

Storm Water Technical Standards Manual

Storm Water Board
City of Portage, Indiana



Adopted by the Storm Water Board June 6, 2024

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Prepared By:



Great Lakes Engineering

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Chapter One

INTRODUCTION

This document, the City of Portage (City) Stormwater Technical Standards Manual, contains the necessary technical standards for administering the requirements of the City Storm Water Management Ordinance and shall be considered as a companion document to the Storm Water Management Ordinance. Whereas the Ordinance contains the majority of the regulatory authority and general requirements of comprehensive stormwater management, this Storm Water Technical Standards Manual contains the necessary means and methods for achieving compliance with the Ordinance. This Technical Standards Manual may be updated and expanded from time to time at the discretion of the Portage Storm Water Management Board as new technology is available, based on improvements in engineering, science, monitoring and local maintenance experience, as well as updated municipal and statutory regulations and updated City standards and details.

The City of Portage Stormwater Management Ordinance sets forth minimum requirements for development activities which require City approval. The City finds that:

- Water bodies, roadways, structures, and other property within, and downstream of the City of Portage are at times subjected to flooding;
- Flooding is a danger to the lives and property of the public and is also a danger to the natural resources of the City and the region;
- Land development alters the hydrologic response of watersheds and can result in increased storm water runoff rates and volumes, flooding, stream channel erosion, and sediment transport and deposition;
- Storm water runoff produced by land development contributes to increased quantities of water-borne pollutants;
- Storm water runoff, soil erosion, and nonpoint source pollution, due to land development within the City of Portage, have resulted in the deterioration of the water resources of the City of Portage and downstream municipalities. Increased storm water runoff rates and volumes, and the sediments and pollutants associated with storm water runoff from development projects with the City of Portage may, absent reasonable regulation and control, adversely affect the City of Portage's water bodies and water resources, and those of downstream municipalities;

- Storm water runoff, soil erosion, and nonpoint source pollution can be controlled and minimized by the regulation of storm water runoff from development;
- Adopting the standards, criteria and procedures contained in the Stormwater Management Ordinance and Stormwater Technical Standards Guide, and implementing the same, will address many of the deleterious effects of storm water runoff;
- Adopting these standards is necessary for the preservation of the public health, safety and welfare.

The City Storm Water Management Ordinance and this Storm Water Technical Standards Manual provide the general requirements and recommended/acceptable methods for design and review of stormwater quantity and quality infrastructure within City Storm

The purpose of this Technical Standards Manual is to present design and review procedures, standards and guidelines for use in complying with the City's requirements for development and land disturbing activities. The Drainage and Storm Water Management Ordinance and this Technical Standards Manual seek to accomplish, among others, the following objectives:

- To reduce flood damage;
- To minimize increased storm water runoff rates and volumes from identified new land development;
- To minimize the deterioration of existing watercourses, culverts and bridges, and other structures associated with storm water conveyance;
- To encourage water recharge into the ground where geologically favorable conditions exist;
- To prevent an increase in nonpoint source pollution into storm drainage facilities, streams and waterways;
- To maintain the integrity of stream channels for biological functions, as well as for drainage and other purposes;
- To minimize the impact of development upon stream bank and streambed stability;
- To reduce erosion from development or construction projects;
- To preserve and protect water supply facilities and water resources by means of controlling increased flood discharges, stream erosion, and runoff pollution;
- To reduce storm water runoff rates and volumes, soil erosion, and nonpoint source pollution, wherever practicable, from lands that were developed without storm water management controls meeting the purposes and standards of the Stormwater Management Ordinance as well as future developments; and,
- To implement the minimum standards established to protect water bodies from degradation resulting from changing land use where there are insufficient storm water management controls.

Definitions, formulas, criteria, procedures and data are presented here in this Technical Standards Manual to provide guidance to developers and consultants in project planning and design, as well as City enforcement staff with permits, applications, plan review, approval and inspections. The Technical Standards Manual presents minimum design requirements. When unusual or complex problems are encountered, it is the responsibility of the designer to identify such conditions and propose solutions. In such cases, the designer shall propose an alternative higher standard, criteria, solution or methodology consistent with good planning and engineering practice and shall receive approval of the change prior to final approval of the design. Use of this Technical Standards Manual, City approval and/or issuance of a permit does not release the designer of the design responsibility and to ensure adequacy of the engineering solution.

The City of Portage has furnished additional policy, criteria and information for the proper implementation of the water quality requirements of the Drainage and StormWater Management Ordinance and this Technical Standards Manual in the form of a Drainage and Storm Water Management Best Management Practice (BMP) Manual. The BMP Manual includes acceptable Best Management Practices (BMPs), including the specific design criteria for each storm water practice. This Technical Standards Manual may be updated and expanded from time to time at the discretion of the City as new technology is available, based on improvements in engineering, science, monitoring and local maintenance experience, as well as to update municipal and statutory regulations and to comply with updated City standards and detail

Chapter Two

DRAINAGE AND STORM WATER MANAGEMENT APPROVAL

General Approval Requirements

Any land alteration must be accomplished in conformance with the requirements of the City of Portage Stormwater Management Ordinance and Stormwater Technical Standards Manual. Virtually any land disturbing activity that changes the contour, elevation, drainage pattern, existing drainage facility; or increases the rainfall runoff rate or impermeability of the ground surface, or creates a drainage facility, including impoundments, is considered a land alteration and therefore requires City storm water approval. In addition, construction, enlargement or location of any building on a permanent foundation other than a one or two-family dwelling or accessory structure in a non-impacted drainage area, requires City stormwater approval.

Compliance With Standards and Regulations

All land alterations accomplished in the City of Portage shall adhere to and, be in compliance with, the minimum drainage and storm water management standards of the Stormwater Management Storm Water Management Ordinance, Stormwater Technical Standards Manual, City Standard Details, BMP Manual and all regulations adopted by the City in accordance with the Stormwater Management.

Exemptions

With the exception of the specific exemptions listed in the Storm Water Management Ordinance, nearly all land alterations will require application for and receipt of City approval for drainage and storm water management. Stormwater Management and Drainage approval for subdivision, commercial and industrial projects are obtained from the city Stormwater Utility office and as part of the subdivision/development Plan Commission approval process. Approval for Site Plans for individual residential lots is through building permit application and approval from City Building Department. Primary exemptions include soil testing by qualified individuals; agricultural activities; gardening; fill placed on top of natural terrain involving a depth less than one foot and a total volume less than 50 cubic yards; maintenance of drainage facilities; installation of septic systems, installation of utilities and driveway construction. Erosion and sediment control, as specified in the Stormwater Management Ordinance, Stormwater Technical Standards Manual, BMP Manual and IDEM requirements shall still be required for activities exempt from City approval.

Land alterations which are not on the list of exemptions but which an applicant feels qualify as an exemption shall be presented to the City Storm Water Management Board in writing for a variance. The burden of proof is upon the applicant to provide the appropriate evidence upon which the Storm Water Management Board will make its decision. Such requests will be reviewed on an individual case basis and may delay the permit approval process at the applicant's expense.

Design and construction for all land altering activities shall comply with the Storm Water Management Ordinance and Stormwater Technical Standards Manual. If an applicant for storm water approval desires to vary from these standards, they must file with the Storm Water Board for a variance.

Variance Procedure

Requests to waive the drainage and storm water management plan requirements contained in the Storm Water Management Ordinance and Storm Water Technical Standards Manual shall be submitted to the Board for approval. The Board may modify or waive, at its discretion, any minimum standard found in the Storm Water Management Ordinance or Storm Water Technical Standards Manual, in whole or in part, provided that an applicant for drainage and storm water management approval can demonstrate that:

1. A minimum drainage and storm water management standard regulation is unfeasible or unreasonably burdensome, and
2. It can be demonstrated that the proposed development is not likely to impair attainment of the objectives of this ordinance, and
3. Alternative minimum requirements for on-site management of storm water discharges have been established in a storm water management plan, and
4. Meeting the minimum on-site management requirements is not feasible due to the natural or existing physical characteristics (restraints) of a site.

To be eligible for a variance, the applicant must demonstrate to the satisfaction of the Board that the immediately downstream waterways will not be subject to:

1. Deterioration of existing culverts, bridges, dams, and other structures;
2. Deterioration of biological functions or habitat;
3. Accelerated streambank or streambed erosion or sediment loading;
4. Increased threat of flood damage to public health, life and property.
5. Overloading of existing downstream storm water facilities.

Furthermore, where compliance with minimum requirements for drainage and storm water management is waived, the board may require the applicant to satisfy the minimum requirements by providing mitigation measures selected by the Storm Water Management Board.

Application Procedures For Storm Water Drainage Approval

Persons, partnerships, corporations or their designees, which will be responsible for accomplishing the land alteration, shall apply for drainage and storm water management approval. It is the responsibility of the applicant to know the requirements of the Stormwater Management Ordinance , Storm Water Technical Standards Manual, City Standard Details, City BMP Manual and all other City requirements and prepare an application in accordance with the identified provisions.

