MRBC MODEL STORMWATER TECHNICAL STANDARDS MANUAL

June 2014 Edition

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Chapter One

INTRODUCTION

This document, the [Jurisdiction Entity] Stormwater Technical Standards Manual, prepared by Christopher B. Burke Engineering, Ltd. for [Jurisdiction Entity], contains the necessary technical standards for administering the requirements of the [Jurisdiction Entity] Stormwater Management Ordinance. This document should be considered as a companion document to the Ordinance. Whereas the Ordinance contains the majority of the regulatory authority and general requirements of comprehensive stormwater management, this document contains the necessary means and methods for achieving compliance with the Ordinance. It is not intended as a regulatory document, but rather guidance to assist plan reviewers, developers, and designers. In case there are conflicts between the requirements contained in this document and the ordinance, the requirements of the Ordinance shall prevail. In addition to the stormwater standards provided in this document, [Jurisdiction Entity] may have adopted, or may adopt in the future, separate other technical standards regarding various aspects of stormwater conveyance systems that for various reasons may not have been incorporated in this Technical Standards document. In case there are conflicts between the requirements contained in this document and the noted standards, the most restrictive requirements shall prevail.

This document contains formulas and methodologies for the review and design of both stormwater quantity and stormwater quality facilities. Chapters 2 through 6 contain stormwater conveyance and detention calculations and requirements. Chapters 7 through 8 contain information on erosion control requirements, pollution prevention measures for active construction sites, and stormwater permit requirements and procedures. Chapters 9 through 10 cover calculations required to properly size and design stormwater quality features that will treat runoff long-term following construction completion. Chapter 11 contains miscellaneous requirements regarding Grading and Building Pad Elevations, Acceptable Outlet and Adjoining Property Impact Policies, and No Net Loss Floodplain Storage Policy. A comprehensive glossary of terms is provided in Appendix A. Appendix B contains several useful and necessary standard forms. Best Management Practices (BMPs) for erosion control measures during the construction phase are contained in Appendix C. It is the intent of [Jurisdiction Entity] that to provide consistency the material presented in Appendix C will be revised or eliminated once the Indiana Storm Water Quality Manual (ISWQM) is updated to include details regarding the BMPs currently included in Appendix C.

Chapter Two

METHODOLOGY FOR DETERMINATION OF RUNOFF RATES

Runoff rates shall be computed for the area of the parcel under development plus the area of the watershed flowing into the parcel under development. The rate of runoff which is generated as the result of a given rainfall intensity may be calculated as follows:

A. Development Sites Less than or Equal to 5 Acres in Size, With a Contributing Drainage Area Less than or Equal to 50 Acres and No Depressional Storage

The Rational Method may be used. A computer model, such as TR-55 (NRCS), TR-20 (NRCS), HEC-HMS (COE), and HEC-1 (COE), that can generate hydrographs based on the NRCS TR-55 time of concentration and curve number calculation methodologies may also be used along with a 24-hour duration NRCS Type 2 storm. Note that for the purpose of determining the post-developed conditions curve numbers, due to significant disturbance to the upper soil layers during the construction activities, the initially determined hydrologic soil group for disturbed areas should be changed to the next less infiltrating capacity category (i.e., A to B, B to C, and C to D). 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.

Values for the runoff coefficient "C" are provided in **Tables 2-1** and **2-2**, 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 2-3** provides runoff coefficients and inlet times for different land use classifications.

Rainfall intensity shall be determined from the rainfall frequency data shown in **Table 2-4**.

In general, the time of concentration (t_c) methodology to be used for all stormwater management projects within [Jurisdiction Entity] shall be as outlined in the U.S. Department of Agriculture (USDA) - NRCS TR-55 Manual. In urban or developed areas, the methodology to be used shall be the sum of the inlet time and flow time in the stormwater 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's Equation (see Chapter 4). 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.

TABLE 2-1

Urban Runoff Coefficients	
Type of Surface	*Runoff Coefficient "C"*
◆ **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 1995.

TABLE 2-2

Rural Runoff Coefficients	
Type of Surface	*Runoff Coefficient "C"*
◆ **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 1995.

TABLE 2-3

Runoff 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

Source: HERPICC Stormwater Drainage Manual, July 1995.

(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. If the inlet times to be used exceed 15 minutes, the runoff coefficient "C" shall be determined, based on "The Three River Coordinating Council Master Plan for Storm Drainage, April 1972", according to the following relationship:

Estimated Percent Impervious Surface	Runoff Coefficient
0 to 5	0.25 & less
5 to 10	0.25 to 0.30
10 to 15	0.30 to 0.35
15 to 23	0.35 to 0.40
23 to 30	0.40 to 0.45
30 to 45	0.45 to 0.55
45 to 60	0.55 to 0.65
60 to 80	0.65 to 0.80
80 to 100	0.80 to 1.00

B. Development Sites Greater Than 5 Acres in Size or Contributing Drainage Area Greater than 50 Acres or With Significant Depressional Storage

The runoff rate for these development sites and contributing drainage areas shall be determined by a computer model that can generate hydrographs based on the NRCS TR-55 time of concentration and curve number calculation methodologies and the 24-hour NRCS Type 2 Rainfall Distribution. Note that for the purpose of determining the post-developed conditions curve numbers, due to significant disturbance to the upper soil layers during the construction activities, the initially determined hydrologic soil group for disturbed areas should be changed to the next less infiltrating capacity category (i.e., A to B, B to C, and C to D). 24-hour Rainfall depth for various frequencies shall be taken from **Table 2-5**. The NRCS Type 2 distribution ordinates are found in **Table 2-6**. Examples of computer models that can generate such hydrographs include TR-55 (NRCS), TR-20 (NRCS), HEC-HMS (COE), and HEC-1 (COE). These programs may be downloaded free of charge from the associated agencies' web sites. The computer models ICPR and Pond Pack may also be used. However, the latter computer software are proprietary. If interconnected ponds are utilized, the use of ICPR or Pond Pack may be required to appropriately model the more complex hydrologic and hydraulic relationships associated with such system. Other models may be acceptable and should be accepted by the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator] prior to their utilization.

TABLE 2-4

Rainfall Intensities for Various Return Periods and Storm Durations						
Intensity (Inches/Hour)						
Duration	*Return Period (Years)*					
	2	5	10	25	50	100
5 Min.	4.63	5.94	6.81	7.86	8.63	9.39
10 Min.	3.62	4.61	5.25	6.01	6.54	7.07
15 Min.	2.95	3.77	4.31	4.95	5.40	5.86
30 Min.	1.97	2.58	2.99	3.50	3.86	4.23
1 Hr.	1.21	1.62	1.90	2.27	2.54	2.83
2 Hrs.	0.72	0.97	1.14	1.37	1.55	1.74
3 Hrs.	0.51	0.68	0.81	0.98	1.11	1.25
6 Hrs.	0.30	0.40	0.48	0.58	0.66	0.75
12 Hrs.	0.17	0.23	0.27	0.33	0.38	0.42
24 Hrs.	0.10	0.13	0.16	0.19	0.21	0.24

Source: NOAA, National Weather Service, "Precipitation-Frequency Atlas of the United States", NOAA Atlas 14, Volume 2, Version 2, 2004, for Fort Wayne, Indiana. (values for intermediate durations can be logarithmically interpolated.)

TABLE 2-5

Rainfall Depths for Various Return Periods						
Depth (Inches)						
Duration	*Return Period (Years)*					
	2	5	10	25	50	100
24 Hrs.	2.40	3.18	3.74	4.49	5.08	5.70

Source: NOAA, National Weather Service, "Precipitation-Frequency Atlas of the United States", NOAA Atlas 14, Volume 2, Version 2, 2004, for Fort Wayne, Indiana.

TABLE 2-6

NRCS Type II Rainfall Distribution Ordinates			
Cumulative Percent of Storm Time	*Cumulative Percent of Storm Depth*	*Cumulative Percent of Storm Time*	*Cumulative Percent of Storm Depth*
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		

NOTE: For use when not already built in the computer program.

C. Development Sites with Drainage Areas Greater than or Equal to One Square Mile

For the design of any major drainage system, as defined in **Appendix A**, the discharge must be obtained from, or be accepted by, the IDNR. Other portions of the site must use the discharge methodology in the applicable section of this Article.

Chapter Three

METHODOLOGY FOR DETERMINATION OF DETENTION STORAGE VOLUMES

A. Development Sites Less than or Equal to 5 Acres in Size, With a Contributing Drainage Area Less than or Equal to 50 Acres and No Depressional Storage

The required volume of stormwater storage may be calculated using the Rational Method and based on the runoff from 10-year and 100-year return period storms. A computer model, such as TR-55 (NRCS), TR-20 (NRCS), HEC-HMS (COE), and HEC-1 (COE), that can generate hydrographs based on the NRCS TR-55 time of concentration and curve number calculation methodologies may also be used along with a 24-hour duration NRCS Type 2 storm. Note that for the purpose of determining the post-developed conditions curve numbers, due to significant disturbance to the upper soil layers during the construction activities, the initially determined hydrologic soil group for disturbed areas should be changed to the next less infiltrating capacity category (i.e., A to B, B to C, and C to D).

The following 9-step procedure, based on the Rational Method, may be used to determine the required volume of storage

Step Procedure

1. Determine total drainage area in acres "A".
2. Determine the parcel area tributary to each outlet and determine the post-development 100-year release runoff rate (Q_u) based on general release rates provided in Chapter 6 of these Technical Standards document.
3 Determine composite runoff coefficient "C_d" based on developed conditions and a 100-year return period.
4. Determine 100-year return rainfall intensity "I_d" for various storm durations "t_d" up through the time of concentration for the developed area using **Table 2-4**.
5. Determine developed inflow rates "Q_d" for various storm durations "t_d", measured in hours.

$$Q_d = (C_d)(I_d)(A_d)$$

6. Compute a storage rate "$S(t_d)$" for various storm durations "t_d" up through the time of concentration of the developed area.

$$S(t_d) = (Q_d) - (Q_u)$$

7. Compute required storage volume "S_R" in acre-feet for each storm duration "t_d". This assumes a triangular hydrograph of duration ($2t_d$) hours with a peak flow of $S(t_d)$ at t_d hours.

$$S_R = S(t_d)\left(\frac{t_d}{12}\right)$$

8. Select largest storage volume computed in Step 7 for any storm duration "t_d" for detention basin design.

9. Repeat Steps 2-8 of this process for the post-developed 10-year storm.

B. Development Sites Greater Than 5 Acres in Size or Contributing Drainage Area Greater than 50 Acres or With Significant Depressional Storage

All runoff detention storage calculations for these development sites shall be prepared using a computer model that can generate hydrographs based on the NRCS TR-55 time of concentration and curve number calculation methodologies. Note that for the purpose of determining the post-developed conditions curve numbers, due to significant disturbance to the upper soil layers during the construction activities, the initially determined hydrologic soil group for disturbed areas should be changed to the next less infiltrating capacity category (i.e., A to B, B to C, and C to D). The 24-hour NRCS Type 2 Rainfall Distribution shall be utilized to determine the required storage volume. The allowable release rates shall be determined based on the methodologies provided in Chapter 6 of these Technical Standards document. Examples of computer models that can generate such hydrographs include TR-55 (NRCS), TR-20 (NRCS), HEC-HMS (COE), and HEC-1 (COE). These programs may be downloaded free of charge from the associated agencies' web sites. Other models may be acceptable and should be accepted by the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator] prior to their utilization. The computer models ICPR and Pond Pack may also be used. However, the latter computer software are proprietary. If interconnected ponds are utilized, the use of ICPR or Pond Pack may be required to appropriately model the more complex hydrologic and hydraulic relationships associated with such system.

Chapter Four

STORM SEWER DESIGN STANDARDS AND SPECIFICATIONS

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. Design Storm Frequencies and Easements

1. All storm sewers, inlets, catch basins, and street gutters shall accommodate (subject to the "allowable spread" provisions discussed later in this Section), as a minimum, peak runoff from a 24-hour, 10-year return frequency storm calculated based on methodology described in Chapter 2. Additional discharges to storm sewer systems allowed in Section L below of this Section must be considered in all design calculations. For Rational Method analysis, the duration shall be equal to the time of concentration for the drainage area. In computer based analysis, the duration is as noted in the applicable methodology associated with the computer program.

2. Culverts shall be capable of accommodating peak runoff from a 24-hour, 50-year frequency storm when crossing under a road which is part of the [Jurisdiction Entity] Thoroughfare Plan or is classified as freeway, arterial, parkway, and/or collectors by the [Jurisdiction Entity] Zoning Ordinance or provides the only access to and from any portion of any commercial or residential developments.

3. For portions of the system considered minor drainage systems, the allowable spread of water on Collector Streets is limited to maintaining two clear (free of standing or flowing water) 10-foot moving lanes of traffic during the 10-year storm event. A minimum of one 10-foot clear lane is to be maintained on two lane Local Roads, while a minimum of 6-foot clear lane is to be maintained for other access lanes (such as a subdivision cul-de-sac). An overflow channel/swale between sag inlets and overflow paths 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 measured from elevation of gutter during the 10-year design storm. The street sidewalk behind the sag inlet shall be graded in such a way to ensure the unimpeded flow of water to the overflow channel/swale, maintaining the noted maximum flow depth at the gutter.

4. Facilities functioning as a major drainage system as defined in **Appendix A** must also meet IDNR design standards in addition to the [Jurisdiction Entity] standards. In case of discrepancy, the most restrictive shall apply.

5. Minimum easement widths for storm drains that are not accepted as a [Jurisdiction Entity-owned/maintained Drain, if any] shall be as provided below. More stringent requirements for stormwater easement size and additional covenants may be made by the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator] based upon individual site conditions.

Depth of Drain From Finish Grade to Crown	Diameter of Storm Drain	Maintain Easement Width
3 feet or less	15" or less	15 feet
More than 3 feet	15" or less	20 feet
3 feet or less	Greater than 15"	25 feet
More than 3 feet	Greater than 15"	30 feet

6. Pipe, 12 inches or larger in diameter, shall be placed in a 30-foot easement (15 feet from centerline on each side) and shall be designated on the record plat as 30-foot [Jurisdiction Entity] [Jurisdiction Entity-owned/maintained Drain, if any] Easement (RDE). Wider easements may be required by the [Jurisdiction Entity] [Jurisdiction Entity Highest Stormwater Approval Administrative Body] and/or [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator] when the depth of pipe is greater than 6 to 10 feet, depending on the pipe size.

7. The statutory 75-foot (each side) drainage easement for [Jurisdiction Entity-owned/maintained Drain, if any]s already within the [Jurisdiction Entity]'s system may be reduced if the drain is re-classified by the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator] as an Urban Drain.

8. An annual maintenance assessment shall be set up on each new [Jurisdiction Entity-owned/maintained Drain, if any] established in a subdivision. The amount of the assessment will be determined by the [Jurisdiction Entity] [Jurisdiction Entity Highest Stormwater Approval Administrative Body] and/or [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator] and so certified.

9. If the [Jurisdiction Entity] [Jurisdiction Entity Highest Stormwater Approval Administrative Body] and/or [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator] accepts the petition for incorporation into their system, the following statement shall become part of the Restrictive Covenants of every platted subdivision and shown on recorded plat: "channels, tile drains 12-inch or larger, inlets and outlets of detention and retention ponds, and appurtenances thereto within designated drain

easements are extensions of the [Jurisdiction Entity]'s stormwater drainage system and are the responsibility of the [Jurisdiction Entity] [Jurisdiction Entity Highest Stormwater Approval Administrative Body]. Drainage swales and tile drains less than 12-inch in inside diameter shall be the responsibility of owner or homeowner association."

10. The following statement shall be put on each subdivision plat: "A petition addressed to the [Jurisdiction Entity] [Jurisdiction Entity Highest Stormwater Approval Administrative Body] has been filed in duplicate with the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator], requesting that the subdivision's storm drainage system and its easements be accepted into the [Jurisdiction Entity]'s [Jurisdiction Entity-owned/maintained Drain, if any]age system. The storm drainage system and its easements that are accepted into the [Jurisdiction Entity]'s [Jurisdiction Entity-owned/maintained Drain, if any]age system are delineated on the plat as [Jurisdiction Entity-owned/maintained Drain, if any]age Easements (RDEs). [Jurisdiction Entity-owned/maintained Drain, if any]age Easements are stormwater easements and drainage rights of way that are hereby dedicated to the public and to the [Jurisdiction Entity], Indiana, [Jurisdiction Entity Highest Stormwater Approval Administrative Body] for the sole and exclusive purpose of controlling surface water and/or for the installation, operation, and maintenance of storm sewers and tile drains as defined in [Jurisdiction Entity] Stormwater Management Ordinance. These drainage easements are established under authority of the Indiana Drainage Code and the said [Jurisdiction Entity Highest Stormwater Approval Administrative Body] may exercise powers and duties as provided in said code (e.g., annual drainage assessment per lot). All other storm drainage easements have not been accepted into the [Jurisdiction Entity]'s system. All drainage improvements performed relative to the conveyance of Stormwater runoff and the perpetual maintenance thereof, within the latter easements, shall be the responsibility of the owner or homeowner association. The [Jurisdiction Entity] [Jurisdiction Entity Highest Stormwater Approval Administrative Body] assumes no responsibility relative to said improvements or the maintenance thereof. This subdivision contains _____ linear feet of open ditches and _____ linear feet of subsurface drains that will be included in the [Jurisdiction Entity]'s [Jurisdiction Entity-owned/maintained Drain, if any]age System." The noted [Jurisdiction Entity-owned/maintained Drain, if any] lengths, broken down by the length of open and tile drains, shall also be shown in tabular form in a prominent position on the plat.

11. Any crossing and/or encroachment not recognized or stipulated during the platting or development process will require a consent application and approval through the [Jurisdiction Entity] [Jurisdiction Entity Highest Stormwater Approval Administrative Body].

B. Manning's Equation

Determination of hydraulic capacity for storm sewers sized by the

Rational Method analysis must be done using Manning's Equation. where:

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

Then:

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

Where:

Q = capacity in cubic feet per second

V = mean velocity of flow in feet per second

A = cross sectional area in square feet

R = hydraulic radius in feet

S = 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. Allowable "n" values and maximum permissible velocities for storm sewer materials are listed in **Table 4-1**.

C. Backwater Method for Pipe System Analysis

For hydraulic analysis of existing or proposed storm drains which possess submerged outfalls, a more sophisticated design/analysis methodology than Manning's equation will be required. The backwater analysis method provides a more accurate estimate of pipe flow by calculating individual head losses in pipe systems that are surcharged and/or have submerged outlets. These head losses are added to a known downstream water surface elevation to give a design water surface elevation for a given flow at the desired upstream location. Total head losses may be determined as follows:

Total head loss = frictional loss + manhole loss + velocity head loss + junction loss

Various computer modeling programs such as HYDRA, ILLUDRAIN, and STORMCAD are available for analysis of storm drains under these conditions. Computer models to be utilized, other than those listed, must be accepted by the

[Jurisdiction Entity] [Jurisdiction Entity Highest Stormwater Approval Administrative Body] and/or [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator].

TABLE 4-1

Typical Values of Manning's "n"		
Material	*Manning's "n"*	*Maximum Velocities (feet/second)*
☐ Closed Conduits		
Concrete	0.013	10
Vitrified Clay	0.013	10
HDPE	0.013	10
PVC	0.013	10
☐ 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
☐ **Open Channels**		
Concrete, Trowel Finish	0.013	10
Concrete, Broom Finish	0.015	10
Gunite	0.018	10
Riprap Placed	0.030	10
Riprap Dumped	0.035	10
Gabion	0.028	10
New Earth **(1)**	0.025	4
Existing Earth **(2)**	0.030	4
Dense Growth of Weeds	0.040	4
Dense Weeds and Brush	0.040	4
Swale with Grass	0.035	4
☐ **Culverts**		
Concrete Culverts	0.013	10

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

D. Minimum Size for Storm Sewers

The minimum diameter of all storm sewers shall be 12 inches. When the minimum 12-inch diameter pipe will not limit the rate of release to the required amount, the rate of release for detention storage shall be controlled by an orifice plate or other device, subject to acceptance of the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator].

E. Pipe Cover, Grade, and Separation from Sanitary Sewers and Water Mains

Pipe grade shall be such that, in general, a minimum of 2.0 feet of cover is maintained over the top of the pipe. If the pipe is to be placed under pavement, then the minimum pipe cover shall be 2.5 feet from top of pavement to top of pipe. Pipe cover less than the minimum may be allowed per manufacturer's specifications or recommendation and used only upon written acceptance from the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator]. 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 between 2.5 and 10 feet per second, respectively, when the sewer is flowing full. Maximum permissible velocities for various storm sewer materials are listed in **Table 4-1**.

A minimum of 2.0 feet of vertical separation between storm sewers and sanitary sewers shall be required. When this is not possible, the sanitary sewer must be encased in concrete or ductile steel within 5 feet, each side, of the crossing centerline. Storm sewers shall be laid at least 10 feet horizontally from any existing or proposed parallel water main. The distance shall be measured edge to edge. In cases where it is not practical to maintain a ten-foot separation between parallel storm sewer and water main, the appropriate reviewing agency may allow deviation on a case-by-case basis, if supported by data from the design engineer. Such deviation may allow installation of the storm sewer closer to a water main, provided that the water main is in a separate trench or on an undisturbed earth shelf located on one side of the storm sewer and at the elevation so the bottom of the water main is at least 18 inches above the top of the storm sewer.

F. Alignment

Storm sewers shall be straight between manholes and/or inlets.

G. Manholes/Inlets

All new installations or replacements of catch basins, grates, and inlet/manhole covers for [Jurisdiction Entity] and/or privately owned projects must be permanently pre-stamped with an appropriate "clean water" message that visibly states in some way that no waste or polluting materials may be dumped into the storm drain as this drains to our waterways. Manholes and/or inlets shall be installed to provide human access to continuous underground storm sewers for the purpose of inspection and maintenance. The casting access minimum inside diameter shall be no less than 22 inches or a rectangular opening of no less than 22 inches by 22 inches. Manholes shall be provided at the following locations:

1. Where two or more storm sewers converge.

2. Where pipe size or the pipe material changes.

3. Where a change in horizontal alignment occurs.

4. Where a change in pipe slope 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 shown in **Table 4-2**.

TABLE 4-2

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

In addition to the above requirements, a minimum drop of 0.1 foot through manholes and inlet structures should be provided. When changing pipe size, match crowns of pipes, unless detailed modeling of hydraulic grade line shows that another arrangement would be as effective. Pipe slope should not be so steep that inlets surcharge (i.e. if pipe is under pressure, hydraulic grade line should remain below rim elevation, with the downstream starting water surface elevation assumed at top of the pipe or the maximum 10-year flood pond/receiving water body elevation, whichever is higher).

6. Manhole/inlet inside sizing shall be as shown in **Table 4-3**.

TABLE 4-3

Manhole/Inlet Inside Sizing		
Depth of Structure	**Minimum Diameter**	**Minimum Square Opening**
Less than 5 feet	36 inches	36" x 36"
5 feet or more	48 inches	48" x 48"

H. Inlet Sizing and Spacing

Inlets or drainage structures shall be utilized to collect surface water through grated openings and convey it to storm sewers, channels, or culverts. The inlet grate opening provided shall 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. Inlet design and spacing may be done using the hydraulic equations by manufacturers or orifice/weir equations. Use of the U.S. Army Corps of Engineers HEC-12 computer program is also an acceptable method. Gutter spread on continuous grades may be determined using the Manning's equation, or by using **Figure 4-1**. Further guidance regarding gutter spread calculation may be found in the latest edition of HERPICC Stormwater Drainage Manual, available from the Local Technical Assistance Program (LTAP). At the time of printing of this document, contact information for LTAP was:

Indiana LTAP
Purdue University
Toll-Free: (800) 428-7369 (Indiana only)
Phone: (765) 494-2164
Fax: (765) 496-1176
Email: inltap@ecn.purdue.edu
Website: www.purdue.edu/INLTAP/

I. Installation and Workmanship

The point of commencement for laying a storm sewer pipe shall be the lowest point in the proposed sewer line. All pipes shall be laid, without break, upgrade from structure to structure. All storm sewer pipe shall have concrete footing supports with appropriate mechanism to constrain movement at end of pipe. Bedding and backfill materials around storm sewer pipes, sub-drains, and the associated structures are limited to: #8 or #9 crushed stone, hand-tamped or walked-in; flowable fill; and native or structural backfill, compacted to 95% Standard Proctor density. The specific location requirements for the use of these

materials are dependent on pipe location in relation to pavement structures and on pipe material as detailed in **Figure 4-2** and **Figure 4-3**. The specifications for the construction of storm sewers and sub-drains, including backfill requirements, shall not be less stringent than those set forth in the latest edition of the INDOT "Standard Specifications". Additionally, ductile iron pipe shall be laid in accordance with American Water Works Association (AWWA) C-600 and clay pipe shall be laid in accordance with either American Society of Testing Materials (ASTM) C-12 or the appropriate American Association of State Highway and Transportation Officials (AASHTO) specifications. Dips/sags on newly installed storm systems will not be allowed. Also, infiltration from cracks, missing pieces, and joints would not be allowed. Variations from these standards must be justified and receive written acceptance from the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator].

J. Materials

Storm sewer manholes and inlets shall be constructed of cast in place concrete or precast reinforced concrete. Material and construction shall conform to the latest edition of the Indiana Department of Transportation (INDOT) "Standard Specifications", Sections 702 and 720.

Pipe and fittings used in storm sewer construction shall be extra-strength clay pipe (ASTM C-12), ductile iron pipe (AWWA C-151), poly vinyl chloride pipe (AASHTO M252), polyethylene pipe (AASHTO M252 or AASHTO M294), or concrete pipe (AASHTO M170). Other pipe and fittings not specified herein or in Sections 907-908 of the latest edition of the INDOT “Standard Specifications” may be used only when specifically authorized by the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator]. Pipe joints shall be flexible and watertight and shall conform to the requirements of Section 906, of the latest edition of the INDOT "Standard Specifications". **If the storm sewer pipe is to be placed within a road right-of-way or in an area subject to loading, the pipe and fittings shall be concrete. A higher class concrete may be required for cover depths in excess of 10 feet or less than 2 feet.**

K. Special Hydraulic Structures

Special hydraulic structures required to control the flow of water in storm runoff drainage systems include junction chambers, drop manholes, 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. Certification of special structures by a certified Structural Engineer may also be required.

L. Connections to Storm Sewer System

To allow any connections to the storm sewer system, provisions for the connections shall be shown in the drainage calculations for the system. Specific language shall be provided in the protective covenants, on the record plat, or with the parcel deed of record, noting the ability or inability of the system to accommodate any permitted connections, for example, sump pumps and footing drains.

1. **Sump pumps** installed to receive and discharge groundwater or other stormwater shall be connected to the storm sewer where possible or discharged into a designated storm drainage channel/swale. 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 stormwater/groundwater or the discharge of sanitary sewage.

2. **Footing drains and perimeter drains** shall be connected to Manholes or Curb inlets, where possible, or to designated storm sewers or discharged into designated storm drainage channels/swales.

3. All **roof downspouts**, roof drains, or roof drainage piping shall discharge onto the ground and shall not be directly connected to the storm drainage system. Variation from this requirement may be requested and granted by the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator] in special circumstances. No downspouts or roof drains shall be connected to the sanitary sewers.

4. **Swimming Pool drains** shall not be connected to the storm sewers.

In addition, none of the above mentioned devices shall be connected to any street underdrains, unless specifically authorized by the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator].

M. Drainage System Overflow Design (Before Reaching the Pond)

Overflow path/ponding areas (paths leading to the detention/retention ponds) throughout the development resulting from a 100-year storm event, calculated based on all contributing drainage areas, on-site and off-site, in their proposed or reasonably anticipated land use and with storm pipe system assumed completely plugged, shall be determined. The centerline of this 100-year overflow path shall be clearly shown as a distinctive line symbol on the plans, and except for side lot overflow paths, a minimum width of 30 feet along the centerline of the flow path (15 feet from centerline on each side) designated as permanent drainage easements. If the overflow path is between two adjacent lots and no under-drain tile or storm pipe is underneath, then the easement width may be reduced to 15 feet. No fences or landscaping can be constructed within the easement areas that

may impede the free flow of Stormwater. These areas are to be maintained by the property owners or be designated as common areas that are to be maintained by the homeowners association. The Lowest Adjacent Grade for all residential, commercial, or industrial buildings shall be set a minimum of 1 foot above the noted overflow path/ponding elevation.

All buildings shall have the Lowest Adjacent Grade shown on the secondary plat. Lowest Adjacent Grade of all structures fronting a pond or open ditch shall be no less than 2 feet (1 foot for the 100-year overflow path as the storm drains are assumed plugged as an additional safety factor) above any adjacent 100-year local or regional flood elevations, whichever is greater, for all windows, doors, unsealed pipe entrances, window well rim elevations, and any other structure member where floodwaters can enter a building.

The overflow path/ponding may be modeled as successive series of natural ponds and open channel segments. Ponds should be modeled similar to that discussed for modeling depressional areas in Chapter 6. Channels should be modeled according to modeling techniques discussed in Chapter 5. The calculations for determining the 100-year overflow path/ponding elevations may be based on hand calculation methods utilizing normal depth calculations and storage routing techniques or performed by computer models. Examples of computer models that either individually or in combination with other models can handle the required computations include TR-20, HEC-HMS, and HEC-1, combined with HEC-RAS. Other models may be acceptable and should be submitted to the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator] for acceptance prior to their utilization.

Values in Table 4-4 may be utilized as an alternative to the above-noted detailed calculations for determining the required pad elevations of buildings near an overflow path without the need for calculating the 100-year flood elevation along the overflow path.

TABLE 4-4

Building Pad Elevations With Respect to Overflow Path Invert Elevations		
Drainage Area (acres)	**Building Pad/Lowest Adjacent Grade Above Overflow Path Invert (ft.)**	**Building Pad/Lowest Adjacent Grade Above Overflow Path Invert, if Overflow Path is in the Street (ft.)**
Up to 5	2.5	1.5
6-10	3.0	1.5
11-15	3.25	1.75
16-20	3.5	1.75
21-30	4.0	2.0
30-50	4.25	2.0

If Table 4-4 is used, the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator] reserves the right to require independent calculations to verify that the proposed building pads provide approximately 1 foot of freeboard above the anticipated overflow path/ponding elevations.

In the case of existing upstream detention, an allowance equivalent to the reduction in flow rate provided may be made for upstream detention only when: (1) such detention and release rate have previously been accepted by the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator] official charged with the approval authority at the time of the acceptance, and (2) evidence of its construction and maintenance can be shown.

Requirements for Emergency Flow Routing (from the detention retention pond to the receiving water body) are discussed in Chapter 6, Section C of these Standards.

FIGURE 4-1
Street and Gutter Capacities (continuous grade)

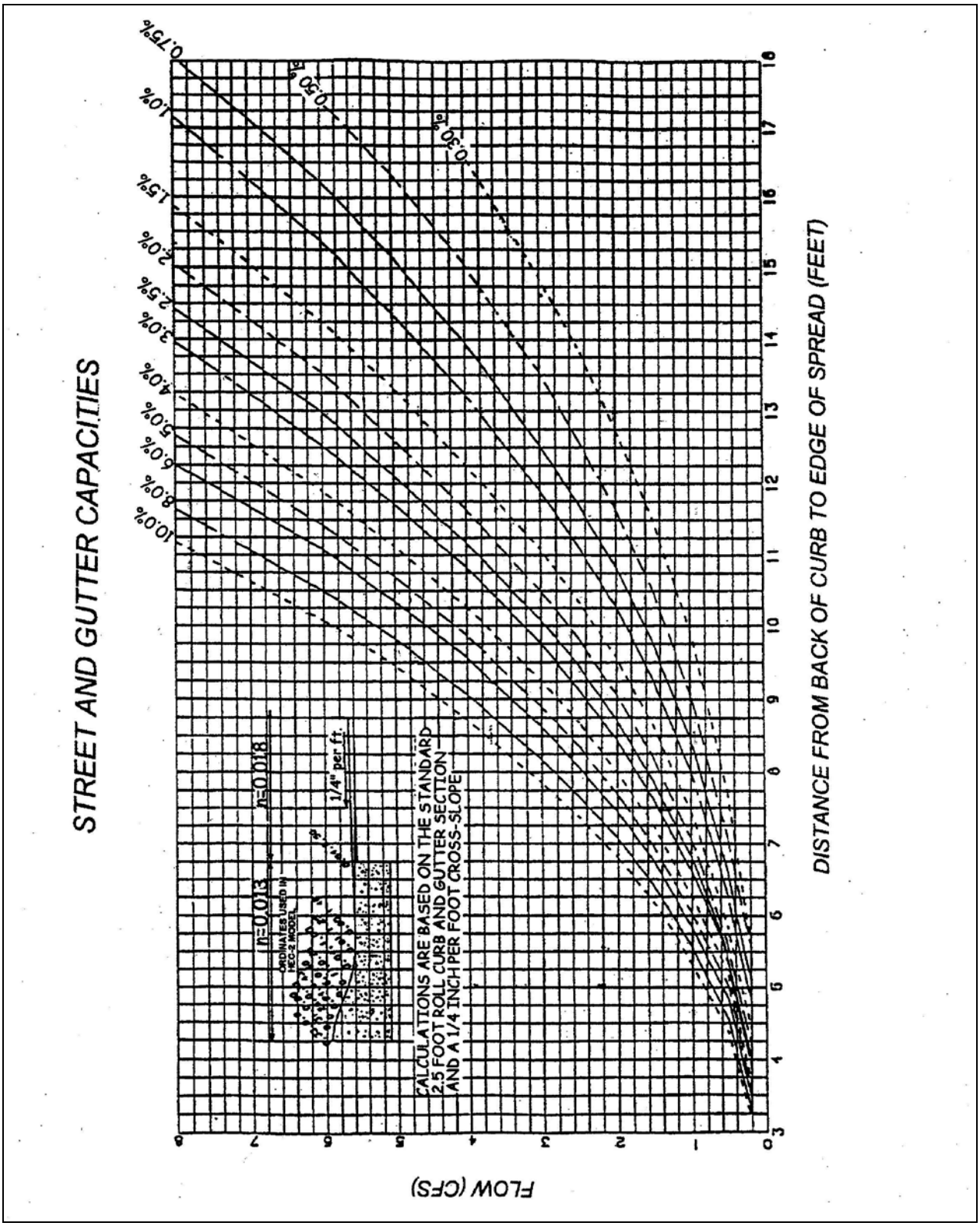
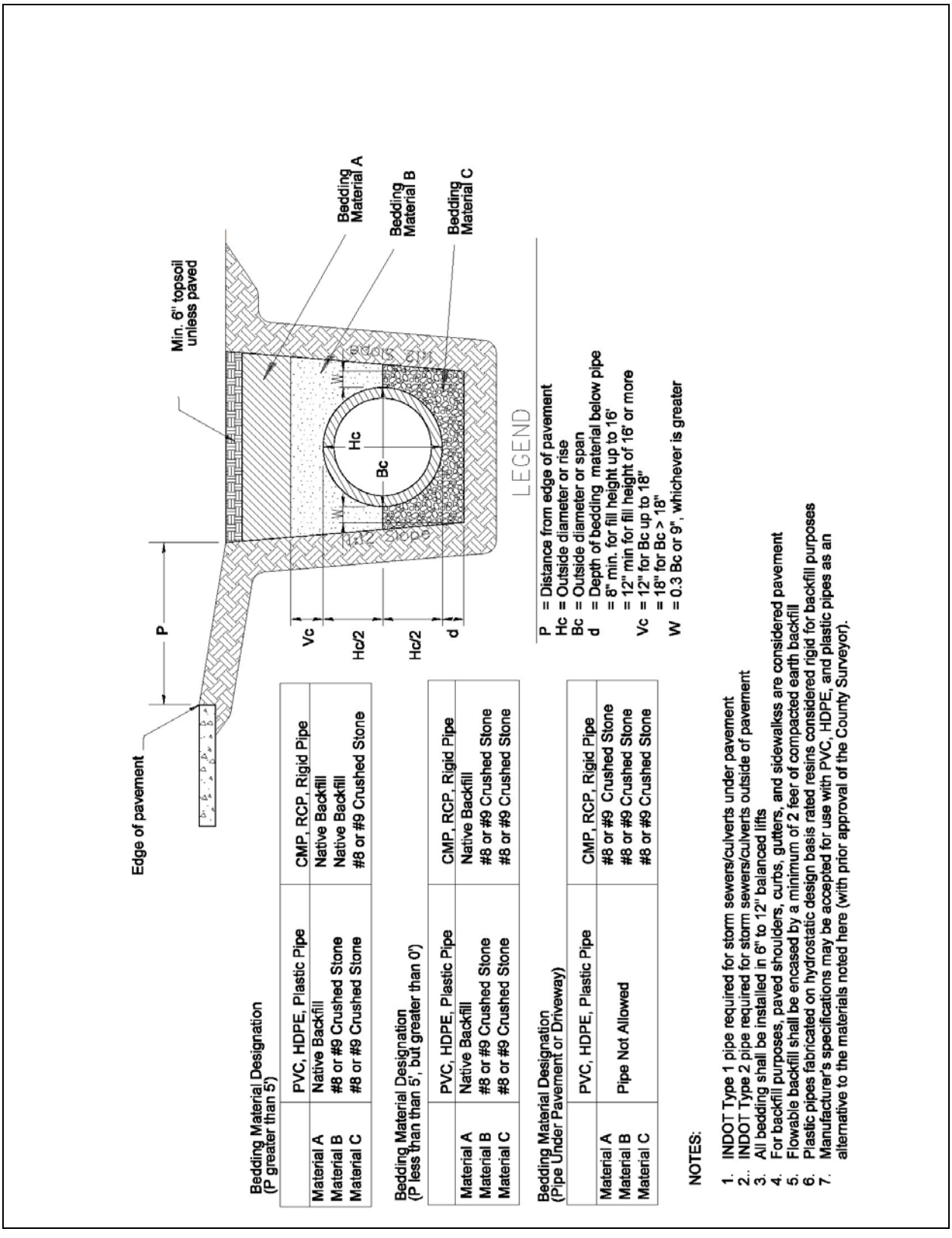


