of water have all slopes between the riprap and high water line sodded and the remaining land area hydro seeded; are equipped with electrically driven aeration devices, if required to maintain proper aerobic conditions and sustain aquatic life; have a four-foot wide crushed limestone walkway at the high water line entirely around the body of water; provide suitable public access acceptable to the responsible governmental agency; and have the high water line not closer than 75 feet to any property line.

(5) Dry detention ponds shall have all slopes, bottom of the basin and areas above the high water line hydro seeded; and shall have the high water line not closer than 50 feet to any development boundary.

N. Inspections:

All public and privately owned detention storage facilities can be inspected by representatives of the County not less often than once every 2 years. If inspected, a certified inspection report covering physical conditions, available storage capacity and operational condition of key facility elements will be provided to the owner.

O. Corrective Measures:

If deficiencies are found by the inspector, the owner of the detention/retention facility will be required to take the necessary measures to correct such deficiencies. If the owner fails to do so, the County will undertake the work and collect from the owner using lien rights, if necessary.

P. 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

.

Q. Installation of Control Systems:

Runoff and erosion control systems shall be installed as soon as possible during the course of 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 pond 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.

R. Detention Facilities in Floodplains:

If detention storage is provided within a floodplain, only the net increase in storage volume above that which naturally existed on the floodplain shall be credited to the development. No credit will be granted for volumes below the elevation of the regulatory flood at the location unless compensatory storage is also provided.

S. 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 offsite drains shall be at the discretion of the Plan Commission.

XIV. Certifications Required:

After completion of the project and before final approval and acceptance can be made, a professionally prepared and certified "As Built" set of plans shall be submitted to the Plan Commission for review. These plans shall include all pertinent data relevant to the completed storm drainage system and shall include:

(1) Pipe size and pipe material.

(2) Invert elevations.

(3) Top rim elevations.

(4) Lengths of all pipe structures.

(5) Data and calculations showing detention basin storage volume.

(6) Certified statement on plans stating the completed storm drainage system substantially complies with construction plans as approved by the Plan Commission.

All such submitted plans shall be reviewed for compliance within 30 days after submission to the Plan Director and County Surveyor. If notice of non-compliance is not given within 30 days of submission of the plans, the plans shall be construed as approved and accepted.

XV. Changes in Plan:

If the applicant wishes to amend the site plan in any way after the Drainage Plan has been approved by the Plan Commission, the applicant must inform the County Plan Director of the mandated or proposed change. If the County Plan Director determines the change in the building or site plan significantly changes the drainage as proposed under the currently approved Final Drainage Plan, he may require addition information and that the change be reviewed by the Plan Commission subject to their approval.

XVI. Other Requirements:

A. Sump Pumps:

Sump pumps installed to receive and discharge ground waters or other storm waters shall be connected to the storm sewer where possible or discharged into a designated storm drainage channel. Sump pumps installed to receive and discharge floor drain flow or other sanitary sewage shall be connected to the sanitary sewers. A sump pump shall be used for one function only, either the discharge of storm waters or the discharge of sanitary sewage.

B. Down Spouts:

All down spouts or roof drains shall discharge onto the ground or be connected to the storm sewer. No down spouts or roof drains shall be connected to the sanitary sewers.

C. Footing Drains:

Footing drains shall be connected to storm sewers where possible or designated storm drainage channels. No footing drains or drainage tile shall be connected to the sanitary sewer.

D. Basement Floor Drains:

Basement floor drains shall be connected to the sanitary sewers

.

XVII. 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 that land uses permitted will be free from storm water damage. This ordinance shall not create liability on the part of Marshall County or any officer or employee thereof for any damage which may result from reliance on this ordinance or on any administrative decision lawfully made thereunder.

XIII. Corrective Action:

Nothing herein contained shall prevent Marshall County 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.

XIX. Repealer:

All ordinances or parts thereof in conflict with the provisions of this ordinance are repealed.

XX. When Effective:

This ordinance shall become effective after its final passage, approval and publication as required by law.

XXI. Exempt Projects:

Single Family and two-family dwellings, building additions, and accessory structures appurtenant to either a single family or two-family dwelling **less than 4000 square feet in area.** Any commercial, institutional or industrial construction project, as well as any major or minor residential subdivision which has had its drainage plan approved prior to the effective date of this ordinance.