Drainage and Storm Water Management Plans

A drainage and storm water management plan fulfilling the requirements of the Stormwater Management Ordinance and this Stormwater Technical Standards Manual shall be submitted to City before drainage and storm water management approval can be obtained for a proposed land alteration. The drainage and storm water management plan shall contain complete, accurate and specific information regarding the proposed land alteration and impact upon adjacent properties and drainage facilities. The following minimum information shall demonstrate and describe surface and subsurface drainage and storm water management strategy and shall accompany each drainage and storm water management plan submitted for approval:

Construction Features:

1. Scale: As appropriate.
2. North arrow on each sheet.
3. Existing land contours:
 - A. 1-foot contour intervals for land slopes less than 10%.
 - B. 2-foot contour intervals for land slopes equal to or greater than 10%, but less than 20%.
 - C. 5-foot contour intervals for land slopes equal to or greater than 20%.
4. Benchmarks, based on NGVD 29 or NAVD 88 datum, which are easily accessible and relocatable (a benchmark not based on these datum may be assumed for areas less than two acres in size).
5. Location and vicinity map for the proposed land alteration.
6. Existing and proposed drainage and storm water management facilities, including storm drains, manholes, inlets, swales, ditches, natural or manmade drainageways, storm water outlets and Best Management Practices (BMPs). The plans shall identify:
 - A. Location of the drainage and storm water management facility by planimetric distances, referenced from traverse lines, USGS section lines, property markers or road centerlines. In areas where such physical features are unavailable, the State of Indiana coordinate system or other acceptable horizontal and vertical datum may be used.
 - B. Direction of flow.
 - C. Elevation of storm drain and BMP rim and inverts.
 - D. Gradient of storm drain and BMPs.

- E. Size of storm drain and BMPs.
- F. Capacity of storm drain and BMPs.
- G. A sequence describing when each post construction stormwater quality treatment BMP will be installed.
- H. Overland Flow Routes.
- I. Impacted Drainage areas and SFHAs.
- J. Locations of Buffer Zones.

7. Plan (top portion) and profile (bottom portion) shall be shown on the same sheet. The plans shall include:
 - A. Scale: 1 inch = 50 feet (horizontal), 1 inch = 5 feet (vertical).
 - B. Appropriate right-of-way and easement limits.
 - C. Sufficient information downstream to show effect of the drainage and storm water management facility on the outfall channel.
 - D. Centerline grade of road for existing or proposed storm drains located in a pavement or shoulder area.
 - E. Existing grade above existing or proposed storm drain located outside of pavement or shoulder areas.
 - F. Profile of undisturbed earth for storm drains and BMPs constructed on fill.
8. An Erosion Control Plan pursuant to 327 IAC 15-5 which includes but is not limited to treatment controls, temporary and permanent seeding schedule, construction schedule, and maintenance schedule.
9. If detention/retention basins or water quality features are required for the development, a geotechnical report prepared by a licensed geotechnical engineer shall be provided. A geotechnical report shall identify ground water levels at all detention/retention and water quality feature sites. In-situ soil permeability shall be obtained and provided at each location where the retention and/or water quality facilities will rely on infiltration.

Design Calculations

Design calculations shall be provided in a separate report and are required as part of the drainage and storm water management plan. These calculations shall be in accordance with all regulations of the Stormwater Management Ordinance and standards established in this Technical Standards Manual. The design calculations / report shall specifically include:

Natural Resources Assessment

1. Maps identifying significant natural features and resources such as undisturbed forest areas, stream buffers and steep slopes that should be preserved to retain some of the original hydrologic function of the site.
2. A site layout and narrative indicating the conservation and preservation of significant natural features.
3. Estimation of storm water runoff.
 - A. Drainage area map with an appropriate scale and base and the 100- year floodplain where applicable.

- B. Weighted runoff coefficient and / or curve number computations.
 - C. Time of concentration (tc) computations.
4. Closed conduit and open channel design computations.
 - A. Size of pipe or channel cross-section.
 - B. Pipe or channel invert.
 - C. Roughness coefficients.
 - D. Flow velocities (in feet per second).
 - E. Design capacities (in cubic feet per second).
 - F. Energy dissipation computations
 5. Head loss computations in manholes and junction chambers.
 6. Hydraulic gradient computations.
 7. Erosion control methods.
 8. Water Quality Volume (WQv) or water quality treatment rate calculations.
 9. Best Management Practices (BMPs) computations.
 10. A drainage narrative describing the existing conditions and flow patterns, the proposed conditions and flow patterns, summarizing the pre- and post-developed runoff calculations, indicating if any off-site flow is entering the site, explaining the effect of the project on both downstream and upstream drainageways and lands, discussing any special considerations / assumptions, etc.

BMP Operation and Maintenance Manual

An operations and maintenance (O&M) manual is required for each BMP as part of the drainage and storm water maintenance plan. The O&M manual will include the following:

1. BMP owner name, address, business phone number, email address, cellular phone number
2. Site drawings (8 ½" by 11"), showing both plan and cross-section views, showing the BMP and applicable features, including dimensions, maintenance easements, outlet works, forebays, signage, connecting structures, weirs, invert elevations, etc.;
3. Schedule and guidance on owner-required routine inspections;
4. Requirement of owner to perform maintenance;
5. Guidance on routine maintenance, including mowing, litter removal, woody growth removal, signage, etc.;
6. Guidance on remedial maintenance; such as inlet replacement, outlet works maintenance, etc.;

7. Schedule and guidance on sediment removal, both narrative and graphical, describing when sediment removal should occur in order to insure that the BMP remains effective as a water quality control device;
8. A statement that the City's representatives have the right to enter the property to inspect or in an emergency and, at the owners cost, maintain the BMP;
9. Copies of recorded deeds, restrictions and agreements for perpetual maintenance responsibility for facilities not in public right of way.
10. A schedule showing inspection and maintenance requirements; and
11. Identification of and contact information for the property / BMP owner as the party r responsible for maintenance, including cost.

Duration of Permit

If the land alteration for which drainage and storm water management approval has been issued has not commenced within two years from the date of its issuance, the approval shall expire. If the drainage activity is only partially completed and no substantial land alteration has occurred on the site for a period of one year, the approval shall expire. The City, however, will consider written requests, based on good cause, for extension of permit durations to allow the completion of work.

Performance Bonds

The City may require the owner, developer or other parties to post a performance guarantee, to provide surety for the satisfactory completion of the approved provisions of a drainage and storm water management approval.

Covenants and Easements

The Board may require the execution of binding covenants to achieve satisfactory present and future drainage and storm water management of a parcel for which drainage and storm water management approval is requested as well as for the area surrounding that parcel.

As a minimum, the Board shall require that the following covenant be executed by the owner or owners of such land which will be included in a recorded plat:

"It shall be the responsibility of the owner of any lot or parcel of land within the area of this plat to comply at all times with the provisions of the drainage and storm water management plan as approved for this plat by the City of Portage and the requirements of all drainage and storm water management approvals for this plat issued by the City".

The drainage and storm water management plans submitted in support of a permit application shall provide sufficient detail to identify existing or proposed

covenants and easements. Applicants are encouraged to identify the planimetric dimensions and location of these and to initiate contact with affected property owners prior to the submittal of any application for approval.

Access easements (easement) shall be provided for all storm water conveyances and facilities to be maintained by the City of Portage. In addition, easements shall be provided for all conveyances, including ponds, carrying or receiving runoff from off-site drainage basins and ponds. Regulated Drains (proposed and existing) may have additional easement requirements to ensure the provisions of this Manual and the Stormwater Management Ordinance are met.

Storm water BMPs must maintain easements as well. Storm water ponds shall maintain the same easement as required for a detention facility. Off-line manufactured BMP structures should maintain an easement that includes the connecting manholes and the weir structure. All easements should be clearly included on the plans. Water quality easements should be included in the O&M manual. On a case-by-case basis the City may determine additional easement requirements. The Board may require such additional easement requirements as are necessary to ensure the provisions of the Stormwater Management Ordinance and this Technical Guide are met. The following table summarizes the easement widths required.

Table A - Easement Requirement

Storm Water Facility Description	Minimum Easement (ft)*
Detention Pond/Facility (Serving > 5.0 ac) (including all storm water pond BMPs)	25 horizontally from the 100-year elevation of the pond or maintainance road, whichever is more restrictive – Detention facilities shall not be constructed within the public right-of-way.
Storm sewer pipe and structures up to 6 depth feet to invert	20 feet (10 feet from centerline of pipe)
Storm sewer pipe and structures (> 6 feet deep to invert)	Depth factor – 20’width + 2’ additional width for each addition foot of depth over 6’, centered on center of pipe/structure)
Drainage Ditch	15 feet minimum from top of bank
Backyard Drainage Swale and Pipe	20 feet minimum (10 feet each side of property line) (Pipe and swale shall be centered in easement.)
Structural and Manufactured BMPs	20 feet from the outside of BMP – Manufactured BMP units must maintain 20 feet from the center of the unit or 10 feet from the outside of the unit (whichever is greater) and include the connecting manholes when in an off-line configuration
* Unless directed otherwise by the City	

Storm water systems, including conveyance systems, swales, structures and appurtenances, other than detention or retention basins, backyard drains and cross connections to backyard drains, shall be placed in the public right of way or dedicated easement adjacent to the public right of way. Stormwater detention basins shall have a minimum of 50 feet of frontage on public right of way. All stormwater systems located outside of the right-of-way shall require approval

from City and shall be placed within a drainage easement. There shall be no trees or shrubs planted, nor any structures or fences erected in any drainage easement, unless otherwise approved by City. Storm drainage systems for maintenance free communities with an association which has binding legal responsibility for maintenance of drainage systems may place stormwater facilities outside of the public right of way if approved by City, at its discretion. Approval will be on a case by case basis. Such systems shall meet all minimum requirements of this Ordinance and Storm Water Technical Standards Manual.