FIGURE 4-2
Bedding and Backfill Standards for Storm Sewers



Bedding Material Designation
(P greater than 5')

	PVC, HDPE, Plastic Pipe	CMP, RCP, Rigid Pipe
Material A	Native Backfill	Native Backfill
Material B	#8 or #9 Crushed Stone	Native Backfill
Material C	#8 or #9 Crushed Stone	#8 or #9 Crushed Stone

Bedding Material Designation
(P less than than 5', but greater than 0')

	PVC, HDPE, Plastic Pipe	CMP, RCP, Rigid Pipe
Material A	Native Backfill	Native Backfill
Material B	#8 or #9 Crushed Stone	#8 or #9 Crushed Stone
Material C	#8 or #9 Crushed Stone	#8 or #9 Crushed Stone

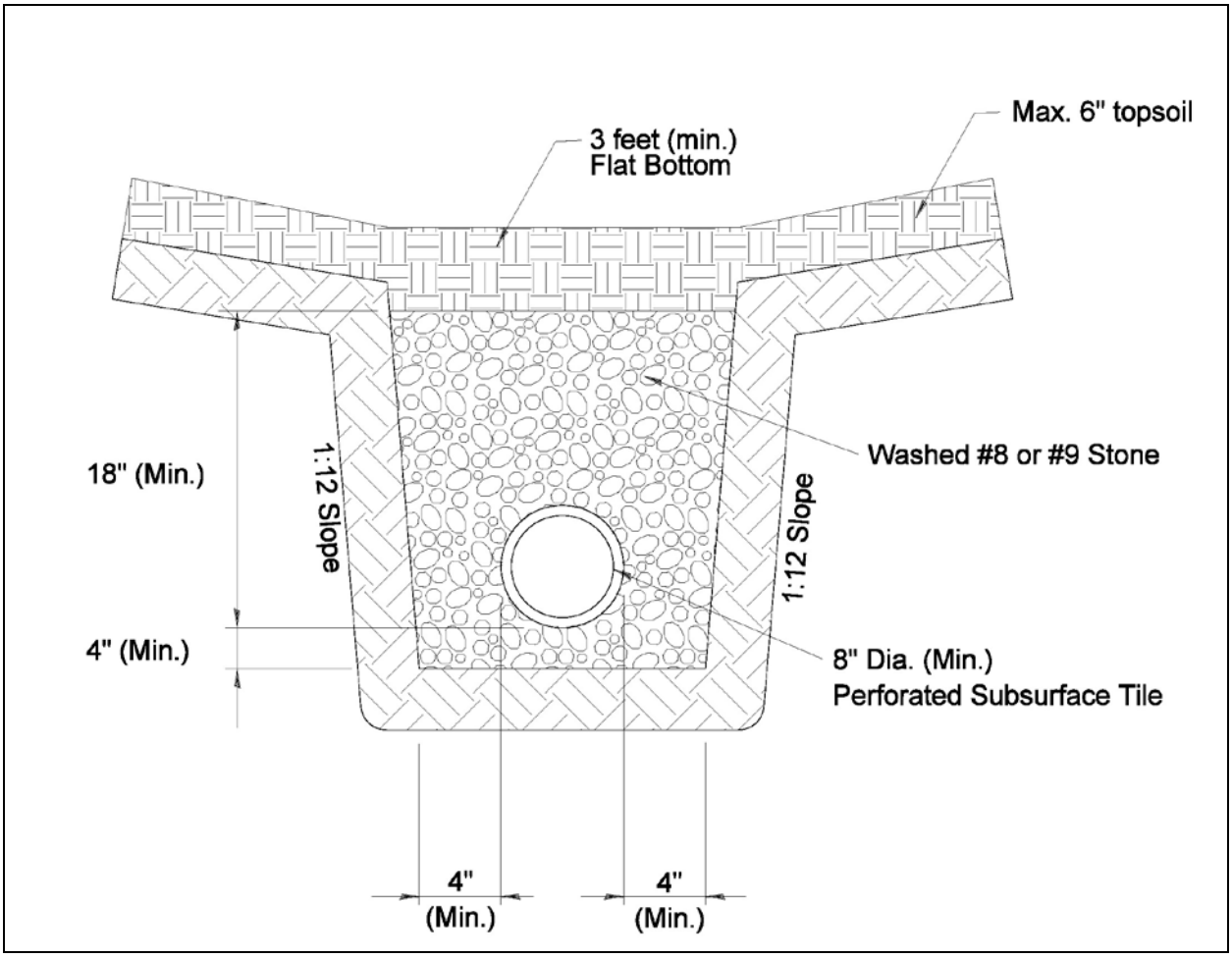
Bedding Material Designation
(Pipe Under Pavement or Driveway)

	PVC, HDPE, Plastic Pipe	CMP, RCP, Rigid Pipe
Material A	Pipe Not Allowed	#8 or #9 Crushed Stone
Material B		#8 or #9 Crushed Stone
Material C		#8 or #9 Crushed Stone

NOTES:

1. INDOT Type 1 pipe required for storm sewers/culverts under pavement
2. INDOT Type 2 pipe required for storm sewers/culverts outside of pavement
3. All bedding shall be installed in 6" to 12" balanced lifts
4. For backfill purposes, paved shoulders, curbs, gutters, and sidewalkss are considered pavement
5. Flowable backfill shall be encased by a minimum of 2 feer of compacted earth backfill
6. Plastic pipes fabricated on hydrostatic design basis rated resins considered rigid for backfill purposes
7. Manufacturer's specifications may be accepted for use with PVC, HDPE, and plastic pipes as an alternative to the materials noted here (with prior approval of the County Surveyor).

FIGURE 4-3
Bedding and Backfill Standards for Sub-drains under Swales



Chapter Five

OPEN CHANNEL DESIGN STANDARDS AND SPECIFICATIONS

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

A. Design Storm Frequencies and Easements

1. All channels and swales shall accommodate, as a minimum, peak runoff from a 24-hour, 10-year return frequency storm calculated based on methodology described in Chapter 2. For Rational Method analysis, the storm duration shall be equal to the time of concentration for the drainage area. In computer-based analysis, the duration is as noted in the applicable methodology associated with the computer program.

2. Channels with a carrying capacity of more than 30 cfs at bank-full stage shall be capable of accommodating peak runoff for a 24-hour, 50-year return frequency storm within the drainage easement.

3. Channel facilities functioning as a major drainage system, as defined in **Appendix A**, must also meet IDNR design standards in addition to the [Jurisdiction Entity] standards. In case of discrepancy, the most restrictive requirements shall apply.

4. The 10-year storm design flow for residential rear and side lot swales shall not exceed 4 cfs. Unless designed as a Post-construction stormwater quality BMP, the maximum length of rear and side lot swales before reaching any inlet shall not exceed 400 feet.

5. Regardless of minimum design frequencies stated above, the performance of all parts of drainage system shall be checked for the 100-year flow conditions to insure that all buildings are properly located outside the 100-year flood boundary and that flow paths are confined to designated areas with sufficient easement.

6. A minimum of 25 feet from top of the bank on each side of a new channel shall be designated on the recorded plat as a Drainage Easement. If the top of bank is not vegetated according the development's landscape plan, a minimum 25-foot width of filter strip shall be installed within the drainage easement.

7. For matters relating to [Jurisdiction Entity-owned/maintained Drain, if any]s and petition for establishing new [Jurisdiction Entity-owned/maintained Drain, if any]s, the requirements in Chapter 4, Sections A.7 through A.11 of this Standards must also be followed.

B. Manning's Equation

The waterway area for channels shall be determined using Manning's Equation, where:

$$A = Q/V$$

A = Waterway area of channel in square feet

Q = Discharge in cubic feet per second (cfs)

V = Steady-State channel velocity, as defined by Manning's Equation (See Chapter 4)

C. Backwater Method for Drainage System Analysis

The determination of 100-year water surface elevation along channels and swales shall be based on accepted methodology and computer programs designed for this purpose. Computer programs HEC-RAS, HEC-2, and ICPR are preferred programs for conducting such backwater analysis. The use of other computer models must be accepted in advance by the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator].

D. Channel Cross-Section and Grade

1. 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 2 feet per second are not acceptable, as siltation will take place and ultimately reduce the channel cross-section area. The maximum permissible velocities in vegetated-lined channels are shown in

Table 5-1. In addition to existing runoff, the channel design should incorporate increased runoff due to the proposed development.

2. Where depth of design flow is slightly below critical depth, channels shall have freeboard adequate to cope with the effect of hydraulic jumps.

3. Along the streets and roads, the bottom of the ditch should be low enough to install adequately-sized driveway culverts without creating "speed bumps". The driveway culvert inverts shall be designed to adequately consider upstream and downstream culvert elevations.

4. Flow of a channel into a closed system is prohibited, unless runoff rate and head loss computations demonstrate the closed conduit to be capable of carrying the 100-year channel flow for developed conditions, either entirely or in combination with a defined overflow channel, with no reduction in flow velocity, calculated flow, or increase in backwater conditions.

E. Channel Side Slopes

1. Earthen channel and swale side slopes shall be no steeper than 3 horizontal to 1 vertical (3:1). Flatter slopes may be required to prevent erosion and for ease of maintenance.

2. Where channels will be lined with riprap, concrete, or other acceptable lining method, side slopes shall be no steeper than 2 horizontal to 1 vertical (2:1) with adequate provisions made for weep holes.

3. Side slopes steeper than 2 horizontal to 1 vertical (2:1) may be used for lined channels provided that the side lining is designed and constructed as a structural retaining wall with provisions for live and dead load surcharge.

4. When the design discharge produces a depth of greater than three (3) feet in the channel, appropriate safety precautions shall be added to the design criteria based on reasonably anticipated safety needs.

TABLE 5-1

Maximum Permissible Velocities in Vegetal-Lined Channels (1)			
Cover	*Channel 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 and Water Conservation".

(2) Use velocities exceeding 5 feet per second only where good channel ground 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 a stone, concrete, or highly resistant vegetative center section.

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

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

F. Channel Stability

1. Characteristics of a stable channel are:

   a] It neither promotes sedimentation nor degrades the channel bottom and sides.

   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, outfalls or elsewhere.

   e] Gullies do not form or enlarge due to the entry of uncontrolled 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 bankfull flow, whichever is greater, using an "n" value for various channel linings as shown in **Tables 4-1 and 5-1**. In no case is it necessary to check channel stability for discharges greater than that from a 100-year frequency storm.

3. Channel stability shall be checked for conditions representing the period immediately after construction. For this stability analysis, the velocity shall be calculated for the expected flow from a 10-year frequency storm on the watershed, or the bankfull flow, whichever is smaller, and the "n" value for the 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" (or the latest guidance document from NRCS) 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.

G. Drainage of Swales

Minimum swale slopes are 1.0% unless designed to act as a Post-construction stormwater quality BMP. All flow shall be confined to the specific easements associated with each rear and side lot swale that are part of the minor drainage system. Swale slopes less than the minimum 1.0% may be allowed by the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator] in rare circumstances. However, unless designed to act as a stormwater quality BMP, vegetated swales with a slope less than 1.0 % shall have tile underdrains to dry the swales. (See Figure 4-3). Tile lines may be outletted through a drop structure at the ends of the swale or through a standard tile outlet. Other choices may be presented for consideration by the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator] on a case by case basis. Further guidance regarding this subject may be found in the latest edition of the Indiana Drainage Handbook.

H. Appurtenant Structures

The design of channels will include provisions for operation and maintenance and the proper functioning of all channels, laterals, travelways, and structures associated with the project. Recessed inlets and structures when needed and/or required 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 will also provide for necessary floodgates, water level control devices, and any other appurtenance structure affecting the functioning of the channels and the attainment of the purpose for which they are built.

The effects 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.

I. Deposition of Spoil

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

1. Minimize overbank wash.

2. Provide for the free flow of water between the channel and floodplain boundary unless the valley routing and water surface profiles 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. Be accepted by the IDNR or COE, if applicable.

J. 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. Gabions
7. Straw or Coconut Mattings (only until grass is established)

Other lining materials must be accepted in writing by the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator]. Materials shall comply with the latest edition of the INDOT, "Standard Specifications" or other specifications source acceptable to [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator].

K. Drainage System Overflow Design

See Chapter 4, Section M of these Standards.

Chapter Six

STORMWATER DETENTION DESIGN STANDARDS

The following shall govern the design of any improvement with respect to the detention of stormwater runoff. Basins shall be constructed to temporarily detain the stormwater runoff that exceeds the maximum peak release rate authorized by the Ordinance. The required 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 10-year or 100-year storm as explained below in Section "B.". Also, basins shall be constructed to provide adequate capacity to allow for sediment accumulation resulting from development and to permit the pond to function for reasonable periods between cleanings.

A. Acceptable Detention Facilities

The increased stormwater runoff resulting from a proposed development should be detained on-site by the provisions of appropriate wet bottom or dry bottom detention facilities, parking lots, or other acceptable techniques. Measures that retard the rate of overland flow and the velocity in runoff channels shall also be used to partially control runoff rates.

B. Allowable Release Rates

1. General Release Rates

Control devices shall limit the discharge to a rate such that the post-developed release rate from the site is no greater than 0.05 cfs per acre of development for 0-10 year return interval storms and 0.18 cfs per acre of developed area for 11 - 100 year return interval storms. The above fixed general release rates may be set at a lower value by the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator] for certain watersheds if more detailed data becomes available as a result of comprehensive watershed studies conducted and/or formally approved and adopted by the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator]'s Office. The applicant shall confirm the applicable release rates with the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator] prior to initiating the design calculations to determine whether a basin-specific rate has been established for the watershed.

For sites where the pre-developed area has more than one (1) outlet, the release rate should be computed based on pre-developed discharge to each outlet point. The computed release rate for each outlet point shall not be exceeded at the respective outlet point even if the post developed

conditions would involve a different arrangement of outlet points. Switching/diversion of flow from one sub-watershed/watershed to another is not generally allowed and shall require prior acceptance from the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator].

2. Site-Specific Release Rates for Sites with Depressional Storage

For sites where depressional storage exists, the general release rates provided above may have to be further reduced. If depressional storage exists at the site, site-specific release rates must be calculated according to methodology described in Chapter 2, accounting for the depressional storage by modeling it as a pond whose outlet is a weir at an elevation that stormwater can currently overflow the depressional storage area. Post developed release rate for sites with depressional storage shall be the 2-year pre-developed peak runoff rate for the post-developed 10-year storm and 10-year pre-developed peak runoff rate for the post-developed 100-year storm. In no case shall the calculated site-specific release rates be larger than general release rates provided above.

Note that by definition, the depressional storage does not have a direct gravity outlet but if in agricultural production, it is more than likely drained by a tile and should be modeled as "empty" at the beginning of a storm. The function of any existing depressional storage should be modeled using an event hydrograph model to determine the volume of storage that exists and its effect on the existing site release rate. To prepare such a model, certain information must be obtained, including delineating the tributary drainage area, the stage-storage relationship and discharge-rating curve, and identifying the capacity and elevation of the outlet(s).

The tributary area should be delineated on the best available topographic data. After determining the tributary area, a hydrologic analysis of the watershed should be performed, including, but not limited to: a calculation of the appropriate composite runoff curve number and time of concentration. Stage-storage data for the depressional area should be obtained from the site topography. The outlet should be clearly marked and any calculations performed to create a stage-discharge rating curve must be included with the stormwater submittal.

Also note that for determining the post-developed peak runoff rates, the depressional storage must be assumed to be filled unless the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator] can be assured, through dedicated easement, that the noted storage will be preserved in perpetuity.

3. Management of Off-site Runoff

Runoff from all upstream tributary areas (off-site land areas) may be bypassed around the detention/retention facility without attenuation. Such runoff may also be routed through the detention/retention facility, provided that a separate outlet system or channel is incorporated for the safe passage of such flows, i.e., not through the primary outlet of a detention facility. Unless the pond is being designed as a regional detention facility, and therefore all off-site runoff to the pond detained, the primary outlet structure shall be sized and the invert elevation of a separate weir to handle the off-site flows determined according to the on-site runoff only. To accomplish this, the 100-year on-site runoff must be determined by temporarily ignoring the off-site runoff and routed through the pond and through the primary outlet pipe. The resulting pond elevation would be the invert elevation of the emergency overflow weir. Once the size and location of primary outlet structure and the invert elevation of the offsite weir are determined by considering on-site runoff, the offsite weir length and the 100-year pond elevation are determined by routing the entire inflow, on-site and off-site, through the pond. Note that the total peak flow released from the outlet system shall not be larger than the total of the allowable release rate and the off-site flow being bypassed through the pond for the 100-year event. A separate emergency overflow spillway would then need to be placed at the 100-year pond elevation and the top of the dam elevation selected with a minimum freeboard of 1 foot.

Note that the efficiency of the detention/retention facility in controlling the on-site runoff may be severely affected if the off-site area is considerably larger than the on-site area. As a general guidance, on-line detention may not be effective in controlling on-site runoff where the ratio of off-site area to on-site area is larger than 5:1. Additional detention (above and beyond that required for on-site area) may be required by the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator] when the ratio of off-site area to on-site area is larger than 5:1.

4. Downstream Restrictions

In the event the downstream receiving channel or storm sewer system is inadequate to accommodate the post-developed 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 [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator], shall be required to store that portion of the runoff exceeding the capacity of the receiving sewers or waterways. When such downstream restrictions are suspected, the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator] may require additional analysis to determine the receiving system's limiting downstream capacity.

If the proposed development makes up only a portion of the undeveloped watershed upstream of the limiting restriction, the allowable release rate for the development shall be in direct proportion to the ratio of its drainage area to the drainage area of the entire watershed upstream of the restriction, unless otherwise determined and/or accepted by the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator].

As an alternative to reduction of release rates, the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator] may allow the applicant to pursue alleviating downstream restrictions. The applicant would be responsible for obtaining all permits and consents required and for incurring all expenses involved in such undertaking.

5. Documentation of Results

The results of the allowable release rate determinations as well as the modeling simulation results must be summarized in a table that shall be included in the Stormwater Drainage Technical Report and on the Drainage Plan. The table must include, for each eventual site outlet, the pre-developed acreage tributary to each eventual site outlet, the unit discharge allowable release rate used, the resulting allowable release rate in cfs for the post-developed 10-year and 100-year events, pre-developed 2-year flow rates in cfs as well as pre- and post-developed flow rates for 10- and 100-year events. The worksheet provided as Table 6-1 should be filled for each final site outlet.

TABLE 6-1

SITE OUTLET #	ITEM	PRE-DEVELOPMENT					POST-DEVELOPMENT				
		D.A. (ac)	Depress. Storage? (yes/no)	2-Yr.	10-Yr.	100-Yr.	D.A. (ac)	Depress. Storage? (yes/no)	2-Yr.	10-Yr.	100-Yr.
1	Default Unit Discharge Allowable Release Rate (cfs/acre)									0.05	0.18
	Basin-Specific Unit Discharge Allowable Release Rate, if any (cfs/acre)										
	Unit Discharge Allowable Release Rate Based on D/S Restrictions, if any (cfs/acre)										
	Adopted Unit Discharge Allowable Release Rate (cfs/acre)										
	Contributing Area of Development Site (ac) and Allowable Release Rate (cfs)										
	Total Contributing DA (ac) and Modeling Results (cfs)							no			

C. General Detention Basin Design Requirements

1. The detention facility shall be designed in such a manner that a minimum of 90% of 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 from the start of the storm unless additional storms occur within the period. In other words, the design shall ensure that a minimum 90% of the original detention capacity is restored within 48 hours from the start of the design 100-year storm.

2. The 100-year elevation of stormwater detention facilities shall be separated by not less than 25 feet from any building or structure to be occupied. The Lowest Adjacent Grade (including walkout basement floor elevation and any other above ground entry elevations) for all residential, commercial, or industrial buildings shall be set a minimum of 2 feet above the 100-year pond elevation or 2 feet above the emergency overflow weir elevation, whichever is higher. In addition to the Lowest Adjacent Grade requirements, any basement floor for a structure adjacent to a wet-bottom pond must be at least one foot above the normal water level. Generally, to avoid the overuse of sump pumps and frequent flooding of the basement, basement floors shall be placed at least one foot above the local groundwater table if an adequate gravity footing drain outlet is not available.

3. Due to the safety considerations of the public and emergency rescue personnel, no detention facility or other water storage area, permanent or temporary, shall be constructed under or within twenty (20) feet of any high voltage electric line or utility pole. Likewise, utility poles or high voltage electric lines shall not be placed within twenty (20) feet of any detention facility or other water storage area. Variation from this policy shall require written approval from the affected utility and a variance request and approval of the same by the [Jurisdiction Entity] [Jurisdiction Entity Highest Stormwater Approval Administrative Body].

4. All stormwater detention facilities shall be separated from any road right-of-way by no less than 50 feet, measured from the top of bank or the 100-year pool if no defined top of bank is present, using the most restrictive right-of-way possible. Use of adequately-designed guard rails, berms, or other structural measures are encouraged and may be considered in lieu of the above-noted setbacks to minimize the chances of vehicles sliding into the pond.

5. Slopes no steeper than 3 horizontal to 1 vertical (3:1) for safety, erosion control, stability, and ease of maintenance shall be permitted.

6. Safety screens having an opening of four (4) inches shall be provided for all above-surface and accessible (outside of an enclosed and lidded structure) pipe or open end sections 12-inch in diameter or larger to prevent children or large animals from crawling into the structures.

7. Prior to final acceptance, danger signs shall be mounted at appropriate locations to warn of deep water, possible flood conditions during storm periods, and other dangers that exist. The locations of the noted danger signs shall be shown on the plans.

8. Use of fences around all detention ponds is strongly encouraged to ensure safety.

   Unless specifically required by the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator], the decision to use fencing around detention ponds is left to the owner or the developer. Recommendations contained within this document do not relieve the applicant and owner/developer from the responsibility of taking all necessary steps to ensure public safety with regards to such facilities.

9. Outlet control structures shall be designed to operate solely by gravitational acceleration and shall require little or no maintenance and/or attention for proper operation. For maintenance purposes, the outlet from the pond shall be a minimum of 0.5 foot above the normal water level of the receiving water body. They shall limit discharges into existing or planned downstream channels or conduits so as not to exceed the predetermined maximum authorized peak flow rate. For above ground ponds (not underground detention facilities), if an outlet control structure includes an orifice to restrict the flow rate, such orifice shall be no less than 6 inches in diameter, even if the 6 inch diameter orifice results in a discharge that exceeds the predetermined maximum authorized peak flow release rates. However, note that the sizing of the pond should still be based on the more restrictive maximum allowable release rate.

10. Emergency overflow facilities such as a weir or spillway shall be provided for the release of exceptional storm runoff. The overflow facility shall be of such design that its operation is automatic and does not require manual attention.

    Pond's emergency overflow facilities shall be designed to handle the peak inflow discharge and peak flow velocity resulting from the 100-year design storm event runoff from the entire contributing watershed draining to the detention/retention facility (Total peak 100-year inflow to the pond, i.e., assuming the reservoir is already full), assuming post-development condition on-site and existing condition off-site. The length of the weir is to be determined using the weir equation, with the overflow weir control

elevation at the Pond's 100-year elevation (pond is assumed full to the overflow weir control elevation) and a discharge equal to the peak 100-year inflow. The maximum head on the emergency weir for the noted design flow shall be 1 foot. A larger head may be accepted by the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator], provided that the Lowest Adjacent Grades of all structures around the pond are at least 1 foot higher than the maximum water surface elevation resulting from the loading of the emergency weir design flow.

The emergency overflow routing from the emergency overflow facility to an adequate receiving system must be positive (by gravity) and shown on the construction plans and on the plat. It must be sized to accommodate the design flow of the pond's emergency overflow weir. Thirty (30) feet along the centerline of this emergency overflow route (15 feet each side) shall be designated as permanent drainage easement, or if accepted by the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator] and/or [Jurisdiction Entity] [Jurisdiction Entity Highest Stormwater Approval Administrative Body], as a [Jurisdiction Entity-owned/maintained Drain, if any] Easement. No fences or landscaping can be constructed within the easement areas. The Lowest Adjacent Grade of all residential, commercial, or industrial buildings along this emergency overflow route shall be set a minimum of 1 foot above the flood elevation along the route, calculated based on the pond's emergency overflow weir design discharge, and shown on the plat.

11. Grass or other suitable cover/erosion protection measure shall be provided along the banks of the detention storage basin. Vegetative cover around detention facilities should be maintained as appropriate.

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

13. No residential lots or any part thereof, shall be used for any part of a detention basin, assumed full to the 100-year water surface elevation or the emergency overflow weir elevation, whichever is higher. Detention basins, assumed full to the 100-year water surface elevation or the emergency overflow weir elevation, whichever is higher, shall be placed within a common area either platted or legally described and recorded as a perpetual stormwater easement. A minimum of fifteen (15) feet horizontally from the top of bank of the facility, or the 100-year pool if no defined top of bank is present, shall be dedicated as permanent stormwater easement if the above-noted boundary of the common area does not extend that far.

D. Additional Requirements for Wet-Bottom Facility Design

Where part of a detention facility will contain a permanent pool of water, all the items required for detention storage shall apply. Also, a controlled positive outlet will be required to maintain the design water level in the wet bottom facility and provide required detention storage above the design water level. However, the following additional conditions shall apply (For visual clarification, refer to **Figures 6-1** and **6-2)**.

1. Facilities designed with permanent pools or containing permanent lakes shall have a water area of at least one-half (0.5) acre. If fish are to be used to keep the pond clean, a minimum depth of approximately ten (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 to install the safety ramp, safety ledge, and BMPs as required below. Construction trash or debris shall not be placed within the permanent pool.

2. A safety ledge six (6) to ten (10) feet in width, depending on the presence of a security fence, is required and shall be installed in all lakes approximately 18 inches below the permanent water level (normal pool elevation). In addition, a similar maintenance ledge 12 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. The slopes below the safety ledge shall be 3:1 (horizontal to vertical) or flatter. The slopes above the safety ledge shall be 4:1 or flatter, unless a safety fence is used, in which case the side slopes above the safety ledge (except for the safety ramp area) shall be 3:1 or flatter.

   As illustrated in Figures 6-1 and 6-2, the safety ledge is currently required to be 18 inches below the normal pool and 6-10 feet wide, depending on the presence of a security fence. As an alternative to providing a security fence, the depth of safety ledge could be changed to be anywhere from 0 to 6 inches below normal pool to encourage vegetation growth. Wetland plants can be installed as container grown plants or as seed at the time of construction, or the area can be left to be naturally colonized. When a vegetated ledge is used in lieu of a security fence, the safety ledge width shall be increased to 15 feet to allow more room to stop in the event of accidental entry into the pond. The vegetated ledge might discourage play near the edge of the pond and help stop a wayward bike or sled. Additional benefits to the vegetated ledge are stormwater quality improvement and goose deterrence. In lieu of a vegetated safety ledge, a zone of dense shrubs could be installed around the perimeter of the pond to discourage access. Shrubs and vines with briars and thorns or dense growth patterns make good deterrents.

Special Regulatory Note:

Detention ponds that include wetland features will not fall within the jurisdiction of IDEM or COE as long as:

- The pond is clearly identified on plans and in accompanying documentation as a stormwater treatment Best Management Practice (BMP).
- The pond has not been abandoned, and is maintained as originally designed.
- The pond is not part of required wetland mitigation.
- Construction of the pond does not impact existing jurisdictional wetlands or waterways.

Therefore, detention pond maintenance would not require a permit just because wetland features have been included in their construction.

3. A safety ramp exit from the lake shall be required in all cases and shall have a minimum width of twenty (20) feet and exit slope of 6 horizontal to 1 vertical (6:1). The safety ramp shall be constructed of suitable material to prevent structural instability due to vehicles or wave action.

4. Periodic maintenance is required in lakes to control weed and larval growth. The facility shall also be designed to provide for access and easy removal of sediment that will accumulate during Pond's life. A means of maintaining the designed water level of the lake during prolonged periods of dry weather may also need to be considered.

5. Methods to prevent pond stagnation, including but not limited to aeration facilities, should be included on all wet-bottom ponds. Design calculations to substantiate the effectiveness of proposed 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 [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator].

E. Additional Requirements for Dry-Bottom Facility Design

In addition to general design requirements, detention facilities that will not contain a permanent pool of water shall comply with the following requirements:

1. Provisions shall be incorporated into facilities for complete interior drainage of dry bottom facilities, including the provisions of natural grades to outlet structures, longitudinal and transverse grades to perimeter drainage facility, paved gutters, or the installation of subsurface drains.

2. For residential developments, the maximum planned depth of stormwater stored shall not exceed six (feet), with the majority of the pond having a maximum of four (4) feet in depth.

3. In excavated detention facilities, a side slope of 3:1 or flatter shall be provided for stability. In the case of valley storage, natural slopes may be considered to be stable.

F. Parking Lot Storage

Paved parking lots may be designed to provide temporary detention storage of stormwater on all or a portion of their surfaces. Outlets for parking lot storage of stormwater will be designed so as to empty the stored waters slowly. Depths of storage shall be limited to a maximum depth of nine (9) 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. Before such detention method is allowed, a perpetual maintenance agreement must be executed by the owner or the developer and filed with the [Jurisdiction Entity] [Jurisdiction Entity Highest Stormwater Approval Administrative Body]. In addition, the 100-year inundation boundary should be determined and clearly shown on the construction plans.

G. Detention Facilities in Floodplains

Placement of detention ponds within the 100-year floodplain is not appropriate. In rare cases when the [Jurisdiction Entity] [Jurisdiction Entity Highest Stormwater Approval Administrative Body] and/or the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator] may allow a detention storage to be provided within a 100-year floodplain, only the net increase in storage volume above that which naturally existed on the floodplain shall be credited to the development. In order to be hydraulically effective, the rim elevation (top of embankment) of such detention pond, including any open spillways, should be at or above the 100-year floodplain elevation and, unless the detention pond storage is provided entirely above the 100-year flood elevation, any pipe outlets must be equipped with a backflow prevention device. A detention pond constructed within the 100-year floodplain and utilizing a backflow prevention device will eliminate the floodplain storage that existed on the detention pond site, and will therefore require compensatory floodplain storage. The detention analysis for a detention pond in the floodplain must consider appropriate tailwater impacts and the effect of any backflow prevention device.

H. Joint Development of Control Systems

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

I. Diffused Outlets

When the allowable runoff is released in an area that is susceptible to flooding or erosion, 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. Diffused outlets are not generally permitted. In rare circumstances where utilization of a diffused outlet is considered appropriate, specific requirements for such a release will be determined on a case by case basis at the discretion of the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator].

J. IDNR Requirements

All designs for basins to be constructed in the floodway of a stream with a drainage area of one square mile or more must also satisfy IDNR permit requirements.

K. Allowance for Sedimentation

Detention basins shall be designed with an additional ten (10) 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, such as a forebay, so that removal costs are kept to a minimum. For wet-bottom ponds, the sediment allowance may be provided below the permanent pool elevation. No construction trash or debris shall be allowed to be placed within the permanent pool. If the pond is used as a sediment control measure during active construction, the performance sureties will not be released until sediment has been cleaned out of the pond and elevations and grades have been re-established as noted in the accepted plans for post-construction conditions.

FIGURE 6-1
Wet –Bottom Detention Facility – With Fence

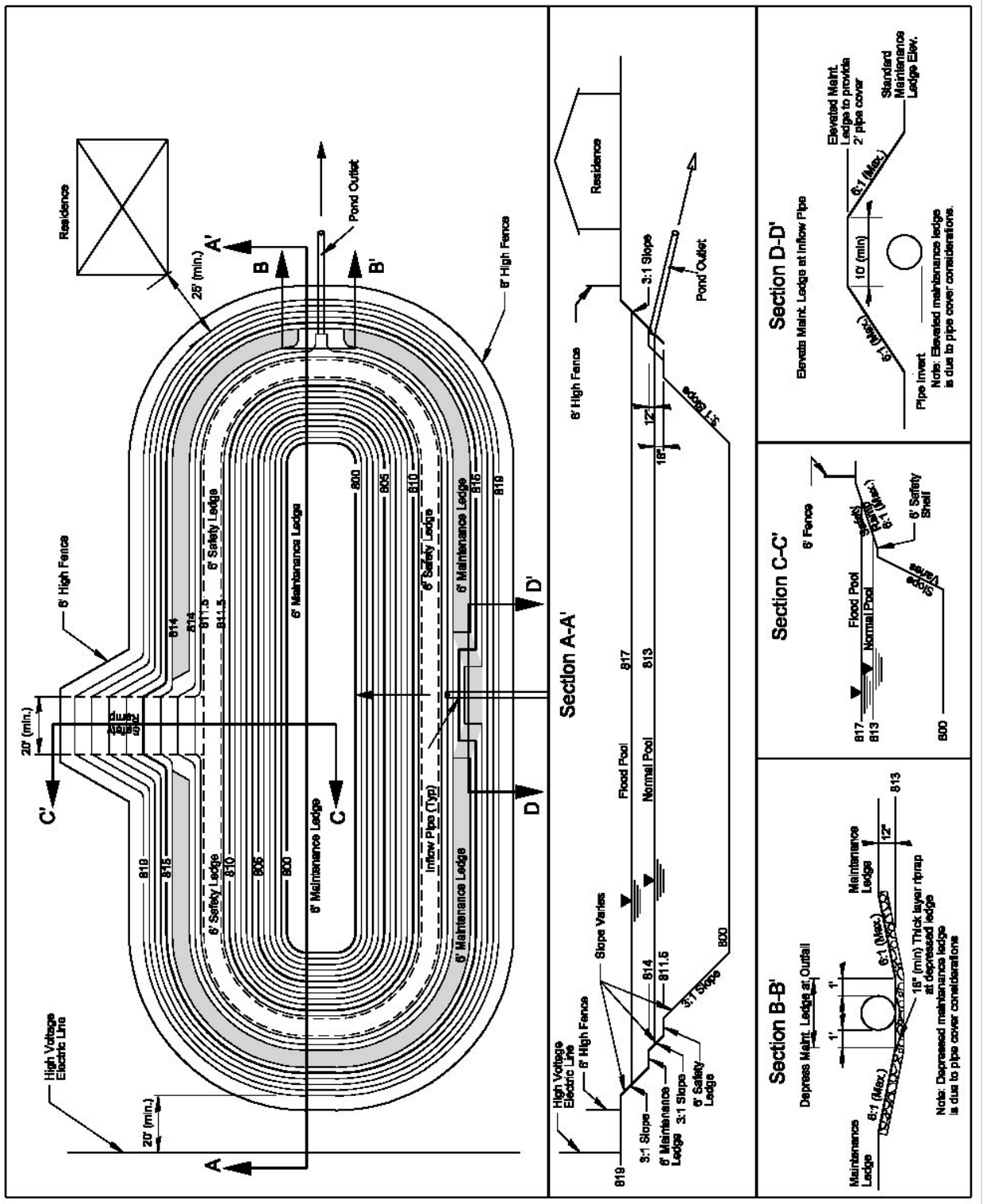
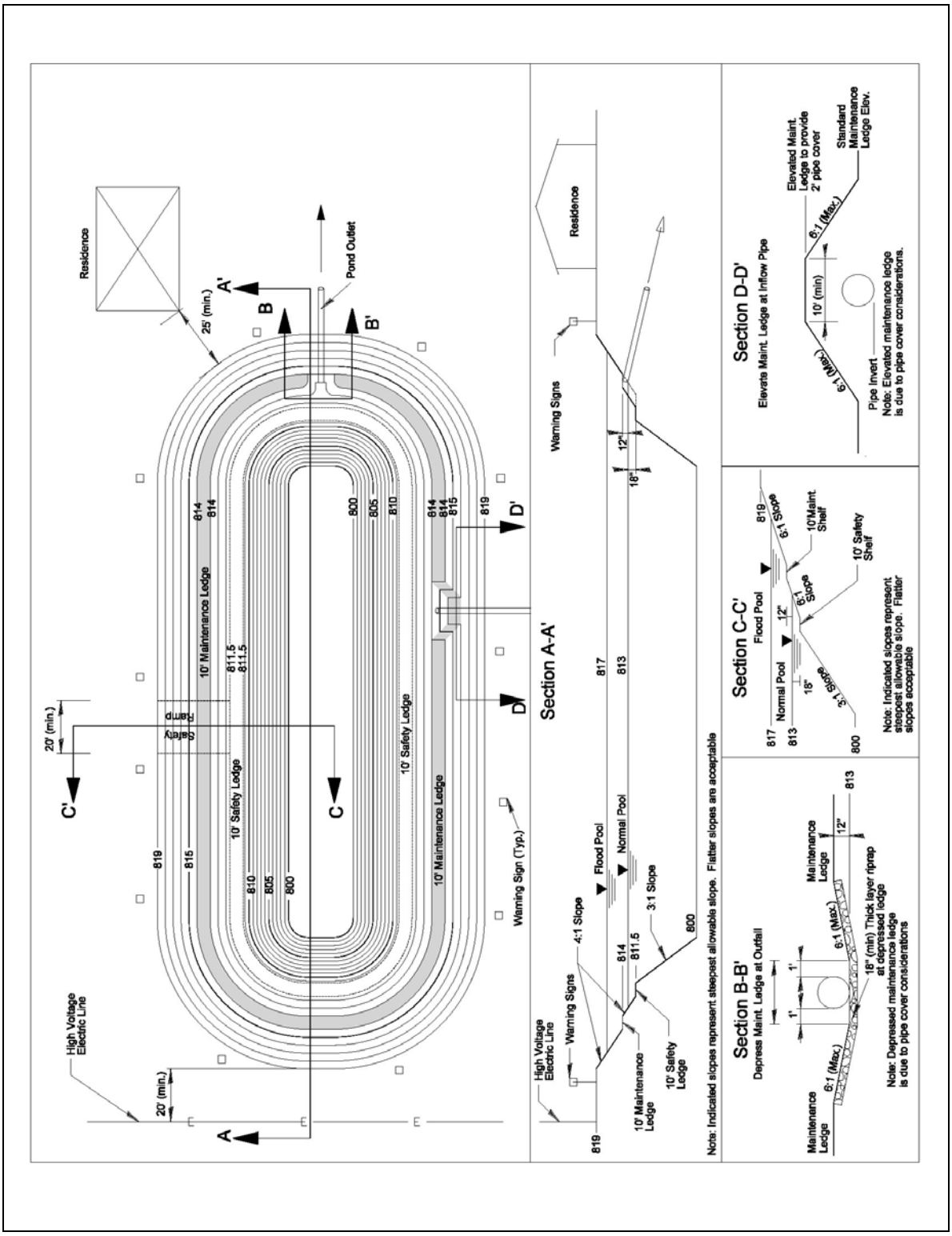


FIGURE 6-2
Wet –Bottom Detention Facility – Without Fence



Chapter Seven

EROSION CONTROL PRACTICES AND CONSTRUCTION PHASE BMPs

The requirements contained in this chapter are intended to prevent stormwater pollution resulting from soil erosion and sedimentation or from mishandling of solid and hazardous waste. Practices and measures included herein should assure that no foreign substance, (e.g. sediment, construction debris, chemicals) be transported from a site and allowed to enter any drainageway, whether intentionally or accidentally, by machinery, wind, rain, runoff, or other means.