XXII. Project sizes and types that are regulated by this ordinance:

Any **agricultural**, new commercial, industrial, or institutional construction project that lies within the Regulated Area and has. a combined impervious or semi-impervious surface area of 4,000 square feet or greater shall be regulated by this ordinance. For example, this would include the construction of a building(s) with 4,000 square feet of surface area, a 4,000 square foot parking area, or any combination of new development that together has a combined aggregate impervious or semi-impervious surface area of 4,000 square feet or greater. Furthermore, this ordinance also regulates any major or minor residential subdivision, as regulated by the Marshall County Subdivision Ordinance effective November 7, 2007.

XXIII. Financial Guarantees

Financial guarantees shall be a prerequisite to the Plan Commission Office action on the application for the approval of the Drainage Plan. The Plan Commission Office shall approve the Drainage Plan only after notice has been received and has been filed with and approved by one of the following:

A. A certification to the effect that the drainage improvements have been graded and installed in accordance with the specifications of this ordinance.

B. A performance bond is posted with the Board of County Commissioners,

(1). In the name of the Marshall County Board of Commissioners.
(2). Be in the amount equal to 100 percent of the cost, as estimated by the Board, of all improvements and installations as required under this Ordinance, excluding, however, the cost of any said improvements and installations which have been constructed, installed and completed in compliance with the requirements of this Ordinance prior to the providing of this bond and for which sufficient written proof of such construction, installations and completion has been furnished to the Board.

(3). Be satisfactory to the Board of County Commissioners.

(4). Run until and terminate sixty (60) days after the filing with the County Plan Director a completion affidavit obtained from the County Plan Commission's office.

C. Cash bonds or other negotiable securities acceptable and assigned to the Board of County Commissioners is posted in lieu of the performance bond.

Any funds received from the financial guarantees required by this Ordinance shall be used only for the purpose of making drainage improvements for which said guarantees were provided, in accordance with the specifications and requirements of this Ordinance.

XXIV. Application and, review procedure.

A. An application for Drainage Plan Approval should be obtained from and filed with the Marshall County Plan Commission's office. The application must be accompanied by five (5) copies of the Preliminary Drainage Plan, topographic and soils maps, as well as the other maps and descriptive materials that are a part of the informational requirements of this Ordinance. Upon receipt of the application for Drainage Plan Approval, the County Plan Director and County Surveyor will review the proposed drainage plans to determine whether they have been prepared in accordance with the terms of this Ordinance.

(1). If the County Plan Director and County Surveyor finds that the application has been submitted with the correct informational requirements and has been prepared in accordance with the terms of this ordinance, The Plan Director shall advise the applicant in writing .

(2). If the County Plan Director or County Surveyor finds that the application has not been submitted with the correct informational requirements or has not been prepared in accordance with the terms of this Ordinance, he shall advise the applicant in writing of the items of non-conformance.

B. The Plan Commission Office shall, upon the filing of an application for Drainage Plan Approval, review the final plat along with the accompanying data and determine whether or not the Drainage Plan meets all of the minimum requirements and standards of this Ordinance. The Plan Commission Office shall then take one of the following actions on the application within thirty (30) days after its submission or a mutually agreed extension.

(1). Conditional Approval. If the Plan Commission Office determines that upon the satisfactory completion of one or more specified conditions consistent with the requirements, standards and specifications of this Ordinance, the Plan Commission may give conditional approval to the Drainage Plan.

(2). Approval. The Plan Commission Office shall give Drainage Plan Approval only after it has determined the Drainage Plan meets the requirements of this Ordinance and that sufficient financial guarantees have been submitted in accordance with this Ordinance.

(3). Disapproval. Should the Plan Commission Office disapprove the Drainage Plan, written notice of such action, together with reasons therefore, shall be transmitted to the applicant. Such action shall also be entered on the official records of the Commission. If disapproved, the applicant may at any time reapply for Drainage Plan Approval.

(4). Refer to County Plan Director or County Surveyor. Should the Plan Commission have a question about a specific technical aspect of the Drainage Plan, the Plan Commission may refer a question to the County Surveyor or Plan Director for a finding.

Upon approval of the Final Drainage Plan, the Plan Director and County Surveyor shall affix their signatures to the original tracing of the Final Drainage Plan. Final approval of the Drainage Plan by the Plan Commission Office shall not be construed as an acceptance of any street dedication or approval of any building permit which requires the approval of other state or local agencies which has jurisdiction.