All drainage improvements and methods relative to the conveyance of stormwater runoff, and the perpetual maintenance thereof outside of public right of way and within the latter easements, shall be the responsibility of the development owner or homeowner association for maintenance and shall be included in covenant or deed language that is recorded with the Porter County Recorder. Maintenance shall be in accordance with Ordinance and City Storm Water Technical Standards Manual.

Enforcement Response for Violation

Any person, partnership or corporation violating the provisions or minimum standards of the Stormwater Management Ordinance, Storm Water Technical Standards Manual or other regulations and standards promulgated by the City shall be subject to the enforcement provisions below, as well as, Section 7 (Compliance and Enforcement) of the Stormwater Management Ordinance.

If the City determines that an applicant or other responsible person has contributed to an illicit discharge, has failed to comply with the City Stormwater Management Ordinance, Stormwater Technical Standards Manual, the terms and conditions of a permit, an approved stormwater management design plan, approved SWPPP, or a recorded stormwater management maintenance agreement, it shall issue a written Notice of Violation to such applicant or other responsible person and/or the owner of the property. Where a person is engaged in activity covered by this ordinance without having first secured approval, the notice of violation shall be served on the owner or the responsible person in charge of the activity being conducted on the site.

The notice of violation can be in the form of a citation ticket, email and/or a written letter that would contain detailed inspection findings, conclusions of law, disposition of warning or fines assessed, stipulated remedial actions, reasonable deadlines for those remedial actions, and the date of re-inspection.

The City has established an Enforcement Response Schedule as noted in the table below that standardizes the approach that the City may, in its discretion, employ in dealing with stormwater regulations offenses subject to the Ordinance and the Stormwater Technical Standards Manual. When so employed, this Schedule shall apply separately to each offense in the following manner: The first offense is the underlying violation itself, while the subsequent offenses 2 thru 8 (as necessary) are failures of compliance.

Offense #	Type of Response Anticipated
1 st offense	Email Notice, Letter of Violation or Written Warning, each with or without Administrative Penalty
2 nd offense	Letter of Violation, Administrative Penalty and Site Visit
3 rd offense	Letter of Violation, Administrative Penalty and Site Visit
4 th offense	Letter of Violation, Administrative Penalty and Site Visit
5 th offense	Agreed Order, Administrative Penalty and Site Visit
6 th offense	Administrative Order, Administrative Penalty and Site Visit
7 th offense	Compliance Schedule, Administrative Penalty and Site Visit
8 th offense	Litigation and Administrative Penalty

Likewise, in order to standardize the approach that the City may, in its discretion, employ in the imposition of Administrative Penalties, the City has established the following Schedule of Administrative Penalties. Again, the penalty for the 1st offense would apply to the violation itself, while the subsequent penalties 2 through 4 (as necessary) would apply to failures of compliance. At its discretion, the City may impose penalties up to the amount specified in this Schedule.

Offense #	Penalty
1 st offense	\$250.00
2 nd offense	\$500.00
3 rd offense	\$1,000.00
4 th offense	\$2,500.00

The City reserves the right to issue a maximum fine for any offense or violation deemed sufficiently egregious or otherwise determined by the City to warrant a maximum penalty.

Stop Work Order

In addition to the penalties listed above, if land disturbance activities are conducted and are in non-compliance, failing to meet all City approvals, the City may order the work stopped by notice in writing served on any person engaged in the doing or causing of such work to be done, and any such persons shall forthwith stop such work immediately until authorized by the City to proceed with the work.

Note that per IC 13-18-27-18 for construction projects that are operating under a SWPPP approved by the City, if a Stop Work Order is issued on the grounds that the erosion and sediment control measures included in the construction plan are not adequate, the project site owner shall be notified in writing of the inadequacies in the erosion and sediment control measures and the project site owner has seventy-two (72) hours after receiving written notice to resolve the identified inadequacies before the Stop Work Order can take effect.

The seventy-two (72) hour period to resolve identified inadequacies on a construction project does not apply if the Stop Work Order is issued to a construction project where the project site owner is creating a public health or safety hazard or the project site owners are failing to meet an approved SWPPP and all city approvals. Note, the 72 hour period only applies to violations due to the inadequacy of approved SWPPP plans. Stop work orders for other violations shall be effective immediately.

A Stop Work Order will be posted on the site by the City and it is unlawful for any person to remove the notice or continue any work on the site without permission from the City. The City may also undertake or cause to be undertaken, any necessary or

advisable protective measures to prevent violations of this Ordinance or to avoid or reduce the effects of noncompliance herewith. The cost of any such protective measures shall be the responsibility of the owner of the property upon which the work is being done and the responsibility of any person carrying out or participating in the work.

The City may bring an action under IC 34-28-5-1 (b), to be read together with IC 34-6-2-86(1)(B) and 13-21-3-12(4), to enforce a stop work order against any person who neglects or fails to comply with a stop work order.

Complete regulations regarding violations and enforcement are included in the City Stormwater Management Ordinance.



Chapter Three

METHHODOLOGY FOR DERMINATION OF RUNOFF RATES

Runoff quantities shall be computed for the area of the parcel under development plus the area of the watershed flowing into the parcel under existing and future development conditions. At least one waterway opening shall be provided for each watershed at the upstream edge of the parcel to accept upstream drainage.

Reasonable future development for the area upstream of the parcel should be considered. The nature of future development shall be that projected by the Comprehensive Land Use Plan for the City of Portage adopted by the Plan Commission or that allowed by current zoning districts, whichever reflects the more intense use. The amount of runoff not accommodated in connection with such future development shall be determined by good engineering practice and may assume use of retention-detention systems.

Drainage and storm water management facilities for a parcel shall be provided which allows drainage and treatment of storm water runoff from each portion of the parcel, as well as the upstream area, which drains through the parcel. The drainage and storm water management facilities shall:

1. Accommodate the storm water runoff from the required rainfall event or greater without endangering public safety and health or causing significant damage to the property;
2. Be designed to treat the Water Quality Volume (WQv) or the water quality treatment rate.
3. Be durable;
4. Be easily maintained;
5. Be safe to persons;
6. Minimize off-site sedimentation to the maximum extent practicable; and
7. Minimize erosion to the maximum extent practicable.

Additionally, the drainage and storm water management facilities should be designed to operate in accordance with the provisions of the Storm Water Management Ordinance and Storm Water Technical Standards Manual.

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 25 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:

$$Q = CIA$$

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 **Tables 3-4** and **3-5**.

In general, the time of concentration (t_c) methodology to be used for all stormwater management projects within City 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. 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 3-1

Urban Runoff Coefficients				
<i>Type of Surface</i>	<i>Runoff Coefficient "C"</i> <i>(by Storm Recurrence Interval)</i>			
	<i>< 25 year</i>	<i>25 year</i>	<i>50 year</i>	<i>100 year</i>
<input type="checkbox"/> Hard Surfaces				
Asphalt	0.82	0.90	1.00	1.00
Gravel	0.85	0.94	1.00	1.00
Concrete	0.85	0.94	1.00	1.00
Roof	0.85	0.94	1.00	1.00
<input type="checkbox"/> Lawns (Sandy)				
Flat (0-2% Slope)	0.07	0.08	0.09	0.12
Rolling (2-7% Slope)	0.12	0.13	0.16	0.20
Steep (Greater than 7% Slope)	0.17	0.19	0.22	0.28
<input type="checkbox"/> Lawns (Clay)				
Flat (0-2% Slope)	0.16	0.18	0.21	0.26
Rolling (2-7% Slope)	0.21	0.23	0.28	0.35
Steep (Greater than 7% Slope)	0.30	0.33	0.40	0.50

Source: HERPICC Stormwater Drainage Manual, July 1995, and other sources.

TABLE 3-2

Rural Runoff Coefficients				
<i>Type of Surface</i>	<i>Runoff Coefficient "C"</i> <i>(by Storm Recurrence Interval)</i>			
	<i>< 25 year</i>	<i>25 year</i>	<i>50 year</i>	<i>100 year</i>
<input type="checkbox"/> Woodland (Sandy)				
Flat (0-2% Slope)	0.10	0.11	0.13	0.17
Rolling (2-7% Slope)	0.25	0.28	0.33	0.41
Steep (Greater than 7% Slope)	0.30	0.33	0.40	0.50
<input type="checkbox"/> Woodland (Clay)				
Flat (0-2% Slope)	0.30	0.33	0.40	0.50
Rolling (2-7% Slope)	0.35	0.39	0.46	0.58
Steep (Greater than 7% Slope)	0.50	0.55	0.66	0.83
<input type="checkbox"/> Pasture (Sandy)				
Flat (0-2% Slope)	0.10	0.11	0.13	0.17
Rolling (2-7% Slope)	0.16	0.18	0.21	0.26
Steep (Greater than 7% Slope)	0.22	0.24	0.29	0.36
<input type="checkbox"/> Pasture (Clay)				
Flat (0-2% Slope)	0.30	0.33	0.40	0.50
Rolling (2-7% Slope)	0.36	0.40	0.48	0.59
Steep (Greater than 7% Slope)	0.42	0.46	0.55	0.69
<input type="checkbox"/> Cultivated (Sandy)				
Flat (0-2% Slope)	0.30	0.33	0.40	0.50
Rolling (2-7% Slope)	0.40	0.44	0.53	0.66
Steep (Greater than 7% Slope)	0.52	0.57	0.69	0.86
<input type="checkbox"/> Cultivated (Clay)				
Flat (0-2% Slope)	0.50	0.55	0.66	0.83
Rolling (2-7% Slope)	0.60	0.66	0.79	0.99
Steep (Greater than 7% Slope)	0.72	0.79	0.95	1.00

Source: HERPICC Stormwater Drainage Manual, July 1995, and other sources.