A. POLLUTANTS OF CONCERN DURING CONSTRUCTION

The major pollutant of concern during construction is sediment. Natural erosion processes are accelerated at a project site by the construction process for a number of reasons, including the loss of surface vegetation and compaction damage to the soil structure itself, resulting in reduced infiltration and increased surface runoff. Clearing and grading operations also expose subsoils which are often poorly suited to re-establish vegetation, leading to longer term erosion problems.

Problems associated with construction site erosion include: transport of pollutants attached to transported sediment; increased turbidity (reduced light) in receiving waters; recreational use impairment. The deposited sediment may pose direct toxicity to wildlife, or smother existing spawning areas and habitat. This siltation also reduces the capacity of waterways, resulting in increased flood hazards to the public.

Other pollutants of concern during the construction process are hazardous wastes or hydrocarbons associated with the construction equipment or processes. Examples include concrete washoff, paints, solvents, and hydrocarbons from refueling operations. Poor control and handling of toxic construction materials pose an acute (short-term) or chronic (long-term) risk of death to both aquatic life, wildlife, and the general public.

B. EROSION AND SEDIMENT CONTROL REQUIREMENTS

The following principles should govern erosion and sediment control practices on all sites:

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

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

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

4. 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. No construction trash or debris shall be allowed to be placed within the permanent pool of the detention/retention ponds. If the pond is used as a sediment control measure during active construction, the performance sureties will not be released until sediment has been cleaned out of the pond and elevations and grades have been reestablished as noted in the accepted plans.

5. 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.

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

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

8. 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.

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

10. All disturbed ground left inactive for fifteen (15) or more days shall be stabilized by seeding, sodding, mulching, covering, or by other equivalent erosion control measures.

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

12. During the period of construction activity at a site, erosion control measures necessary to meet the requirements of the Ordinance shall be maintained by the applicant.

C. COMMON CONTROL PRACTICES

All erosion control and stormwater pollution prevention measures required to comply with the Ordinance shall meet the design criteria, standards, and specifications similar to or the same as those outlined in the “Indiana Drainage Handbook” and “Indiana Storm Water Quality Manual,”

(ISWQM) published by the Indiana Department of Natural Resources and the Indiana Department of Environmental Management, or other comparable and reputable references. Table 7-1 lists some of the more common and effective practices for preventing stormwater pollution from construction sites. Details of each practice can be found in the ISWQM or in Appendix C. These practices should be used to protect ***every*** potential pollution pathway to stormwater conveyances.

Table 7-1
Common Stormwater Pollution Control Practices for Construction Sites

Practice No.	BMP Description	Applicability	Fact Sheet*
1	Site Assessment	All sites	ISWQM (Ch.2)
2	Development Of A Construction Sequence Schedule	All sites	ISWQM (Ch. 5)
3	Tree Preservation and Protection	Nearly all sites	ISWQM
4	Temporary Construction Ingress/Egress Pad	All sites	ISWQM
5	Wheel Wash	All sites	CN - 101
6	Silt Fence	Small drainage areas	ISWQM
7	Surface Roughening	Sites with slopes that are to be stabilized with vegetation	ISWQM
8	Temporary Seeding	Areas of bare soil where additional work is not scheduled to be performed for a minimum of 15 days	ISWQM
9	Mulching	Temporary surface stabilization	ISWQM
10	Erosion Control Blanket (Surface)	Temporary surface stabilization, anchor for mulch	ISWQM
11	Temporary Diversion	Up-slope and down-slope sides of construction site, above disturbed slopes within site	ISWQM
12	Rock Check Dam	2 acres maximum contributing drainage area	ISWQM
13	Temporary Slope Drain	Sites with cut or fill slopes	ISWQM
14	Straw Bale Dam	Small drainage areas	ISWQM
15	Geotextile Fabric Drop Inlet Protection	1 acre maximum contributing drainage area	ISWQM
16	Insert (Basket) Curb Inlet Protection	1 acre maximum contributing drainage area	ISWQM
17	Stone Bag Curb Inlet Protection	1 acre maximum contributing drainage area	ISWQM
18	Temporary Sediment Trap	5 acre maximum contributing drainage area	ISWQM
19	Temporary Dry Sediment Basin	30 acre maximum contributing drainage area	ISWQM
20	Dewatering Structures	Sites requiring dewatering	CN-102
21	Dust Control	All sites	ISWQM
22	Spill Prevention and Control	All sites	CN - 103
23	Solid Waste Management	All sites	CN - 104
24	Hazardous Waste Management	All sites	CN - 105

* See ISWQM Chapter 7 (2007 or latest version), unless otherwise noted. (http://www.in.gov/idem/stormwater/)

D. INDIVIDUAL LOT CONTROLS

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.

This can be accomplished using numerous erosion and sediment control measures. A standard erosion control plan for individual lots is provided in Appendix B. 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.

Construction sequence on individual lots should be as follows:

1. Clearly delineate areas of trees, shrubs, and vegetation that are to be undisturbed. To prevent root damage, the areas delineated for tree protection should be at least the same diameter as the crown.
2. Install perimeter silt fence at construction limits. Position the fence to intercept runoff prior to entering drainage swales.
3. Avoid disturbing drainage swales if vegetation is established. If drainage swales are bare, install erosion control blankets or sod to immediately stabilize.
4. Install drop inlet protection for all inlets on the property.
5. Install curb inlet protection, on both sides of the road, for all inlets along property frontage and the along the frontage of adjacent lots.
6. Install gravel construction entrance that extends from the street to the building pad.
7. Perform primary grading operations.
8. Contain erosion from any soil stockpiles created on-site with silt fence around the base.
9. Establish temporary seeding and straw mulch on disturbed areas.
10. Construct the home and install utilities.
11. Install downspout extenders once the roof and gutters have been constructed. Extenders should outlet to a stabilized area.
12. Re-seed any areas disturbed by construction and utilities installation with temporary seed mix within 3 days of completion of disturbance.
13. Grade the site to final elevations.
14. Install permanent seeding or sod.

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, please see the “Individual Lot Erosion and Sediment Control Plan and Certification” form in Appendix B or the IDNR,

Division of Soil Conservation's pamphlet titled "Erosion and Sediment control for Individual Building Sites".

Chapter Eight

STORMWATER PERMIT REQUIREMENTS AND PROCEDURES

I.) GENERAL REQUIREMENTS

A. EROSION CONTROL DURING CONSTRUCTION

1. Any project that includes clearing, grading, excavation, and other land disturbing activities, resulting in the disturbance of one (1) acre or more of total land area, is subject to erosion and sediment control requirements. These requirements also apply to disturbances of less than one (1) acre of land that are part of a larger common plan of development or sale if the larger common plan will ultimately disturb one (1) or more acres of land.

2. It will be the responsibility of the project site owner to complete a stormwater permit application and ensure that a sufficient construction plan and Stormwater Pollution Prevention Plan (SWPPP) are completed and submitted to the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator]. The project site owner must complete a sufficient Notice of Intent letter (NOI) to be sent to the Indiana Department of Environmental Management (IDEM) if there is a disturbance of one (1) acre or more of total land area. All stormwater quality measures and erosion and sediment controls necessary to comply with 327 IAC 15-5 must be implemented in accordance with the construction plan and sufficient to satisfy 327 IAC 15-5-7(b). It will be the responsibility of the project site owner to ensure proper construction and installation of all stormwater BMPs in compliance with the approved stormwater management permit, and to notify the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator] with a Notice of Termination letter upon completion of the project and stabilization of the site.

3. The Stormwater Pollution Prevention Plan shall serve as a guideline for stormwater quality, but should not be interpreted to be the only basis for implementation of stormwater quality measures for a project site. The project site owner is responsible for implementing, in accordance with 327 IAC 15-5, all measures necessary to adequately prevent polluted stormwater run-off.

4. If the construction plan is determined to be deficient, the [Jurisdiction Entity], SWCD, or other entity designated by IDEM as the reviewing agency may require modifications, terms, and conditions as necessary to meet the requirements of 327 IAC 15-5. The initiation of construction activity following notification by the reviewing agency that the plan does not meet the requirements of 327 IAC 15-5 is a violation and subject to enforcement action.

5. All persons engaging in construction activities on a project site shall be responsible for complying with the stormwater pollution prevention plan. The project site owner shall inform

all general contractors, construction management firms, grading or excavating contractors, utility contractors, and the contractors that have primary oversight on individual building lots of the terms and conditions of 327 IAC 15-5 and the conditions and standards of the Stormwater Pollution Prevention Plan and the schedule for proposed implementation.

6. The following construction activities are categorically exempt from obtaining a Stormwater Pollution Prevention Plan.

i.) Agricultural land disturbing activities. (Ref: 327 IAC 15-5-2(b))

ii.) Forest harvesting activities. However, any land clearing activities conducted in conjunction with tree cutting are not exempt. (Ref: 327 IAC 15-5-2(b))

iii.) Any part of an Indiana Department of Transportation (INDOT) project that was covered by INDOT's 327 IAC 15-5 submission to IDEM is exempt. All other activities that were not specifically included in INDOT's 327 IAC 15-5 submission (for example, the contractor's off-site spoil area, staging area, etc.) are not exempt. (Ref: 327 IAC 5-4-6(a)(4))

iv.) The following activities are exempt from obtaining a Stormwater Pollution Prevention Plan, provided other applicable permits contain provisions requiring immediate implementation of soil erosion control measures:

a. Landfills that have been issued a certification of closure under 329 IAC 10.

b. Coal mining activities permitted under IC 14-34.

c. Municipal solid waste landfills that are accepting waste pursuant to a permit issued by IDEM under 329 IAC 10 that contains equivalent storm water requirements, including the expansion of landfill boundaries and construction of new cells either within or outside the original solid waste permit boundary. (Ref: 327 IAC 15-5-2(c))

B. POST CONSTRUCTION

1. The Stormwater Pollution Prevention Plan, which is to be submitted to the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator] as part of the stormwater management permit application, must also include post-construction stormwater quality measures. These measures are incorporated as a permanent feature into the site plan and are left in place following completion of construction activities to continuously treat stormwater runoff from the stabilized site. Any project located within [Jurisdiction Entity] that includes clearing, grading, excavation, and other land disturbing activities, resulting in the disturbance of 1 acre or more of total land area, is subject to post-construction requirements. This includes both new development and re-development, and disturbances of less than one (1) acre of land that are part of a larger common plan of development or sale if the larger common plan will ultimately disturb one (1) or more acres of land, within the [Jurisdiction Entity] area or areas served by agreement or permittee under the [Jurisdiction Entity] NPDES Permit.

The requirements do not apply to the following activities:

A. agricultural land disturbing activities; or

B. forest harvesting activities; or
C. construction activities associated with a single family residential dwelling disturbing less than 5 acres, when the dwelling is not part of a larger common plan of development or sale; or
D. single family residential developments consisting of four or less lots; or
E. a single-family residential strip development where the developer offers for sale or lease without land improvements and the project is not part of a larger common plan of development of sale; or
F. individual building lots within a larger permitted project.

The requirements also do not apply to the following activities, provided other applicable State permits contain provisions requiring immediate implementation of soil erosion control measures:

A. Landfills that have been issued a certification of closure under 329 IAC 10.
B. Coal mining activities permitted under IC 14-34.
C. Municipal solid waste landfills that are accepting waste pursuant to a permit issued by the Indiana Department of Environmental Management under 329 IAC 10 that contains equivalent stormwater requirements, including the expansion of landfill boundaries and construction of new cells either within or outside the original solid waste permit boundary.

C. PROJECTS IN SINGLE OR MULTIPLE JURISDICTIONS

1. For a project where construction activity will occur within the [Jurisdiction Entity] area or areas served by agreement or permittee under the [Jurisdiction Entity] NPDES Permit, the following apply:
   a. For [Jurisdiction Entity]-operated construction activities within the [Jurisdiction Entity] area or areas served by agreement or permittee under the [Jurisdiction Entity] NPDES Permit, construction plans and a copy of the completed Notice of Intent Letter (NOI) must be submitted to the [Jurisdiction Entity] Soil and Water Conservation District (SWCD) or other entity designated by IDEM for review and approval. If the [Jurisdiction Entity] does not receive either a notice of deficiency or an approval within thirty-five (35) days of the submittal, the plan will be considered adequate. (Ref: 327 IAC 15-13-15(i))
   b. The project site owner must comply with all appropriate ordinances and regulations within the [Jurisdiction Entity] area or areas served by agreement or permittee under the [Jurisdiction Entity] NPDES Permit related to storm water discharges.
2. For a project where construction activity will occur in more than one regulated MS4 area, the following apply:
   a. Project site owners of project sites occurring in multiple MS4 areas, but not in non-designated areas, shall submit the information required in paragraph C.1 above to each appropriate MS4 operator.
   b. Project site owners of project sites occurring in one (1) or more MS4 areas and in non-designated areas shall submit the information required in 327 IAC 15-5-6

subsections (a) through (c) to all appropriate MS4 operators or other entity designated by IDEM.

II.) PERMIT PROCESS & REQUIREMENTS

A. PRELIMINARY DRAINAGE PLAN REVIEW

i. In order to ensure that an adequate drainage outlet(s) exists for a proposed development, an owner or developer seeking a Primary Plat, Primary Development Plan or Improvement Location Permit for land not in a Platted Subdivision or subject to a Secondary Development Plan from the [Jurisdiction Entity] Plan Commission, must first apply for a Preliminary Stormwater Management Permit issued by the [Jurisdiction Entity Stormwater Administrator].

ii. As part of the noted Preliminary Stormwater Management Permit application, an owner or developer shall submit conceptual drainage plans for review by the [Jurisdiction Entity Stormwater Administrator] prior to the Plan Commission hearing. Any Preliminary Stormwater Management Permit issued by the [Jurisdiction Entity Stormwater Administrator] as a result of such a review is based on preliminary data and shall not be construed as a final drainage approval or considered binding on either party. The Preliminary Plans must include a Letter of Intent for obtaining any needed consents, off-site easements, or right-of-way, a Project Narrative and Supporting Documents showing existing topography, watercourses, and regulated drains, and a set of Conceptual Plans. Please see the form titled [Jurisdiction Entity] Application for Preliminary Drainage Plan Review/Checklist for a list of detailed items to be included in the Preliminary Stormwater Management Permit Application.

B. SECONDARY STORMWATER APPROVAL REQUIREMENTS AND PROCEDURES

i. The project site owner or developer shall submit an application for a Secondary Stormwater Management Permit to the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator]'s Office. The project site owner or developer will have the option to submit all the necessary drainage plans at once (Full Stormwater Drainage Plan Submittal) or submit a Stormwater Pollution Prevention Plan for mass/initial grading (Partial Drainage Plan Permit) only, followed at a later date by the Full Drainage Plan submittal, and hence take a Multi-Step Stormwater Plan submittal approach. For a full stormwater permit, the application will include the following:

- Full Drainage Plan Permit Fee and Application Fee. Legal description must be included and match acreage used to figure Full Drainage Plan Permit Fee
- Draft Notice of Intent letter (NOI)
- Construction Plan Sheets
- Stormwater Drainage Technical Report

- Stormwater Pollution Prevention Plan for Construction Sites (see applicability requirements in section I above)
- Post-Construction Pollution Prevention Plan (see applicability requirements in section I above)
- [Jurisdiction Entity] Application for Stormwater Permit
- Any other necessary support information

ii. For a multi-step stormwater permit approach, the initial application will include the following at the time the Partial Drainage Plan is submitted:

- Partial Drainage Plan Permit Fee (a Full Drainage Plan Permit Fee and Application Fee will also be required when the Full Drainage Plan is submitted at a later date) and Erosion and Sediment Control Inspection Fee. Legal description must be included and match acreage used to figure Partial Drainage Plan Permit Fee
- Draft Notice of Intent letter (NOI) for the Partial Drainage Plan Permit only
- Stormwater Pollution Prevention Plan for Construction Sites (see applicability requirements in section I above). Additionally, an updated Stormwater Pollution Prevention Plan will need to be submitted to the [Jurisdiction Entity Stormwater Administrator]'s Office at the time the Full Drainage Plan is submitted if changes have occurred since the submittal of the original Stormwater Pollution Prevention Plan
- [Jurisdiction Entity] Application for Stormwater Permit
- Any other necessary support information

iii. Specific information to be included in the applications can be found in the Stormwater Plan Submittal Checklist located in Appendix B. An adequate number of hard copies of each item, as noted in the "[Jurisdiction Entity] Application for Stormwater Permit" form in Appendix B must be submitted to the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator]'s Office. In addition to the hard copies, an optional digital copy of the construction plans may be submitted in a format accepted by the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator] (such as DWG, DGN, DXF, SHP, or PDF file format). The digital copy should be dated and labeled with the appropriate project name and include which phase the plans represent (initial submittal, final approval, for example).

iv. After the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator]'s Office receipt of the application, the applicant will be notified as to whether their application was complete or insufficient. The applicant will be asked for additional information if the application is insufficient. The information provided will be reviewed in detail by the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator] and/or its plan review consultant(s). Once all comments have been received and review completed, the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator] will either approve the project or request modifications.

Full Stormwater Plan Submittal Route

(1) Once a Full Stormwater Plan Permit has been approved and issued, the project site owner must file a Notice of Intent (NOI) a minimum of two (2) business days prior to the initiation of land disturbing activities at the site. Notification shall be in the form of an updated Full Stormwater Plan NOI form. The submittal of the NOI must be provided to the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator]'s Office or other designated reviewing authority and, if the total disturbance is 1 acre or more, to IDEM as well. The IDEM submittal must include the completed NOI form, proof of publication, verification that the jurisdictional entity approved the plan, and a $100 fee. If the NOI letter is determined to be deficient, the project site owner must address the deficient items and submit an amended NOI letter to IDEM. For the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator]'s Office submittal, the applicant should include copies of the final, approved construction plans, stormwater drainage technical report, stormwater pollution prevention plan for construction sites, and post-construction stormwater pollution prevention plan. These items should accompany the above-noted written NOI notification and proof of publication, the Stormwater Quantity Inspection Fee, Post Construction BMP Inspection Fee, and Erosion and Sediment Control Inspection Fee. The number of required copies varies from case to case and additional copies may be requested by the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator]'s Office.

(2) A pre-construction meeting is required to be held with the participation of the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator]'s Office and other entities that may be involved prior to any site grading activity in order to review the erosion control plan before grading and ensure that appropriate perimeter control measures have been implemented on the site and the location of any existing tiles has been properly marked.

(3) Prior to start of construction and as a condition of permit, the project site owner, or their designated developer is required to post Performance Assurance in the amount of 100% of the estimated cost of all components of the stormwater management facilities. The said assurance will be released upon receipt of a "verified" NOT and receipt of Maintenance Assurance noted under item 7 below.

(4) The project site owner, or their designated developer, must notify IDEM and the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator]'s Office within two (2) business days of actual construction activity start-up to inform them of the actual project start date. The actual project start date will be used to calculate the maximum five-year duration date of the permit before a renewal is required. Once construction starts, the project owner shall monitor construction activities and inspect all stormwater pollution prevention measures to verify compliance with Title 19 of the [Jurisdiction Entity] Code ([Jurisdiction Entity] Stormwater Management Ordinance) and the terms and conditions of the approved permit. The [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator]'s Office will also conduct site inspections to verify compliance with the approved permit and ordinance.

(5) Upon completion of construction activities, as-built plans must be submitted to the

[Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator]'s Office. A Notice of Termination (NOT) for the project shall be sent to the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator]'s Office once the construction site meets the requirements set forth in 327 IAC 15-5-8. Notice of scheduled date for completion of construction shall be provided to the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator]'s Office at least three (3) business days prior to its planned completion. The project site owner will schedule the final inspection with the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator]'s Office.

(6) The [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator], or a representative, shall inspect the construction site to verify the requirements for a NOT have been met. If the requirements for a NOT have been met and no corrective actions are needed, the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator]'s Office will forward a "verified" NOT copy to the applicant and to IDEM. Permits issued under this scenario will expire five (5) years from the date of issuance. If construction is not completed within five (5) years, the NOI must be resubmitted at least ninety (90) days prior to expiration.

(7) Additionally, the property owner, developer, or contractor shall be required to file a three-year maintenance bond or other acceptable guarantee with the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator], prior to final project acceptance. The bond or other acceptable guarantee shall be in effect for a period of three years after the date of the final project acceptance by the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator] and/or the [Jurisdiction Entity] [Jurisdiction Entity Highest Stormwater Approval Administrative Body], as applicable.

Multi-Step Stormwater Plan Submittal Route

(1) Once a Partial Stormwater Plan Permit has been approved and issued, the project site owner must file a Partial Drainage Plan Notice of Intent (NOI) a minimum of two (2) business days prior to the initiation of land disturbing activities at the site. Notification shall be in the form of an updated Partial Drainage Plan NOI form. The submittal of the NOI must be provided to the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator]'s Office or other designated reviewing authority and, if the total disturbance is 1 acre or more, to IDEM as well. The IDEM submittal must include the completed NOI form, proof of publication, verification that the jurisdictional entity approved the plan, and a $100 fee. The NOI that is submitted should directly reflect what is represented in the project plans. A separate NOI must be submitted for each permit application. The Partial Drainage Plan NOI must be submitted to the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator]'s Office and IDEM with a distinct identifier for the activity represented in the permit (i.e. XYZ Subdivision – Initial Earthmoving). **This Partial Permit NOI is a separate permit from the Full Permit NOI submittal that will occur at a later date and will also require the completed NOI form, verification of plan approval, application fee of $100, and proof of publication.** If the NOI letter is determined to

be deficient, the project site owner must address the deficient items and submit an amended NOI letter to IDEM. For the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator]'s Office submittal, copies of the approved stormwater pollution prevention plan for the construction site must also accompany the above-noted written NOI notification and proof of publication. The number of required copies varies from case to case and additional copies may be requested by the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator]'s Office.

(2) A pre-construction meeting is required to be held with the participation of the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator]'s Office and other entities that may be involved prior to any site grading activity in order to review the erosion control plan before grading and ensure that appropriate perimeter control measures have been implemented on the site and the location of any existing tiles has been properly marked.

(3) Prior to start of construction and as a condition of permit, the project site owner, or their designated developer is required to post Performance Assurance in the amount of 100% of the estimated cost of all components of the stormwater management facilities. The said assurance will be released upon receipt of a "verified" NOT and receipt of Maintenance Assurance noted under item 11 below.

(4) The project site owner, or their designated developer, must notify IDEM and the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator]'s Office within two (2) business days of actual construction activity start-up to inform them of the actual project start date. The actual project start date will be used to calculate the maximum five-year duration date of the permit before a renewal is required. Once construction starts, the project owner shall monitor construction activities and inspect all stormwater pollution prevention measures to verify compliance with Title 19 of the [Jurisdiction Entity] Code ([Jurisdiction Entity] Stormwater Management Ordinance) and the terms and conditions of the approved permit. The [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator]'s Office will also conduct site inspections to verify compliance with the approved permit and ordinance.

(5) At which time the Full Drainage Plans are completed, the Full Stormwater Drainage Plan submittal shall include the Full Drainage Plan Permit Fee, Application Fee, an updated Stormwater Pollution Prevention Plan, and a new Draft NOI for the Full Drainage Plan Permit. Specific information to be included in the application can be found in the [Jurisdiction Entity] Application for Stormwater Permit and the [Jurisdiction Entity] Stormwater Plan Submittal Checklist located in Appendix B. An adequate number of hard copies of each application material, as noted in the "[Jurisdiction Entity] Application for Stormwater Permit" form contained in Appendix B must be submitted to the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator]'s Office. In addition to the hard copies, an optional digital copy of the construction plans may be submitted in a format accepted by the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator] (such as DWG, DGN, DXF, SHP, or PDF file format). The digital copy should be dated and labeled

with the appropriate project name and include which phase the plans represent (initial submittal, final approval, for example).

(6) After the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator]'s Office receipt of the application, the applicant will be notified as to whether their application was complete or insufficient. The applicant will be asked for additional information if the application is insufficient. The information provided will be reviewed in detail by the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator] and/or its plan review consultant(s). Once all comments have been received and review completed, the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator] will either approve the project or request modifications.

(7) Once the Final Stormwater Drainage Plans are approved, an updated Full Drainage Plan NOI must be submitted to the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator]'s Office and, if the total disturbance is 1 acre or more, to IDEM as well. The IDEM submittal requires a completed NOI form, verification of plan approval, application fee of $100, and proof of publication. For the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator]'s Office submittal, the applicant should include copies of the final, approved construction plans, stormwater drainage technical report, stormwater pollution prevention plan for construction sites, and post-construction stormwater pollution prevention plan. These items should accompany the above-noted written NOI notification and proof of publication and the Stormwater Quantity Inspection Fee and Post Construction BMP Inspection Fee.

(8) For the NOI that was previously submitted for a Partial Mass/Initial Grading Permit, a Notice of Termination (NOT) must be submitted to the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator]'s Office upon the submittal of the Full Drainage Plan NOI. The [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator], or a representative, shall inspect the construction site to verify the requirements for an NOT have been met (proper erosion and sediment control being implemented on the site). If the requirements for a NOT have been met and no corrective actions are needed, the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator]'s Office will forward a "verified" NOT copy to the applicant and to IDEM for the Partial Permit.

(9) Upon completion of construction activities, as-built plans must be submitted to the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator]'s Office. A Notice of Termination (NOT) for the Full Drainage Plan NOI shall be sent to the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator]'s Office once the construction site meets the requirements set forth in 327 IAC 15-5-8. Notice of scheduled date for completion of construction shall be provided to the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator]'s Office at least three (3) business days prior to its planned completion. The project site owner will schedule the final inspection with the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator]'s Office.

(10) The [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator], or a representative, shall inspect the construction site to verify the requirements for a NOT have been met. If the requirements for a NOT have been met and no corrective actions are needed, the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator]'s Office will forward a "verified" NOT copy to the applicant and to IDEM. Permits issued under this scenario will expire five (5) years from the date of issuance. If construction is not completed within five (5) years, the NOI must be resubmitted at least ninety (90) days prior to expiration.

(11) Additionally, the property owner, developer, or contractor shall be required to file a one year maintenance bond or other acceptable guarantee with the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator], prior to final project acceptance. The bond or other acceptable guarantee shall be in effect for a period of one year after the date of the final project acceptance by the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator] and/or the [Jurisdiction Entity] [Jurisdiction Entity Highest Stormwater Approval Administrative Body], as applicable.

Figure 1 is a flowchart summarizing the plan review/permit approval process and can be found at the end of this Chapter.

C. REVIEW OF INDIVIDUAL RESIDENTIAL LOTS WITHIN A PERMITTED PROJECT

(1) Prior to the issuance of a "verified" NOT for the larger project, the individual lot owner or owner's agent will be required to obtain an erosion control plan for the individual lot from the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator]'s Office upon applying for an Improvement of Location Permit. The individual lot owner or owner's agent will also be required to pay an inspection fee for future [Jurisdiction Entity Stormwater Administrator]'s Office site inspections. All individual building lots must comply with the provisions and requirements under 327 IAC 15-5 subsections 7.5(a) and 7.5(b). All stormwater management measures necessary to comply with Title 19 of the [Jurisdiction Entity] Code ([Jurisdiction Entity] Stormwater Management Ordinance) must be implemented in accordance with the permitted plan for the larger project. Upon completion of construction, a survey of the lot must be provided to the [Jurisdiction Entity Stormwater Administrator]'s Office.

(2) For individual lots developed within a larger permitted project where the larger permitted project has been issued a "verified" NOT by the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator]'s Office, a formal review and issuance of an Individual Lot Plot Plan Permit will be required before a building permit can be issued. The individual lot owner must complete a NOI if the land disturbance will be one (1) acre or more. Information to be provided by the individual lot owner or the owner's agent for obtaining an Individual Lot Plot Plan Permit is included in the

section below titled Individual Lot Plot Plan Permit Requirements and can also be found in Appendix B.

(3) At the discretion of the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator]'s Office, a pre-construction meeting may be required to be held with the participation of the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator]'s Office and other entities that may be involved prior to any site grading activity in order to review the erosion control plan before grading and ensure that appropriate perimeter control measures have been implemented on the site and the location of any existing tiles has been properly marked.

(4) The project site owner or contractor must notify the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator]'s Office within two (2) business days of actual construction activity start-up to allow the ability of site inspections to be conducted to verify compliance with the Individual Lot Plot Plan Permit. The individual lot operator or the owner's agent shall monitor construction activities and inspect all stormwater pollution prevention measures to verify compliance with Title 19 of the [Jurisdiction Entity] Code ([Jurisdiction Entity] Stormwater Management Ordinance) and the terms and conditions of the approved permit.

D. REVIEW OF INDIVIDUAL RESIDENTIAL LOTS

(1) For individual single-family residential projects that are not part of a larger common plan of development or sale, the following need to be submitted to the [Jurisdiction Entity Stormwater Administrator]'s Office before a building permit can be issued:

a. For construction activities associated with a single-family residential dwelling disturbing one (1) or more acres of land area:

1. Submittal of a Draft Notice of Intent (NOI) is required; and

2. A formal review and issuance of an Individual Lot Plot Plan Permit will be required before a building permit can be issued. The information to be provided by the individual lot owner or the owner's agent for obtaining an Individual Lot Plot Plan Permit is included in Appendix B. All stormwater management measures necessary to comply with Title 19 of the [Jurisdiction Entity] Code ([Jurisdiction Entity] Stormwater Management Ordinance) must be implemented.

b. For a single-family residential development consisting of four (4) or fewer lots or a single-family residential strip development where the developer offers lots for sale or lease without land improvements:

1. The project site owner shall develop a set of construction plans containing stormwater quality measures that achieve the minimum project site requirements specified in 327 IAC 15-5-7; and

2. The construction plan must also include the information required by 327 IAC 15-5-6.5(b). (Ref: 327 IAC 15-5-6.5(b))

3. If the project will disturb one (1) or more acres of land area, submittal of a Draft Notice of Intent (NOI) is required.

(2) Once a permit has been issued, the project site owner must file a Notice of Intent a minimum of two (2) business days prior to the commencement of construction activities. Notification shall be in the form of an updated NOI form. The submittal of the NOI must be provided to the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator]'s Office and to IDEM as well. The IDEM submittal must include the completed NOI form, proof of publication, verification that the jurisdictional entity approved the plan, and a $100 fee.

(3) At the discretion of the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator]'s Office, a pre-construction meeting may be required to be held with the participation of the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator]'s Office and other entities that may be involved prior to any site grading activity in order to review the erosion control plan before grading and ensure that appropriate perimeter control measures have been implemented on the site and the location of any existing tiles has been properly marked. The project site owner or contractor must notify the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator]'s Office within two (2) business days of actual construction activity start-up to allow the ability of site inspections to be conducted to verify compliance with the Individual Lot Plot Plan Permit.

(4) Once construction starts, the project owner or owner's agent shall monitor construction activities and inspect all stormwater pollution prevention measures to verify compliance with Title 19 of the [Jurisdiction Entity] Code ([Jurisdiction Entity] Stormwater Management Ordinance) and the terms and conditions of the approved permit. Upon completion of construction activities, as-built plans must be submitted to the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator]'s Office, if applicable. If a NOI was previously submitted for the project, a Notice of Termination (NOT) shall be sent to the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator]'s Office once the construction site has been stabilized and all temporary erosion and sediment control measures have been removed. The [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator], or a representative, shall inspect the construction site to verify the requirements for a NOT have been met. If the requirements for a NOT have been met and no corrective actions are needed, the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator]'s Office will forward a "verified" NOT copy to the applicant and to IDEM. Permits issued under this scenario will expire five (5) years from the date of issuance. If construction is not completed within five (5) years, the NOI must be resubmitted at least ninety (90) days prior to expiration.

E. INDIVIDUAL LOT PLOT PLAN PERMIT REQUIREMENTS

(1) The following provisions must be submitted to the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator]'s Office by the individual lot owner or the owner's

agent for review and acceptance as part of a request for issuance of an Individual Lot Plot Plan Permit:

A. The individual lot operator must complete an Individual Lot Plot Plan Permit Request form and include the name, address, telephone number, and list of qualifications of the trained individual in charge of the mandatory stormwater pollution prevention self-monitoring program for the project site. See Appendix B for this form.
B. The applicable permit review and inspection fees must be paid in full.
C. Submittal must include a certified site layout for the subject lot and all adjacent lots showing building pad location, dimensions, elevations, and the drainage patterns and swales.
D. The individual lot operator, whether owning the property or acting as the agent of the property owner, shall be responsible for erosion and sediment control requirements associated with activities on individual lots until the site is stabilized. An erosion and sediment control plan must be provided that, at a minimum, includes the following measures:
    i. Must specify and show installation and maintenance of a stable construction site access.
    ii. Must specify and show installation and maintenance of appropriate perimeter erosion and sediment control measures prior to land disturbance.
    iii. Must specify and show erosion and sediment control measures for sheet flow and concentrated flow areas.
    iv. Must specify and show nearby storm sewer inlet protection measures.
    v. Statement of measures taken for the minimization of sediment discharge and tracking from the lot throughout the land disturbing activities on the lot until permanent stabilization has been achieved.
    vi. Guidelines stating the clean-up of sediment that is either tracked or washed onto roads. Bulk clearing of sediment shall not include flushing the area with water. Cleared sediment must be redistributed or disposed of in a manner that is in compliance with all applicable statutes and rules.
    vii. Statement that adjacent lots disturbed by an individual lot operator must be repaired and stabilized with temporary or permanent surface stabilization.
    viii. For individual residential lots, final stabilization meeting the criteria in 327 IAC 15-5-7(b)(20) will be achieved when the individual lot operator:
        1. Completes final stabilization; or
        2. Has installed appropriate erosion and sediment control measures for an individual lot prior to occupation of the home by the homeowner and has informed the homeowner of the requirement for, and benefits of, final stabilization.
E. Any additional measures requested by the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator] to meet the requirements set forth in the [Jurisdiction Entity] Stormwater Management Ordinance.

F. NON-RESIDENTIAL PROJECT REQUIREMENTS

(1) Any non-residential project or construction activity that results in the disturbance of one (1) acre or more of total land area must submit an application for a Secondary Stormwater Management Permit to the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator]'s Office regardless of whether the project site is part of a larger permitted project. In addition, a Notice of Intent (NOI) must be submitted to the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator]s Office and to IDEM.