No Building Permits or Improvement Location Permits will be issued by the Marshall County Plan Commission or other co-adopting localities for any developments that are regulated by this ordinance unless they receive a copy of the Drainage Plan signed by the Plan Commission Office, or a waiver signed by the Marshall County Plan Director, as well as the Marshall County Surveyor.

APPENDIX A

STORM DRAINAGE AND SEDIMENT CONTROL ORDINANCE WAIVER

After being reviewed by the Marshall County Plan Director and the County Surveyor ,the development described below has been deemed to have no significant drainage impact on neighboring properties, as well as County roads and dedicated drainage ditches. This project is hereby released from the requirement of submitting a drainage plan to the Marshall County Plan Commission.

Name and Address of Property Owner

Description of the Project

Attach site plan.

If the design of this project is changed, this waiver is voided, and the property owner must obtain a new waiver or get approval from the Marshall County Plan Commission.

DATE:_____

Approval: ---------- ----------

Plan Director County Surveyor

Appendix B

EROSION AND SEDIMENT CONTROL ORDINANCE

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The intent of this ordinance is the control of soil erosion and sedimentation caused by land disturbing activities within Marshall County. Measures taken to control erosion and sedimentation should assure that sediment is not transported from a site by storm events or construction activities.

1. AUTHORITY

This ordinance is adopted under the authority granted by Indiana Code #36-1-4-11, #36-7-4, and all acts supplemental and mandatory thereto. This authority provides for the administration, enforcement and amendment of this ordinance for controlling soil erosion within Marshall County.

2. FINDINGS AND PURPOSE

A. Soil erosion resulting from land disturbing activities causes a significant amount of sediment and other pollutants to be transported off-site to locations including ditches, streams, wetlands, lakes, and reservoirs.

B. The purpose of this ordinance is to conserve the natural resources; to protect the quality of air and water, and to protect and promote the health, safety and welfare of people to the extent practicable by minimizing the amount of sediment and other pollutants, resulting from soil erosion due to and disturbing activities, from being transported off-site to adjacent public or private lands including ditches, streams, lakes, wetlands, and reservoirs.

3. APPLICABILITY

The ordinance applies to all land disturbing activities on land within the boundaries and jurisdiction of Marshall County unless superseded by local city or town ordinance. Agricultural Land Disturbing Activities as defined in Section 5, and Soil & Water Conservation projects, implemented through the Marshall County Soil and Water Conservation District and the Marshall County Surveyor's Office, are exempt from the requirements of this ordinance.

This section applies to the following sites with land disturbing activities:

A. Those requiring a minor or major subdivision plat approval or local improvement location permit for the construction of commercial, residential, industrial or institutional buildings on lots of approved subdivision plats;

B. Those involving grading, removal of protective ground cover or vegetation, excavation, land filling, or other land disturbing activity affecting a surface area of 10,000 square feet or more;

C. Those involving excavation, filling or a combination of excavation and filling affecting 1,000 cubic yards or more of soil, sand, gravel, stone or other material.

This ordinance does not preclude the applicant from acquiring any other necessary local, state and federal permits.

4. CONFLICTING ORDINANCES/REQUIREMENTS

The provisions of this ordinance shall be deemed as additional requirements to minimum standards required by the Indiana General Permit Rule for Storm Water Runoff Associated With Construction Activity (Rule 5), 327 IAC 15-5 (or most recent revision). In case of conflicting requirements, the most restrictive shall apply.

5. DEFINITIONS

Administering authority means the designated unit of government given the authority to issue permits.

Agricultural land disturbing activities means the disturbance of land, including the clearing of land, for the production of animal or plant life, including forestry, pasturing of livestock, and planting, growing, cultivating, and harvesting crops for human or livestock consumption. This also includes the construction of farm facilities such as dwellings, barns, sheds or other structures.

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

Erosion control measure means a practice or a combination of practices to control erosion and resulting sedimentation.

Erosion control plan means a written description of pertinent information concerning erosion control measures designed to meet the requirements of this ordinance.

Land disturbing activity means any man-made change of the land surface, including removing vegetative cover, excavating, filling, transporting and grading.

Runoff means waters derived from melting snow or rain falling within a tributary drainage basin that exceed the infiltration capacity of the soils of that basin, flow over the surface of the ground, or are collected in channels or conduits.