ABLE 3-3

Runoff Coefficients by Land Use, Typical Inlet Times, and Storm Recurrence Interval		
<i>Land Use</i>	<i>Runoff Coefficients "C"</i> <i>(by Storm Recurrence Interval)</i>	<i>Inlet Time</i>

	Flat (1)				Rolling (2)				Steep (3)				(Minutes) (4)
	< 25 year	25 year	50 year	100 year	< 25 year	25 year	50 year	100 year	< 25 year	25 year	50 year	100 year	
Commercial (CBD)	0.75	0.83	0.99	1.00	0.83	0.91	1.00	1.00	0.91	1.00	1.00	1.00	5
Commercial (Neighborhood)	0.54	0.59	0.71	0.89	0.60	0.66	0.79	0.99	0.66	0.73	0.87	1.00	5 - 10
Industrial	0.63	0.69	0.83	1.00	0.70	0.77	0.92	1.00	0.77	0.85	1.00	1.00	
Garden Apartments	0.54	0.59	0.71	0.89	0.60	0.66	0.79	0.99	0.66	0.73	0.87	1.00	
Churches	0.54	0.59	0.71	0.89	0.60	0.66	0.79	0.99	0.66	0.73	0.87	1.00	
Schools	0.31	0.34	0.41	0.51	0.35	0.39	0.46	0.58	0.39	0.43	0.51	0.64	10 - 15
Semi Detached Residential	0.45	0.50	0.59	0.74	0.50	0.55	0.66	0.83	0.55	0.61	0.73	0.91	
Detached Residential	0.40	0.44	0.53	0.66	0.45	0.50	0.59	0.74	0.50	0.55	0.66	0.83	
Quarter Acre Lots	0.36	0.40	0.48	0.59	0.40	0.44	0.53	0.66	0.44	0.48	0.58	0.73	
Half Acre Lots	0.31	0.34	0.41	0.51	0.35	0.39	0.46	0.58	0.39	0.43	0.51	0.64	
Parkland	0.18	0.20	0.24	0.30	0.20	0.22	0.26	0.33	0.22	0.24	0.29	0.36	To be Computed

Source: HERPICC Stormwater Drainage Manual, July 1995, and other sources.

- Notes:** (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.

**TABLE 2-4
RAINFALL INTENSITIES FOR VARIOUS RETURN PERIOD AND STORM
DURATIONS**

Duration	2	5	10	25	50	100
5 min	4.20	5.16	6.12	7.56	8.76	10.20
10 min	3.66	4.56	5.34	6.60	7.68	9.00
15 min	3.12	3.88	4.56	5.64	6.60	7.68
20 min	2.63	3.28	3.84	4.75	5.56	6.47

30 min	2.14	2.68	3.12	3.86	4.52	5.26
40 min	1.75	2.19	2.55	3.16	3.70	4.31
50 min	1.52	1.90	2.21	2.73	3.20	3.73
1 hr	1.36	1.70	1.98	2.45	2.87	3.35
2 hr	0.84	1.05	1.23	1.52	1.77	2.07
3 hr	0.62	0.77	0.90	1.11	1.30	1.52
6 hr	0.36	0.45	0.53	0.65	0.76	0.89
12 hr	0.21	0.26	0.31	0.38	0.44	0.52
24 hr	0.12	0.15	0.18	0.22	0.25	0.30

Source: "Rainfall Frequency Atlas of the Midwest," by Floyd A. Huff and James R Angel, 1992

**TABLE 3-5
RAINFALL DEPTHS FOR VARIOUS RETURN PERIOD AND STORM DURATIONS**

Duration	2	5	10	25	50	100
5 min	0.35	0.43	0.51	0.63	0.73	0.85
10 min	0.61	0.76	0.89	1.10	1.28	1.50
15 min	0.78	0.97	1.14	1.41	1.65	1.92
20 min	0.88	1.09	1.28	1.58	1.85	2.16
30 min	1.07	1.34	1.56	1.93	2.26	2.63
40 min	1.17	1.46	1.70	2.10	2.46	2.87
50 min	1.26	1.58	1.84	2.28	2.67	3.11
1 hr	1.36	1.70	1.98	2.45	2.87	3.35
2 hr	1.68	2.09	2.45	3.03	3.54	4.13
3 hr	1.85	2.31	2.70	3.34	3.90	4.56
6 hr	2.17	2.71	3.16	3.91	4.57	5.34
12 hr	2.51	3.14	3.67	4.54	5.31	6.19
24 hr	2.89	3.61	4.22	5.22	6.10	7.12

Source: "Rainfall Frequency Atlas of the Midwest," by Floyd A. Huff and James R Angel, 1992

B. DEVELOPMENT SITES GREATER THAN 5 ACRES IN SIZE OR CONTRIBUTING DRAINAGE AREA GREATER THAN 25 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. 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 for runoff calculations. 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. This table should be used only when the rainfall distribution is not a default option in the computer

program. Examples of computer models that can generate such hydrographs include TR-55 (NRCS), TR-20 (NRCS), and HEC-HMS (COE). These programs may be downloaded free of charge from the associated agencies' web sites. Other models may be acceptable on a case-by-case basis.

TABLE 2-6

NRCS Type II Rainfall Distribution Ordinates					
<i>Cumulative Storm Time (hr)</i>	<i>Cumulative Percent of Storm Depth</i>	<i>Cumulative Storm Time (hr)</i>	<i>Cumulative Percent of Storm Depth</i>	<i>Cumulative Storm Time (hr)</i>	<i>Cumulative Percent of Storm Depth</i>
0.00	0	8.25	12.6	16.50	89.3
0.25	0.2	8.50	13.3	16.75	89.8
0.50	0.5	8.75	14	17.00	90.3
0.75	0.8	9.00	14.7	17.25	90.8
1.00	1.1	9.25	15.5	17.50	91.3
1.25	1.4	9.50	16.3	17.75	91.8
1.50	1.7	9.75	17.2	18.00	92.2
1.75	2	10.00	18.1	18.25	92.6
2.00	2.3	10.25	19.1	18.50	93
2.25	2.6	10.50	20.3	18.75	93.4
2.50	2.9	10.75	21.8	19.00	93.8
2.75	3.2	11.00	23.6	19.25	94.2
3.00	3.5	11.25	25.7	19.50	94.6
3.25	3.8	11.50	28.3	19.75	95
3.50	4.1	11.75	38.7	20.00	95.3
3.75	4.4	12.00	66.3	20.25	95.6
4.00	4.8	12.25	70.7	20.50	95.9
4.25	5.2	12.50	73.5	20.75	96.2
4.50	5.6	12.75	75.8	21.00	96.5
4.75	6	13.00	77.6	21.25	96.8
5.00	6.4	13.25	79.1	21.50	97.1
5.25	6.8	13.50	80.4	21.75	97.4
5.50	7.2	13.75	81.5	22.00	97.7
5.75	7.6	14.00	82.5	22.25	98
6.00	8	14.25	83.4	22.50	98.3
6.25	8.5	14.50	84.2	22.75	98.6
6.50	9	14.75	84.9	23.00	98.9
6.75	9.5	15.00	85.6	23.25	99.2
7.00	10	15.25	86.3	23.50	99.5
7.25	10.5	15.50	86.9	23.75	99.8
7.50	11	15.75	87.5	24.00	100
7.75	11.5	16.00	88.1		
8.00	12	16.25	88.7		

Source: National Resources Conservation Service (NRCS), "TR-20 Computer Program for Project Formulation Hydrology", page F9, May 1982.

NOTE: For use only when SCS Type II rainfall distribution is not a default option 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 Chapter.



Chapter Four

METHODOLOGY FOR DETERMINATION OF RETENTION/DETENTION STORAGE VOLUMES

The required volume of stormwater storage for all development sites shall be computed using a computer model that can generate hydrographs based on the NRCS TR-55 time of concentration and curve number calculation methodologies. Examples of computer models that can generate such hydrographs include TR-55 (NRCS), TR-20 (NRCS), and HEC-HMS (COE). Other models may be acceptable on a case by case basis.

A. POST-DEVELOPMENT HYDROLOGIC PARAMETERS

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).