(2) For non-residential projects or construction activities that result in the disturbance of less than (1) acre of total land area, where the disturbance results in a building permit or an occupancy permit being required, a formal review and issuance of an Individual Lot Plot Plan Permit will be required regardless of whether the project site is part of a larger permitted project.

G. CHANGES TO PLANS

i. Any changes or deviations in the detailed plans and specifications after approval of the applicable stormwater management permit shall be filed with, and accepted by, the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator] prior to the land development involving the change. Copies of the changes, if accepted, shall be attached to the original plans and specifications. Additionally, an updated NOI may need to be submitted to IDEM if these changes result in differences between the original NOI submittal and the newly accepted plans and specifications.

H. CERTIFICATION OF AS-BUILT PLANS

i. After completion of construction of the project and before final project acceptance (issuance of a "verified" NOT and [Jurisdiction Entity] [Jurisdiction Entity Highest Stormwater Approval Administrative Body] Final Project Acceptance), a professionally prepared and certified 'as-built' set of plans certified as to location and elevation by a Registered Professional Land [Jurisdiction Entity Stormwater Administrator] shall be submitted to the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator] for review. In addition to the hard copy, a digital copy of the 'as-built' plans is required in a format accepted by the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator] (such as DWG, DGN, DXF, and SHP file format). The PDF file format is unacceptable for the digital 'as-built' plan submittal. The digital copy must be dated and labeled with the appropriate project name, name of person and affiliated company that prepared the as-built plans along with contact information, and include which phase and section the plans represent (Section 1 'As-built' plans, for example). These plans shall include all pertinent data relevant to the completed storm drainage system and stormwater management facilities, and shall include at a minimum the following together with any other details required by the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator]'s Office:

A. The exact as-built location of stormwater manholes, inlets, catch basins, end sections, risers, culverts, water main lines, emergency overflow weirs, streets, pipes, pipe sizes (in inches), pipe material, and pipe structure lengths

B. Invert elevations and top rim elevations

C. Swales and ditches and the flow line of swales and ditches

D. Elevation of the emergency overflow (spillway) for ponds

E. Sanitary sewer manholes and pipes, pipe sizes, pipe length, and pipe material

F. BMP types, dimensions, and the locations of any boundaries and all easements

G. "As-planted" plans for BMPs, as applicable

H. Detention-Retention Ponds with Normal Pool Elevation & Top of Bank. Also include data and calculations showing detention basin storage volume

I. Data and calculations showing BMP treatment capacity

J. Infrastructure line work must be continuous polylines with beginning and ending at a structure insertion point, connecting only two structures per line. Lines must be drawn with the direction of flow

K. All on-site elevations shall be given in North American Vertical Datum of 1988 (NAVD). The horizontal datum of topographic map shall be based on Indiana State Plane Coordinates, NAD83

L. Certified statement on plans stating the completed storm drainage system and stormwater management facilities substantially comply with construction plans and the stormwater management permit as approved by the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator]. (See certificate in Appendix B.)

M. All stormwater structures must have their attributes attached to that respective structure. The name of each structure or pipe line should be unique and not repeat within the same section or across sections of the same subdivision. For example, if line A is used in section 1, it should not be used as a naming convention again in future sections of that same subdivision. The storm structure attributes must be provided to the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator]'s Office in a format that can be imported and incorporated into [Jurisdiction Entity]'s GIS system. The following minimum attributes must be provided for each stormwater structure (including those that were pre-existing before the project started) showing the as-built data of each structure:

Pipe: name, size, material, length, percent slope

Inlet: name, type, size, number of pipe infalls, number of pipe outfalls, casting type, invert elevations, top rim elevations
Manhole: name, type, size, number of pipe infalls, number of pipe outfalls, casting type, invert elevations, top rim elevations
Outfall: name, outfall structure type, size of pipe, pipe material
Trash Rack: name, size of pipe, pipe material
Control Structure: name, type of structure, control elevation, length of weir, overall length of structure

I. INSPECTION & MAINTENANCE

a. During construction, the project site owner shall implement a self-monitoring program that includes the following:

i. A trained individual shall perform a written evaluation of the project site:

1. By the end of the next business day following each "measurable storm event" (defined as a precipitation event that results in a total measured precipitation accumulation equal to, or greater than, one-half (0.5) inch of rainfall); and
2. At a minimum of one (1) time per week.

ii. The evaluation must:

1. Address the maintenance of existing stormwater quality measures to ensure they are functioning properly; and
2. Identify additional measures necessary to remain in compliance with all applicable statutes and rules.

iii. Written evaluation reports must include:

1. The name of the individual performing the evaluation;
2. The date of the evaluation;
3. Problems identified at the project site; and
4. Details of corrective actions recommended and completed.

iv. All evaluation reports for the project site must be made available to the inspecting authority (the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator]'s Office, SWCD or IDEM as appropriate) within two (2) business days of a request. (Ref: 327 IAC 15-5-7(b)(18))

b. IDEM or its designated representative may inspect any project site involved in construction activities regulated by 327 IAC 15-5 at reasonable times. IDEM or its designated representatives may make recommendations to the project site owner or their representative to install appropriate measures beyond those specified in the stormwater pollution prevention plan to achieve compliance. (Ref: 327 IAC 15-5-10(a))

J. NOTICE OF TERMINATION LETTER (NOT)

a. The project site owner shall submit a Notice of Termination (NOT) letter to the agency or agencies that reviewed the construction plans in accordance with the following:

1. Regular Release. Except as provided in the following paragraph (2) for early release from compliance with 327 IAC 15-5, the project site owner shall submit an NOT letter when the following conditions have been met:
   a. All land disturbing activities, including construction on all building lots, have been completed and the entire site has been stabilized; and
   b. All temporary erosion and sediment control measures have been removed.

   The NOT letter must contain a verified statement that each of the conditions listed above have been met. (Ref: 327 IAC 15-5-8(b))

2. Early Release. The project site owner may submit an NOT letter to obtain early release from compliance with 327 IAC 15-5 if the following conditions are met:
   a. The remaining, undeveloped acreage does not exceed five (5) acres, with contiguous areas not to exceed one (1) acre;
   b. A map of the project site, clearly identifying all remaining undeveloped lots, is attached to the NOT letter. The map must be accompanied by a list of names and addresses of individual lot owners or individual lot operators of all undeveloped lots;
   c. All public and common improvements, including infrastructure, have been completed and permanently stabilized and have been transferred to the appropriate local entity;
   d. The remaining acreage does not pose a significant threat to the integrity of the infrastructure, adjacent properties, or water quality; and
   e. All permanent storm water quality measures have been implemented and are operational. (Ref: 327 IAC 15-5-8(b))
   f. Following acceptance of the NOT letter for early release as discussed above, the project site owner shall notify all current individual lot owners and all subsequent individual lot owners of the remaining undeveloped acreage and acreage with construction activity that they are responsible for complying with 327 IAC 15-5-7.5. The remaining individual lot owners do not need to submit an NOI letter or NOT letter. The notice must contain a verified statement that each of the conditions in 327 IAC 15-5-8(b)(2) have been met. The notice must also inform the individual lot owners of the requirements to:
      1. Install and maintain appropriate measures to prevent sediment from leaving the individual building lot; and
      2. Maintain all erosion and sediment control measures that are to remain on-site as part of the construction plan. (Ref: 327 IAC 15-5-8(c))

b. For projects approved by the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator]'s Office, the NOT, including an NOT with early release, must be accompanied by the [Jurisdiction Entity Stormwater Administrator]'s Office verification that the termination requirements specified in 327 IAC 15-5 have been satisfied.

c. The [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator]'s Office, SWCD, IDEM or their designees, may inspect the project site to evaluate the adequacy of the remaining storm water quality measures and compliance with the NOT letter

requirements. If the inspecting entity finds that the project site owner has sufficiently filed an NOT letter, the entity shall forward notification to IDEM. Upon receipt of the verified NOT letter by IDEM and receipt of written approval from IDEM, the project site owner shall no longer be responsible for compliance with 327 IAC 15-5. (Ref: 327 IAC 15-5-8(d))

FIGURE 1: PERMIT APPROVAL PROCESS

Chapter Nine

POST-CONSTRUCTION WATER QUALITY BMPs

A. INTRODUCTION

[Jurisdiction Entity] has established a minimum standard that the measurement of the effectiveness of the control of stormwater runoff quality will be based on the management of Total Suspended Solids (TSS). This requirement is being adopted as the basis of the [Jurisdiction Entity] stormwater quality management program for all areas of jurisdiction.

This chapter of the manual establishes minimum standards for the selection and design of construction water quality BMPs. The information provided in this chapter establishes performance criteria for stormwater quality management and procedures to be followed when preparing a BMP plan for compliance. Post-Construction BMPs must be sized to treat the water quality volume, WQv, for detention-based BMPs or the water quality discharge, Qwq, for flow-through BMPs. Chapter 10 provides the methodology for calculating the WQv and Qwq values.

BMPs noted in this chapter refer to post-construction BMPs, which continue to treat stormwater after construction has been completed and the site has been stabilized. Installing certain BMPs, such as bioretention areas and sand filters, prior to stabilization can cause failure of the measure due to clogging from sediment. If such BMPs are installed prior to site stabilization, they should be protected by traditional erosion control measures.

Conversely, detention ponds and other BMPs can be installed during construction and used as sediment control measures. In those instances, the construction sequence must require that the pond is cleaned out with pertinent elevations and storage and treatment capacities reestablished as noted in the accepted stormwater management plan.

B. POST-CONSTRUCTION PLAN PREPARATION

(1) Elements of an Effective Post-Construction Plan

A post-construction plan must:

(a) Include a pre- and post-development hydrologic analysis. A hydrologic analysis or drainage report that includes the pre- and post-development runoff must be conducted for the following storm sizes:

(1) The 2-year storm, also known as the "water quality storm," to protect natural channels from erosion;

(2) The 10-year or higher storm, to size storm drainage infrastructure; and

(3) The 100-year storm, to address flooding.

(b) Optimize site design. The project should mimic a site's pre-development hydrology by utilizing optimum site design principles, including minimizing the project's impervious footprint, conserving natural areas, and minimizing directly connected impervious areas. Such practices encourage infiltration and reduce the volume of stormwater discharged from the site. Practices that follow these principles include:

(1) Low impact development (“LID”) and other green designs;

(2) Alternative pavers or green parking;

(3) Green roofs;

(4) Bioretention practices such as rain gardens; and

(5) Infiltration basins or infiltration trenches.

(c) Identify pollution prevention measures. The design must include practices to minimize and control the sources of pollutants. These measures are usually the most cost-effective methods of controlling pollutants in stormwater. Examples of pollution prevention measures include:

(1) Designing outdoor material storage and trash storage areas to minimize exposure to stormwater;

(2) Using efficient irrigation systems and landscape design;

(3) Designing vehicle and equipment wash areas to minimize discharges to the storm drain;

(4) Designing fueling areas to prevent spills and exposure to stormwater;

(5) Providing storm drain stenciling and signage; and

(6) Identifying controls that provide treatment and reduce stormwater volume and velocity.

(d) Identify pollutants of concern (“POCs”).

(1) Known or suspected POCs must be identified and addressed through appropriate BMPs. The POCs that are most likely to be found at various types of development are listed in **Table 9-3**. The SWPPP must include BMPs to address the POCs that are or will be present at the site during and after construction has been completed.

(2) Any person installing new or replacement fuel dispensing facilities or tanks shall install appropriate proprietary BMPs to reduce lead, copper, zinc and polyaromatic hydrocarbons in stormwater runoff, pursuant to 327 IAC 15-13-16.

(e) Identify treatment controls. Treatment controls in the form of structural BMPs must be installed where site design and source controls are not adequate to reduce stormwater pollutants to the levels required by this chapter. BMPs must be designed to control runoff from the design storm events required by this chapter, and must be selected based on their effectiveness in reducing the identified pollutants of concern at the project. BMPs with relatively low removal efficiency for a given pollutant are discouraged when other BMPs with higher removal efficiency are available. Examples of treatment controls can be found in the tables at the end of this chapter. For further information, please see Chapter 8 of the IDEM *Indiana Storm Water Quality Manual.*

(f) Identify post-construction inspection and maintenance requirements and responsibilities. Refer to the standards in the *Indiana Storm Water Quality Manual*, Chapter 8, for guidance.

C. INNOVATIVE BMPs

(1) BMPs not previously accepted by the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator] must be certified by a professional engineer licensed in the State of Indiana and accepted through the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator]. ASTM standard methods must be followed when verifying performance of new measures. New BMPs, individually or in combination, must meet the 80% TSS removal rate at 50-125 micron range (silt/fine sand) without re-entrainment and must have a low to medium maintenance requirement to be considered by the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator]. Testing to establish the TSS removal rate and/or POC removal rate must be conducted by an independent testing facility, not the BMP manufacturer, and provide maintenance requirements and other pertinent design information.

D. PRE-APPROVED PERFORMANCE BASED BMPs

(1) There are two categories of BMPs that are most frequently used in post-construction stormwater quality management: “performance based” and

"proprietary."

(a) Performance based BMPs, including such measures as detention basins, bioretention and grass swales, are the most common stormwater quality control structures. Design standards for performance based BMPs are based on numerous performance tests comparing inlet and outlet samples to determine pollutant removal. If a BMP is designed and constructed according to performance based design criteria and is properly maintained, it should perform at or near its rated efficiency indefinitely.

(b) [Jurisdiction Entity] has designated a number of pre-approved BMP methods to be used alone or in combination to achieve the 80% TSS removal stormwater quality goals for a given project. These BMP measures are listed along with their anticipated average TSS removal rates in **Table 9-1 and 9-2**. Where there is a range of rates for a particular item, the lowest rate in the range will be the accepted rate for that device or measure. Pre-approved BMPs must be constructed in accordance with the guidelines in the *Indiana Storm Water Quality Manual*, Chapter 8, except as modified by the requirements in this chapter.

(c) The pre-approved BMPs have been proven/are assumed to achieve the average/median TSS removal rates indicated in Table 9-1 and 9-2. These rates have been accepted by the [Jurisdiction Entity] as the performance rates for use of the listed BMPs. Applicants desiring to use a different TSS removal rate for these BMPs must follow the requirements discussed above for Innovative BMPs. Details regarding the applicability and design of these pre-approved BMPs are contained within fact sheets presented in the *Indiana Storm Water Quality Manual* (http://www.in.gov/idem/stormwater/).

(d) Note that a single BMP measure may not be adequate to achieve the [Jurisdiction Entity]'s 80% TSS removal goal and the water quality goals for a project. It is for this reason that a "treatment train", a number of BMPs in series, is often required for a project.

E. PRE-APPROVED PROPRIETARY BMPs

(a) Proprietary BMPs include manufactured devices such as hydrodynamic separation units, oil and floatable debris skimmers and cartridge filter systems.

(b) A list of proprietary BMPs that have been adopted from the City of Indianapolis for use in [Jurisdiction Entity] is included in **Table 9-4** at the end of this chapter. The list will be updated within the [Jurisdiction Entity] Technical Standards Manual and [Jurisdiction Entity] website on a periodic basis. Pre-approved BMPs listed in the *Indiana Storm Water Quality Manual*, Chapter 8, must be constructed in accordance with the guidelines in Chapter 8 of that document, except as modified by the requirements in this chapter.

(c) Any proprietary BMP that is proposed for use at a project site and that is not on the pre-approved list must be approved by the [Jurisdiction Entity] prior to implementation. Proprietary BMPs must, either alone or as part of a BMP treatment chain:

(i.) Achieve the [Jurisdiction Entity]'s minimum 80% TSS removal rate at 50-125 micron range (silt/fine sand) without re-entrainment;

(ii.) Have a low to medium maintenance requirement;

(iii.) Be certified by a professional engineer licensed in the State of Indiana;

(iv.) Be based on design flow capacity, on design volume, or on continuous runoff and water quality simulation;

(v.) Be tested by an independent testing facility, not the BMP manufacturer, to establish the TSS removal rate;

(vi.) Be designed in accordance with ASTM standard methods; and

(vii.) Be approved by the [Jurisdiction Entity]. When applying for approval, the applicant must submit the following materials to the [Jurisdiction Entity]:

(a.) General process for product evaluation;

(b.) Interim product approval; and

(c.) Final product approval.

(d) BMP Configuration. BMPs must be configured as off-line units unless a detailed hydraulic analysis demonstrates that the upstream and downstream pipes will have sufficient capacity, and that surcharging created by high rainfall events will not result in loss of previously captured material. The [Jurisdiction Entity] must approve the use of in-line BMPs.

TABLE 9-1
Pre-approved Post-construction BMPs

BMP Description	Anticipated Average % TSS Removal Rate[D]	Fact Sheet*	Maintenance Easement Requirements
Bioretention Systems[A]	90	ISWQM	25 feet wide along the perimeter
Constructed Storm Water Wetlands	67	ISWQM	25 feet wide along the outer perimeter of forebay & 30 feet wide along centerline of outlet
Subsurface Detention/Retention[E]	70	ISWQM	20 feet wide strip from access easement to tank's access shaft & 30 feet wide along centerline of inlet and outlet
Dry Extended Detention Basins[E]	61	ISWQM	25 feet wide along the outer perimeter of forebay & 30 feet wide along centerline of outlet
Infiltration Basin[A]	87	ISWQM	25 feet wide along the perimeter
Infiltration Trench[A]	90	ISWQM	25 feet wide along the perimeter
Sand Filters	70	ISWQM	25 feet wide along the perimeter
Gravity/Hydrodynamic Separators	NA[B]	ISWQM	20 feet wide strip from access easement to chamber's access shaft
Filter Strip	48	ISWQM (Ch. 7)	25 feet wide along the length on the pavement side
Vegetated Swale	81	ISWQM	25 feet wide along the top of bank on one side
Wet Detention Ponds[E]	80	ISWQM	25 feet wide along the outer perimeter of forebay & 30 feet wide along centerline of outlet

*See ISWQM Chapter 8 (2007 or latest version), unless otherwise noted. (http://www.in.gov/idem/stormwater/)

Notes:

A. Based on capture of 0.5-inch of runoff volume as best available data. Effectiveness directly related to captured runoff volume, increasing with larger capture volumes.
B. The removal rate for this category varies widely between various models and manufacturers. Independent testing must be provided, rather than the manufacturer's testing data.
C. Must provide vendor data for removal rates.
D. Removal rates shown are based on typical results. These rates are also dependent on proper installation and maintenance. The ultimate responsibility for determining whether additional measures must be taken to meet the Ordinance requirements for site-specific conditions rests with the applicant.
E. Note that if the Detention Pond is to have a dual (quantity and quality) use, adherence to both design criteria (that stated in Chapter 6 of this Standards document and that stated in Chapter 8 of the ISWQM) will be required. Design and construction of a detention pond that would meet both water quantity and water quality criteria is very challenging and can become very expensive.

Table 9-2

Effectiveness of Management Practices for Runoff Control

Runoff Treatment or Control Practice Category or Type	Median Pollutant Removal (Percent)							
	No. of Studies	TSS	TP	OP	TN	NOx	Cu	Zn
Quality Control Pond	3	3	19	N/A	5	9	10	5
Dry Extended Detention Pond	6	61	20	N/A	31	-2	29	29
Wet Extended Detention Pond	14	**(50-90)**	**(30-90)**	69	35	63	44	**(40-50)**
Multiple-Pond System	1	91	76	N/A	N/A	87	N/A	N/A
Wet Ponds	43	80	51	65	33	43	57	66
Shallow Marsh	20	83	43	66	26	73	33	42
Extended Detention Wetland	4	**(67)**	**(49)**	59	**(28)**	35	**(41)**	**(45)**
Pond/Wetland System	10	71	56	37	19	40	58	56
Submerged Gravel Wetland	2	83	64	14	19	81	21	55
Organic Filter	7	88	61	30	41	-15	66	89
Perimeter Sand Filter	3	79	41	68	47	-53	25	69
Surface Sand Filter	7	87	59	N/A	31.5	-13	49	80
Vertical Sand Filter	2	**(70)**	**(33)**	21	**(21)**	-87	32	**(45)**
Bioretention	1	**(90)**	**(70-83)**	N/A	**(68-80)**	16	**(93-98)**	**(93-98)**
Infiltration Trench	3	**(90)**	**(60)**	100	**(60)**	82	**(90)**	**(90)**
Porous Pavement	3	95	65	10	83	N/A	N/A	99
Ditches ①	9	31	-16	N/A	-9	24	14	0
Grass Channel	3	68	29	32	N/A	-25	42	45
Dry Swale	4	**(81)**	**(9)**	70	92	**(38)**	**(51)**	**(71)**
Wet Swale	2	74	28	-31	40	31	11	33
Oil-Grit Separator	1	**(40)**	**(5)**	40	**(5)**	47	-11	17

Notes to Table:

1. Refers to open channel practices not designed for water quality.
2. The rate (percentage) for each practice in the Table shall be the accepted rate for use of that practice in [Jurisdiction Entity]. Where there is a range of rates, the lowest rate will be the accepted rate unless the person proposing a higher rate provides conclusive evidence supported by independent testing that the higher rate is the correct rate.
3. Cu=copper, OP=ortho-phosphorus, TN=total nitrogen, TP=total phosphorus, TSS=total suspended solids, NOx=nitrate and nitrite nitrogen, Zn=zinc.

Sources: USEPA, 2005; and the *Indiana Storm Water Quality Manual*, October 2007 (numbers in **bold**).

TABLE 9-3

Potential Pollutants for Various Land Uses

	Potential Pollutants for Various Land Uses						
Category	Sediments	Nutrients	Heavy Metals	Trash & Debris	Oil & Grease	Bacteria & Viruses	Pesticides
Residential Development	X	X		X	X	X	X
Commercial Development	X	X		X	X	X	X
Auto Repair Shops			X	X	X		
Restaurants				X	X	X	
Parking Lots	X	X		X	X		X
Streets and Highways	X	X		X	X		
Source: USEPA, adapted from San Diego Co-Permittees, 2002.							

Table 9-4

Pre-Approved Proprietary BMPs

Created: March 3, 2008
Revised:

Manufactured SQU	SQU System Model	Max Treatment Flow (cfs)
Stormceptor® 1	STC 450	0.3
	STC 900	0.64
	STC 2400	1.06
	STC 4800	1.77
	STC 7200	2.47
	STC 11000	3.53
	STC 16000	4.94
Downstream Defender® 1	4 Foot Diameter	1.3
	6 Foot Diameter	4.1
	8 Foot Diameter	9.4
	10 Foot Diameter	17.7
VortSentry®	VS30	0.26
	VS40	0.58
	VS50	1.07
	VS60	1.77
	VS70	2.7
	VS80	3.9
Vortechs® 1	1000	0.3
	2000	1
	3000	1.6
	4000	2.3
	5000	3.2
	7000	4.1
	9000	5.2
	11000	6.4
Vortechs®	16000	9.3
	PC1319 or 1319 CIP	10.9
	PC1421 or 1421 CIP	12.7
	1522 CIP	14.6
	1624 CIP	16.6
	1726 CIP	18.7
	1827 CIP	21
	1929 CIP	23.4

		2030 CIP	25.9
		2131 CIP	28.5
		2233 CIP	31.3
		2334 CIP	34.2
		2436 CIP	37.3
		2538 CIP	40.4
		2639 CIP	43.7
		2740 CIP	47.2
		2842 CIP	50.7
		2943 CIP	54.4
		3045 CIP	58.2
		3146 CIP	62.2
		3349 CIP	70.5
		3958 CIP	98.4
		4060 CIP	103.5
Aqua-Swirl™		AS-2	0.29
		AS-3	0.5
		AS-4	0.75
		AS-5	1.2
		AS-6	1.7
		AS-7	2.3
		AS-8	3
		AS-9	3.8
		AS-10	4.7
		AS-12	6.8
CDS Technologies	**Inline**	PMIU20_15_4	0.33
		PMIU20_15	0.33
		PMSU20_15_4	0..33
		PMSU20_15	0.33
		PMSU20_20	0.52
		PMSU20_25	0.75
		PMSU30_20	0.94
		PMSU30_30	1.41
		PMSU40_30	2.12
		PMSU40_40	2.82
	Offline	PSWC20_15	0.33
		PSWC20_20	0.52
CDS Technologies		PSWC20_25	0.75
		PSWC30_20	0.94
		PSWC30_30	1.41
		PSWC40_30	2.12
		PSWC40_40	2.82
		PSWC56_40	4.23
		PSWC56_53	6.58

		PSWC56_68	8.93
		PSWC56_78	11.75
	Offline	PSW30_30	1.41
		PSW50_42	4.23
		PSW50_50	5.17
		PSW70_70	12.22
		PSW100_60	14.1
		PSW100_80	21.62
		PSW100_100	30.08
ADS Stormwater Quality Units2		3620WQB	0.7
		3640WQB	1.6
		4220WQB	0.86
		4240WQB	1.83
		4820WQB	1.13
		4840WQB	2.39
		6020WQB	1.47
		6040WQB	3.12

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Chapter Ten

METHODOLOGY FOR DETERMINATION OF REQUIRED SIZING OF BMPs

A. INTRODUCTION

Structural Water Quality BMPs are divided into two major classifications: detention BMPs and Flow-through BMPs. Detention BMPs impound (pond) the runoff to be treated, while flow through BMPs treat the runoff through some form of filtration process.

B. DETENTION BMP SIZING

Water Quality Detention BMPs must be designed to store the water quality volume for treatment. The water quality volume, WQv, is the storage needed to capture and treat the runoff from the first one inch of rainfall. The water quality volume is equivalent to one inch of rainfall multiplied by the volumetric runoff coefficient (Rv) multiplied by the site area, or:

$$WQv = \frac{(P)\,(Rv)\,(A)}{12}$$

where:
WQv = water quality volume (acre-feet)
P = 1 inch of rainfall
Rv = volumetric runoff coefficient
A = area in acres

The volumetric runoff coefficient is a measure of imperviousness for the contributing area, and is calculated as:

$$Rv = 0.05 + 0.009(I)$$

Where:
I is the percent impervious cover

For example, a proposed commercial site will be designed to drain to three different outlets, with the following drainage areas and impervious percentages:

Subarea ID	On-site Contributing Area (acres)	Impervious Area %	Off-Site Contributing Area (acres)
A	7.5	80	0.0
B	4.3	75	0.0
C	6.0	77	0.0

Calculating the volumetric runoff coefficient for subareas A, B and C yields:

Rv (subarea A) = 0.05+0.009(80)=0.77
Rv (subarea B) = 0.05+0.009(75)=0.73
Rv (subarea C) = 0.05+0.009(77)=0.74

The water quality volumes for these three areas are then calculated as:

WQv (subarea A) = (1")(Rv)(A)/12=0.77(7.5)/12=0.48 acre-feet
WQv (subarea B) = 0.73(4.3)/12=0.26 acre-feet
WQv (subarea C) = 0.74(6.0)/12=0.37 acre-feet

Note that this example assumed no offsite sources of discharge through the water quality detention BMPs. If there were significant sources of off-site runoff (sometimes called runon for upstream areas draining to the site), the designer would have the option of diverting off-site runoff around the on-site systems, or the detention BMP should be sized to treat the water quality volume for the entire contributing area, including off-site sources.

C. FLOW THROUGH BMP SIZING

Flow through BMPs are designed to treat runoff at a peak design flow rate through the system. Examples of flow through BMPs include catch basin inserts, sand filters, and grassed channels. Another flow through BMP which is gaining popularity is a dynamic separator. Dynamic separators are proprietary, and usually include an oil-water separation component.

The following procedure should be used to estimate peak discharges for flow through BMPs (adopted from Maryland, 2000). It relies on the volume of runoff computed using the Small Storm Hydrology Method (Pitt, 1994) and utilizes the NRCS, TR-55 Method.

Using the WQv methodology, a corresponding Curve Number (CNwq) is computed utilizing the following equation:

$$CNwq = \frac{1000}{\left[10 + 5P + 10Qa - 10\sqrt{Qa^2 + 1.25QaP}\right]}$$

where:

CNwq = curve number for water quality storm event
P = 1" (rainfall for water quality storm event)
Qa = runoff volume, in inches = 1"×Rv = Rv (inches)
Rv=volumetric runoff coefficient (see previous section)

Due to the complexity of the above equation, the water quality curve number is represented as a function of percent imperviousness in **Figure 10-1**.

The water quality curve number, CNwq, is then used in conjunction with the standard calculated time-of-concentration, tc, and drainage area as the basis input for TR-55 calculations. Using the SCS Type II distribution for 1 inch of rainfall in 24-hours, the water quality treatment rate, Qwq, can then be calculated.

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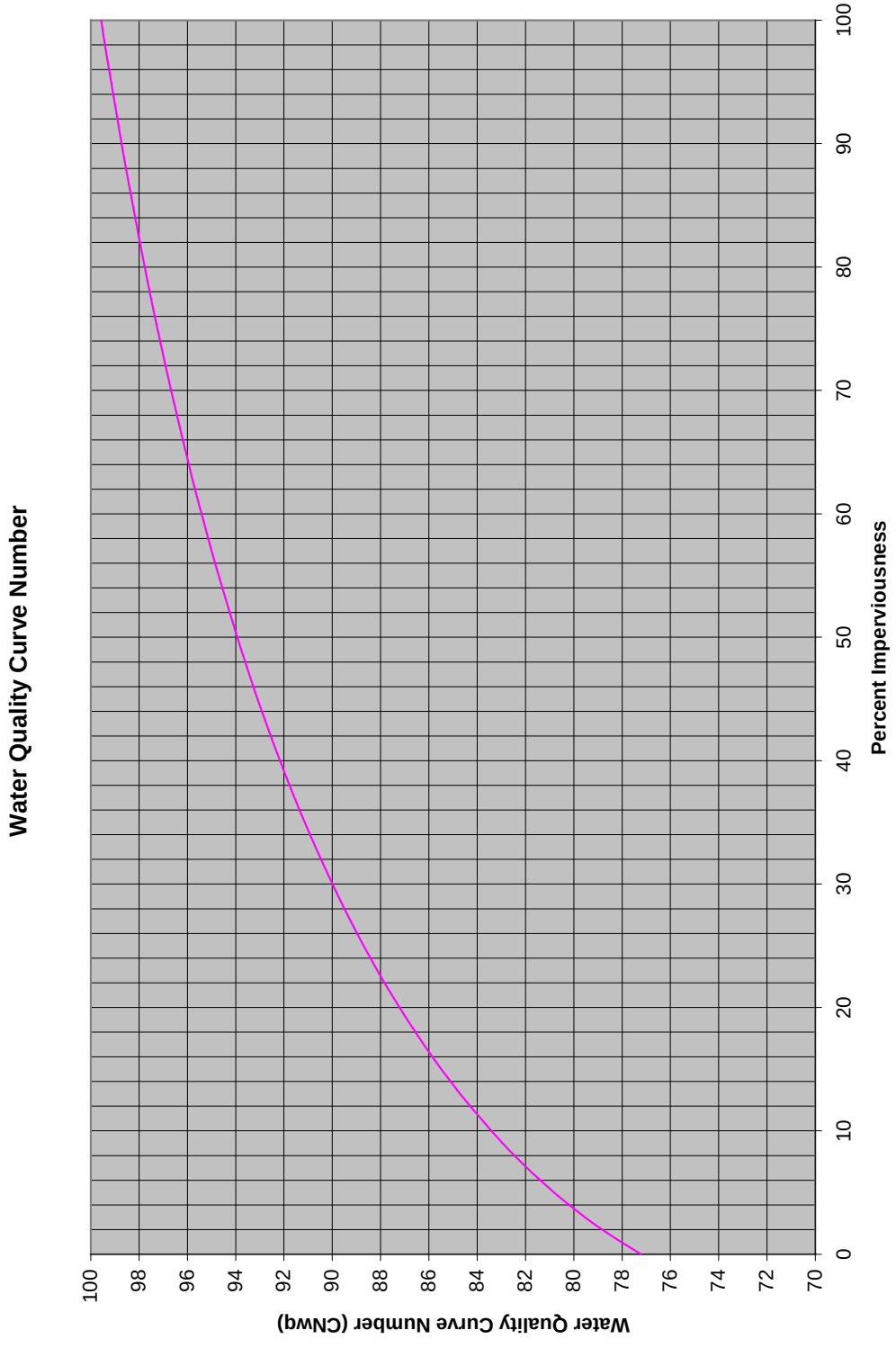
Figure 10-1
Curve Number Calculation for Water Quality Storm Event



Chapter Eleven

MISCELLANEOUS REQUIREMENTS

A. Grading and Building Pad Elevations

Maximum yard slopes are 3:1 where soil has been disturbed during construction processes. Finished floor elevation must be no less than 6 inches above finished grade and a minimum of 15 inches above an adjacent road elevation unless a written variance is granted by the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator].

For all structures located in the Special Flood Hazards Area (SFHA) as shown on the FEMA maps, the lowest floor elevations of all residential, commercial, or industrial buildings shall be such that Lowest Floor elevation, including basement, shall be at the flood protection grade and therefore have 2 feet of freeboard above the 100-year flood elevation.

The Lowest Adjacent Grade for residential, commercial, or industrial buildings outside a FEMA or IDNR designated floodplain (including buildings adjacent to any stream/ditch, waterway, lake, or detention/retention pond, overflow drainage paths, and depressional area that generally stores more than 0.75 acre-feet) shall have two feet of freeboard (1 foot for the 100-year overflow path as the storm drains are assumed plugged as an additional safety factor) above the flooding source's 100-year flood elevation under proposed conditions. In case of a conflict between estimated 1% chance (100-year) floodplain elevation of various flooding sources affecting asite, the most restrictive shall apply.

It shall be the property owners' responsibility to maintain the natural features on their lots and to take preventive measures against any and all erosion and/or deterioration of natural or manmade features on their lots.

B. Acceptable Outlet and Adjoining Property Impact Policies

Design and construction of the stormwater facility shall provide for the discharge of the stormwater runoff from off-site land areas as well as the stormwater from the area being developed (on-site land areas) to an acceptable outlet(s) (as determined by the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator]) having capacity to receive upstream (off-site) and on-site drainage. The flow path from the development outfall(s) to a [Jurisdiction Entity-owned/maintained Drain, if any] or natural watercourse (as determined by the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator]) shall be provided on an exhibit that includes topographic information. Any existing field tile encountered during the construction shall also be incorporated into

the proposed stormwater drainage system or tied to an acceptable outlet. In addition, no activities conducted as part of the development shall be allowed to obstruct the free flow of flood waters from an upstream property.

Where the outfall from the stormwater drainage system of any development flows through real estate owned by others prior to reaching a regulated drain or watercourse, no approval shall be granted for such drainage system until all owners of real estate crossed by the outfall consent in writing to the use of their real estate through a recorded easement that will be shown on the recorded plat.

If an adequate outlet is not located on site, then off-site drainage improvements may be required. Those improvements may include, but are not limited to, extending storm sewers, clearing, dredging and/or removal of obstructions to open drains or natural water courses, and the removal or replacement of undersized culvert pipes as required by the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator].

C. No Net Loss Floodplain Storage Policy

Floodplains exist adjacent to all natural and man-made streams, regardless of contributing drainage area or whether they have been previously identified or mapped. Due to potential impacts of floodplain loss on peak flows in streams and on the environment, disturbance to floodplains should be avoided. When the avoidance of floodplain disturbance is not practical, the natural functions of floodplain should be preserved to the extent possible.

In an attempt to strike a balance between the legitimate need for economic development within [Jurisdiction Entity] and the need to preserve the natural functions of floodplains to the extent possible, compensatory excavation equivalent to the **floodplain storage lost** shall be required for all activities within floodplain of streams located in [Jurisdiction Entity] where drainage area of the stream is equal or larger than one square mile. This requirement shall be considered supplementary to the minimum requirements provided in the applicable flood hazard areas ordinance currently in effect in [Jurisdiction Entity]. The [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator] may alter the compensation ratio, based on extenuating circumstances, for a specific project.

General Requirements

Note that by definition, compensatory storage is the replacement of the existing floodplain and, in rare exceptions, the floodway storage lost due to fill. Compensatory storage is required when a portion of the floodplain is filled, occupied by a structure, or when as a result of a project a change in the channel hydraulics occurs that reduces the existing available floodplain storage.

Compensatory storage must:

- Equal at least 1 times the volume of flood storage lost below the 10-year and 100-year flood elevations;

- Be operational prior to placement of fill, structures, or other materials temporarily or permanently placed in the regulatory floodplain;
- Be provided in the immediate vicinity of the flood storage lost, where practicable;
- Be provided in addition to the site retention/detention volume; and
- Drain freely and openly to the waterway.

Compensatory storage is also required to be provided incrementally such that:

- All regulatory floodplain storage lost below the existing regulatory 10-year flood elevation shall be compensated for below the proposed regulatory 10-year flood elevation; and
- All regulatory floodplain storage lost above the existing regulatory 10-year flood elevation shall be compensated for above the proposed regulatory 10-year flood elevation.