Site means the entire area included in the legal description of the land on which land disturbing activity has been proposed in the permit application.

SWCD means Soil and Water Conservation District, a subdivision of state government charged with the responsibility of establishing programs and setting policy to protect the natural resources with Marshall County boundaries.

6. GENERAL PRINCIPLES

The following principles apply to all land disturbing activities subject to this ordinance.

A. To minimize the potential for soil erosion, development should fit the topography and soils of the site. Areas with steep slopes where deep cuts and fills may be required should be avoided wherever possible, and natural contours should be followed as closely as possible.

B. Natural vegetation should be retained and protected wherever possible. Areas immediately adjacent to watercourses and lakes also should be left undisturbed wherever possible.

C. All activities on a site should be conducted in a logical sequence so that the smallest practical area of land will be exposed for the shortest practical period of time during development.

D. Provisions should be made to accommodate the increased runoff caused by changed soil and surface conditions (impervious areas) during and after development.

E. Minimize the length and steepness of slopes to reduce erosion potential.

7. DESIGN CRITERIA, STANDARDS AND SPECIFICATIONS FOR EROSION CONTROL MEASURES

All erosion control measures including but not limited to those required to comply with this ordinance shall meet the design criteria, standards, and specifications for erosion control

measures similar to or the same as those outlined in the “Indiana Handbook for Erosion Control in Developing Areas” published by the Indiana Department of Natural Resources.

8. EROSION AND SEDIMENT CONTROL REQUIREMENTS

The following requirements shall govern erosion and sediment control practices on all sites:

A. Sediment-laden water flowing from the site shall be detained by erosion control measures appropriate to minimize sedimentation.

B. Water shall not be discharged in a manner that causes erosion at or downstream of the point of discharge.

C. All access to building sites that cross a natural watercourse, drainage easement, or swale/channel shall have a culvert of appropriate size.

D. Wastes or unused building materials, including but not limited to garbage, debris, cleaning wastes, wastewater, toxic materials, and hazardous substances, shall not be carried by runoff from a site. All wastes shall be disposed of in a proper manner.

E. Sediment being tracked from a site onto public or private roadways shall be minimized. This can be accomplished initially by a temporary gravel construction entrance, in addition to a well planned layout of roads, access drives, and parking areas.

F. Public or private roadways shall be kept cleared of accumulated sediment. Bulk clearing of sediment shall not include flushing the area with water.

G. All storm drain inlets shall be protected against sedimentation with barriers meeting accepted criteria, standards and specifications.

H. Runoff passing through a site from adjacent areas shall be controlled by diverting it around disturbed areas, where practical. Diverted runoff shall be conveyed in a manner that will not erode the channel and receiving areas. Alternatively, the existing channel may be left undisturbed or improved to prevent erosion or sedimentation from occurring.

I. Drainage ways and swales shall be designed and adequately protected so that their final gradients and resultant velocities will not cause channel or outlet scouring.

J. All disturbed ground left inactive for fourteen (14) or more days shall be stabilized by seeding, sodding, mulching, covering, or by other equivalent erosion control measures.

K. Appropriate sediment control practices shall be installed prior to any land disturbance and thereafter whenever necessary.

L. During the period of construction activity at a site, erosion control

measures necessary to meet the requirements of this ordinance shall be maintained by the applicant.

9. EROSION AND SEDIMENT CONTROL ON PROJECTS THAT DISTURB LESS THAN ONE (1) ACRE

Although individual lots within a larger development may not appear to contribute as much sediment as the overall development, the cumulative effect of lot development is of concern. From the time construction on an individual lot begins, until the individual lot is stabilized, the builder must take steps to:

- protect adjacent properties from sedimentation
- prevent mud/sediment from depositing on the street
- protect drainageways from erosion and sedimentation
- prevent sediment laden water from entering storm sewer inlets.

The standard plan includes perimeter silt fence, stabilized construction entrance, curb inlet protection, drop inlet protection, stockpile containment, stabilized drainage swales, downspout extensions, temporary seeding and mulching, and permanent vegetation. Every relevant measure should be installed at each individual lot site.

All erosion and sediment control measures must be properly maintained throughout construction. Temporary and permanent seeding should be watered as needed until established. For further information on individual lot erosion and sediment control, see the Indiana Department of Natural Resources, Division of Soil Conservation's pamphlet titled "Erosion and Sediment control for Individual Building Sites.