B. DESIGN STORM & ALLOWABLE RELEASE RATES FOR DEVELOPMENT SITES WITH ON-SITE DETENTION FACILITIES

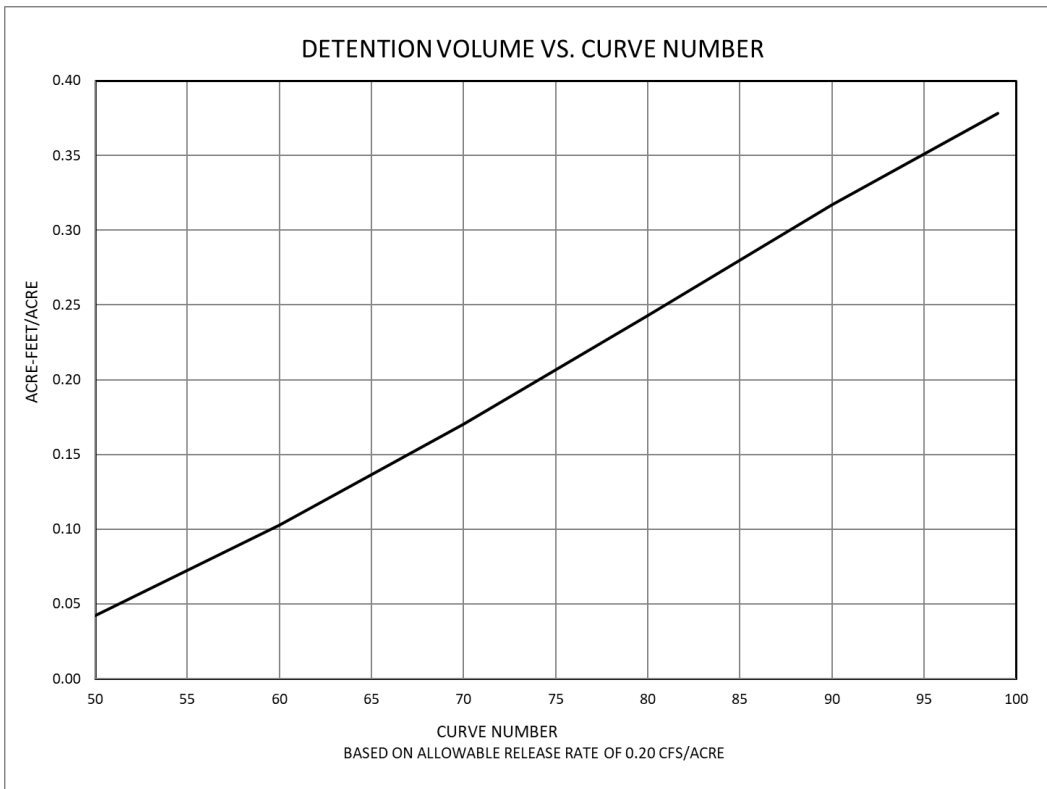
The 24-hour NRCS Type 2 Rainfall Distribution shall be utilized to determine the required storage volume. The allowable release rates shall be determined based on methodologies provided in Chapter 5 of this Technical Standards document.

In general, the allowable release rate of storm water from a proposed development should not exceed a rate of 0.20 cfs/acre.

**RAINFALL DEPTHS FOR VARIOUS RETURN PERIODS AND
STORM DURATIONS**

Storm Duration	Return Interval (years)					
	2	5	10	25	50	100
5-min	0.44	0.52	0.59	0.68	0.75	0.82
10-min	0.69	0.81	0.92	1.04	1.14	1.24
15-min	0.84	0.99	1.13	1.28	1.41	1.53
30-min	1.12	1.36	1.56	1.81	2.02	2.22
60-min	1.38	1.71	1.99	2.35	2.66	2.96
2-hr	1.59	2.02	2.40	2.89	3.31	3.74
3-hr	1.72	2.19	2.60	3.15	3.62	4.11
6-hr	2.05	2.63	3.15	3.88	4.51	5.18
12-hr	2.39	3.03	3.62	4.43	5.14	5.88
24-hr	2.82	3.64	4.31	5.29	6.12	7.01

Source: NOAA, National Weather Service, "Precipitation-Frequency Atlas of the United States", NOAA Atlas 14, Volume 2, Version 3, rev 2006, for Portage, Indiana. (values for intermediate durations can be logarithmically interpolated.)





Chapter Five

STORMWATER DETENTION DESIGN STANDARDS FOR PEAK FLOW CONTROL

Basins shall be constructed to retain and/or temporarily detain the stormwater runoff that exceeds the maximum peak release rate authorized by the Storm Water Management Ordinance and Storm Water Technical Standards Manual. 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 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. SUGGESTED CALCULATION SEQUENCES FOR DESIGNING A DETENTION POND FOR PEAK FLOW CONTROL

In addition to the requirement for peak flow control through retention and/or detention, the Stormwater Management Ordinance and Technical Standards require the developer to address Channel Protection and Water Quality Control requirements discussed in this Technical Standards Manual. The proper way to accommodate the water quality, channel protection, and peak flow rate control of a site is to first consider addressing the water quality and channel protection volume requirements and then determine the size and dimensions of the required retention or detention storage for peak flow rate control.

B. ACCEPTABLE DETENTION FACILITIES

The increased stormwater runoff resulting from a proposed development should be detained on-site (if retention is not feasible due to limited infiltration capacity) by the provisions of appropriate above- or below-ground 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.

C. ALLOWABLE RELEASE RATES

1. General Release Rate

Control devices shall limit the discharge to a rate such that the post-developed release rate from the site is no greater 0.2 cfs per acre of developed area for 100-year return interval storms.

2. Downstream Receiving Facility Provisions

In the event the downstream receiving channel or storm sewer system is inadequate to accommodate the established 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 and as approved by the City. Additional detention, as determined by the City, shall be required to store that portion of the runoff exceeding the capacity of the receiving sewers or waterways. The developer may be required to conduct a drainage study on the downstream facilities. As an alternative to reduction of release rates, the City may require the applicant to pursue alleviating downstream restrictions and improving the downstream drainage system. The applicant would be responsible for obtaining all permits and consents required, and incurring all expenses involved in such undertaking.

The requirement for downstream receiving facility provisions will be at the discretion of the City when:

- a. Downstream system is inadequate to handle the fixed allowable release rate.
 - b. When the allowable runoff is released in an area that is susceptible to flooding, the developer may be required to construct appropriate storm drains through the area to avert increased flood hazards caused by the concentration of allowable runoff at one point instead of the natural overland distribution.
3. Discharge to Field Tiles
 - a. Discharge to field tiles is prohibited.
 4. Tailwater of Receiving Streams and Water Bodies
 - a. The 100-year tailwater elevation of the receiving stream or water body shall be taken into consideration during the calculations for the purposes of starting hydraulic grade line elevation.
 - b. Detention storage facilities that outlet to a stream or water body shall be sized using a zero release rate below the 100-year flood elevation.
 5. 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.
 6. The above fixed general release rates may be set at a lower value by the City for certain geographical areas or 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 City. The applicant shall confirm the applicable release rates with the City or designee prior to initiating the design calculations to determine whether a basin-specific release rate has been established for the watershed of their interest or whether the site is located within a designated or an Impact Drainage Area.

C. 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, the allowable release rate will be less of either the following: .2 cfs/acre of the watershed or the modeled runoff rate in which the model accounts for 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. 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, 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 City can be assured, through dedicated easement, that the noted storage will be preserved in perpetuity.

1. Management of Off-site Runoff

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

If off-site runoff enters the detention facility, the allowable release rate shall be based on the development area under control by the applicant. The peak 100-year flowrate from off-site/upstream areas shall be included in the capacity of the emergency overflow weir for the facility. In no event shall the total release rate from the site being developed be greater than that established in this Technical Standards Manual, unless otherwise directed by City.

Drainage and storm water management facilities shall have adequate capacity to convey the storm water runoff from all upstream tributary

areas through the development under consideration for a storm of a 100-year design return period calculated on the basis of the upstream land in its present state of development. An allowance, equivalent to the reduction in flow rate provided, should be made for upstream detention when such upstream detention and release rate have previously been approved by the Board and evidence of its construction can be shown. The overflow shall be designed to accommodate the peak 100-year inflow to the detention facility with 1' of freeboard.

2. Documentation of Results

The results of the allowable release rate determinations (if retaining the entire required peak flow rate volume is not feasible) 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 2-, 10-, and 100-year events.