Note that compensatory storage is required for activities in the regulatory floodplain. There is no threshold to compensatory storage; any volume of fill requires compensatory storage be provided. However, the compensatory storage requirement does not apply to specific activities in the regulatory floodplain, such as the floodproofing of an existing building, where the floodproofing measures such as berms or floodwalls are within 10 feet of the building, or crossing improvements, where artificially created storage is lost due to a reduction in head loss.

Computing Compensatory Storage

Computations must show 1 times compensation for floodplain storage volume lost for 10-year and 100-year storm events. Storage lost between the existing ground and the existing 10-year flood elevation must be compensated by providing 1 times the amount lost and be placed between the existing ground elevation and the proposed 10-year floodplain elevation. Storage lost between the existing 10-year and the existing 100-year elevation must be compensated by providing 1 times the amount lost and be placed between the proposed 10-year and proposed 100-year.

When preparing a grading plan, thought should be given to how compensatory storage will be quantified. The most common methodology is the use of cross sections and the

"average end area method". The following requirements should be followed when preparing cross sections:

1. Prepare a detailed topographic survey tied to North American Vertical Datum of 1988 and the local Survey Control Network benchmarks.

2. Locate cross sections parallel to each other and perpendicular to a reference line, often times a property line or fence line. Cross sections used in a hydraulic model are always perpendicular to flood flows, and not always parallel to each other. Therefore, these are often not suitable for computing flood fringe compensatory storage volumes.

3. Plot cross sections at a standard engineering scale so as to allow the reviewer to verify areas. Horizontal scale should be a maximum of 1"=50' and vertical scale should be a maximum of 1"=5', or as approved by the County.

4. Show existing grades, proposed grades, existing and proposed 10-year flood elevations, existing and proposed 100-year flood elevations, normal water level, a reference line, and floodway limits on the cross sections on the plans.

5. Locate cross sections no more than 150 feet apart, with a minimum of three cross sections per cut/fill area, or as necessary to accurately quantify cuts and fills.

6. Locate cross sections to pick up critical features such as berms, ditches, and existing and proposed structures.

7. Each cross section should be numbered or lettered and referenced on the plans.

This information is then utilized to compute the areas of cut and fill. A sample grading plan, a typical cross section, and associated compensatory storage calculations for the 10-year flood are provided below on **Figures 11-1** and **11-2**, and **Table 1**, respectively.

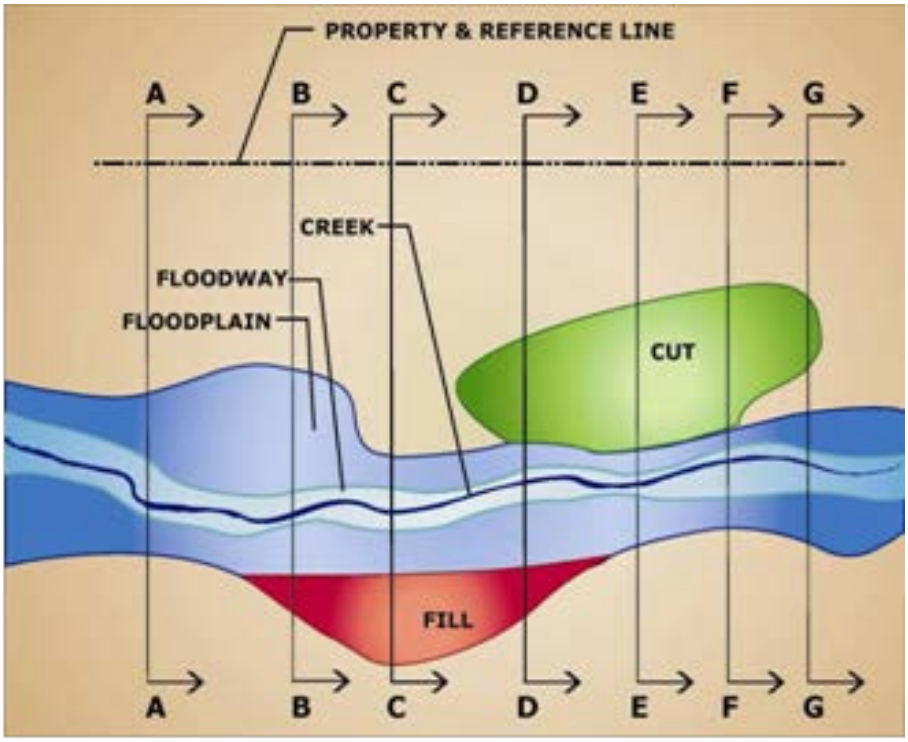
Volume of Fill between cross sections are calculated by finding the average fill cross sectional area and multiplying it by the distance between the two cross sections. For example, the fill volume between cross sections A and B is calculated as follows:

Average Fill Area = (Fill Area "A" + Fill Area "B")/2 = (0 ft^2 +100 ft^2)/2 = 50 ft^2
Volume of Fill = (Average Fill Area) × (Distance) = (50 ft^2) × (150 ft) = 7,500 ft^3

Once the total volume of fill placed, for this example, between the 0-and 10-yr flood elevations is determined, the total required compensatory storage can be calculated and compared against the total compensatory storage volume provided by the design as shown in the table. For this example:

Required Compensatory Storage = (1) × (Total Volume of Fill) = (1) × (36,250 ft^3)
= 36,250 ft^3

Figure 11-1 - Example Compensatory Storage Grading Plan



* Not to Scale & Topography not shown for clarity.

Figure 11-2 – Example Cross Section D-D

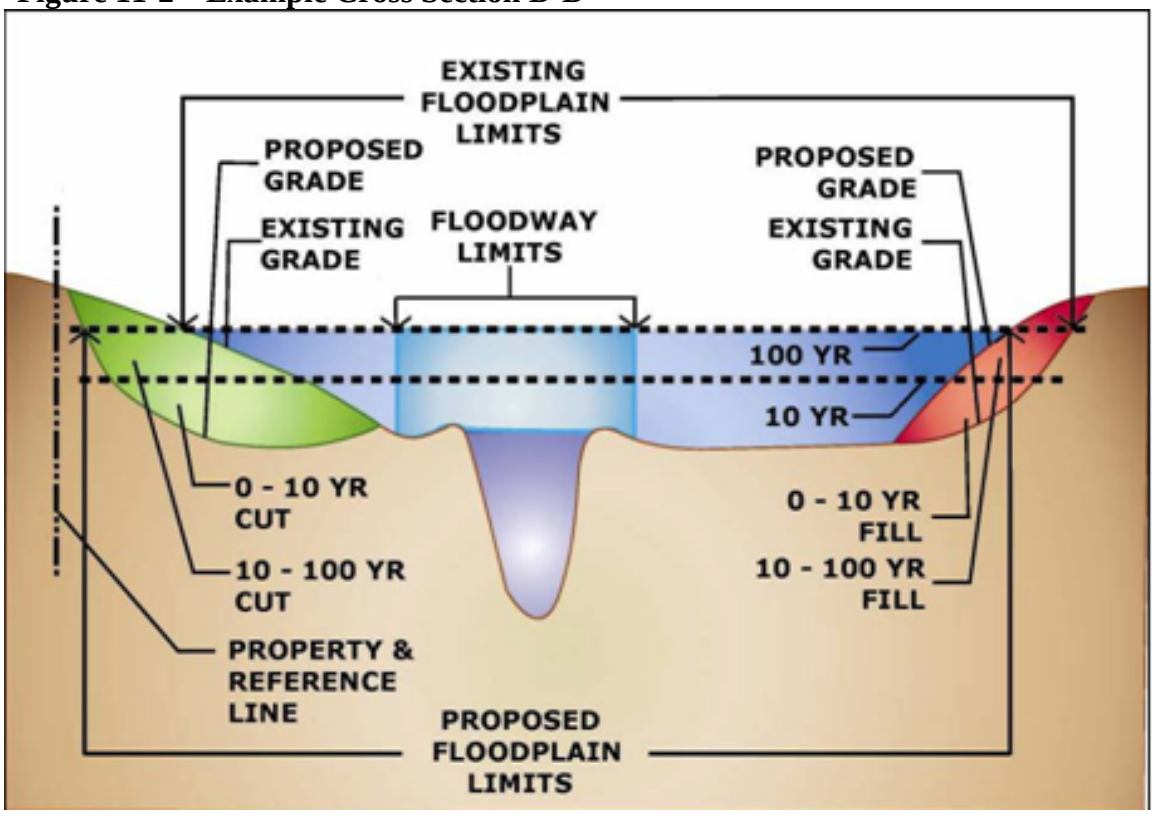


Table 1 - Example Compensatory Storage Calculations for 0-10 year event

Cross Section	Distance Between Sections (ft.)	Fill Area (sq. ft.)	Average Fill Area (sq. ft.)	Volume of Fill (cu. Ft.)	Cut Area (sq. ft.)	Average Cut (sq. ft.)	Volume of Cut (cu. Ft.)
A		0			0		
	150		50	7,500		0	
B		100			0		
	90		125	11,250		20	1,800
C		150			40		
	100		125	12,500		65	6,500
D		100			90		
	100		50	5,000		100	10,000
E		0			110		
	100		0	0		120	12,000
F		0			130		
	85		0	0		85	7,225
G		0			40		
Total Fill				**36,250**	Total Cut		**37,525**

Since the total amount of cut provided (37,525 ft^3 as shown in the table) is larger than that required (36,250 ft^3), the design meets the compensatory storage requirement for the 10-year flood. An additional table and calculation should be completed for the 100-year flood elevation in a similar manner to determine whether the design meets the compensatory storage requirement for the 100-year flood.

Location of Compensatory Storage

Compensatory storage must be located on-site and adjacent to or opposite the areas filled or occupied by a structure. In those rare instances when compensatory storage cannot be located adjacent to or opposite to the areas filled or occupied, engineering computations demonstrating that hydraulically equivalent compensatory storage has been provided is required. These computations must show that no increase in flood flows or flood depths will result as a result of the location of the proposed compensatory storage.

Compensatory storage must be constructed to drain freely and openly to watercourses. In some rare cases it may be necessary to install pipes to construct and/or operate a compensatory storage basin. This may occur when site constraints, such as a roadway or sidewalk, separate the waterway from the compensatory storage area. This is illustrated in the top half of **Figure 10-3**.

Another scenario may occur when a site cannot meet the incremental storage requirements discussed in this document. If incremental storage requirements from the 10-year to 100-year elevations cannot be met, pipes could be installed with a flap gate to prevent the water from entering from the stream bed at lower elevations. The berm could then be set at the elevation of the 10-year flood elevation, thus allowing the storage to only become effective above the 10-year flood elevation. This is illustrated in the bottom half of the illustration in Figure 10-3.

The use of pipes in compensatory storage will require approval by the County. If approved, two pipes will be required to reduce the risk of clogging. Pipes must be a minimum of 15 inches in diameter so as to allow water to enter and exit freely with a minimum head differential. If the compensatory storage is proposed to be combined with detention, it must be demonstrated the compensatory storage and detention do not interfere with one another.

APPENDIX A

ABBREVIATIONS AND DEFINITIONS

APPENDIX A

ABBREVIATIONS AND DEFINITIONS

ABBREVIATIONS

BFE	Base Flood Elevation
BMP	Best Management Practice
CFS	Cubic Feet Per Second
CLOMR	Conditional Letter of Map Revision (from FEMA)
CLOMR-F	Conditional Letter of Map Revision Based on Fill (from FEMA)
CN	Curve Number
COE	United States Army Corps of Engineers
CSMP	Comprehensive Stormwater Management Program
CSO	Combined Sewer Overflow
CWA	Clean Water Act
ERM	Elevation Reference Mark
E&SC	Erosion and Sediment Control
EPA	Environmental Protection Agency
ETJ	Extraterritorial Jurisdiction
FBFM	Flood Boundary and Floodway Map
FEMA	Federal Emergency Management Agency
FHBM	Flood Hazard Boundary Map
FIRM	Flood Insurance Rate Map
FIS	Flood Insurance Study
FPG	Flood Protection Grade
FPS	Feet Per Second
GIS	Geographical Information System
GPS	Global Positioning System
HGL	Hydraulic Grade Line

HHW	Household Hazardous Waste
HUC	Hydrologic Unit Code
IDEM	Indiana Department of Environmental Management
IDNR	Indiana Department of Natural Resources
INDOT	Indiana Department of Transportation.
LAG	Lowest Adjacent Grade
LOMA	Letter of Map Amendment (from FEMA)
LOMR	Letter of Map Revision (from FEMA)
LOMR-F	Letter of Map Revision Based on Fill (from FEMA)
MCM	Minimum Control Measure
MS4	Municipal Separate Storm Sewer System
NAVD	North American Vertical Datum of 1988
NFIP	National Flood Insurance Program
NGVD 1929	National Geodetic Vertical Datum of 1929
NRCS	USDA-Natural Resources Conservation Service
NPDES	National Pollution Discharge Elimination System
NPS	Non-point source
POTW	Publicly Owned Treatment Works
SFHA	Special Flood Hazard Area
SWCD	Soil and Water Conservation District
SWPPP	Stormwater Pollution Prevention Plan
SWQMP	Stormwater Quality Management Plan
Tc	Time of Concentration
TMDL	Total Maximum Daily Load
USCS	Unified Soil Classification System
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service

DEFINITIONS

Acre-Foot (AF). A measure of water volume equal to the inundation of a flat one-acre area to a dept of one foot (43,560 cubic feet).

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

Agricultural land disturbing activity. Tillage, planting, cultivation, or harvesting operations for the production of agricultural or nursery vegetative crops. The term also includes pasture renovation and establishment, the construction of agricultural conservation practices, and the installation and maintenance of agricultural drainage tile. For purposes of this rule, the term does not include land disturbing activities for the construction of agricultural related facilities, such as barns, buildings to house livestock, roads associated with infrastructure, agricultural waste lagoons and facilities, lakes and ponds, wetlands; and other infrastructure.

Agricultural land use conservation practices. Use of land for the production of animal or plant life, including forestry, pasturing or yarding of livestock, and planting, growing, cultivating, and harvesting crops for human or livestock consumption. Practices that are constructed on agricultural land for the purposes of controlling soil erosion and sedimentation. These practices include grass waterways, sediment basins, terraces, and grade stabilization structures.

Amortization Period. The length of time used to repay a debt or mortgage or to depreciate an initial cost.

Antecedent Runoff Condition. The index of runoff potential before a storm event. The index, developed by the Soil Conservation Service (SCS), is an attempt to account for the variation of the SCS runoff curve number (CN) from storm to storm.

Backflow Preventer. Device that allows liquids to flow in only one direction in a pipe. Backflow preventers are used on sewer pipes to prevent a reverse flow during flooding situations.

Backwater. The rise in water surface elevation caused by some obstruction such as a narrow bridge opening, buildings or fill material that limits the area through which the water shall flow.

Base Flood Elevation. The water surface elevation corresponding to a flood having a one percent probability of being equaled or exceeded in a given year.

Base Flood. See "Regulatory Flood".

Base Flow. Stream discharge derived from groundwater sources as differentiated from surface runoff. Sometimes considered to include flows from regulated lakes or reservoirs.

Basement. A building story that is all or partly underground but having at least one-half of its height below the average level of the adjoining ground. A basement shall not be counted as a story for the purpose of height regulations.

Benchmark. A marked point of known elevation from which other elevations may be established.

Best Management Practices. Design, construction, and maintenance practices and criteria for stormwater facilities that minimize the impact of stormwater runoff rates and volumes, prevent erosion, and capture pollutants.

Buffer Strip. An existing, variable width strip of vegetated land intended to protect water quality and habitat.

Building. See “structure”.

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.

Catch Basin. A chamber usually built at the curb line of a street for the admission of surface water to a storm drain or subdrain, having at its base a sediment sump designed to retain grit and detritus below the point of overflow.

Centerline of Channel. The thalweg of a channel.

Channel Improvement. Alteration, maintenance, or reconstruction of the channel area for the purpose of improving the channel capacity or overall drainage efficiency. The noted "improvement" does not necessarily imply water quality or habitat improvement within the channel or its adjacent area.

Channel Modification. Alteration of a channel by changing the physical dimensions or materials of its bed or banks. Channel modification includes damming, rip-rapping or other armoring, widening, deepening, straightening, relocating, lining, and significant removal of bottom or woody vegetation. Channel modification does not include the clearing of dead or dying vegetation, debris, or trash from the channel. Channelization is a severe form of channel modification typically involving relocation of the existing channel (e.g., straightening).

Channel Stabilization. Protecting the sides and bed of a channel from erosion by controlling flow velocities and flow directions using jetties, drops, or other structures and/or by fining the channel with vegetation, riprap, concrete, or other suitable lining material.

Channel. A portion of 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.

Class V injection well. A type of well, which typically has a depth greater than its largest surface dimension, emplaces fluids into the subsurface, and does not meet the definitions of Class I through Class IV wells as defined under 40 CFR 146.5. While the term includes the specific examples described in 40 CFR 144.81, septic systems that serve more than one (1) single-family dwelling or provide service for non-domestic waste, dug wells, bored wells, improved sinkholes, french drains, infiltration sumps, and infiltration galleries, it does not include surface impoundments, trenches, or ditches that are wider than they are deep.

Closed Conduit. A pipe, tube, or tile used for transmitting water.

Combined Sewer Overflow. A system designed and used to receive and transport combined sewage so that during dry periods the wastewater is carried to a treatment facility. During storm events, the excess water is discharged directly into a river, stream, or lake without treatment.

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

Compost. Organic residue (or a mixture of organic residue and soil) that has undergone biological decomposition until it has become relatively stable humus.

Comprehensive Stormwater Management Program. A comprehensive stormwater program for effective management of stormwater quantity and quality throughout the community.

Constructed Wetland. A manmade shallow pool that creates growing conditions suitable for wetland vegetation and is designed to maximize pollutant removal.

Construction activity. Land disturbing activities, and land disturbing activities associated with the construction of infrastructure and structures. This term does not include routine ditch or road maintenance or minor landscaping projects.

Construction plan. A representation of a project site and all activities associated with the project. The plan includes the location of the project site, buildings and other infrastructure, grading activities, schedules for implementation and other pertinent information related to the project site. A storm water pollution prevention plan is a part of the construction plan.

Construction site access. A stabilized stone surface at all points of ingress or egress to a project site, for the purpose of capturing and detaining sediment carried by tires of vehicles or other equipment entering or exiting the project site.

Contiguous. Adjoining or in actual contact with.

Contour Line. Line on a map which represents a contour or points of equal elevation.

Contour. An imaginary line on the surface of the earth connecting points of the same elevation.

Contractor or subcontractor. An individual or company hired by the project site or individual lot owner, their agent, or the individual lot operator to perform services on the project site.

Control Structure. A structure designed to control the rate of flow that passes through the structure, given a specific upstream and downstream water surface elevation.

Conveyance. Any structural method for transferring stormwater between at least two points. The term includes piping, ditches, swales, curbs, gutters, catch basins, channels, storm drains, and roadways.

Convolution. The process of translating precipitation excess into a runoff hydrograph.

Crawl Space. Low space below first floor of a house where there has not been excavation deep enough for a basement, usually less than seven (7) feet in depth, but where there is access for pipes, ducts, utilities and similar equipment.

Critical Duration Analysis. The process of testing different rainfall durations to find that "critical duration", which produces the highest peak runoff or the highest storage volume.

Cross-Section. A graph or plot of ground elevation across a stream valley or a portion of it, usually along a line perpendicular to the stream or direction of flow.

Crown of Pipe. The elevation of top of pipe.

Cubic Feet Per Second (CFS). Used to describe the amount of flow passing a given point in a stream channel. One cubic foot per second is equivalent to approximately 7.5 gallons per second.

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

Curve Number (CN). The Soil Conservation Service index that represents the combined hydrologic effect of soil, land use, land cover, hydrologic condition and antecedent runoff condition.

Dam. A barrier to confine or impound water for storage or diversion, to prevent gully erosion, or to retain soil, sediment, or other debris.

Damage. Measurable rise in flood heights on buildings currently subject to flooding, flooding of buildings currently not subject to flooding and increases in volume or velocity to the point where the rate of land lost to erosion and scour is substantially increased.

Datum. Any level surface to which elevations are referred, usually Mean Sea Level.

Dechlorinated swimming pool discharge. Chlorinated water that has either sat idle for seven (7) days following chlorination prior to discharge to the MS4 conveyance, or, by analysis, does not contain detectable concentrations (less than five-hundredths (0.05) milligram per liter) of chlorinated residual.

Depressional Storage Areas. Non-riverine depressions in the earth where stormwater collects. The volumes are often referred to in units of acre-feet.

Design Storm. A selected storm event, described in terms of the probability of occurring once within a given number of years, for which drainage or flood control improvements are designed and built.

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 Facility. A facility designed to detain a specified amount of stormwater runoff assuming a specified release rate. The volumes are often referred to in units of acre-feet.

Detention Storage. The temporary detaining of stormwater in storage facilities, on rooftops, in streets, parking lots, school yards, parks, open spaces or other areas under predetermined and controlled conditions, with the rate of release regulated by appropriately installed devices.

Detention Time. The theoretical time required to displace the contents of a tank or unit at a given rate of discharge (volume divided by rate of discharge).

Detention. Managing stormwater runoff by temporary holding and controlled release.

Detritus. Dead or decaying organic matter; generally contributed to stormwater as fallen leaves and sticks or as dead aquatic organisms.

Developer. Any person financially responsible for construction activity, or an owner of property who sells or leases, or offers for sale or lease, any lots in a subdivision.

Development. Any man-made change to improved or unimproved real estate including but not limited to:

1. Construction, reconstruction, or placement of a building or any addition to a building;
2. Construction of flood control structures such as levees, dikes, dams or channel improvements;
3. Construction or reconstruction of bridges or culverts;
4. Installing a manufactured home on a site, preparing a site for a manufactured home, or installing a recreational vehicle on a site for more than hundred eight (180) days;
5. Installing utilities, erection of walls, construction of roads, or similar projects;
6. Mining, dredging, filling, grading, excavation, or drilling operations;
7. Storage of materials; or

8. Any other activity that might change the direction, height, or velocity of flood or surface waters.

"Development" does not include activities such as the maintenance of existing buildings and facilities such as painting, re-roofing, resurfacing roads, or gardening, plowing and similar agricultural practices that do not involve filling, grading, excavation, or the construction of permanent buildings.

Direct Release. A method of stormwater management where runoff from a part or the entire development is released directly to the receiving stream without providing detention.

Discharge. Usually the rate of water flow. A volume of fluid passing a point per unit time commonly expressed as cubic feet per second, cubic meters per second, gallons per minute, or millions of gallons per day.

Disposal. The discharge, deposit, injection, spilling, leaking, or placing of any solid waste or hazardous waste into or on any land or water so that the solid waste or hazardous waste, or any constituent of the waste, may enter the environment, be emitted into the air, or be discharged into any waters, including groundwater.

Ditch. A man-made, open drainageway in or into which excess surface water or groundwater drained from land, stormwater runoff, or floodwaters flow either continuously or intermittently.

Drain. A buried slotted or perforated pipe or other conduit (subsurface drain) or a ditch (open drain) for carrying off surplus groundwater or surface water.

Drainage. The removal of excess surface water or groundwater from land by means of ditches or subsurface drains. Also see Natural drainage.

Drainage Area. The area draining into a stream at a given point. It may be of different sizes for surface runoff, subsurface flow and base flow, but generally the surface runoff area is considered as the drainage area.

Drainage Classification (soil). As a natural condition of the soil, drainage refers to both the frequency and duration of periods when the soil is free of saturation. Soil drainage conditions are defined as:

- *Well-drained*--Excess water drains away rapidly, and no mottling occurs within 36 in. of the surface.
- *Moderately well drained*--Water is removed from the soil somewhat slowly resulting in small but significant periods of wetness, and mottling occurs between 18 and 36 in.
- *Poorly drained*--Water is removed so slowly that it is wet for a large part of the time, and mottling occurs between 0 and 8 in.
- *Somewhat poorly drained*--Water is removed from the soil slowly enough to keep it wet for significant periods but not all of the time, and mottling occurs between 8 to 18 in.
- *Very poorly drained*--Water is removed so slowly that the water table remains at or near the surface for the greater part of the time; there may also be periods of surface ponding; the soil has a black to gray surface layer with mottles up to the surface.

Drainage Facility. Infrastructure constructed or installed for conveyamnce and/or storage of stormwater or floodwater.

Drop Manhole. 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 Well. A type of infiltration practice that allows stormwater runoff to flow directly into the ground via a bored or otherwise excavated opening in the ground surface.

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.

Earth Embankment. A man-made deposit of soil, rock, or other material often used to form an impoundment.

Elevation Certificate. A form published by the Federal Emergency Management Agency that is used to certify the 100-year or base flood elevation and the lowest elevation of usable space to which a building has been constructed.

Elevation Reference Mark (ERM). Elevation benchmark tied to the National Geodetic Vertical Datum of 1929 and identified during the preparation of a Flood Insurance Study prepared for the Federal Emergency Management Agency.

Emergency Spillway. Usually a vegetated earth channel used to safely convey flood discharges around an impoundment structure.

Energy Dissipater. A device to reduce the energy of flowing water.

Environment. The sum total of all the external conditions that may act upon a living organism or community to influence its development or existence.

Erodibility Index (EI). The soil erodibility index (EI) provides a numerical expression of the potential for a soil to erode considering the physical and chemical properties of the soil and the climatic conditions where it is located. The higher the index, the greater the investment needed to maintain the sustainability of the soil resource base if intensively cropped. It is defined to be the maximum of (RxKxLS)/T (from the Universal Soil Loss Equation) and (CxI)/T (from the Wind Erosion Equation), where R is a measure of rainfall and runoff, K is a factor of the susceptibility of the soil to water erosion, LS is a measure of the combined effects of slope length and steepness, C is a climatic characterization of windspeed and surface soil moisture and I is a measure of the susceptibility of the soil to wind erosion. Erodibility Index scores equal to or greater than 8 are considered highly erodible land.

Erosion and sediment control measure. A practice, or a combination of practices, to control erosion and resulting sedimentation and/or off-site damages.

Erosion and sediment control system. The use of appropriate erosion and sediment control measures to minimize sedimentation by first reducing or eliminating erosion at the source and then as necessary, trapping sediment to prevent it from being discharged from or within a project site.

Erosion control plan. A written description and site plan of pertinent information concerning erosion control measures designed to meet the requirements of the Ordinance.

Erosion. The wearing away of the land surface by water, wind, ice, gravity, or other geological agents. The following terms are used to describe different types of water erosion:

- *Accelerated erosion*--Erosion much more rapid than normal or geologic erosion, primarily as a result of the activities of man.

- *Channel erosion* --An erosion process whereby the volume and velocity of flow wears away the bed and/or banks of a well-defined channel.

- *Gully erosion* --An erosion process whereby runoff water accumulates in narrow channels and, over relatively short periods, removes the soil to considerable depths, ranging from 1-2 ft. to as much as 75-100 ft.

- *Rill erosion*--An erosion process in which numerous small channels only several inches deep are formed; occurs mainly on recently disturbed and exposed soils (see Rill).

- *Splash erosion*--The spattering of small soil particles caused by the impact of raindrops on wet soils; the loosened and spattered particles may or may not be subsequently removed by surface runoff.

- *Sheet erosion*--The gradual removal of a fairly uniform layer of soil from the land surface by runoff water.

Extraterritorial Jurisdiction (ETJ). Areas located outside the corporate limits of a community over which the community has statutory development authority.

Farm or Field Tile. A pipe installed in an agricultural area to allow subsurface drainage of farmland for the purpose of agricultural production.

FEMA. The Federal Emergency Management Agency.

Fill Material. Any material used for primary purpose of replacing a wetland area with dry land or of changing the bottom elevation of a wetland or a waterbody. This definition shall be considered to be automatically amended to conform with the definition of fill material established from time to time by the United States of America or United States Army Corps of Engineers.

Filter Strip. Usually a long, relatively narrow area (usually, 20-75 feet wide) of undisturbed or planted vegetation used near disturbed or impervious surfaces to filter stormwater pollutants for the protection of watercourses, reservoirs, or adjacent properties.

Final stabilization. The establishment of permanent vegetative cover or the application of a permanent nonerosive material to areas where all land disturbing activities have been completed and no additional land disturbing activities are planned under the current permit.

Floatable. Any solid waste that will float on the surface of the water.

Flood (or Flood Waters). A general and temporary condition of partial or complete inundation of normally dry land areas from the overflow, the unusual and rapid accumulation, or the runoff of surface waters from any source.

Flood Boundary and Floodway Map (FBFM). A map prepared by the Federal Emergency Management Agency the depicts the FEMA designated floodways within a community. This map also includes delineation of the 100-year and 500-year floodplain boundaries and the location of the Flood Insurance Study cross-sections.

Flood Crest. The maximum stage or elevation reached or expected to be reached by the waters of a specific flood at a given time.

Flood Duration. The length of time a stream is above flood stage or overflowing its banks.

Flood Easement. Easement granted to identify areas inundated by the 100-year flood and prohibit or severely restrict development activities.

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

Flood Fighting. Actions taken immediately before or during a flood to protect human life and to reduce flood damages such as evacuation, emergency sandbagging and diking.

Flood Forecasting. The process of predicting the occurrence, magnitude and duration of an imminent flood through meteorological and hydrological observations and analysis.

Flood Frequency. A statistical expression of the average time period between floods equaling or exceeding a given magnitude. For example, a 100-year flood has a magnitude expected to be equaled or exceeded on the average of once every hundred years; such a flood has a one-percent chance of being equaled or exceeded in any given year. Often used interchangeably with "recurrence interval".

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

Flood Hazard Boundary Map (FHBM). A map prepared by the Federal Emergency Management Agency that depicts Special Flood Hazard Areas as a Zone A within a community. There are no study text, base flood elevations, or floodways associated with this map.

Flood Insurance Rate Map (FIRM). A map prepared by the Federal Emergency Management Agency that depicts Special Flood Hazard Areas within a community. This map also includes the 100-year or Base Flood Elevation at various locations along the watercourses. More recent versions of the FIMR may also show the FEMA designated floodway boundaries and the location of the Flood Insurance Study cross-sections.

Flood Insurance Study (FIS). A study prepared by the Federal Emergency Management agency to assist a community participating in the National Flood Insurance Program in its application of the program regulations. The study consists of a text which contains community background information with respect to flooding, a floodway data table, summary of flood discharges, flood profiles, a Flood Insurance Rate Map, and a Flood Boundary and Floodway Map.

Flood Profile. A graph showing the relationship of water surface elevation to a specific location, the latter generally expressed as distance above the mouth of a stream of water flowing in a channel. It is generally drawn to show surface elevation for the crest or a specific magnitude of flooding, but may be prepared for conditions at any given time or stage.

Flood Protection Grade (FPG). The elevation of the lowest floor of a building, including the basement, which shall be two feet above the elevation of the regulatory flood.

Flood Resistant Construction (Flood Proofing). Additions, changes or adjustments to structures or property that are designed to reduce or eliminate the potential for flood damage.

Flood Storage Areas. Depressions, basins, or other areas that normally stand empty or partially empty, but fill with rainfall runoff during storms to hold the runoff and reduce downstream flow rates. The volumes are often referred to in units or acre-feet.

Floodplain Management. The operation of a program of corrective and preventive measures for reducing flood damage, including but not limited to flood control projects, floodplain land use regulations, flood proofing of buildings, and emergency preparedness plans.

Floodplain Regulations. General term applied to the full range of codes, ordinances and other regulations relating to the use of land and construction within floodplain limits. The term

encompasses zoning ordinances, subdivision regulations, building and housing codes, encroachment laws and open area (space) regulations.

Floodplain. The channel proper and the areas adjoining the channel which have been or hereafter may be covered by the regulatory or 100-year flood. Any normally dry land area that is susceptible to being inundated by water from any natural source. The floodplain includes both the floodway and the floodway fringe districts.

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

Floodway. The channel of a river or stream and those portions of the floodplains adjoining the channel which are reasonably required to efficiently carry and discharge the peak flow of the regulatory flood of any river or stream.

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

Forebay (or Sediment Forebay). A small pond placed in front of a larger retention/detention structure such as a wet pond, dry pond, or wetland to intercept and concentrate a majority of sediment that is coming into the system before it reaches the larger structure.

Freeboard. An increment of height added to the base flood elevation to provide a factor of safety for uncertainties in calculations, unknown local conditions, wave actions and unpredictable effects such as those caused by ice or debris jams. (See Flood Protection Grade).

French Drain. A drainage trench backfilled with a coarse, water-transmitting material; may contain a perforated pipe.

Gabion. An erosion control structure consisting of a wire cage or cages filled with rocks.

Garbage. All putrescible animal solid, vegetable solid, and semisolid wastes resulting from the processing, handling, preparation, cooking, serving, or consumption of food or food materials.

Geographical Information System. A computer system capable of assembling, storing, manipulation, and displaying geographically referenced information. This technology can be used for resource management and development planning.

Geotextile Fabric. A woven or non-woven, water-permeable synthetic material used to trap sediment particles, prevent the clogging of aggregates with fine grained soil particles, or as a separator under road aggregate.

Geotextile Liner. A synthetic, impermeable fabric used to seal impoundments against leaks.

Global Positioning System. A system that provides specially coded satellite signals that is processed by a receiver, which determines position, velocity, and time. The system is funded and controlled by the U.S. Department of Defense.

Grade. (1) 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. (2) The finished surface of a canal bed, roadbed, top of embankment, or bottom of excavation; any surface prepared to a design elevation for the support of construction, such as paving or the laying of a conduit. (3) To finish the surface of a canal bed, roadbed, top of embankment, or bottom of excavation, or other land area to a smooth, even condition.

Grading. The cutting and filling of the land surface to a desired slope or elevation.

Grass. A member of the botanical family Graminae, characterized by blade-like leaves that originate as a sheath wrapped around the stem.

Grassed swale. A type of vegetative practice used to filter stormwater runoff via a vegetated, shallow-channel conveyance.

Grassed Waterway. A natural or constructed waterway, usually broad and shallow, covered with erosion-resistant grasses and used to conduct surface water from an area.

Ground Cover (horticulture). Low-growing, spreading plants useful for low-maintenance landscape areas.

Groundwater Recharge. The infiltration of water into the earth. It may increase the total amount of water stored underground or only replenish supplies depleted through pumping or natural discharge.

Groundwater. Accumulation of underground water, natural or artificial. The term does not include manmade underground storage or conveyance structures.

Habitat. The environment in which the life needs of a plant or animal are supplied.

Hard Surface. See "Impervious Surface."

High Water. Maximum designed permitted, or regulated water level for an impoundment.

Highly Erodible Land (HEL). Land that has an erodibility index of eight or more.

Household Hazardous Waste. Solid waste generated by households that is ignitable, toxic, reactive, corrosive, or otherwise poses a threat to human health or the environment.

Hydraulic Grade Line (HGL). For Channel flow, the HGL is equal to the water surface whereas for pressure flow it is the piezometric surface.

Hydraulics. A branch of science that deals with the practical application of the mechanics of water movement. A typical hydraulic study is undertaken to calculate water surface elevations.

Hydrodynamic Loads. Forces imposed on structures by floodwaters due to the impact of moving water on the upstream side of the structure, drag along its sides, and eddies or negative pressures on its downstream side.

Hydrograph. For a given point on a stream, drainage basin, or a lake, a graph showing either the discharge, stage (depth), velocity, or volume of water with respect to time.

Hydrologic Unit Code. A numeric United States Geologic Survey code that corresponds to a watershed area. Each area also has a text description associated with the numeric code.

Hydrology. The science of the behavior of water in the atmosphere, on the surface of the earth, and underground. A typical hydrologic study is undertaken to compute flow rates associated with specified flood events.

Hydrometeorologic. Water-related meteorological data such as rainfall or runoff.

Hydrostatic Loads. Those loads or pressures resulting from the static mass of water at any point of floodwater contact with a structure. They are equal in all direction and always act perpendicular to the surface on which they are applied. Hydrostatic loads can act vertically on

structural members such as floors, decks and roofs, and can act laterally on upright structural members such as walls, piers, and foundations.

IDNR. Indiana Department of Natural Resources.

Illicit Discharge. Any discharge to a conveyance that is not composed entirely of stormwater except naturally occurring floatables, such as leaves or tree limbs.

Impact Areas. Areas defined or mapped that 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.

Impaired Waters. Waters that do not or are not expected to meet applicable water quality standards, as included on IDEM's CWA Section 303(d) List of Impaired Waters.

Impervious surface. Surfaces, such as pavement and rooftops, which prevent the infiltration of stormwater into the soil.

Individual building lot. A single parcel of land within a multi-parcel development.

Individual lot operator. A contractor or subcontractor working on an individual lot.

Individual lot owner. A person who has financial control of construction activities for an individual lot.

INDOT. Indiana Department of Transportation. Generally used here to refer to specifications contained in the publication "INDOT Standard Specifications."

Infiltration practices. Any structural BMP designed to facilitate the percolation of run-off through the soil to ground water. Examples include infiltration basins or trenches, dry wells, and porous pavement.

Infiltration. Passage or movement of water into the soil. Infiltration practices include any structural BMP designed to facilitate the percolation of run-off through the soil to groundwater. Examples include infiltration basins or trenches, dry wells, and porous pavement.

Infiltration Swales. A depressed earthen area that is designed to promote infiltration.

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

Invert. The inside bottom of a culvert or other conduit.

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.