D. GENERAL DETENTION BASIN DESIGN REQUIREMENTS

1. The retention/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 retention/detention capacity is restored within 48 hours from the start of the design 100-year storm.
2. The 100-year elevation of stormwater retention/detention facilities shall be separated by not less than 50 feet from any building or structure to be occupied. The Lowest Adjacent Grade (including walkout basement floor elevation) 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, or 2 feet above required freeboard, whichever is higher. In addition to the Lowest Adjacent Grade requirements, any basement floor must be at least a foot above the normal water level of any wet-bottom pond or the local groundwater table, whichever is higher, to avoid the overuse of sump pumps and frequent flooding of the basement.
3. No detention facility or other water storage area, permanent or temporary, shall be constructed under or within twenty (20) feet of any pole or high voltage electric line. Likewise, poles or high voltage electric lines shall not be placed within twenty (20) feet of any detention facility or other water storage area.
4. Detention facilities shall be separated from parking lots and roadways by an appropriately-selected and designed method of safety barrier, such as guard rails, bollards, or other physical barriers capable of deterring the passage of a vehicle 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~~ required.
6. Safety screens having a maximum opening of four (4) inches shall be provided for any pipe or opening end sections 12-inch in diameter or larger. Storm drainpipes outleting into the pond shall not be submerged.
7. Outlet control structures shall be designed to operate as simply as possible and shall require little or no maintenance and/or attention for proper operation. For maintenance purposes, the outlet from the pond (if any) 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. If an outlet control structure includes an orifice to restrict the flow rate, such orifice shall be no less than 4 inches in diameter.
8. Emergency overflow facilities such as a weir or spillway shall be provided for the release of exceptional storm runoff or in emergency conditions should the normal discharge devices become totally or partially

inoperative. The overflow facility shall be of such design that its operation is automatic and does not require manual attention. The design for such weir or spillway shall be as specified in the Ordinance and these Technical Standards.

Emergency overflow facilities shall be designed to convey, without overtopping the detention facility banks the 100-year design storm event runoff, with (one) 1' of freeboard, from the entire contributing watershed draining to the detention/retention facility, 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), discharge equal to the peak 100-year inflow, and the maximum head being the difference between the weir control elevation and the top of the bank.

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. It must be sized to accommodate the design flow of the pond's emergency overflow weir. A minimum of thirty (30) feet width along the centerline of this emergency overflow route or the flow width required to accommodate the emergency spillway design flow, whichever is greater, shall be designated as permanent drainage easement. This emergency overflow path/easement area shall be shown clearly on the plans. 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 2 feet above the flood elevation along the route, calculated based on the pond's emergency overflow weir design discharge. Overflow weirs shall not outlet within 30' of, nor directly onto, adjacent property without adequate provision to control and convey overflow drainage, as well as permission granted in a dedicated drainage easement, as part of the overall stormwater design when release offsite is part of a regional drainage plan or the receiving facility is not adjacent to the site.

10. Grass or other suitable vegetative cover shall be provided along the banks of the retention/detention storage basin. Vegetative cover around detention facilities should be maintained as appropriate.
11. Debris and trash removal and other necessary maintenance shall be performed on a regular basis to assure continued operation in conformance to design.
12. 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, or required freeboard, whichever is higher. Detention basins, assumed full to the 100-year water surface elevation or the emergency overflow weir elevation, or required freeboard, whichever is higher, shall be placed within a common area either platted or legally described and recorded as a perpetual stormwater easement.

13. A minimum of twenty five (25) feet horizontally from the top of bank of the facility, or the required freeboard pool, if no defined top of bank is present, shall be dedicated as permanent stormwater. No trees shall be planted within 50 feet of any pipe outlet entering the pond or the outlet for the pond.

In addition, an exclusive easement, minimum 25' in width, to assure access to the pond from an adjacent public street/road right of way shall be required. No above-ground utilities or other obstruction that may hinder access shall be allowed within this exclusive access easement. Additional access easements may be required for larger ponds at City discretion,

14. All storm water detention facilities should be separated by not less than 50 feet from any building or structure to be occupied.

15. Detention basins shall be constructed with a minimum frontage of 50 feet along public right-of-way

16. The bottom slopes of dry bottom basins shall all drain to the outlet drain and must contain either minimum grades of 1% or under drains leading to the outlet drain. Naturalized basins planted with native vegetation may include bottom slopes less than 1%.

E. 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:

1. Facilities designed with permanent pools or containing permanent lakes shall have a water area of at least one-half (0.5) acre with a minimum depth of eight (8) feet over the majority of pond area. 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. All wet detention/retention ponds must be constructed in as natural a shape (footprint) as possible and have a vegetated safety ledge (approximately 6 inches below normal pool) ~~and/or have~~ Native vegetation planted on the pond banks to create a riparian buffer (minimum 10 feet wide) should also be considered by developer. Native vegetation can be installed as container grown plants or as seed at the time of construction. If native vegetation is planted on the pond banks, signage must be provided indicating that it is a natural "Do Not Mow" area. The vegetation should be planted in a manner so as not to hide or disguise the edge of the pond. Maintenance of the vegetated barrier shall

be the responsibility of the owner or the homeowners' association. All pond slopes shall be 3:1 (horizontal to vertical) or flatter.

3. For wet-bottom facilities, a maintenance ledge ten (10) feet in width is required and shall be installed approximately 12 inches above the permanent water level and a safety ledge ten (6) feet in width is required and shall be installed approximately 6 inches below the permanent water level. The slope between the two ledges shall be stable and protected from erosion with hard armoring or bioengineered techniques.

The maintenance ledge may be waived if pond side slopes above normal water are 6:1 or flatter.

4. Prior to final acceptance of construction and release of bonds, danger signs warning of deep water, possible flood conditions during storm periods, or other dangers, shall be installed at an interval of 400 feet around the perimeter of wet-bottom facilities. At a minimum, signs shall be placed on sides of the basin if lengths are less than 400 feet. Maintenance of the warning signs shall be the responsibility of the owner or the homeowners' association.

5. If a retaining wall is used below the normal pool of wet detention pond, the wall shall have either steps or a ladder incorporated into the construction at the center of the wall span. The location of the steps/ladder shall be clearly indicated by signage or other acceptable means.

3. A safety ramp exit 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. Adequate access to the safety ramp shall be provided by locating it adjacent to public right-of-way or by providing a clear route recorded within an access easement or a common area. The location of the ramp shall be clearly indicated by signage or other acceptable means.

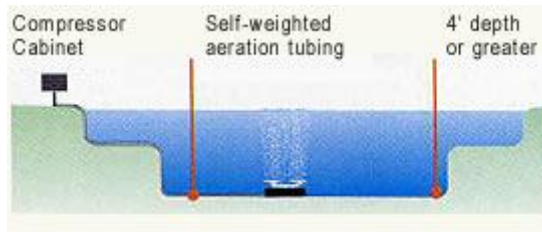
4. In addition to provisions specified in this Chapter (if applicable), parks, playgrounds, and athletic fields shall be separated from all stormwater detention facilities by no less than 100 feet, measured from the 100-year pool of the pond. Trails and sidewalks shall be separated from all stormwater detention facilities by no less than 25 feet, measured from the 100-year pool of the pond.

5. Periodic maintenance is required to control weed and larval growth. The facility shall also be designed to provide for the easy removal of sediment that will accumulate during periods of reservoir operation. A means of maintaining the designed water level of the lake during prolonged periods of dry weather may also be required. Maintenance plans and procedures shall be included in the Operations and Maintenance Manual.

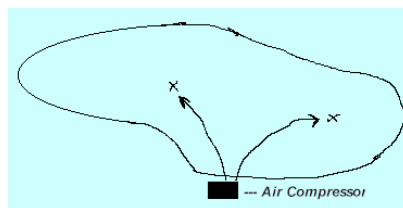
6. For maintenance purposes, the outlet of storm sewers entering the pond shall be a minimum of 0.5 foot above the normal pool level.

7. Methods to prevent pond stagnation, including but not limited to surface or sub-surface aeration or destratification facilities that can, at the

minimum, achieve one complete pond volume turnover per day should be considered. Figure below shows a typical diffuser aeration system that consists of a quiet air compressor at the shore, aeration tubing, and one or more sets of diffuser head(s).



Irregularly shaped ponds should be treated as two or three separate ponds. Likewise, larger ponds will also need multiple aeration units.



Design calculations to substantiate the effectiveness of proposed aeration facilities shall be submitted with final engineering plans. Design calculations should, at a minimum, indicate that the device and/or series of devices are providing a minimum volume turnover of once per 24 hours over the majority of the pond volume (i.e. pump radius of influence calculations, etc.). Agreements for the perpetual operation and maintenance of aeration facilities by the property owner or the HOA shall be prepared similar to that noted for post-construction BMPs noted in this Technical Standards Manual.

If the detention pond is also proposed to be used as a post-construction stormwater BMP, alternative means of aeration (such as diffuser aeration systems) shall be used that would not result in re-suspension of sediment particles and would not prevent the efficient settling of sediment particles.

11. If the facility is being located near an airport, a minimum horizontal separation distance between the airport property and the pond will need to be provided in accordance to Federal Aviation Administration (FAA) advisory Circular 150/5200-33, titled "Hazardous Wildlife Attractions On or Near Airports" and dated 8/28/2007, or the latest update of the same.

F. ADDITIONAL REQUIREMENTS FOR DRY-BOTTOM FACILITY DESIGN

In addition to general design requirements, retention/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 (if any), longitudinal and transverse grades to perimeter drainage facility. Unless designed as a retention facility, a 6-inch underdrain with a minimum of 1.5 feet of cover shall be provided within all dry-bottom ponds.
2. The maximum planned depth of stormwater stored shall not exceed four (4) feet.
3. In excavated retention/detention facilities, a minimum side slope of 3:1 shall be provided for stability. In the case of valley storage, natural slopes may be considered to be stable.
4. A safety ledge six (6) feet in width is required and shall be installed approximately 12 inches below the 100 year design storage water level.

G. DETENTION FACILITIES IN FLOODPLAINS

No detention facilities are allowed within FEMA regulatory floodplains.

H. JOINT DEVELOPMENT OF CONTROL SYSTEMS

Stormwater control systems may be planned and constructed jointly by two or more developers, with approval by the city, as long as compliance with this 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. The requirement of diffused outlet drains shall be at the discretion of the City.

K. ALLOWANCE FOR SEDIMENTATION

Retention/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 to facilitate easier sediment removal and less disturbance to pond bottom during periodic sediment removal operations. 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 reestablished as noted in the approved plans.

L. Parking Lot Detention

Paved parking lots may be designed to provide temporary detention storage of accumulated storm water on all or a portion of their surfaces. Outlets will be designed so as to empty the stored waters slowly. Depths of storage must be limited to a maximum depth of 6 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 and should not be provided in the natural path of pedestrians

M. MAINTENANCE

The routine maintenance of stormwater detention facilities (i.e. trash removal, aeration, weed control, sediment removal, etc.) is the responsibility of the Owner and HHOA. The schedule, plan and procedures shall be included in the Operations and Maintenance Manual.



Chapter Six

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. Proposed storm sewer systems must be sized and designed to convey at least the 10-year frequency on-site stormwater runoff, as well as the anticipated 10-year frequency tributary off-site stormwater runoff based on the future developed condition (using Table 6-1 of the Technical Standards). An analysis of the emergency routing of stormwater runoff through the subject development must be provided to confirm that the development will not obstruct the free flow of floodwaters from the tributary off-site property in its current condition and after development. In addition, the Drainage System Overflow Design must be completed in accordance with of this chapter to ensure the safe routing of flood waters through the subject development with the tributary off-site property in its current condition and after development.

A. DESIGN STORM FREQUENCIES

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 10-year return frequency storm calculated based on methodology described in Additional discharges to storm sewer systems allowed in below of this Section must be considered in all design calculations.
2. Culvert capacities for conveyance under interior local, collector, or arterial streets without roadway overtopping shall be the runoff resulting from the 25-year, 50-year, and 100-year frequency storms, respectively, for off-site areas under existing condition and on-site areas under post-developed conditions. Driveway culvert capacities shall be capacities required for the street classification to which the driveway connects. Greater culvert capacity shall be required to protect the finished floor elevation of buildings from the post-developed 100-year frequency storm when, in the opinion of the design engineer or the City, the finished floor elevation is threatened. If the street or road provides the only access to or from any portion of any commercial or residential development, the crossing shall be designed for a minimum of 100-year frequency storm.
3. Inlets shall be spaced and sized such that the allowable spread of water, with 50% of the sag inlet area clogged, on Collector Streets for the design storm is limited to maintaining two clear 10-foot moving lanes of traffic. One lane is to be maintained on Local Roads, while other access lanes (such as a subdivision cul-de-sac) can have a water spread equal to one-half of their total width.

4. To ensure access to buildings and allow the use of the roadway by emergency vehicles during storms larger than the design storm, an overflow channel/swale between sag inlets and overflow paths or basins shall be provided at sag inlets so that the maximum depth of water that might be ponded in the street sag shall not exceed 6 inches measured from elevation of gutter. All water shall be contained in the right-of-way for a 100-year storm.
5. New drain tiles and pipes, including backyard drains, shall be placed in drainage easements as specified in Table 2-1 in this Technical Guide and shall be designated on the recorded plat as Drainage Easements. Wider easements may be required by the City when the depth of pipe is greater than 6, depending on the pipe size.
6. Backyard drain inlets shall be spaced such that all lots shall have direct access to a backyard inlet. The minimum diameter of pipe for a backyard drain shall be 8". Backyard drain pipes shall be perforated and installed according to City Standard Details.

B. DETERMINATION OF HYDRAULIC CAPACITY FOR STORM SEWERS USING 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 full-flow maximum permissible velocities for storm sewer materials are listed in Table 6-1.

TABLE 6-1

Typical Values of Manning's "n"		
<i>Material</i>	<i>Manning's "n"</i>	<i>Maximum Velocities (feet/second)</i>
☐ Closed Conduits		
Concrete	0.013	10
Vitrified Clay	0.013	10
HDPE & Polypropylene	0.012	10
PVC	0.012	10
☐ Circular CMP, Annular Corrugations, 2 2/3 x 1/2 inch		
Unpaved	0.024	7
25% Paved	0.021	7
50% Paved	0.018	7
100% Paved	0.013	7
Concrete Culverts	0.013	10
HDPE or PVC	0.012	10
☐ 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

Source of manning "n" values: HERPICC Stormwater Drainage Manual, July 1995.

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

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.

Tailwater conditions assumed for this computation should be verified by appropriate calculations. 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 City or designee.

D. MINIMUM SIZE FOR STORM SEWERS

The minimum diameter of all storm sewers, exclusive of backyard drains, shall be 12 inches. The minimum diameter of backyard drain pipes shall be 8". 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 City.

E. PIPE COVER, GRADE, AND SEPARATION FROM SANITARY SEWERS

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, or within 5 feet of the pavement, then the minimum pipe cover shall be 2.5 feet from top of pavement to top of pipe. 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. 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.

F. ALIGNMENT

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

G. MANHOLES/INLETS

Manholes and/or inlets shall be installed to provide human access to continuous underground storm sewers for the purpose of inspection and maintenance. Minimum manhole diameters shall be as shown on the City Standard Detail sheets. The casting access minimum inside diameter shall be no less than 36 inches or a rectangular opening of no less than 22 inches by 22 inches. Steps shall be provided in structures deeper than 4 feet, with the first step at the depth of 2 feet and the following steps spaced every 1 foot until the bottom is reached. When grade adjustments of manholes and inlets are required in the field to meet finish design or existing curb grade, adjustment rings with a maximum height of 12 inches may be used. 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 or vertical alignment occurs.
5. Where a change in grade occurs.
6. 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)
All Pipe Sizes	300'

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. hydraulic grade line should remain below rim elevation).

Manhole/inlet inside sizing shall be according to the City Standard Construction Details.

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. Inlets shall be provided so that surface water is not carried across or around any intersection nor for a distance greater than five hundred (500) feet. An overflow 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 6-1**.

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. Bedding and backfill materials around storm sewer pipes, sub-drains, and the associated structures shall be City Standard Details. The specific location requirements for the use of these materials are dependent on pipe location in relation to pavement structures and on pipe material. The specifications for the construction of storm sewers and sub-drains, including backfill requirements, 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 shall not be allowed. Also, infiltration from cracks, missing pieces, and joints shall not be allowed. Variations from these standards must be justified and receive written acceptance from the City. To verify that all enclosed drains and sewers are functioning properly, all storm sewers including sub-drains shall be cleaned and televised with visual recordings (via closed circuit television). Two visual recordings will be scheduled, 30 days after installation and at least 90 days prior to the expiration of the maintenance bond. Reports summarizing the results of the noted visual recordings shall be reviewed and accepted by the City before maintenance sureties would be recommended to be released.

Based on the review of visual recordings, the City shall determine the need for additional inspection of the storm sewers or sub-drains to assess the condition of the system. Newly installed storm systems covered under the maintenance bond shall meet the minimum requirements established in the AASHTO Culvert and Storm Drain Inspection Guide constituting a Condition Rating of 1 or "Good" as defined in Section 4, Condition Rating System and as established below in **Table 6-2**.

TABLE 6-2

Pipe Inspection Criteria	
<i>Material</i>	<i>(1) Good Rating Condition</i>
HDPE, PVC or PP	Barrel maintains round shape with less than 5% vertical deformation of original ID. No indication of wear, abrasion, splits or cracking.
Concrete	No measurable crack width greater than 0.01 in. No spalling, slabbing, delamination, scaling or abrasion.
CMP	Barrel maintains round shape with less than 5% vertical deformation of inside diameter. No dents, rust, abrasion or localized damage.

J. MATERIALS

Storm sewer manholes and inlets shall be constructed of pre-cast 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 conform to the latest edition of the INDOT "Standard Specifications", Section 907 and 908. In addition, ductile iron pipe and fittings shall conform to AWWA C-151. Polyethylene pipe shall conform to ASTM F2648 or INDOT specifications. 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 City. Pipe joints shall be flexible and leak resistant as defined in AASHTO R82, with a maximum leakage rate of 200 gal/in.-dia/mi/day. 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 reinforced concrete (RCP) or corrugated polypropylene (CPP).

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.

2. Footing drains and perimeter drains shall not be connected to storm sewers.
3. Roof downspouts, roof drains, or roof drainage piping of residential developments shall discharge onto a grass surface that is no closer than 25 feet to the right-of-way of any street and shall not be directly connected to the storm drainage system. Variation from this requirement may be requested and granted by the City in special circumstances. No downspouts or roof drains shall be connected to the public storm or sanitary sewers.

Commercial, industrial, and institutional buildings that have their own private storm sewers may direct such drains directly to their systems.

4. Garage floor drains shall not be connected to the storm sewers.
5. Swimming Pool drains shall not be connected to the storm sewers .

In addition, none of the above-mentioned drains shall be connected to any road sub-drain/street underdrains.