Land Surveyor. A person licensed under the laws of the State of Indiana to practice land surveying.

Land-disturbing Activity. Any man-made change of the land surface, including removing vegetative cover that exposes the underlying soil, excavating, filling, transporting and grading.

Larger common plan of development or sale. A plan, undertaken by a single project site owner or a group of project site owners acting in concert, to offer lots for sale or lease; where such land is contiguous, or is known, designated, purchased or advertised as a common unit or by a common name, such land shall be presumed as being offered for sale or lease as part of a

larger common plan. The term also includes phased or other construction activity by a single entity for its own use.

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

Life Cycle Cost. Cost based on the total cost incurred over the system life including research, development, testing, production, construction, operation, and maintenance. Costs are normally determined on present worth or equivalent annual cost basis.

Low Entry Elevation. The elevation in a structure where overbank flooding can enter the structure.

Lowest Adjacent Grade. The elevation of the lowest grade adjacent (abutting) to a structure, where the soil meets the foundation around the outside of the structure (including structural members such as basement walkout, patios, decks, porches, support posts or piers, and rim of the window well.

Lowest Floor. Refers to the lowest of the following:

1. The top of the basement floor;

2. The top of the garage floor, if the garage is the lowest level of the building;

3. The top of the first floor of buildings constructed on a slab or of buildings elevated on pilings or constructed on a crawl space with permanent openings; or

4. The top of the floor level of any enclosure below an elevated building where the walls of the enclosure provide any resistance to the flow of flood waters unless:

    a] The walls are designed to automatically equalize the hydrostatic flood forces on the walls by allowing for the entry and exit of flood waters, by providing a minimum of two opening (in addition to doorways and windows) having a total area of one (1) square foot for every two (2) square feet of enclosed area subject to flooding. The bottom of all such openings shall be no higher than one (1) foot above grade.

    b] Such enclosed space shall be usable only for the parking of vehicles or building access.

Major Drainage System. Drainage system carrying runoff from an area of one or more square miles.

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

Manning Roughness Coefficient or Manning's "n" Value. A dimensionless coefficient ("n") used in the Manning's equation to account for channel wall frictional losses in steady uniform flow.

Measurable storm event. A precipitation event that results in a total measured precipitation accumulation equal to, or greater than, one-half (0.5) inch of rainfall.

Minimum Control Measure. Minimum measures required by the NPDES Phase II program. The six (6) MCMs are: Public education and outreach, Public participation and involvement, Illicit discharge detection and elimination, Construction site runoff control, Post-construction runoff control, and Pollution prevention and good housekeeping.

Minor Drainage Systems. Drainage system carrying runoff from an area of less than one square mile.

Minor Subdivision. See Subdivision, Minor.

Mulch. A natural or artificial layer of plant residue or other materials covering the land surface which conserves moisture, holds soil in place, aids in establishing plant cover, and minimizes temperature fluctuations.

Multi-Family. Any structure which contains three or more dwelling units. A dwelling unit is any structure, or part of a structure, which is constructed to a house a family.

Municipal Separate Storm Sewer System. An MS4 meets all the following criteria: (1) is a conveyance or system of conveyances owned by the state, county, city, town, or other public entity; (2) discharges to waters of the U.S.; (3) is designed or used for collecting or conveying stormwater; (4) is not a combined sewer; and, (5) is not part of a Publicly Owned Treatment Works (POTW).

Municipal, state, federal, or institutional refueling area. An operating gasoline or diesel fueling area whose primary function is to provide fuel to either municipal, state, federal, or institutional equipment or vehicles.

Mutual Drain. A drain that: (1) Is located on two or more tracts of land that are under different ownership; (2) was established by the mutual consent of all the owners; and (3) was not established under or made subject to any drainage statute.

National Flood Insurance Program (NFIP). The NFIP is a Federal program enabling property owners to purchase flood insurance. The Federal Emergency Management Agency administers the NFIP in communities throughout the Unites States. The NFIP is based on an agreement between local communities and the Federal government which states that if a community will implement floodplain management measures to reduce future flood risks to new construction and substantially improved structures in flood hazard areas, the Federal government will make flood insurance available within the community as a financial protection against flood losses that do occur.

National Geodetic Vertical Datum of 1929. The nationwide, Federal Elevation datum used to reference topographic elevations to a known value.

National Pollution Discharge Elimination System (NPDES). A permit developed by the U.S. EPA through the Clean Water Act. In Indiana, the permitting process has been delegated to IDEM. This permit covers aspects of municipal stormwater quality.

Natural Drainage. The flow patterns of stormwater run-off over the land in its pre-development state.

Nonagricultural land use. Commercial use of land for the manufacturing and wholesale or retail sale of goods or services, residential or institutional use of land intended primarily to shelter people, highway use of land including lanes, alleys, and streets, and other land uses not included in agricultural land use.

Nonpoint Source Pollution. Pollution that enters a water body from diffuse origins on the watershed and does not result from discernable, confined, or discrete conveyances.

Normal Depth. Depth of flow in an open conduit during uniform flow for the given conditions.

North American Vertical Datum of 1988 (NAVD 1988). The nationwide, Federal Elevation datum used to reference topographic elevations to a known value.

Nutrient(s). (1) A substance necessary for the growth and reproduction of organisms. (2) In water, those substances (chiefly nitrates and phosphates) that promote growth of algae and bacteria.

Off-site. Everything not located at or within a particular site.

Off-site Land Areas. Those areas that by virtue of existing topography naturally shed surface water onto or through the developing property.

100-Year Frequency Flood. See "regulatory flood".

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

Open Drain. A natural watercourse or constructed open channel that conveys drainage water.

Open Space. Any land area devoid of any disturbed or impervious surfaces created by industrial, commercial, residential, agricultural, or other manmade activities.

Orifice. A device which controls the rate of flow from a detention basin.

Outfall scouring. The deterioration of a streambed or pondbed from an outfall discharge to an extent that the excessive settling of solid material results and suitable aquatic habitat is diminished.

Outfall. The point, location, or structure where a pipe or open drain discharges to a receiving body of water.

Outlet. The point of water disposal from a stream, river, lake, tidewater, or artificial drain.

Overland Flow. Consists of sheet flow, shallow concentrated flow and channel flow.

Peak Discharge (or Peak Flow). The maximum instantaneous flow from a given storm condition at a specific location.

Percolation. The movement of water through soil.

Perennial Stream. A stream that maintains water in its channel throughout the year.

Permanent stabilization. The establishment, at a uniform density of seventy percent (70%) across the disturbed area, of vegetative cover or permanent non-erosive material that will ensure the resistance of the soil to erosion, sliding, or other movement.

Permeability (soil). The quality of a soil that enables water or air to move through it. Usually expressed in inches per hour or inches per day.

Pervious. Allowing movement of water.

Pesticides. Chemical compounds used for the control of undesirable plants, animals, or insects. The term includes insecticides, herbicides, algicides, rodenticides, nematicides, fungicides, and growth regulators.

pH. A numerical measure of hydrogen ion activity, the neutral point being 7.0. All pH values below 7.0 are acid, and all above 7.0 are alkaline.

Phasing of construction. Sequential development of smaller portions of a large project site, stabilizing each portion before beginning land disturbance on subsequent portions, to minimize exposure of disturbed land to erosion.

Phosphorus (available). Inorganic phosphorus that is readily available for plant growth.

Piping. The formation of "pipes" by underground erosion. Water in the soil carries the fine soil particles away, and a series of eroded tubes or tunnels develop. These openings will grow progressively larger and can cause a dam failure.

Planimetric Data. Horizontal measurements involving distances or dimensions on a diagram, map, Plat of Survey or topographic map. Normally in units of feet.

Plat of Survey. A scaled diagram showing boundaries of a tract of land or subdivision. This may constitute a legal description of the land and be used in lieu of a written description.

Point Source. Any discernible, confined, and discrete conveyance including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, or container from which pollutants are or maybe discharged (P.L. 92-500, Section 502[14]).

Pollutant of concern. Any pollutant that has been documented via analytical data as a cause of impairment in any waterbody.

Porosity. The volume of pore space in soil or rock.

Porous pavement. A type of infiltration practice to improve the quality and reduce the quantity of storm water run-off via the use of manmade, pervious pavement which allows run-off to percolate through the pavement and into underlying soils

Private Drain. A drain that: (1) Is located on land owned by one person or by two or more persons jointly; and (2) was not established under or made subject to any drainage statute.

Professional Engineer. A person licensed under the laws of the State of Indiana to practice professional engineering.

Programmatic Indicator. Any data collected by an MS4 entity that is used to indicate implementation of one (1) or more minimum control measures.

Project site owner. The person required to submit a stormwater permit application, and the Notice of Intent (NOI) letter, and required to comply with the terms of the ordinance, including a developer or a person who has financial and operational control of construction activities, and project plans and specifications, including the ability to make modifications to those plans and specifications.

Project site. The entire area on which construction activity is to be performed.

Probable Maximum Flood. The most severe flood that may be expected from a combination of the most critical meteorological and hydrological conditions that are reasonably possible in the drainage basin. It is used in designing high-risk flood protection works and siting of structures and facilities that shall be subject to almost no risk of flooding. The probable maximum flood is usually much larger that the 100-year flood.

Publicly Owned Treatment Works (POTW). A municipal operation that breaks down and removes contaminants in the wastewater prior to discharging to a stream through primary and/or secondary treatment systems.

Qualified professional. An individual who is trained and experienced in storm water treatment techniques and related fields as may be demonstrated by state registration, professional certification, experience, or completion of coursework that enable the individual to make sound, professional judgments regarding storm water control or treatment and monitoring, pollutant fate and transport, and drainage planning.

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

Rain garden. A vegetative practice used to alter impervious surfaces, such as roofs, into pervious surfaces for absorption and treatment of rainfall.

Rainfall Intensity. The rate at which rain is falling at any given instant, usually expressed in inches per hour.

Reach. Any length of river, channel or storm drain.

Receiving Stream, Receiving Channel, or Receiving Water. The body of water into which runoff or effluent is discharged. The term does not include private drains, unnamed conveyances, retention and detention basins, or constructed wetlands used as treatment.

Recharge. Replenishment of groundwater reservoirs by infiltration and transmission from the outcrop of an aquifer or from permeable soils.

Recurrence Interval. A statistical expression of the average time between floods equaling or exceeding a given magnitude.

Redevelopment. Alterations of a property that change a site or building in such a way that there are disturbances of one (1) acre or more of land. The term does not include such activities as exterior remodeling.

Refueling area: An operating gasoline or diesel fueling area whose primary function isto provide fuel to equipment or vehicle.

Regional Pond. A detention/retention basin sized to detain/retain the runoff from the entire watershed, on-site and off-site, tributary to the pond's outlet.

Regional Pond. A detention/retention basin sized to detain/retain the runoff from the entire watershed, on-site and off-site, tributary to the pond's outlet.

Regulated Area. The following areas within [Jurisdiction Entity]:

1. All territory of the [Jurisdiction Entity] except for a territory of a municipality located within the [Jurisdiction Entity] unless the municipality has entered into an agreement to adopt the [Jurisdiction Entity] Stormwater Management Ordinance.

2. All areas, within a municipality, that directly drain to a [Jurisdiction Entity-owned/maintained Drain, if any].

Regulated Drain. A drain subject to the provisions of the Indiana Drainage Code, I.C.-36-9-27.

Regulatory or 100-Year Flood. The discharge or elevation associated with the 100-year flood as calculated by a method and procedure which is acceptable to and approved by the Indiana Department of Natural Resources and the Federal Emergency Management Agency. The "regulatory flood" is also known as the "base flood".

Regulatory Floodway. See Floodway.

Release Rate - The amount of storm water release from a storm water control facility per unit of time.

Reservoir. A natural or artificially created pond, lake or other space used for storage, regulation or control of water. May be either permanent or temporary. The term is also used in the hydrologic modeling of storage facilities.

Retail gasoline outlet. An operating gasoline or diesel fueling facility whose primary function is the resale of fuels. The term applies to facilities that create five thousand (5,000) or more square feet of impervious surfaces, or generate an average daily traffic count of one hundred (100) vehicles per one thousand (1,000) square feet of land area.

Retention basin. A type of storage practice, that has no positive outlet, used to retain storm water run-off for an indefinite amount of time. Runoff from this type of basin is removed only by infiltration through a porous bottom or by evaporation.

Retention. The storage of stormwater to prevent it from leaving the development site. May be temporary or permanent.

Retention Facility. A facility designed to completely retain a specified amount of stormwater runoff without release except by means of evaporation, infiltration or pumping. The volumes are often referred to in units of acre-feet.

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 any one year.

Revetment. Facing of stone or other material, either permanent or temporary, placed along the edge of a stream to stabilize the bank and protect it from the erosive action of the stream. Also see Revetment riprap.

Right-of-Way for a County Drain. The statutory right of way as defined by Indiana Code for a regulated drain.

Riparian habitat. A land area adjacent to a waterbody that supports animal and plant life associated with that waterbody.

Riparian zone. Of, on, or pertaining to the banks of a stream, river, or pond.

Riprap. Broken rock, cobble, or boulders placed on earth surfaces, such as the face of a dam or the bank of a stream, for protection against the action of water (waves). Revetment riprap is material graded such that: (1) no individual piece weighs more than 120 lbs. and (2) 90-100% will pass through a 12-inch sieve, 20-60% through a 6-inch sieve, and not more than 10% through a 12-inch sieve.

River Restoration. Restoring the channel of a stream or ditch to its perceived original, non-obstructed capacity by means of clearing & snagging, obstruction removal, and inexpensive streambank protection measures. The term "restoration", as noted, does not necessarily imply restoration or improvement of water quality or habitat within the channel or its adjacent area.

Riverine. Relating to, formed by, or resembling a stream (including creeks and rivers).

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

Runoff. That portion of precipitation that flows from a drainage area on the land surface, in open channels, or in stormwater conveyance systems.

Sand. (1) Soil particles between 0.05 and 2.0 mm in diameter. (2) A soil textural class inclusive of all soils that are at least 70% sand and 15% or less clay.

Sanitary Backup. The condition where a sanitary sewer reaches capacity and surcharges into the lowest area.

Scour. The clearing and digging action of flowing water.

Sediment. Solid material (both mineral and organic) that is in suspension, is being transported, or has been moved from its site of origin by air, water, gravity, or ice and has come to rest on the earth's surface.

Sediment Forebay. See "Forebay".

Sedimentation. The process that deposits soils, debris and other unconsolidated materials either on the ground surfaces or in bodies of water or watercourses.

Seepage. The passage of water or other fluid through a porous medium, such as the passage of water through an earth embankment or masonry wall.

Sensitive Areas. Any area that includes highly erodible soils, wetlands, threatened or endangered species habitat, outstanding waters, impaired waters, recreational waters, and surface drinking water sources.

Sensitive Water. A water body in need of priority protection or remediation base on meeting one of the following characteristics:

- providing habitat for threatened or endangered species,
- usage as a public water supply intake,
- relevant community value,
- usage for full body contact recreation,
- exceptional use classification as found in 327 IAC 2-1-11(b), outstanding state resource water classification as found in 327 IAC 2-1-2(3) and 327 IAC 2-1.5-19(b).
- outstanding state resource water classification as found in 327 IAC 2-1-2(3) and 327 IAC 2-1.5-19(b).

Settling Basin. An enlargement in the channel of a stream to permit the settling of debris carried in suspension.

Silt Fence. A fence constructed of wood or steel supports and either natural (e.g. burlap) or synthetic fabric stretched across area of non-concentrated flow during site development to trap and retain on-site sediment due to rainfall runoff.

Silt. (1) Soil fraction consisting of particles between 0.002 and 0.05 mm in diameter. (2) A soil textural class indicating more than 80% silt.

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.

Site. The entire area included in the legal description of the land on which land disturbing activity is to be performed.

Slope. Degree of deviation of a surface from the horizontal, measured as a numerical ratio or percent. Expressed as a ratio, the first number is commonly the horizontal distance (run) and the second is the vertical distance (rise)--e.g., 2:1. However, the preferred method for designation of slopes is to clearly identify the horizontal (H) and vertical (V) components (length (L) and Width

(W) components for horizontal angles). Also note that according to international standards (Metric), the slopes are presented as the vertical or width component shown on the numerator--e.g., 1V:2H. Slope expressions in the Ordinance follow the common presentation of slopes--e.g., 2:1 with the metric presentation shown in parenthesis--e.g., (1V:2H). Slopes can also be expressed in "percents". Slopes given in percents are always expressed as (100*V/H) --e.g., a 2:1 (1V:2H) slope is a 50% slope.

Soil and Water Conservation District. A public organization created under state law as a special-purpose district to develop and carry out a program of soil, water, and related resource conservation, use, and development within its boundaries. A subdivision of state government with a local governing body, established under IC 14-32.

Soil. The unconsolidated mineral and organic material on the immediate surface of the earth that serves as a natural medium for the growth of land plants.

Solid Waste. Any garbage, refuse, debris, or other discarded material.

Special Flood Hazard Area. An area that is inundated during the 100-Year flood.

Spill. The unexpected, unintended, abnormal, or unapproved dumping, leakage, drainage, seepage, discharge, or other loss of petroleum, hazardous substances, extremely hazardous substances, or objectionable substances. The term does not include releases to impervious surfaces when the substance does not migrate off the surface or penetrate the surface and enter the soil.

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

Standard Project Flood. A term used by the U.S. Army Corps of Engineers to designate a flood that may be expected from the most severe combination of meteorological and hydrological conditions that are considered reasonable characteristics of the geographical area in which the drainage basin is located, excluding extremely rare combinations. The peak flow for a standard project flood is generally 40 – 60 percent of the probable maximum flood for the same location.

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

Storage practices. Any structural BMP intended to store or detain stormwater and slowly release it to receiving waters or drainage systems. The term includes detention and retention basins.

Storm drain signing. Any marking procedure that identifies a storm sewer inlet as draining directly to a receiving waterbody so as to avoid dumping pollutants. The procedures can include painted or cast messages and adhesive decals.

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

Storm Event. An estimate of the expected amount of precipitation within a given period of time. For example, a 10-yr. frequency, 24-hr. duration storm event is a storm that has a 10% probability of occurring in any one year. Precipitation is measured over a 24-hr. period.

Storm Frequency. The time interval between major storms of predetermined intensity and volumes of runoff--e.g., a 5-yr., 10-yr. or 20-yr. storm.

Storm Sewer. A closed conduit for conveying collected storm water, while excluding sewage and industrial wastes. Also called a storm drain. For the purpose of this document, an underdrain, agricultural tile drain, or on-site residential conduits installed to convey sump drains, downspouts, etc. are not considered a storm sewer.

Stormwater 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, storage facilities, swales, streams, culverts, streets and pumping stations.

Stormwater Facility. All ditches, channels, conduits, levees, ponds, natural and manmade impoundments, wetlands, tiles, swales, sewers and other natural or artificial means of draining surface and subsurface water from land.

Stormwater Pollution Prevention Plan. A plan developed to minimize the impact of storm water pollutants resulting from construction activities.

Stormwater Quality Management Plan. A comprehensive written document that addresses stormwater runoff quality.

Stormwater Quality Measure. A practice, or a combination of practices, to control or minimize pollutants associated with storm water runoff.

Stormwater runoff. The water derived from rains falling within a tributary basin, flowing over the surface of the ground or collected in channels or conduits.

Stormwater. Water resulting from rain, melting or melted snow, hail, or sleet.

Stream Gauging. The quantitative determination of streamflow using gauges, current meters, weirs, or other measuring instruments at selected locations (see Gauging station').

Stream Length. The length of a stream or ditch, expressed in miles, from the confluence of the stream or ditch with the receiving stream to the upstream extremity of the stream or ditch, as indicated by the solid or dashed, blue or purple line depicting the stream or ditch on the most current edition of the seven and one-half (72) minute topographic quadrangle map published by the United States Geological Survey, measured along the meanders of the stream or ditch as depicted on the map.

Stream. See lntermittent stream, Perennial stream, Receiving stream.

Streambanks. The usual boundaries (not the flood boundaries) of a stream channel. Right and left banks are named facing downstream.

Strip development. A multi-lot project where building lots front on an existing road.

Structure. Refers to a structure that is principally above ground and is enclosed by walls and a roof. The term includes but is not limited to, a gas or liquid storage tank, a manufactured home or a prefabricated building, and recreational vehicles to be installed on a site for more than 180 days.

Structural Engineer. A person licensed under the laws of the State of Indiana to engage in the designing or supervising of construction, enlargement or alteration of structures or any part thereof.

Structural Floodplain. Management Measures. Those physical or engineering measures employed to modify the way foods behave, (e.g., dams, dikes, levees, channel enlargements and diversions).

Subarea/Subbasin. Portion of a watershed divided into homogenous drainage units which can be modeled for purposes of determining runoff rates. The subareas/subbasins have distinct boundaries, as defined by the topography of the area.

Subdivision. Any land that is divided or proposed to be divided into lots, whether contiguous or subject to zoning requirements, for the purpose of sale or lease as part of a larger common plan of development or sale.

Subdivision, Minor. The subdivision of a parent parcel into any combination of not more than three (3) contiguous or non-contiguous new residential, commercial, or industrial building sites. The parcel shall front upon an existing street which is an improved right-of-way maintained by eh County or other governmental entity and not involve any new street.

Subsoil. The B horizons of soils with distinct profiles. In soils with weak profile development, the subsoil can be defined as the soil below which roots do not normally grow.

Subsurface Drain. A pervious backfield trench, usually containing stone and perforated pipe, for intercepting groundwater or seepage.

Subwatershed. A watershed subdivision of unspecified size that forms a convenient natural unit. See also Subarea.

Sump Failure. A failure of the sump pump that results in inundation of crawl space or basement.

Sump Pump. A pump that discharges seepage from foundation footing drains.

Surcharge. Backup of water in a sanitary or storm sewer system in excess of the design capacity of the system.

Surface Runoff. Precipitation that flows onto the surfaces of roofs, streets, the ground, etc., and is not absorbed or retained by that surface but collects and runs off.

Suspended Solids. Solids either floating or suspended in water.

Swale. An elongated depression in the land surface that is at least seasonally wet, is usually heavily vegetated, and is normally without flowing water. Swales conduct stormwater (typically a maximum of 4 cfs) into primary drainage channels and may provide some groundwater recharge or may include underdrain to keep them dry.

Tailwater. The water surface elevation at the downstream side of a hydraulic structure (i.e. culvert, bridge, weir, dam, etc.).

Temporary Stabilization. The covering of soil to ensure its resistance to erosion, sliding, or other movement. The term includes vegetative cover, anchored mulch, or other non-erosive material applied at a uniform density of seventy percent (70%) across the disturbed area.

Thalweg. The deepest point (or centerline) of a channel.

Tile Drain. Pipe made of perforated plastic, burned clay, concrete, or similar material, laid to a designed grade and depth, to collect and carry excess water from the soil.

Tile Drainage. Land drainage by means of a series of tile lines laid at a specified depth, grade, and spacing.

Time of Concentration (tc). The travel time of a particle of water from the most hydraulically remote point in the contributing area to the point under study. This can be considered the sum of an overland flow time and times of travel in street gutters, storm sewers, drainage channels, and all other drainage ways.

Topographic Map. Graphical portrayal of the topographic features of a land area, showing both the horizontal distances between the features and their elevations above a given datum.

Topography. The representation of a portion of the earth's surface showing natural and man-made features of a given locality such as rivers, streams, ditches, lakes, roads, buildings and most importantly, variations in ground elevations for the terrain of the area.

Topsoil. (1) The dark-colored surface layer, or a horizon, of a soil; when present it ranges in depth from a fraction of an inch to 2-3 ft. (2) Equivalent to the plow layer of cultivated soils. (3) Commonly used to refer to the surface layer(s), enriched in organic matter and having textural and structural characteristics favorable for plant growth.

Total Maximum Daily Load. Method used to establish allowable loadings for specified pollutants in a surface water resource to meet established water quality standards.

Toxicity. The characteristic of being poisonous or harmful to plant or animal life. The relative degree or severity of this characteristic.

TP-40 Rainfall. Design storm rainfall depth data for various durations published by the National Weather Service in their Technical Paper 40 dated 1961.

Trained individual. An individual who is trained and experienced in the principles of storm water quality, including erosion and sediment control as may be demonstrated by state registration, professional certification, experience, or completion of coursework that enable the individual to make judgments regarding storm water control or treatment and monitoring.

Transition Section. Reaches of the stream of floodway where water flows from a narrow cross-section to a wide cross-section or vice-versa.

Tributary. Based on the size of the contributing drainage area, a smaller watercourse which flows into a larger watercourse.

Turbidity. (1) Cloudiness of a liquid, caused by suspended solids. (2) A measure of the suspended solids in a liquid.

Underdrain. A small diameter perforated pipe that allows the bottom of a detention basin, channel or swale to drain.

Unified Soil Classification System. A system of classifying soils that is based on their identification according to particle size, gradation, plasticity index, and liquid limit.

Uniform Flow. A state of steady flow when the mean velocity and cross-sectional area remain constant in all sections of a reach.

Unit Hydrograph. A unit hydrograph is the hydrograph that results from one inch of precipitation excess generated uniformly over the watershed at a uniform rate during a specified period of time.

Urban Drain. A drain defined as “Urban Drain” in Indiana Drainage Code.

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.

Vegetated swale. A type of vegetative practice used to filter stormwater runoff via a vegetated, shallow-channel conveyance.

Vegetative practices. Any nonstructural or structural BMP that, with optimal design and good soil conditions, utilizes various forms of vegetation to enhance pollutant removal, maintain and

improve natural site hydrology, promote healthier habitats, and increase aesthetic appeal. Examples include grass swales, filter strips, buffer strips, constructed wetlands, and rain gardens.

Vegetative Stabilization. Protection of erodible or sediment producing areas with: permanent seeding (producing long-term vegetative cover), short-term seeding (producing temporary vegetative cover), or sodding (producing areas covered with a turf of perennial sod-forming grass).

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

Water Quality. A term used to describe the chemical, physical, and biological characteristics of water, usually in respect to its suitability for a particular purpose.

Water Resources. The supply of groundwater and surface water in a given area.

Water Table. (1) The free surface of the groundwater. (2) That surface subject to atmospheric pressure under the ground, generally rising and failing with the season or from other conditions such as water withdrawal.

Waterbody. Any accumulation of water, surface, or underground, natural or artificial, excluding water features designed as water pollution control facilities.

Watercourse. Any river, stream, creek, brook, branch, natural or man-made drainageway in or into which stormwater runoff or floodwaters flow either continuously or intermittently.

Watershed Area. All land and water within the confines of a drainage divide. See also Watershed.

Watershed. The region drained by or contributing water to a specific point that could be along a stream, lake or other stormwater facilities. Watersheds are often broken down into subareas for the purpose of hydrologic modeling.

Waterway. A naturally existing or manmade open conduit or channel utilized for the conveyance of water.

Weir. A channel-spanning structure for measuring or regulating the flow of water.

Wellhead protection area. Has the meaning set forth at 327 IAC 8-4.1-1(27).

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.

Wetlands. Areas that are inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas. This definition shall be considered to be automatically amended to conform with the definition of a wetlands established from time to time by the United States of America or United States Army Corps of Engineers.

APPENDIX B

APPLICATIONS, FORMS AND MISCELLANEOUS SHEETS REQUIRED TO COMPLY WITH THE [JURISDICTION ENTITY] STORMWATER MANAGEMENT ORDINANCE

B1 – Conceptual Drainage Plan Review Forms
Conceptual Drainage Plan Review Application

B2 – Stormwater Permit Forms
Stormwater Plan Submittal Checklist
Notice of Intent – State Form #47487
Statement of Financial Responsibility
Application for Stormwater Permit

B3 – Construction Inspection/Completion Forms
Construction Site Inspection and Maintenance Evaluation
Certification of Completion & Compliance
Notice of Termination – State Form #51514
Notice of Termination Inspection

B4 – Individual Residential Lot Permit Forms
Instructions for Individual Lot Plot Plan Permit Request
Individual Lot Plot Plan Permit Request Application
Individual Lot Typical Erosion & Sediment Control Plan and Certification

B5 – Post-Construction Maintenance and Inspections Forms
Post-Construction BMP Inspection Checklists

B1 – Conceptual Drainage Plan Review Forms

Conceptual Drainage Plan Review Application/Checklist

[Jurisdiction Entity]
Application for Preliminary Drainage Plan Review/Checklist

Project Name:		
Project Location Description:		
Plan Submittal Date:	Township:	
Section:	Total Acres Involved:	
Project Site Owner:		
Contact Name:		
Address:		
City:	State:	Zip:
Phone:	FAX:	
Plan Preparer Name:		
Affiliation:		
Address:		
City:	State:	Zip:
Phone:	FAX:	

1. Preliminary Drainage Plan Review Fee

Check attached with applicable fees paid (Yes/No)	

2. Letter of Intent Submitted

Letter of Intent for obtaining any needed consents, off-site easements, or right-of-way (Y/N/NA)	

3. Project Narrative and Supporting Documents (place an "X" next to each item submitted)

	Description of the nature and purpose of the project.
	General description of the existing and proposed drainage systems in narrative form.
	General description of regulated drains, farm drains, inlets and outfalls in narrative form, if any of record.
	General description of all existing storm, sanitary, combined sewer, and septic tank systems and outfalls in narrative form.
	Vicinity map depicting the project site location in relation to recognizable local landmarks, towns, and major roads, such as a USGS topographic quadrangle map or county or municipal road map.
	A map showing the location, name, and normal water level of all wetlands, lakes, ponds, and water courses on or adjacent to the project site.
	A map showing one hundred (100) year floodplains, floodway fringes, and floodways. Please note if none exists.
	A map showing watershed boundaries with USGS contours or best information possible.
	A map showing existing watercourse or regulated drains.

4. Conceptual Plans (place an "X" next to this item if submitted)

	Two (2) complete sets of conceptual plans showing general project layout, including existing and proposed drainage systems and proposed outlets (plan sheets must be larger than 11" by 17", but not to exceed 24" by 36").

B2 – Stormwater Permit Forms

Stormwater Plan Submittal Checklist
Notice of Intent – State Form #47487
Statement of Financial Responsibility
Application for Stormwater Permit

[Jurisdiction Entity]
Stormwater Plan Submittal Checklist

The following items must be provided when applying for an [Jurisdiction Entity] Stormwater Permit.

Note: when applying for a Partial Grading Permit, section 3 (Stormwater Pollution Prevention Plan for Construction Sites) need only be submitted. Submit the remaining items at the time of the Full Permit submittal, along with an updated Stormwater Pollution Prevention Plan.

1. Construction Plans

	Construction Plan to include the following information:	
	Title sheet which includes location map, vicinity map, operating authority, design company name, developer name, and index of plan sheets.	
	A copy of a legal boundary survey for the site, performed in accordance with Rule 12 of Title 865 of the Indiana Administrative Code or any applicable and subsequently adopted rule or regulation for the subdivision limits, including all drainage easements and wetlands.	
	A reduced plat or project site map showing the parcel identification numbers, the lot numbers, lot boundaries, easements, and road layout and names. The reduced map must be legible and submitted on a sheet or sheets no larger than eleven (11) inches by seventeen (17) inches for all phases or sections of the project site.	
	An existing project site layout that must include the following information:	
		A general site plan exhibit with the proposed construction area superimposed on the [Jurisdiction Entity] [GIS map (if any)] at a scale of 1"=100'. The exhibit should provide 2-foot contour information and include all roads and buildings within a minimum 500' radius beyond the project boundaries. All on-site elevations shall be given in North American Vertical Datum of 1988 (NAVD). The horizontal datum of topographic map shall be based on Indiana State Plane Coordinates, NAD83. The map will contain a notation indicating the noted datum information.
		Location, name, and normal water level of all wetlands, lakes, ponds, and water courses on or adjacent to the project site.
		Location of all existing structures on the project site.
		One hundred (100) year floodplains, floodway fringes, and floodways. Please note if none exists.
		Identification and delineation of vegetative cover such as grass, weeds, brush, and trees on the project site.
		Location of storm, sanitary, combined sewer, and septic tank systems and outfalls.
		Land use of all adjacent properties.
		Identification and delineation of sensitive areas.
		The location of regulated drains, farm drains, inlets and outfalls, if any of record.
		Location of all existing PLSS corners within the proposed development and a plan to protect and preserve them.
	A grading and drainage plan, including the following information:	
		All information from the existing site layout items listed above
		Location of all proposed site improvements, including roads, utilities, lot delineation and identification, proposed structures, and common areas.
		One hundred (100) year floodplains, floodway fringes, and floodways. Please note if none exists.
		Delineation of all proposed land disturbing activities, including off-site activities that will provide services to the project site.
		Information regarding any off-site borrow, stockpile, or disposal areas that are associated with a project site, and under the control of the project site owner.
		Existing and proposed topographic information at a contour interval appropriate to indicate drainage patterns.
		Location, size, and dimensions of all existing streams to be maintained, and new drainage systems such as culverts, bridges, storm sewers, conveyance channels, and 100-year overflow paths/ponding areas shown as hatched areas, along with the associated easements.
		Pipes and associated structures data, including sizes, lengths, and material
		Location, size, and dimensions of features such as permanent retention or detention facilities, including existing or manmade wetlands, used for the purpose of stormwater management.

		Include existing retention or detention facilities that will be maintained, enlarged, or otherwise altered and new ponds or basins to be built.
		Emergency flood routing path(s) and their invert elevations from detention facilities to the receiving system
		One or more typical cross sections of all existing and proposed channels or other open drainage facilities carried to a point above the 100-year high water and showing the elevation of the existing land and the proposed changes, together with the high water elevations expected from the 100 year storm under the controlled conditions called for by the ordinance, and the relationship of structures, streets, and other facilities
		A drainage summary, which summarizes the basic conditions of the drainage design, including site acreage, off-site/upstream acreage, allowable release rates, post-developed 10-year, and 100-year flows leaving the site, volume of detention required, volume of detention provided, and any release rate restrictions
		Arrows designating the direction of stormwater runoff
		Spot elevations appropriate to define elevations
	Utility plan sheet(s) showing the location of all existing and proposed utility lines for the project, including all available information related to the utilities, such as pipe size and material, and invert elevations	
	Storm sewer plan/profile sheet(s) at a scale of 5 vertical and 50 horizontal showing the elevation, size, length, location of all proposed storm sewers. Existing and proposed ground grades, storm sewer structures elevations, and utility crossings also must be included. The actual correct datum (not an assumed one) must be used for the profile sheets and all pipe inverts, top of casting elevations, casting types, structure numbers, and pipe slopes clearly labeled.	
	A 24-inch by 36-inch plat on the same sheet size used for recording, including the following information:	
		Legal description.
		Cross reference to Rule 12.
		Regulated drain statement and table.
	Proposed subdivision landscape plans	
	A copy of the subdivision covenants	
	Any other information required by the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator] in order to thoroughly evaluate the submitted material.	

2. Stormwater Drainage Technical Report

	A summary report, including the following information:	
		Description of the nature and purpose of the project.
		The significant drainage problems associated with the project.
		The analysis procedure used to evaluate these problems and to propose solutions.
		Any assumptions or special conditions associated with the use of these procedures, especially the hydrologic or hydraulic methods.
		The proposed design of the drainage control system along with storm design and detention design computations.
		The results of the analysis of the proposed drainage control system showing that it does solve the project's drainage problems and that it meets the requirements of the ordinance and these standards. This must include a table summarizing, for each eventual site outlet, the pre-developed acreage tributary to each eventual site outlet, the unit discharge allowable release rate used, the resulting allowable release rate in cfs for the post-developed 10-year and 100-year events, pre-developed 2-year flow rates in cfs as well as pre- and post-developed flow rates for 10- and 100-year events. The worksheet provided in the [Jurisdiction Entity] Stormwater Technical Standards Manual as Table 6-1 should be filled and submitted as part of the report. Any hydrologic or hydraulic calculations or modeling results must be adequately cited and described in the summary description. If hydrologic or hydraulic models are used, the input and output files for all necessary runs must be included in the appendices. A map showing any drainage area subdivisions used in the analysis must accompany the report.
		Soil properties, characteristics, limitations, and hazards associated with the project site and the measures that will be integrated into the project to overcome or minimize adverse soil conditions.
		A narrative and photographic record of the condition of the downstream receiving system
		Identification of any other state or federal water quality permits that are required for construction

		activities associated with the owner's project site.
		Proof of Errors and Omissions Insurance for the registered professional engineer or licensed [Jurisdiction Entity Stormwater Administrator] showing a minimum amount of $1,000,000 in coverage.
	A Hydrologic/Hydraulic Analysis, consistent with the methodologies and calculation included in the [technical standards], and including the following information:	
		A hydraulic report detailing existing and proposed drainage patterns on the subject site. The report should include a description of present land use and proposed land use. Any off-site drainage entering the site should be addressed as well. This report should be comprehensive and detail all of the steps the engineer took during the design process.
		All hydrologic and hydraulic computations must be included in the submittal. These calculations must include, but are not limited to: runoff curve numbers and runoff coefficients, runoff calculations, stage-discharge relationships, times-of-concentration and storage volumes.
		Copies of all computer runs. These computer runs must include both the input and the outputs. Electronic copies of the computer runs with input files will expedite the review process and is required to be submitted.
		A set of exhibits must be included showing the drainage sub-areas and a schematic detailing of how the computer models were set up.
		A conclusion which summarizes the hydraulic design and details how this design satisfies the Ordinance.
3. Stormwater Pollution Prevention Plan for Construction Sites		
	Stormwater Pollution Prevention Plan to include the following:	
	Contours at intervals appropriate to indicate drainage patterns, show the locations of all wetlands, retention or detention facilities, streams, and swales along with arrows designating the direction of stormwater runoff. Provide status of state or federal water quality permits that are required for construction activities associated with the project site.	
	Location, dimensions, detailed specifications, and construction details of all temporary and permanent stormwater erosion and sediment control measures for all sheet flow and concentrated flow areas, along with any runoff control measures (e.g. diversion dikes, rock check dams, slope drains, etc.) that will be utilized.	
	Stable construction entrance locations and specifications (at all points of ingress and egress).	
	Storm sewer inlet/manhole protection measure locations and specifications.	
	Locations and approximate boundaries of all disturbed areas (construction limits).	
	Identification and delineation of vegetative cover such as grass, weeds, brush, and trees on the project site that will not be disturbed or removed during construction.	
	Erosion and sediment control protection measures utilized for all wetlands, lakes, ponds, and water courses on or adjacent to the project site.	
	Provide stormwater outlet protection measures and specifications.	
	Soil map of the predominant soil types, as determined by the United States Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS) Soil Survey, or as determined by a soil scientist. Hydrologic classification for soils should be shown when hydrologic methods requiring soils information are used. A soil legend must be included with the soil map.	
	14-Digit Watershed Hydrologic Unit Code.	
	An estimate of the peak discharge, based on the ten (10) year storm event, of the project site for post-construction conditions.	
	Locations where stormwater may be directly discharged into groundwater, such as abandoned wells or sinkholes. Please note if none exists.	
	Locations of specific points where stormwater discharge will leave the project site.	
	Name of all receiving waters. If the discharge is to a separate municipal storm sewer, identify the name of the municipal operator and the ultimate receiving water.	
	Temporary stabilization plans and sequence of implementation appropriate for each season.	
	Permanent stabilization plans and sequence of implementation.	
	Temporary and permanent stabilization plans shall include the following:	
		Specifications and application rates for soil amendments and seed mixtures.
		The type and application rate for anchored mulch.
	General construction sequence of how the project site will be built, including phases of construction.	

	Construction sequence describing the relationship between implementation of stormwater quality measures and stages of construction activities.
	Location of all soil stockpiles and borrow areas, including any off-site borrow, stockpile, or disposal areas that are associated with the project site. Off-site areas under the control of the project site owner must have erosion and sediment control measures shown.
	A typical erosion and sediment control plan for individual lot development.
	Self-monitoring program including plan and procedures.
	A description of potential pollutant sources associated with the construction activities, which may reasonably be expected to add a significant amount of pollutants to stormwater discharges.
	Material handling and storage associated with construction activity shall meet the spill prevention and spill response requirements in 327 IAC 2-6.1.
	Name, address, telephone number, FAX number (if available), email (if available), and list of qualifications of the trained individual in charge of the mandatory stormwater pollution prevention self-monitoring program for the project site.

4. Post-Construction Storm Water Pollution Prevention Plan

	Post-Construction Plan to include the following:	
	A description of potential pollutant sources from the proposed land use, which may reasonably be expected to add a significant amount of pollutants to stormwater discharges.	
	Location, dimensions, detailed specifications, and construction details of all post-construction stormwater quality measures.	
	A description of measures that will be installed to control pollutants in stormwater discharges that will occur after construction activities have been completed. Such practices include infiltration of run-off, flow reduction by use of open vegetated swales and natural depressions, buffer strip and riparian zone preservation, filter strip creation, minimization of land disturbance and surface imperviousness, maximization of open space, and stormwater retention and detention ponds.	
	A sequence describing when each post-construction stormwater quality measure will be installed.	
	Stormwater quality measures that will remove or minimize pollutants from stormwater run-off.	
	Stormwater quality measures that will be implemented to prevent or minimize adverse impacts to stream and riparian habitat.	
	An operation and maintenance manual for all post-construction stormwater quality measures to facilitate their proper long term function. This operation and maintenance manual shall be made available to future parties who will assume responsibility for the operation and maintenance of the post-construction stormwater quality measures. The manual shall include the following:	
		Contact information for the BMP owner (i.e. name, address, business phone number, cell phone number, pager number, e-mail address, etc.). A statement that the BMP owner is responsible for all costs associated with maintaining the BMP.
		A right-of-entry statement allowing [Jurisdiction Entity] personnel to inspect and maintain the BMP. Specific actions to be taken regarding routine maintenance, remedial maintenance of structural components, and sediment removal. Sediment removal procedures should be explained in both narrative and graphical forms. A tabular schedule should be provided listing all maintenance activities and dates for performing these required maintenance activities.
		Site drawings showing the location of the BMP and access easement, cross sections of BMP features (i.e. pond, forebay(s), structural components, etc.), and the point of discharge for stormwater treated by the BMP. These drawings need to be submitted both in hard copy and in digital format acceptable to the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator].

Rule 5 - Notice of Intent (NOI)

State Form 47487 (R5 / 10-05)
Indiana Department of Environmental Management
Office of Water Quality
Approved by State Board of Accounts, 2005

Type of Submittal (Check Appropriate Box):
☐ Initial ☐ Amendment ☐ Renewal

Permit Number:

(Note: The initial submittal does not require a permit number; the Department will assign a number. A permit number is required when filing an amendment, applying for renewal, or correspondence related to this permit).

Note: Submission of this Notice of Intent letter constitutes notice that the project site owner is applying for coverage under the National Pollutant Discharge Elimination System (NPDES) General Permit Rule for Storm Water Discharges Associated with Construction Activity. Permitted project site owners are required to comply with all terms and conditions of the General Permit Rule 327 IAC 15-5 (Rule 5).

Project Name and Location

Project Name:

County:

Brief Description of Project Location:

Project Location: *Describe location in Latitude and Longitude (Degrees, Minutes, and Seconds or Decimal representation) and by legal description (Section, Township, and Range, Civil Township)*

Latitude:

Longitude:

Quarter _____ Section _____ Township _____ Range _____ Civil Township _____

Does ☐ all or ☐ part of this project lie within the jurisdictional boundaries of a Municipal Separate Storm Sewer System (MS4) as defined in 327 IAC 15-13? ☐ Yes ☐ No If yes, name the MS4(s):

Project Site Owner and Project Contact Information

Company Name *(If Applicable)*:

Project Site Owner's Name *(An Individual)*:

Title/Position:

Address:

City:

State:

ZIP Code:

Phone:

FAX:

E-Mail Address *(If Available)*:

Ownership Status *(check one)*: Governmental Agency: ☐ Federal ☐ State ☐ Local

Non-Governmental: ☐ Public ☐ Private ☐ Other *(Explain)*: _____

Contact Person:

Company Name *(If Applicable)*:

Affiliation to Project Site Owner:

Address *(if different from above)*:

City:

State:

Zip:

Phone:

FAX:

E-Mail Address *(If Available)*:

Project Information

Project Description:

☐ Residential-Single Family ☐ Residential-Multi-Family ☐ Commercial ☐ Industrial ☐ Other: _____

Name of Receiving Water:

(Note: If applicable, name of municipal operator of storm sewer and the ultimate receiving water. If a retention pond is present on the property, the name of the nearest possible receiving water receiving discharge must be provided).

Project Acreage:

Total Acreage: _____ Proposed Land Disturbance: _____ (in acres)

Total Impervious Surface Area (in square feet, estimated for Completed Project): _____

Project Duration:

Estimated Start Date: _____ Estimated End Date for all Land Disturbing Activity: _____

Construction Plan Certification

By signing this Notice of Intent letter, I certify the following:

A. The storm water quality measures included in the Construction Plan comply with the requirements of 327 IAC 15-5-6.5, 327 IAC 15-5-7, and 327 IAC 15-5-7.5;
B. the storm water pollution prevention plan complies with all applicable federal, state, and local storm water requirements;
C. the measures required by section 7 and 7.5 of this rule will be implemented in accordance with the storm water pollution prevention plan;
D. if the projected land disturbance is One (1) acre or more, the applicable Soil and Water Conservation District or other entity designated by the Department, has been sent a copy of the Construction Plan for review;
E. storm water quality measures beyond those specified in the storm water pollution prevention plan will be implemented during the life of the permit if necessary to comply with 327 IAC 15-5-7; and
F. implementation of storm water quality measures will be inspected by trained individuals.

In addition to this form, I have enclosed the following required information:

☐ Verification by the reviewing agency of acceptance of the Construction Plan.

☐ Proof of publication in a newspaper of general circulation in the affected area that notified the public that a construction activity is to commence, including all required elements contained in 327 IAC 15-5-5 (9). The Proof of Publication **Must** include company name and address, project name, address/location of the project, and the receiving stream to which storm water will be discharged. Following is a sample Proof of Publication:

"XERT Development Inc. (10 Willow Lane, Indianapolis, Indiana 46206) is submitting a Notice of Intent to the Indiana Department of Environmental Management of our intent to comply with the requirements of 327 IAC 15-5 to discharge storm water from construction activities associated with Water Garden Estates located at 24 Washout Lane, Indianapolis, Indiana 46206. Runoff from the project site will discharge to the White River. Questions or comments regarding this project should be directed to Walter Water of XERT Development Inc."

☐ $100 check or money order payable to the Indiana Department of Environmental Management. A permit fee is required for all NOI submittals (initial and renewal). A fee is not required for amendments.

Project Site Owner Responsibility Statement

By signing this Notice of Intent letter, I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information or violating the provisions of 327 IAC 15-5, including the possibility of fine and imprisonment for knowing violations.

Printed Name of Project Owner: _____

Signature of Project Owner: _____ Date: _____

This Notice of Intent must be signed by an individual meeting the signatory requirements in 327 IAC 15-4-3(g).
All NOI submittals must include an original signature (FAX and photo copies are not acceptable).

Note: Within 48 hours of the initiation of construction activity, the project site owner must notify the appropriate plan review agency and IDEM, Office of Water Quality of the actual project start date if it varies from the date provided above.

Note: A permit issued under 327 IAC 15-5 is granted by the commissioner for a period of five (5) years from the date coverage commences. Once the five (5) year permit term duration is reached, a general permit issued under this rule will be considered expired, and as necessary for construction activity continuation, a new Notice of Intent letter (Renewal) is required to be submitted ninety (90) days prior to the termination of coverage. The submittal must include the NOI Letter, Proof of Publication, Fee, and verification that the plan for the project was approved (original verification of plan approval is acceptable provided the scope of the project has not changed from the original submittal).

Mail this form to: **Indiana Department of Environmental Management**
Cashiers Office - Mail Code 50-10C
100 North Senate Avenue
Indianapolis., IN 46204-2251

327 IAC 15-5-6 (a) also requires a copy of the completed Notice of Intent letter be submitted to the local Soil and Water Conservation District or other entity designated by the Department, where the land disturbing activity is to occur.

Questions regarding the development or implementation of the Construction Plan/Storm Water Pollution Prevention Plan should be directed to the local county Soil and Water Conservation District (SWCD). If you are unable to reach the SWCD or have other questions please direct those inquiries to the IDEM Rule 5 Coordinator at 317/233-1864 or 800/451-6027 ext.3-1864.
For information and forms visit: http://www.in.gov/idem/water/npdes/permits/wetwthr/storm/rule5.html

Statement of Financial Responsibility

The undersigned of the proposed project to be known as

_____

do hereby agree to take full responsibility of financial payment of review fees incurred on the above project. I am aware that the review fees will begin as soon as primary and/or secondary application is filed and continues until the project is approved and/or withdrawn. I understand that if the project is withdrawn the review fees are still due and payable from the application date to the date on the letter of withdrawal. No project will receive an approval letter nor will the plat be approved for recording until all fees are paid. All review fees are made payable to the [Jurisdiction Entity] Treasurer.

The undersigned, having duly sworn upon oath, that the above information has been read and fully understood to be true and correct and is (undersigned) voluntary act and deed. The undersigned assumes responsibility for the aforementioned fees.

_____

Signature Mailing Address

_____

Signature Printed City, State, Zip Code

STATE OF INDIANA)
)
COUNTY OF_____)

Subscribed and sworn before me, a Notary Public, within and for said County and State, this _____ day of _____, 20_____.

My Commission Expires_____

Notary Public_____

(Notary Stamp or Seal)

[Jurisdiction Entity]
Application for Stormwater Permit

☐ Full Permit Application

☐ Partial Permit Application

[Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator]'s Office 1 East Main Street, Room 610 Fort Wayne, Indiana 46802

Phone Number: (260) 449-7625
FAX Number: (260) 449-7627
www.co.allen.in.us

Project Name:			
Project Location Description:			
Hydrological Unit Code:	Receiving Water/Point of Discharge:		
Plan Submittal Date:	Civil Township:		
Quarter:	Section:	Township:	Range:
Latitude and Longitude:	Total Project Acreage:		
Acreage to be Disturbed:	Number of Lots:	Parcel Number:	
Project Site Owner *:			
Contact Name:			
Address:			
City:	State:	Zip:	
Phone:	FAX:		
E-Mail:			
Plan Preparer Name:			
Affiliation:			
Address:			
City:	State:	Zip:	
Phone:	FAX:		
E-Mail:			
Site Erosion Control Supervisor:	Phone:		
Address:	FAX:		
City:	State:	Zip:	Email:

Stormwater Permit Application Check-In Checklist (place an "X" next to each item submitted)
(Note: for a Partial Permit Application, submit 1 copy of draft Partial Permit Notice of Intent (NOI), 2 copies of the Stormwater Pollution Prevention Plan for the Construction Site, and 2 copies of this form)

2 Copies of Construction Plans including Plat and 2 Copies of Legal Description:	
2 Copies of Stormwater Pollution Prevention Plan for Construction Sites:	
2 Copies of Post-Construction Stormwater Pollution Prevention Plan:	
2 Copies of [Jurisdiction Entity] Application for Stormwater Permit (this form):	
1 Copy of Stormwater Drainage Technical Report:	
1 Copy of Watershed Maps:	
1 Copy of Completed Draft Notice of Intent (NOI), State Form #47487:	
1 Copy of Statement of Financial Responsibility Form:	
1 Department of Planning Services (DPS) Routing Sheet:	
1 Digital Copy that contains everything (optional):	

Full Permit Application Fees – include Full Permit Review Fee & Application Fee
Partial Permit Application Fees - include Partial Permit Review Fee & Erosion and Sediment Control Inspection Fee

Check(s) attached with applicable fees paid (Yes/No)	

* as defined by 327 IAC 15-5-4, the person required to submit the NOI letter and who is responsible for the permitted project plans being implemented according to plan; normally a developer or person who has financial and operational control of construction activities and project plans and specifications.

Signature of Project Site Owner*: _____ Date: _____

For Office Staff Only - Date Received:

B3 – Construction Inspection/Completion Forms

Construction Site Inspection and Maintenance Evaluation
Certification of Completion & Compliance
Notice of Termination – State Form #51514
Notice of Termination Inspection

Date: _____
Project Name: _____
Inspected by: _____

Type of Inspection: ☐ Scheduled Weekly ☐ Rain Event

Site Issues Identified Below to be Corrected By: _____

[JURISDICTION ENTITY] CONSTRUCTION SITE INSPECTION & MAINTENANCE EVALUATION

(To be Completed by Property Owner or Agent)

All stormwater pollution prevention BMPs shall be inspected and maintained as needed to ensure continued performance of their intended function during construction and shall continue until the entire site has been stabilized and a Notice of Termination has been issued. An inspection of the project site must be completed by the end of the next business day following each measurable storm event (0.5 inch rainfall). If there are no measurable storm events within a given week, the site should be monitored at least once in that week. Maintenance and repair shall be conducted in accordance with the accepted site plans. This log shall be kept as a permanent record and must be made available to the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator], in an organized fashion, within two (2) business days upon request.

Yes	No	N/A	No.	BMP/Activity
			1.	Is street inlet protection installed properly where required and being maintained?
			2.	Is beehive and any other necessary inlet protection installed properly and being maintained?
			3.	Are all swales, ditches, and stormwater conveyances properly protected with effective erosion and sediment control measures?
			4.	Are construction entrances properly installed, maintained, and being used exclusively?
			5.	Are sensitive and natural resource areas such as wetlands, streams, mature trees, etc. properly protected from erosion, sedimentation, and damage?
			6.	Are public and private streets clean of sediment, debris and mud?
			7.	Are all discharge points (outfalls) properly stabilized and free of erosion or sediment transport?
			8.	Are all project perimeter controls and sediment barriers adequately installed and maintained with accumulated sediment periodically removed? *(i.e., if using silt fence, is it entrenched - upright - fabric not torn - terminated to higher ground - properly joined at ends, sediment accumulation cleaned out periodically in front of fence or new fence installed behind old)*
			9.	Are all offsite activities properly maintained and protected with effective erosion and sediment control measures?
			10.	Are temporary onsite soil stockpiles in approved areas & properly protected?
			11.	Are specified stormwater BMP's or post-construction measures installed according to plan and properly protected and maintained?
			12.	Is the earthwork for erosion control practices properly graded, seeded and/or mulched at the appropriate application rates?
			13.	Are all erodible slopes protected from erosion through the implementation of acceptable soil stabilization practices?
			14.	Has temporary or permanent stabilization of unvegetated, disturbed ground that will be or has been left dormant for 15 days or more been addressed?
			15.	Is permanent stabilization of disturbed ground progressing in areas where construction is completed?

			16.	Do all dewatering or water pumping operations have measures in place to minimize sediment discharge and include a stabilized outlet? **Note: violations of this measure must be corrected immediately**
			17.	Is equipment washout being properly deposited in a clearly marked designated washout area established specifically for equipment washout and located away from storm drains, ditches, and wetlands? **Note: violations of this measure must be corrected immediately**
			18.	Are solid waste and non-stormwater materials/pollutants properly contained and handled, prevented from entering the inlets and receiving waters, and have a stable access provided to the storage & pickup area?
			19.	Are fuel tanks and other hazardous materials safely stored, protected and being properly handled?
			20.	Is spill response equipment on-site and easily accessible?

If you answered "No" to any of the above questions, describe any corrective action which must be taken to remedy the problem and when the corrective actions are to be completed. Provide any additional corrective actions that may be needed to comply with the [Jurisdiction Entity] Stormwater Management Ordinance and the sites' Stormwater Pollution Prevention Plan' that may not be included in the above checklist.

Certification of Completion & Compliance

CERTIFICATE OF COMPLETION & COMPLIANCE

Address of premises on which land alteration was accomplished:_____
_____
_____

Inspection Date(s):_____ Permit Number:_____

Relative to plans prepared by:_____ on_____
(date)

I hereby certify that:

1. I am familiar with drainage requirements applicable to such land alteration (as set forth in the [Jurisdiction Entity][Jurisdiction Entity] Stormwater Management Ordinance); and

2. I (or a person under my direct supervision) have personally inspected the completed work and examined the drainage permit and its conditions, as-built plans, and final drainage calculations consistent with as-built conditions performed pursuant to the above referenced drainage permit; and

3. To the best of my knowledge, information, and belief, such land alteration has been performed and completed in conformity with all such drainage requirements, except _____
_____
_____

Signature: _____ Date: _____

Typed or Printed Name: _____ Phone: (___)_____

(SEAL)

Business Address: _____
_____
_____
_____

[JURISDICTION ENTITY STORMWATER ADMINISTRATOR] ENGINEER
(circle one)

Indiana Registration No._____

RULE 5 –
Notice of Termination (NOT)
Storm Water Runoff Associated with Construction Activity
NPDES General Permit Rule 327 IAC 15-5 (Rule 5)

State Form 51514 (R / 1-04)

INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

For questions regarding this form, contact:
IDEM – Rule 5 Coordinator
100 North Senate Avenue, Rm 1255
P.O. Box 6015
Indianapolis, IN 46206-6015
Phone: (317) 233-1864 or
(800) 451-6027, ext. 31864 (within Indiana)
Web Access:
http://www.in.gov/idem/water/npdes/permits/wetwthr/storm/rule5.html

NOTE:
- This Notice of Termination must be signed by an individual meeting the signatory requirements in 327 IAC 15-4-3(g).
- Please submit the completed Notice of Termination form to the SWCD, DNR-DSC, or other Entity Designated by the Department as the reviewing agency. The request for termination will be reviewed for concurrence and either returned to the Project Site Owner or forwarded to the IDEM.

Submission of this Notice of Termination letter constitutes notice to the Commissioner that the project site owner is applying for Termination of Coverage under the National Pollutant Discharge Elimination System (NPDES) General Permit Rule for Storm Water Discharges Associated with Construction Activity.

Project Name and Location:
Permit Number: _____
Project Name: _____ County: _____
Company Name (If Applicable): _____
Project Site Owner's Name (An Individual): _____
Address: _____
City: _____ State: _____ Zip: _____
Phone: _____ FAX: _____ E-Mail Address (If Available): _____

This Notice of Termination is Being Submitted for the Following:

Select one of the three Options that apply to Permit Termination by checking the appropriate box, complete all information associated with that option, and complete the "Project Site Owner Responsibility Statement".

Option # 1

☐ **Certification for Change of Ownership:**

(Does not Apply to the Sale of Individual lots within the Permitted Acreage; only the Sale of the Entire Project Site as Originally Permitted)

By Signing this Notice of Termination, I Certify the Following:

A. The project was sold; I am no longer the project site owner as was designated in my Notice of Intent. The new owner of the project site is:
   Company Name (If Applicable): _____
   Project Site Owner's Name (An Individual): _____
   Address: _____
   City: _____ State: _____ Zip: _____
   Phone: _____ FAX: _____ E-Mail Address (If Available): _____
B. I have notified the new Project Site Owner of his/her responsibilities to comply with 327 IAC 15-5 and the requirements associated with the rule including filing a new Notice of Intent.

Option # 2

☐ **Certification for Termination of Construction Activities:**

By Signing this Notice of Termination, I Certify the Following:

A. All land disturbing activities, including construction on all building lots have been completed and the entire site has been stabilized;
B. No future land disturbing activities will occur on this project site;
C. All temporary erosion and sediment control measures have been removed; and
D. A copy of this notice has been sent to the appropriate SWCD or other designated entity.

Option # 3

☐ **Notice of Termination to Obtain Early Release from Compliance with 327 IAC 15-5**

By Signing this Notice of Termination, I Certify the Following:

A. The remaining, undeveloped acreage does not exceed five (5) acres, with contiguous areas not to exceed one (1) acre.
B. A map of the project site, clearly identifying all remaining undeveloped lots, is attached to this letter. The map must be accompanied by a list of names and addresses of individual lot owners or individual lot operators of all undeveloped lots.
C. All public and common improvements, including infrastructure, have been completed and permanently stabilized and have been transferred to the appropriate local entity.
D. The remaining acreage does not pose a significant threat to the integrity of the infrastructure, adjacent properties, or water quality.
E. All permanent storm water quality measures have been implemented and are operational.

Upon Written Notification of the Department the Project Site Owner Certifies that he/she will Notify:

A. All current individual lot owners and all subsequent individual lot owners of the remaining undeveloped acreage and acreage with construction activity that they are responsible for complying with section 7.5 of 327 IAC 15-5 *(the remaining individual lot owners do not need to submit a Notice of Intent letter or Notice of Termination letter)*; and
B. The individual lot owners of the requirements to install and maintain appropriate measures to prevent sediment from leaving the individual building lot and maintain all erosion and sediment control measures that are to remain on-site as part of the construction plan.

Project Site Owner Responsibility Statement:

By signing this Notice of Termination letter, I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Printed Name of Project Site Owner: _____

Signature of Project Site Owner: _____ Date: _____

This Notice of Termination must be signed by an individual meeting the signatory requirements in 327 IAC 15-4-3(g).

Please submit the completed Notice of Termination form to the SWCD, DNR-DSC, or other Entity Designated by the Department as the reviewing agency. The request for termination will be reviewed for concurrence and either returned to the Project Site Owner or forwarded to the IDEM.

For Agency Use Only

☐ **Accepted: The site referenced above has been inspected and it has been determined that the request to terminate this project is compliant with the requirements of 327 IAC 15-5-8. This form will be forwarded to the IDEM for final approval. Upon written notification by the IDEM, the Project Site Owner's termination for coverage under 327 IAC 15-5 shall be considered approved.**

☐ **Denied: The site referenced above has been inspected and it has been determined that the request to terminate this project is NOT compliant with the requirements of 327 IAC 15-5-8. Continue to implement the Stormwater Pollution Prevention Plan and take appropriate measures to minimize the discharge of pollutants.**

Signature	Printed Name	Agency	Date

Date: _____
Project: _____
Inspected by: _____

[JURISDICTION ENTITY] NOTICE OF TERMINATION INSPECTION

(To be Completed by the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator] or Agent)

All construction sites shall undergo a final inspection by the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator]'s Office following submittal of a Notice of Termination (NOT) by the project owner to ensure the site is stabilized and that post construction BMPs have been properly installed.

Yes	No	N/A	
			1. Have all earth disturbing activities been completed?
			2. Are all soils stabilized with either vegetation or mulch?
			3. Are all drainageways stabilized with either vegetation, rip rap, or other armament?
			4. Have all temporary erosion and sediment control measures been removed?
			5. Has all construction waste, trash, and debris been removed from the site?
			6. Have all permanent stormwater quality BMPs been installed in accordance with the plans, specifications, and details?
			7. Are all permanent BMPs free of sediment accumulation resulting from construction activities?

If you answered "no" to any of the above questions, describe any corrective action which must be taken to remedy the problem and when the corrective actions are to be completed.

B4 – Individual Residential Lot Permit Forms

Instructions for Individual Lot Plot Plan Permit Request
Individual Lot Plot Plan Permit Request Application
Individual Lot Typical Erosion & Sediment Control Plan and Certification

INSTRUCTIONS FOR INDIVIDUAL LOT PLOT PLAN PERMIT REQUEST

1. Request shall be made to the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator]'s Office on standard form only, supplied by the [Jurisdiction Entity Stormwater Administrator]'s Office (See Individual Lot Plot Plan Permit Request Form).
2. The Individual Lot Plot Plan Permit Request Form shall be completely filled out. The [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator]'s Office may require more details if necessary to complete the permit review.
3. The trained individual in charge of the mandatory stormwater pollution prevention self-monitoring program for the project site will be the person the [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator]'s Office will contact initially in the event that the stormwater pollution prevention plan that was approved for the site is not being implemented properly.
4. The applicant or an agent of the applicant must sign the form.
5. A certified Plot Plan that includes a certified site layout for the subject lot and all adjacent lots showing building pad location, dimensions, elevations, and the drainage patterns and swales is required to be submitted with each permit application.
6. The individual lot operator, whether owning the property or acting as the agent of the property owner, shall be responsible for erosion and sediment control requirements associated with activities on individual lots until the site is stabilized. An erosion and sediment control plan is required to be submitted with each permit application. This plan must conform to the minimum requirements in Chapters 7 and 8 of the Technical Standards Manual and must specify and show the following measures at a minimum:
    i. Installation and maintenance of a stable construction site access.
    ii. Installation and maintenance of appropriate perimeter erosion and sediment control measures prior to land disturbance.
    iii. Erosion and sediment control measures for sheet flow and concentrated flow areas.
    iv. Nearby storm sewer inlet protection measures.
    v. Minimization of sediment discharge and tracking from the lot throughout the land disturbing activities on the lot until permanent stabilization has been achieved.
    vi. Clean-up of sediment that is either tracked or washed onto roads. Bulk clearing of sediment shall not include flushing the area with water. Cleared sediment must be redistributed or disposed of in a manner that is in compliance with all applicable statutes and rules.
    vii. Adjacent lots disturbed by an individual lot operator must be repaired and stabilized with temporary or permanent surface stabilization.
    viii. For individual residential lots, final stabilization meeting the criteria in 327 IAC 15-5-7(b)(20) will be achieved when the individual lot operator:
        1. Completes final stabilization; or
        2. Has installed appropriate erosion and sediment control measures for an individual lot prior to occupation of the home by the homeowner and has informed the homeowner of the requirement for, and benefits of, final stabilization.
7. Need to abide by any additional requirements set forth in the [Jurisdiction Entity] Stormwater Management Ordinance.
8. Check or money order is to be made payable to the **[Jurisdiction Entity] Treasurer**. The correct amount of fee, based on the Fee Ordinance, must be included with the application package.

INDIVIDUAL LOT PLOT PLAN PERMIT REQUEST

Name of Subdivision/Minor Plat & Lot #: _____
Parcel Number: _____

Project Name: _____
Section/Township/Range _____
Township Name: _____

Applicant's Name: _____
Address: _____
_____
Phone: (___)_____
Fax: (___)_____

Property Owner: _____
Property Address: _____
_____
Phone: (___)_____
Fax: (___)_____

Contractor/Builder: _____
Address: _____
Phone: (___)_____ Fax: (___)_____
Contact Person: _____ Cell Phone: _____

Type of Lot or Improvement: _____

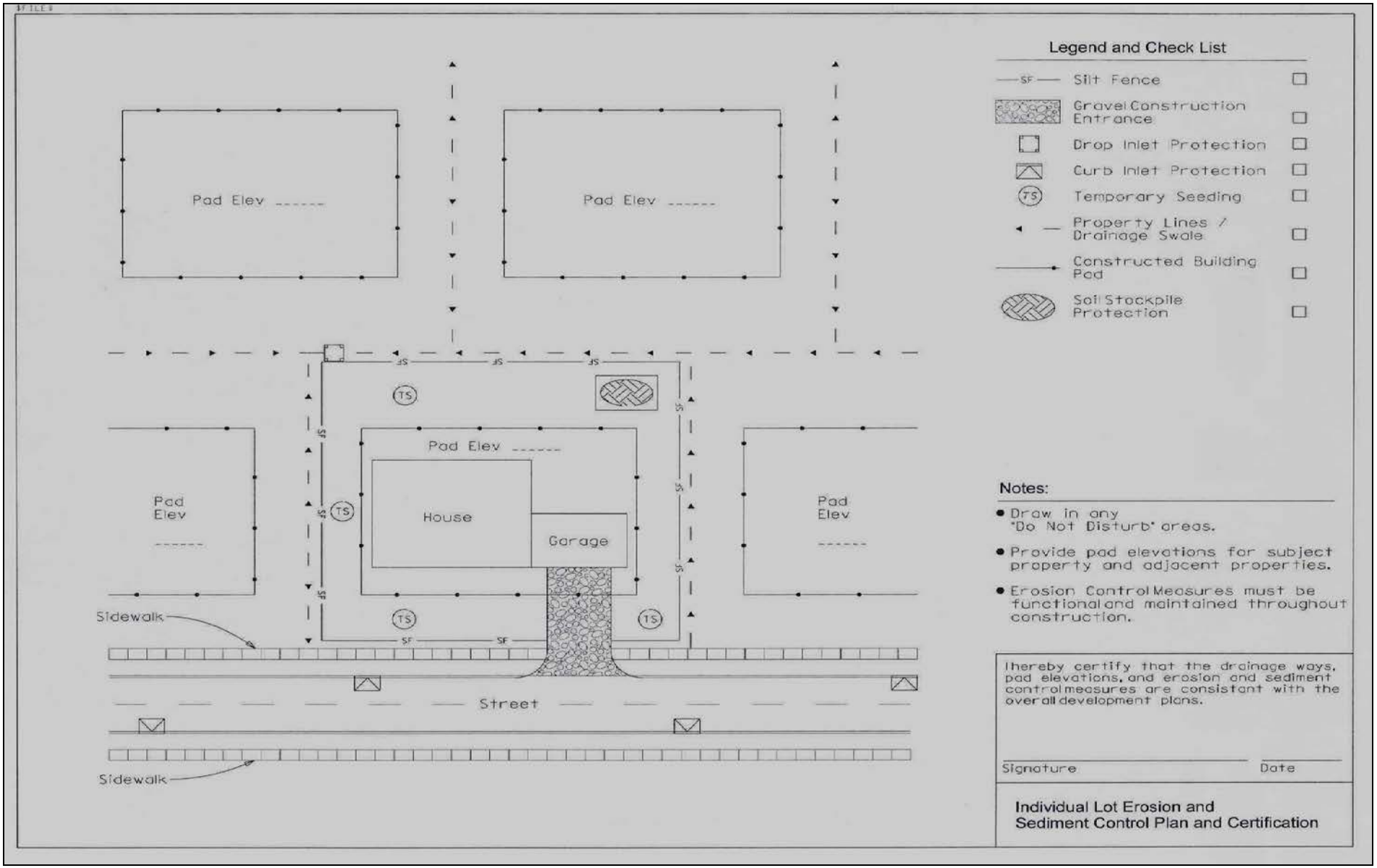
Trained Individual in Charge of the Mandatory Stormwater Pollution Prevention Program
Name:_____ Phone #:_____
FAX: _____ Email: _____
Address:_____
List of Qualifications): _____
_____
_____
_____

The individual lot operator is responsible for installation and maintenance of all erosion and sediment control measures until the site is stabilized.

_____ _____
Signature Date

Check Title: Owner _____ Contractor _____ Engineer _____ Agent _____ Other _____

*** **For Office Use Only** *** Engineering Firm: _____
Permit # _____ Plan Project # _____ Check # _____


Pad Elev ------
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Garage
Sidewalk
Street
Sidewalk
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SF
Legend and Check List
SF Silt Fence
Gravel Construction Entrance
Drop Inlet Protection
Curb Inlet Protection
TS Temporary Seeding
Property Lines / Drainage Swale
Constructed Building Pad
Soil Stockpile Protection
Notes:
• Draw in any "Do Not Disturb" areas.
• Provide pad elevations for subject property and adjacent properties.
• Erosion Control Measures must be functional and maintained throughout construction.
I hereby certify that the drainage ways, pad elevations, and erosion and sediment control measures are consistant with the overall development plans.
Signature
Date
Individual Lot Erosion and Sediment Control Plan and Certification

B5 – Post-Construction Maintenance and Inspection Forms

Post-Construction BMP Inspection Checklists

Bioretention Systems Operation, Maintenance, and Management Inspection Checklist

Project: _____

Location: _____

Date: _____ **Time:** _____

Inspector: _____ **Title:** _____

Signature: _____

Maintenance Item	Satisfactory/ Unsatisfactory	Comments
1. Debris Cleanout		
Bioretention and contributing areas clean of debris (litter, branches, etc.)		
No dumping of yard wastes into BMP		
2. Vegetation		
Plant height not less than design water depth but not greater than 6 inches		
Observed plant types consistent with accepted plans		
Plants covering greater than 85% of total BMP surface area		
Plant community appears thick and healthy		
No evidence of erosion		
3. Sediment Deposits/Accumulation		
No evidence of sediment buildup around check dams or energy dissipaters.		
Sumps are not more than 50% full of sediment		
Sediment is not >20% of BMP design depth.		

4. Filter Bed		
Dewaters between storms		
Filter bed is not blocked or filled inappropriately.		
5. Outlet/Overflow Spillway		
Good Condition, no need for repair		
No evidence of erosion or downstream scour.		
Outlets are free of blockages.		

Actions to be Taken:

Constructed Storm Water Wetland Operation, Maintenance, and Management Inspection Checklist

Project: _____

Location: _____

Date: _____ **Time:** _____

Inspector: _____ **Title:** _____

Signature: _____

Maintenance Item	Satisfactory/ Unsatisfactory	Comments
1. Embankment and Emergency Spillway		
Healthy vegetation with at least 85% ground cover.		
No signs of erosion on embankment.		
No animal burrows.		
Embankment is free of cracking, bulging, or sliding.		
Embankment is free of woody vegetation.		
Embankment is free of leaks or seeps		
Emergency spillway is clear of obstructions.		
2. Riser and Principal Spillway		
Low flow outlet free of obstruction.		
Trash rack is not blocked or damaged.		
Riser is free of excessive sediment buildup		
Outlet pipe is in good condition.		

Control valve is operational		
Outfall channels are stable and free of scouring.		
3. Wetland		
Plants covering greater than 85% of total wetland surface area (excluding open water areas)		
Observed plant types consistent with accepted plans		
No evidence of excessive sediment accumulation in wetland area		
Water depths consistent with accepted plans		
No evidence of erosion on banks.		
Wetland areas clean of debris (litter, branches, etc.)		
No evidence of dumping of yard wastes into BMP		
4. Forebay		
Sediment is being collected by forebay(s)		
Forebay is not in need of cleanout (less than 50% full)		

Actions to be Taken:_____

Infiltration Trench Operation, Maintenance, and Management Inspection Checklist

Project: _____

Location: _____

Date: _____ **Time:** _____

Inspector: _____ **Title:** _____

Signature: _____

Maintenance Item	Satisfactory/ Unsatisfactory	Comments
1. Debris Cleanout		
Trench surface clear of debris		
Inflow pipes clear of debris		
Overflow spillway clear of debris		
Inlet area clear of debris		
2. Sediment Traps or Forebays		
Obviously trapping sediment		
Greater than 50% of storage volume remaining		
3. Trench		
Trench dewaters between storms		
No evidence of sedimentation in trench		
Sediment accumulation doesn't yet require cleanout		
4. Inlets		
Good condition		
No evidence of erosion		

Maintenance Item	Satisfactory/ Unsatisfactory	Comments
5. Outlet/Overflow Spillway		
Good condition, no need for repair		
No evidence of erosion		
6. Aggregate Repairs		
Surface of aggregate clean		
Top layer of stone does not need replacement		
Trench does not need rehabilitation		

Actions to be Taken:

Infiltration Basin Operation, Maintenance, and Management Inspection Checklist

Project: _____

Location: _____

Date: _____ **Time:** _____

Inspector: _____ **Title:** _____

Signature: _____

Maintenance Item	Satisfactory/ Unsatisfactory	Comments
1. Debris Cleanout		
Basin bottom clear of debris		
Inlet clear of debris		
Outlet clear of debris		
Emergency spillway clear of debris		
2. Sediment Traps or Forebays		
Obviously trapping sediment		
Greater than 50% of storage volume remaining		
3. Vegetation		
Mowing done when needed		
No evidence of erosion		
4. Dewatering		
Basin dewatered between storms		

Maintenance Item	Satisfactory/ Unsatisfactory	Comments
5. Sediment Cleanout of Basin		
No evidence of sedimentation		
Sediment accumulation does not yet require cleanout		
6. Inlets		
Good condition		
No evidence of erosion		
7. Outlets/Overflow Spillway		
Good condition, no need for repair		
No evidence of erosion		
8. Structural Repairs		
Embankment in good repair		
Side slopes are stable		
No evidence of erosion		
9. Fences/Access Repairs		
Fences in good condition		
No damage which would allow undesirable entry		
Lock and gate function adequate		
Access point in good condition		

Actions to be Taken:_____

Sand Filters Operation, Maintenance, and Management Inspection Checklist

Project: _____

Location: _____

Date: _____ **Time:** _____

Inspector: _____ **Title:** _____

Signature: _____

Maintenance Item	Satisfactory/ Unsatisfactory	Comments
1. Debris Cleanout		
Contributing areas clean of debris		
Filtration facility clean of debris		
Inlet and outlets clear of debris		
2. Oil and Grease		
No evidence of filter surface clogging		
Activities in drainage area minimize oil and grease entry		
3. Vegetation		
Contributing drainage area stabilized		
No evidence of erosion		
Area mowed and clippings removed		
4. Water Retention Where Required		
Water holding chambers at normal pool		
No evidence of leakage		

Actions to be Taken:_____

_____

_____

_____

_____

Filter Strip Operation, Maintenance, and Management Inspection Checklist

Project: _____

Location: _____

Date: _____ **Time:** _____

Inspector: _____ **Title:** _____

Signature: _____

Maintenance Item	Satisfactory/ Unsatisfactory	Comments
1. Vegetation		
Observed plant types consistent with accepted plans		
Vegetation is healthy		
Plants covering greater than 85% of total BMP surface area		
Grass height not more than 6 inches		
No evidence of concentrated flows		
No evidence of erosion		
2. Level Spreader		
Lip of spreader showing no signs of erosion		
Sediment noted in spreader?		

Actions to be Taken:_____

Vegetated Swale Operation, Maintenance, and Management Inspection Checklist

Project: _____

Location: _____

Date: _____ **Time:** _____

Inspector: _____ **Title:** _____

Signature: _____

Maintenance Item	Satisfactory/ Unsatisfactory	Comments
1. Debris Cleanout		
Contributing drainage areas free from debris		
2. Vegetation		
Mowing performed when needed		
No evidence of erosion		
3. Check Dams or Energy Dissipaters		
No evidence of flow going around structure		
No evidence of erosion at the downstream toe		
Soil permeability		
4. Sediment Forebay		
Sediment cleanout not needed (clean out when 50% full)		

Actions to be Taken:_____

Wet Detention Pond Operation, Maintenance, and Management Inspection Checklist

Project: _____

Location: _____

Date: _____ **Time:** _____

Inspector: _____ **Title:** _____

Signature: _____

Maintenance Item	Satisfactory/ Unsatisfactory	Comments
1. Embankment and emergency spillway		
Healthy vegetation with at least 85% ground cover.		
No signs of erosion on embankment.		
No animal burrows.		
Embankment is free of cracking, bulging, or sliding.		
Embankment is free of woody vegetation.		
Embankment is free of leaks or seeps		
Emergency spillway is clear of obstructions.		
Vertical/horizontal alignment of top of dam "As-Built"		
2. Riser and principal spillway		
Low flow outlet free of obstruction.		
Trash rack is not blocked or damaged.		
Riser is free of excessive sediment buildup		
Outlet pipe is in good condition.		
Control valve is operational		
Outfall channels are stable and free of scouring.		

Maintenance Item	Satisfactory/ Unsatisfactory	Comments
3. Permanent Pool (Wet Ponds)		
No Evidence of undesirable vegetation		
No accumulation of floating or floatable debris		
No evidence of shoreline scour or erosion		
4. Sediment Forebays		
Sediment is being collected by forebay(s)		
Forebay is not in need of cleanout (less than 50% full)		
5. Dry Pond Areas		
Healthy vegetation with at least 85% ground cover.		
No undesirable woody vegetation		
Low flow channels clear of obstructions		
No evidence of sediment and/or trash accumulation		
6. Condition of Outfall into Ponds		
No riprap failures		
No evidence of slope erosion or scouring		
Storm drain pipes are in good condition, with no evidence of non-stormwater discharges		
Endwalls/Headwalls are in good condition		

Actions to be Taken:_____

APPENDIX C

CONSTRUCTION BMPs

BMP CN – 101
WHEEL WASH

DESCRIPTION

When a stabilized construction entrance is not preventing sediment from being tracked onto pavement, a wheel wash may be installed. Wheel washing is generally an effective BMP when installed with careful attention to topography. For example, a wheel wash can be detrimental if installed at the top of a slope abutting a right-of-way where the water from the dripping truck can run unimpeded into the street. Pressure washing combined with an adequately sized and surfaced pad with direct drainage to a large 10-foot x 10-foot sump can be very effective.

ADVANTAGES

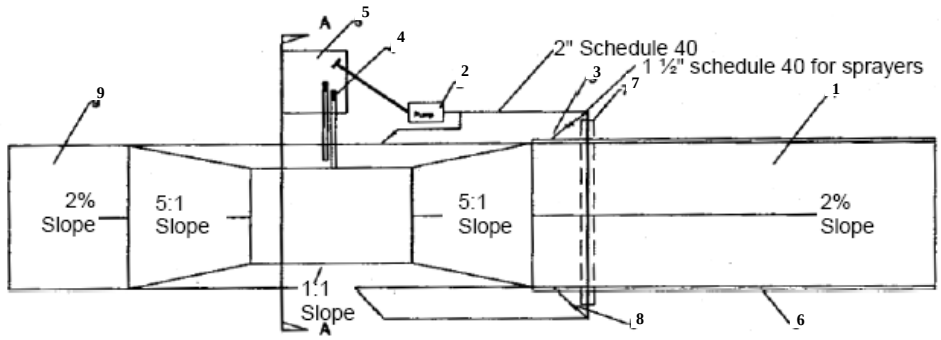
1. Wheel washes reduce the amount of sediment transported onto paved roads by motor vehicles.

DESIGN CRITERIA

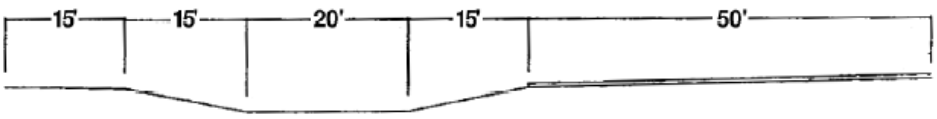
1. Suggested details are shown in Figure CN-101-A. The [Jurisdiction Entity] [Jurisdiction Entity Stormwater Administrator] may allow other designs.
2. A minimum of 6 inches of asphalt treated base (ATB) over crushed base material or 8 inches over a good subgrade is recommended to pave the wheel wash.
3. Use a low clearance truck to test the wheel wash before paving. Either a belly dump or lowboy will work well to test clearance.
4. Keep the water level from 12 to 14 inches deep to avoid damage to truck hubs and filling the truck tongues with water.
5. Midpoint spray nozzles are only needed in extremely muddy conditions.
6. Wheel wash systems should be designed with a small grade change, 6 to 12 inches for a 10-foot-wide pond, to allow sediment to flow to the low side of pond to help prevent re-suspension of sediment.
7. A drainpipe with a 2- to 3-foot riser should be installed on the low side of the pond to allow for easy cleaning and refilling.
8. Polymers may be used to promote coagulation and flocculation in a closed-loop system. Polyacrylamide (PAM) added to the wheel wash water at a rate of 0.25 - 0.5 pounds per 1,000 gallons of water increases effectiveness and reduces cleanup time.
9. If PAM is already being used for dust or erosion control and is being applied by a water truck, the same truck can be used to change the wash water.
10. The wheel wash should start out the day with fresh water. The wash water should be changed a minimum of once per day.
11. On large earthwork jobs where more than 10-20 trucks per hour are expected, the wash water will need to be changed more often.
12. Wheel wash or tire bath wastewater shall be discharged to a separate on-site treatment system, such as closed-loop recirculation or land application, or to the sanitary sewer with proper local sewer utility approval.

REFERENCE

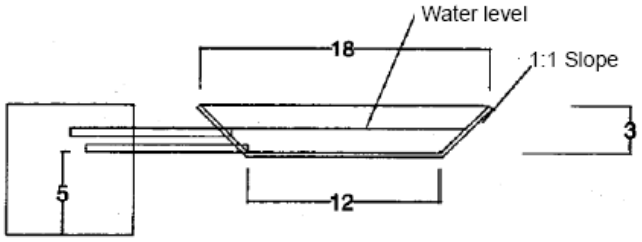
City of Tacoma, Surface Water Management Manual, 2003 or later



Wheel Wash Plan



Elevation View



Section A-A
NTS

Notes:

1. Asphalt construction entrance 6 in. asphalt treated base (ATB).
2. 3-inch trash pump with floats on the suction hose.
3. Midpoint spray nozzles, if needed.
4. 6-inch sewer pipe with butterfly valves. Bottom one is a drain. Locate top pipe's invert 1 foot above bottom of wheel wash.
5. 8 foot x 8 foot sump with 5 feet of catch. Build so can be cleaned with trackhoe.
6. Asphalt curb on the low road side to direct water back to pond.
7. 6-inch sleeve under road.
8. Ball valves.
9. 15 foot. ATB apron to protect ground from splashing water.

Figure CN-101-A

BMP CN – 102
DEWATERING STRUCTURE

DESCRIPTION

Water which is pumped from a construction site usually contains a large amount of sediment. A dewatering structure is designed to remove the sediment before water is released off-site.

This practice includes several types of dewatering structures which have different applications dependent upon site conditions and types of operation. Other innovative techniques for accomplishing the same purpose are encouraged, but only after specific plans and details are submitted to and approved by the [Jurisdiction Entity] [Jurisdiction Entity Highest Stormwater Approval Administrative Body].

DESIGN CRITERIA

1. A dewatering structure must be sized (and operated) to allow pumped water to flow through the filtering device without overtopping the structure.
2. Material from any required excavation shall be stored in an area and protected in a manner that will prevent sediments from eroding and moving off-site.
3. An excavated basin (applicable to "Straw Bale/Silt Fence Pit") may be lined with filter fabric to help reduce scour and to prevent the inclusion of soil from within the structure.
4. Design criteria more specific to each particular dewatering device can be found in Figures CN-102-A through CN-102-C.
5. A dewatering structure may not be needed if there is a well-stabilized, vegetated area onsite to which water may be discharged. The area must be stabilized so that it can filter sediment and at the same time withstand the velocity of the discharged water without eroding. A minimum filtering length of 75 feet must be available in order for such a method to be feasible.
6. The filtering devices must be inspected frequently and repaired or replaced once the sediment build-up prevents the structure from functioning as designed.
7. The accumulated sediment which is removed from a dewatering device must be spread on-site and stabilized or disposed of at an approved disposal site as per approved plan.

<u>Portable Sediment Tank (see Figure CN102-A)</u>

- The structure may be constructed with steel drums, sturdy wood or other material suitable for handling the pressure exerted by the volume of water.
- Sediment tanks will have a minimum depth of 2 ft.
- The sediment tank shall be located for easy clean-out and disposal of the trapped sediment and to minimize the interference with construction activities.
- The following formula shall be used to determine the storage volume of the sediment tank:

  Pump discharge (gallons/min.) x 16 = cubic feet of storage required

- Once the water level nears the top of the tank, the pump must be shut off while the tank drains and additional capacity is made available.
- The tank shall be designed to allow for emergency flow over top of the tank. Clean-out of the tank is required once one-third of the original capacity is depleted due to sediment accumulation. The tank shall be clearly marked showing the clean-out point.

Filter Box (see Figure CN-102-B)

- The box selected should be made of steel, sturdy wood or other materials suitable to handle the pressure requirements imposed by the volume of water. Normally readily available 55 gallon drums welded top to bottom will suffice in most cases.
- Bottom of the box shall be made porous by drilling holes (or some other method).
- Coarse aggregate shall be placed over the holes at a minimum depth of 12 inches, metal "hardware" cloth may need to be placed between the aggregate and the holes if holes are drilled larger than the majority of the stone.
- As a result of the fast rate of flow of sediment-laden water through the aggregate, the effluent must be directed over a well-vegetated strip of at least 50 feet after leaving the base of the filter box.
- The box shall be sized as follows:

  Pump discharge (gallons/min.) x 16 = cubic feet of storage required

- Once the water level nears the top of the box, the pump must be shut off while the box drains and additional capacity is made available.
- The box shall be designed/constructed to allow for emergency flow over the top of this box.
- Clean-out of the box is required once one-third of the original capacity is depleted due to sediment accumulation. The tank shall be clearly marked showing the clean-out point.
- If the stone filter does become clogged with sediment so that it no longer adequately performs its function, the stones must be pulled away from the inlet, cleaned and replaced.
- Using a filter box only allows for minimal settling time for sediment particles; therefore, it should only be used when site conditions restrict the use of the other methods.

Straw Bale/Silt Fence Pit (see Figure CN-102-C)

- Measure shall consist of straw bales, silt fence, a stone outlet (a combination of riprap and aggregate) and a wet storage pit oriented as shown in Figure CN-103-C.
- The structure must have a capacity which is dictated by the following formula:

  Pump discharge (gallons/min.) x 16 = cubic feet of storage required

- In calculating the capacity, one should include the volume available from the floor of the excavation to the crest of the stone weir.
- In any case, the excavated area should be a minimum of 3 feet below the base of the perimeter measures (straw bales or silt fence).
- The perimeter measures must be installed as per the guidelines found in BMP-4, STRAW BALE BARRIER and BMP-5, SILT FENCE.
- Once the water level nears the crest of the stone weir (emergency overflow), the pump must be shut off while the structure drains down to the elevation of the wet storage.
- The wet storage pit may be dewatered only after a minimum of 6 hours of sediment settling time. This effluent should be pumped across a well vegetated area or through a silt fence prior to entering a watercourse.
- Once the wet storage area becomes filled to one-half of the, excavated depth, accumulated sediment shall be removed and properly disposed of.

- Once the device has been removed, ground contours will be returned to original condition.

REFERENCE

United States Army Corps of Engineers, Handbook for the Preparation of Storm Water Pollution Prevention Plans for Construction Activities, 1997 or later

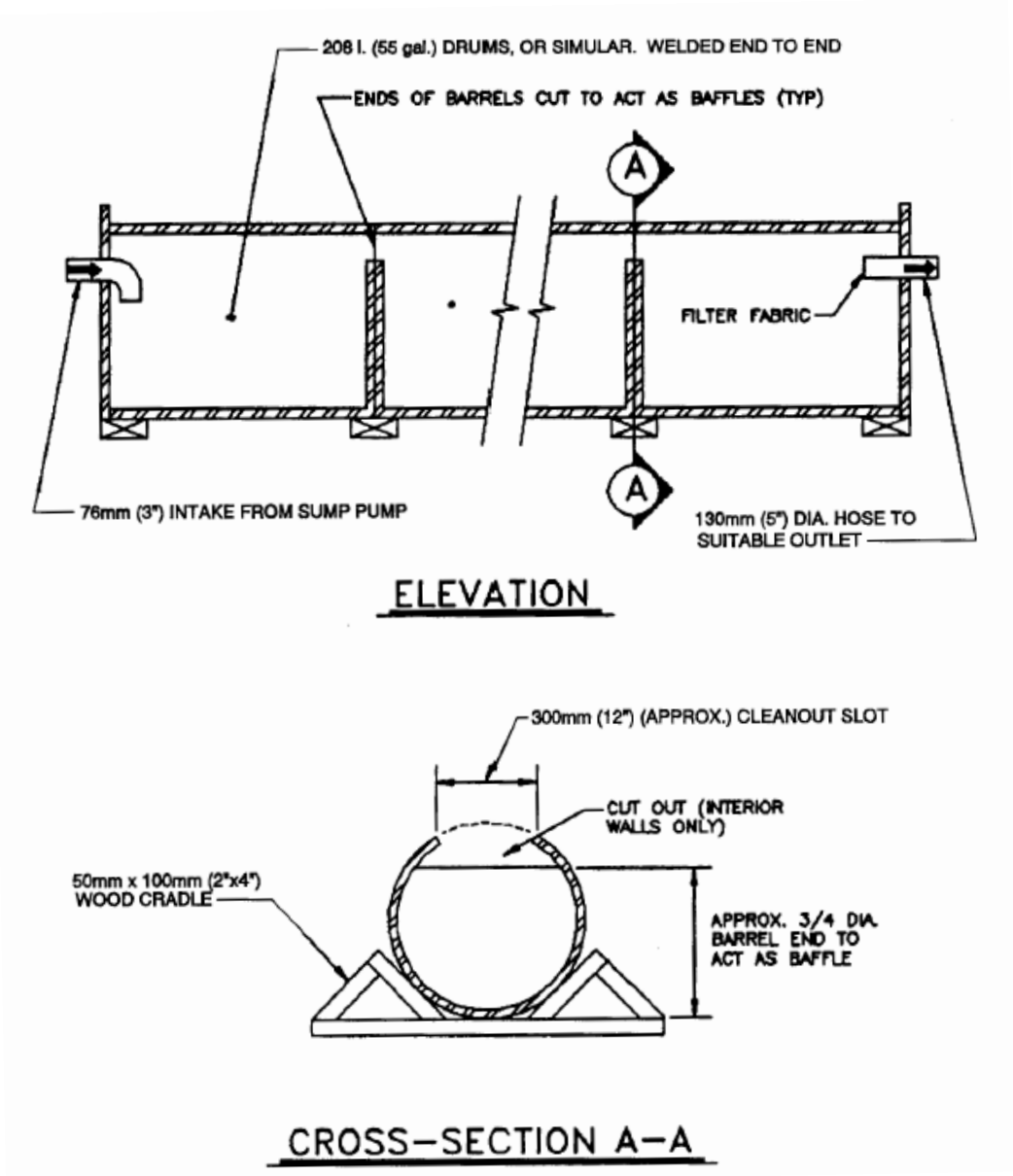


Figure CN-102-A
Portable Sediment Tank

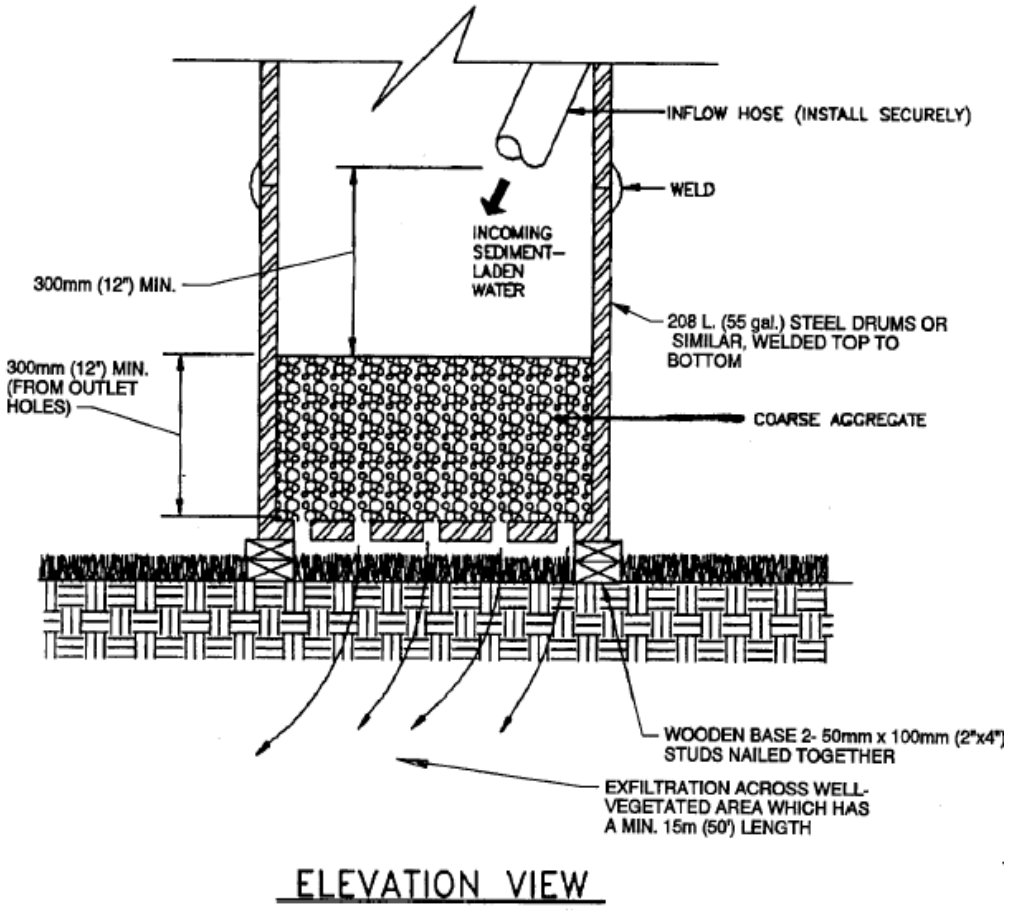
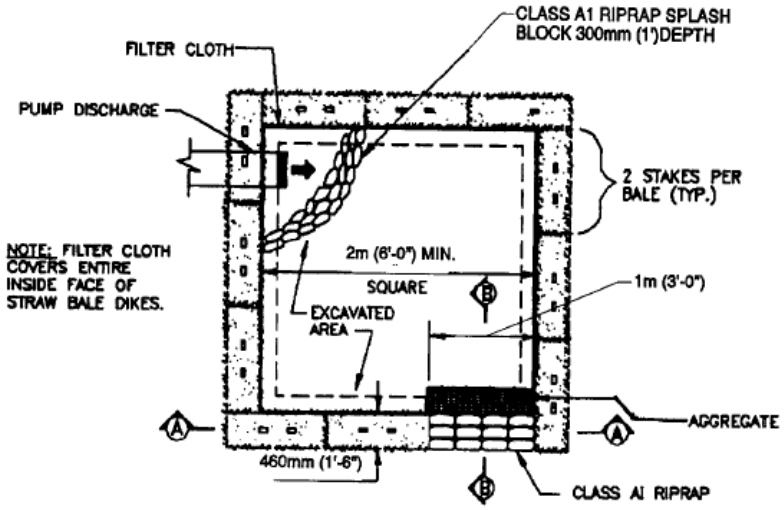
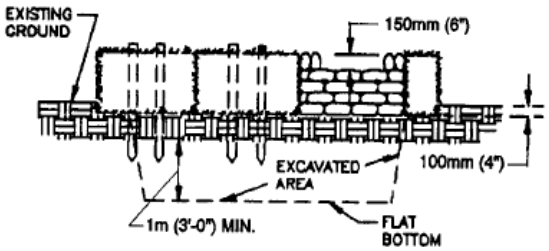


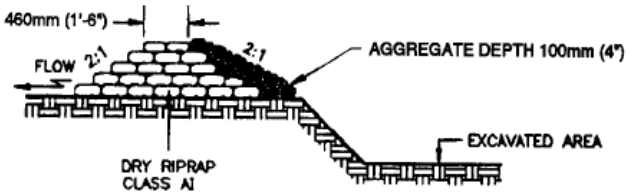
Figure CN-102-B
Filter Box



PLAN VIEW



CROSS-SECTION A-A



CROSS-SECTION B-B

Figure CN-102-C
Straw Bale/Silt Fence Pit

BMP CN – 103
SPILL PREVENTION AND CONTROL

DESCRIPTION

These procedures and practices are implemented to prevent and control spills in a manner that minimizes or prevents the discharge of spilled material to the drainage system or watercourses.

This best management practice (BMP) applies to all construction projects. Spill control procedures are implemented anytime chemicals and/or hazardous substances are stored. Substances may include, but are not limited to:

- Soil stabilizers/binders
- Dust Palliatives
- Herbicides
- Growth inhibitors
- Fertilizers
- Deicing/anti-icing chemicals
- Fuels
- Lubricants
- Other petroleum distillates

To the extent that the work can be accomplished safely, spills of oil, petroleum products, sanitary and septic wastes, and substances listed under 40 CFR parts 110, 117, and 302, and shall be contained and cleaned up immediately.

LIMITATIONS

1. This BMP only applies to spills caused by the contractor.
2. Procedures and practices presented in this BMP are general. Contractor shall identify appropriate practices for the specific materials used or stored on-site in advance of their arrival at the site.

DESIGN CRITERIA

1. To the extent that it doesn't compromise clean up activities, spills shall be covered and protected from stormwater runoff during rainfall.
2. Spills shall not be buried or washed with water.
3. Used clean up materials, contaminated materials, and recovered spill material that is no longer suitable for the intended purpose shall be stored and disposed of in conformance with BMP CN-106: Hazardous Waste Management.
4. Water used for cleaning and decontamination shall not be allowed to enter storm drains or watercourses and shall be collected and disposed of in accordance with BMP CN-106: Hazardous Waste Management.
5. Water overflow or minor water spillage shall be contained and shall not be allowed to discharge into drainage facilities or watercourses.

6. Proper storage, clean-up and spill reporting instruction for hazardous materials stored or used on the project site shall be posted at all times in an open, conspicuous and accessible location.
7. Waste storage areas shall be kept clean, well organized and equipped with ample clean-up supplies as appropriate for the materials being stored. Perimeter controls, containment structures, covers and liners shall be repaired or replaced as needed to maintain proper function.
8. Verify weekly that spill control and clean up materials are located near material storage, unloading, and use areas.
9. Update spill prevention and control plans and stock appropriate clean-up materials whenever changes occur in the types of chemicals used or stored onsite.

Cleanup and Storage Procedures for Minor Spills

- Minor spills typically involve small quantities of oil, gasoline, paint, etc., which can be controlled by the first responder at the discovery of the spill.
- Use absorbent materials on small spills rather than hosing down or burying the spill.
- Remove the absorbent materials promptly and dispose of properly.
- The practice commonly followed for a minor spill is:
  - Contain the spread of the spill.
  - Recover spilled materials.
  - Clean the contaminated area and/or properly dispose of contaminated materials.

Cleanup and Storage Procedures for Semi-Significant Spills

- Semi-significant spills still can be controlled by the first responder along with the aid of other personnel such as laborers and the foreman, etc. This response may require the cessation of all other activities.
- Clean up spills immediately:
- Notify the project foreman immediately. The foreman shall notify the [Jurisdiction Entity] Emergency Management Agency's Hazardous Materials Response Team.
- Contain spread of the spill.
- If the spill occurs on paved or impermeable surfaces, clean up using "dry" methods (absorbent materials, cat litter and/or rags). Contain the spill by encircling with absorbent materials and do not let the spill spread widely.
- If the spill occurs in dirt areas, immediately contain the spill by constructing an earthen dike. Dig up and properly dispose of contaminated soil.
- If the spill occurs during rain, cover spill with tarps or other material to prevent contaminating runoff.

Cleanup and Storage Procedures for Significant/Hazardous Spills

- For significant or hazardous spills that cannot be controlled by personnel in the immediate vicinity, notify the local emergency response by dialing 911. In addition to 911, the contractor will notify the proper [Jurisdiction Entity] officials. It is the contractor's responsibility to have all emergency phone numbers at the construction site.

- For spills of federal reportable quantities, in conformance with the requirements in 40 CFR parts 110,119, and 302, the contractor shall notify the National Response Center at (800) 424-8802.
- Notification shall first be made by telephone and followed up with a written report.
- The services of a spills contractor or a Haz-Mat team shall be obtained immediately. Construction personnel shall not attempt to clean up the spill until the appropriate and qualified personnel have arrived at the job site.

REFERENCE

California Department of Transportation, Construction Site BMP Manual, 2000 or later

BMP CN – 104
SOLID WASTE MANAGEMENT

DESCRIPTION

Solid waste management procedures and practices are designed to minimize or eliminate the discharge of pollutants to the drainage system or to watercourses as a result of the creation, stockpiling, or removal of construction site wastes.

Solid waste management procedures and practices are implemented on all construction projects that generate solid wastes.

Solid wastes include but are not limited to:

1. Construction wastes including brick, mortar, timber, steel and metal scraps, sawdust, pipe and electrical cuttings, non-hazardous equipment parts, Styrofoam and other materials used to transport and package construction materials.
2. Landscaping wastes, including vegetative material, plant containers, and packaging materials.
3. Litter, including food containers, beverage cans, coffee cups, paper bags, plastic wrappers, and smoking materials, including litter generated by the public.

LIMITATIONS

1. Temporary stockpiling of certain construction wastes may not necessitate stringent drainage related controls during the non-rainy season.

DESIGN CRITERIA

1. Dumpsters of sufficient size and number shall be provided to contain the solid waste generated by the project and properly serviced.
2. Littering on the project site shall be prohibited.
3. To prevent clogging of the storm drainage system, litter and debris removal from drainage grates, trash racks, and ditch lines shall be a priority.
4. Trash receptacles with lids shall be provided in the Contractor's yard, field trailer areas, and at locations where workers congregate for lunch and break periods.
5. Construction debris and litter from work areas within the construction limits of the project site shall be collected and placed in watertight dumpsters at least weekly regardless of whether the litter was generated by the Contractor, the public, or others. Collected litter and debris shall not be placed in or next to drain inlets, storm water drainage systems or watercourses.
6. Full dumpsters shall be removed from the project site and the contents shall be disposed of, off-site, in an appropriate manner.;
7. Litter stored in collection areas and containers shall be handled and disposed of by trash hauling contractors.
8. Construction debris and waste shall be removed from the site every two weeks.
9. Stormwater run-off shall be prevented from contacting stored solid waste through the use of berms, dikes, or other temporary diversion structures or through the use of measures to elevate waste from site surfaces.
10. Solid waste storage areas shall be located at least 50 ft from drainage facilities and watercourses and shall not be located in areas prone to flooding or ponding.

11. Except during fair weather, construction and landscaping waste not stored in watertight dumpsters shall be securely covered from wind and rain by covering the waste with tarps, plastic sheeting, or equivalent.
12. Dumpster washout on the project site is not allowed.
13. Notify trash hauling contractors that only watertight dumpsters are acceptable for use on-site.
14. Plan for additional containers during the demolition phase of construction.
15. Plan for more frequent pickup during the demolition phase of construction.
16. Construction waste shall be stored in a designated area. Access to the designated area shall either be well vegetated ground, a concrete or asphalt road or drive, or a gravel construction entrance, to avoid mud tracking by trash hauling contractors.
17. Segregate potentially hazardous waste from non-hazardous construction site waste.
18. Keep the site clean of litter debris.
19. Make sure that toxic liquid wastes (e.g., used oils, solvents, and paints) and chemicals (e.g., acids, pesticides, additives, curing compounds) are not disposed of in dumpsters designated for construction debris.
20. For disposal of hazardous waste, see BMP CN-106: Hazardous Waste Management. Have hazardous waste hauled to an appropriate disposal and/or recycling facility.
21. Salvage or recycle useful vegetation debris, packaging and/or surplus building materials when practical. For example, trees and shrubs from land clearing can be converted into wood chips, then used as mulch on graded areas. Wood pallets, cardboard boxes, and construction scraps can also be recycled.
22. Prohibit littering by employees, subcontractors, and visitors.
23. Wherever possible, minimize production of solid waste materials.

REFERENCE

California Department of Transportation, Construction Site BMP Manual, 2000 or later

BMP CN – 105
HAZARDOUS WASTE MANAGEMENT

DESCRIPTION

These are procedures and practices to minimize or eliminate the discharge of pollutants from construction site hazardous waste to the storm drain systems or to watercourses.

This best management practice (BMP) applies to all construction projects.

Hazardous waste management practices are implemented on construction projects that generate waste from the use of:

- Petroleum Products,
- Asphalt Products,
- Concrete Curing Compounds,
- Pesticides,
- Acids,
- Paints,
- Stains,
- Solvents,
- Wood Preservatives,
- Roofing Tar, or
- Any materials deemed a hazardous waste in 40 CFR Parts 110, 117, 261, or 302.

DESIGN CRITERIA

Storage Procedures

1. Wastes shall be stored in sealed containers constructed of a suitable material and shall be labeled as required by 49 CFR Parts 172,173, 178, and 179.
2. All hazardous waste shall be stored, transported, and disposed as required in 49 CFR 261-263.
3. Waste containers shall be stored in temporary containment facilities that shall comply with the following requirements:
   - Temporary containment facility shall provide for a spill containment volume able to contain precipitation from a 24-hour, 25 year storm event, plus the greater of 10% of the aggregate volume of all containers or 100% of the capacity of the largest tank within its boundary, whichever is greater.
   - Temporary containment facility shall be impervious to the materials stored there for a minimum contact time of 72 hours.
   - Temporary containment facilities shall be maintained free of accumulated rainwater and spills. In the event of spills or leaks accumulated rainwater and spills shall be placed into drums after each rainfall. These liquids shall be handled as a hazardous waste unless testing determines them to be non-hazardous. Non-hazardous liquids shall be sent to an approved disposal site.
   - Sufficient separation shall be provided between stored containers to allow for spill cleanup and emergency response access.
   - Incompatible materials, such as chlorine and ammonia, shall not be stored in the same temporary containment facility.

- Throughout the rainy season, temporary containment facilities shall be covered during non-working days, and prior to rain events. Covered facilities may include use of plastic tarps for small facilities or constructed roofs with overhangs. A storage facility having a solid cover and sides is preferred to a temporary tarp. Storage facilities shall be equipped with adequate ventilation.

4. Drums shall not be overfilled and wastes shall not be mixed.
5. Unless watertight, containers of dry waste shall be stored on pallets.
6. Paint brushes and equipment for water and oil based paints shall be cleaned within a contained area and shall not be allowed to contaminate site soils, watercourses or drainage systems. Waste paints, thinners, solvents, residues, and sludge that cannot be recycled or reused shall be disposed of as hazardous waste. When thoroughly dry, latex paint and paint cans, used brushes, rags, absorbent materials, and drop cloths shall be disposed of as solid waste.
7. Ensure that adequate hazardous waste storage volume is available.
8. Ensure that hazardous waste collection containers are conveniently located.
9. Designate hazardous waste storage areas on site away from storm drains or watercourses and away from moving vehicles and equipment to prevent accidental spills.
10. Minimize production or generation of hazardous materials and hazardous waste on the job site.
11. Use containment berms in fueling and maintenance areas and where the potential for spills is high.
12. Segregate potentially hazardous waste from non-hazardous construction site debris.
13. Keep liquid or semi-liquid hazardous waste in appropriate containers (closed drums or similar) and under cover.
14. Clearly label all hazardous waste containers with the waste being stored and the date of accumulation.
15. Place hazardous waste containers in secondary containment.
16. Do not allow potentially hazardous waste materials to accumulate on the ground.
17. Do not mix wastes.

<u>Disposal Procedures</u>

1. Waste shall be removed from the site within 90 days of being generated.
2. Waste shall be disposed of by a licensed hazardous waste transporter at an authorized and licensed disposal facility or recycling facility utilizing properly completed Uniform Hazardous Waste Manifest forms.
3. A certified laboratory shall sample waste and classify it to determine the appropriate disposal facility.
4. Make sure that toxic liquid wastes (e.g., used oils, solvents, and paints) and chemicals (e.g., acids, pesticides, additives, curing compounds) are not disposed of in dumpsters designated for solid waste construction debris.
5. Properly dispose of rainwater in secondary containment that may have mixed with hazardous waste.
6. Recycle any useful material such as used oil or water-based paint when practical.

<u>Maintenance and Inspection</u>

1. A foreman and/or construction supervisor shall monitor on-site hazardous waste storage and disposal procedures.
2. Waste storage areas shall be kept clean, well organized, and equipped with ample clean-up supplies as appropriate for the materials being stored.

3. Storage areas shall be inspected in conformance with the provisions in the contract documents.
4. Perimeter controls, containment structures, covers, and liners shall be repaired or replaced as needed to maintain proper function.
5. Hazardous spills shall be cleaned up and reported in conformance with the applicable Material Safety Data Sheet (MSDS) and the instructions posted at the project site.
6. The National Response Center, at (800) 424-8802, shall be notified of spills of Federal reportable quantities in conformance with the requirements in 40 CFR parts 110, 117, and 302.
7. Copy of the hazardous waste manifests shall be provided to the Owner.

REFERENCE

California Department of Transportation, Construction Site BMP Manual, 2000 or later

END