M. DRAINAGE SYSTEM OVERFLOW DESIGN

Overflow path/ponding areas 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 a minimum width of 30 feet flow width along the centerline of the flow path (15 feet from centerline on each side) designated as permanent drainage easements. A continuous flood route from the sag inlets to the final outfall shall be shown and the minimum 30-feet along the centerline contained within an easement or road right-of-way, regardless of the 100-year storm event ponding elevation. This overflow path/easement area shall be shown on the plans as hatched area or another distinctive symbol. No fences or landscaping should be constructed within the easement areas. These areas are easements that are to be maintained by the property owners or be designated as common areas to be maintained by the homeowners association.

The minimum adjacent grade of the portion of any residential, commercial, or industrial building (the ground elevation next to the building after construction is completed that sits adjacent to the emergency flood route or

may be subject to flooding by the emergency flood route) shall be a minimum of 1.5 feet above the estimated 100-year elevation of the emergency flood route assuming that all stormwater pipes are fully clogged.

The overflow path/ponding may be modeled as successive series of natural ponds and open channel segments. For simplification, occasional ponding along the overflow path may be ignored. If explicitly modeled, ponds should be modeled similar to that discussed for modeling depression areas in Chapter 5. Channels should be modeled according to modeling techniques discussed in Chapter 7. 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 and HEC-HMS, combined with HEC-RAS. Other models may be acceptable on a case-by-case basis.

However, regardless of the methodology used, the City reserves the right to require independent calculations to verify that the proposed building minimum adjacent grade facing the flood route or the portion of building having a potential to be subject to flooding by the flood route provide adequate freeboard above the anticipated overflow path/ponding elevations.

The Lowest Adjacent Grade (LAG) requirements for buildings adjacent to other flooding sources are discussed in this Technical Standards Manual of this Manual. In case there are more than one flooding sources applicable to a building site, the highest calculated LAG for the building shall govern the placement of the building on that site.



Chapter Seven

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. Unless specifically referenced in a particular provision, the standards contained in this Chapter refer to open channels and not swales. Proposed open channels must be sized and designed to convey at least the 10-year frequency on-site stormwater runoff, as well as the anticipated 10-year frequency tributary off-site stormwater runoff based on the future developed condition specified in the Technical Standards Manual. An analysis of the emergency routing of stormwater runoff through the subject development must be provided to confirm that the development will not obstruct the free flow of floodwaters from the tributary off-site property in its current condition and after development. In addition, the Drainage System Overflow Design must be completed in accordance with the Technical Standards Manual to ensure the safe routing of flood waters through the subject development with the tributary off-site property in its current condition and after development.

A. DESIGN STORM FREQUENCIES

1. All channels and swales shall accommodate, as a minimum, peak runoff from a 10-year return frequency storm calculated based on methodology described in this Technical Standards Manual.
2. Channels with a carrying capacity of more than 30 cfs at bank-full stage shall be capable of accommodating peak runoff for a 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 City 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 300 feet. Direct access to a backyard inlet shall be provided to each lot.
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 ensure that all buildings are properly located outside the 100-year flood boundary and that flow paths are confined to designated areas with sufficient easement. Lowest adjacent grade and/or

opening requirements are found in Chapter 11 of this Technical Standard Manual.

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. No landscaping is allowed within any Drainage Easement, except for a minimum 25-foot width of filter strip or suitable grass that shall be installed along the top of bank.

B. DETERMINATION OF CHANNEL WATERWAY AREA USING 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

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, hydrocad, and ICPR are preferred programs for conducting such backwater analysis. The use of other computer models must be accepted in advance by the City.

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 for the design storm 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.

Open channels are prohibited along the streets and roads in all new development

3. 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 of velocity.

TABLE 5-1

Maximum Permissible Velocities in Vegetal-Lined Channels (1)			
<i>Cover</i>	<i>Channel Slope Range (Percent)</i> (3)	<i>Permissible Velocity (2)</i>	
		<i>Erosion Resistant Soils (ft. per sec.)</i> (4)	<i>Easily Eroded Soils (ft. per sec.)</i> (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.

E. SIDE SLOPES

1. Earthen channel 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 based on reasonably anticipated safety needs at the site.

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 Chapter 6. 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" 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

All swales shall meet the following requirements and the specifications of the City or designee:

1. Minimum swale flow line slopes are 1%. The side slopes of swales shall not be steeper than a 4 (horizontal) to 1 (vertical) slope.
2. Maximum swale flow line slopes are 7%.
3. Minimum swale top width shall be 6 feet.
4. All flow shall be confined to the specific easements associated with each rear and side lot swale that are part of the drainage system.
5. A minimum of 20 feet along the swale (10 feet from each side of the centerline) must be designated on the recorded plat as Drainage Easement.

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 needed for entry of surface and subsurface flow into channels without significant erosion or degradation shall be included in the design of channel improvements. The design 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. DISPOSAL 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.

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, Coconut Mattings, or other accepted material (only until grass is established)

Other lining materials must be accepted in writing by the City. Materials shall comply with the latest edition of the INDOT, "Standard Specifications".



Chapter Eight

CONSTRUCTION SITES STORMWATER POLLUTION PREVENTION STANDARDS

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 drainage facility or 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 washout, 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 aquatic life, wildlife, and the general public.

B. EROSION AND SEDIMENT CONTROL REQUIREMENTS

General and Implementation Requirements - The following general and implementation requirements apply to all land-disturbing activities and shall be considered in the preparation of a SWPPP within the corporate boundaries of the City.

1. Trained Individuals must be utilized for activities associated with the development and design of the SWPPP, stormwater measure implementation, and stormwater project management.
2. Minimize the potential for soil erosion by designing a development that fits the topography and soils of the site. Unless needed to meet requirements and goals of the development, steep slopes should be avoided, and natural contours should be followed.
3. All activities on a site should be conducted in a logical sequence and in accordance with the site's construction phasing plan so that the smallest practical area of land will be exposed for the shortest practical period of time during development.
4. The length and steepness of designed slopes should be minimized to reduce erosion potential. Drainage channels and swales must be designed and adequately protected so that their final gradients and resultant velocities will not cause erosion in the receiving channel or at the outlet. Methods for determining acceptable velocities are included in this Stormwater Technical Standards Manual as well as in the IDEM Storm Water Quality Manual.
5. Sediment-laden water which otherwise would flow from the project site shall be managed by appropriate erosion and sediment control measures to minimize sedimentation to receiving waters and adjacent properties as discussed in the IDEM Storm Water Quality Manual and other authoritative sources.
6. Public roadways and roadways not exclusive to construction traffic shall be kept cleared of accumulated sediment that is a result of runoff or tracking. The following minimum conditions are applicable:
 - a. Clearing of sediment must not include the utilization of mechanical methods that will result in mobilization of dust off the project site or flushing the area with water unless the flushed water is directed to an appropriate sediment control measure.
 - b. Cleared sediment must be redistributed or disposed of in a manner that is in accordance with all applicable statutes and regulations.
 - c. Sediment discharged or tracked onto roadways that are open to traffic must be removed as directed by a regulatory authority or at a minimum, removed by the end of the same day.
7. Phasing of construction activities must be used, when feasible, to minimize the footprint of disturbed unstable areas.
8. Collected runoff leaving a project site must be either discharged directly into a well-defined, stable receiving channel, or diffused and released to adjacent property without causing an erosion or pollutant problem to the adjacent property owner.
9. Natural features, including wetlands and sinkholes (karst features), shall be protected from pollutants associated with stormwater runoff, through appropriate stormwater management and/or treatment measures.

10. Soil compaction is to be minimized, especially in areas where permanent vegetation will be re-established and/or areas that are designated to infiltrate stormwater for the post-construction phase.
11. Topsoil must be preserved, unless infeasible.
12. Existing natural buffers that are adjacent to waters of the state must be preserved to promote infiltration and provide protection of the water resource, unless infeasible. Activities performed by a county drainage board under IC 36-9-27 are excluded.
 - a. Natural buffers must be preserved, including the entire buffer bordering and/or surrounding the water resource. Existing buffers:
 - i. 50 feet or more in width must be preserved to a minimum of 50 feet.
 - ii. less than 50 feet in width must be preserved in their entirety. May be enhanced with vegetation that is native and promotes ecological improvement and sustainability.
 - b. Runoff directed to the natural buffer must be:
 - i. treated with appropriate erosion and sediment control measures prior to discharging to the buffer.
 - ii. managed with appropriate runoff control measures to prevent erosion from occurring within the buffer area.
 - c. Further information regarding buffer requirements is contained in IDEM's "Implementation of Buffers" guidance document.
13. Minimize the generation of dust through dust suppression techniques to prevent deposition into waters of the state and areas located beyond the permitted boundaries of the site as discussed in the IDEM Storm Water Quality Manual and other authoritative sources.
14. A stable construction site access measure must be provided at all points of construction traffic ingress and egress to the project site. Where the selected measure is not effective, an alternative measure or additional controls must be utilized to minimize tracking. Alternative measures may include, but are not limited to, wheel wash systems and rumble strips.
15. During the period of construction activities, all stormwater management measures necessary to meet the requirements of this permit must be maintained. Alternative measures must be selected and implemented, as necessary.
16. Discharge water from dewatering of ground water from excavations, trenches, foundations, etc. must not be discharged when:
 - a. Sediment-laden water is not first directed to an appropriate sediment control measure or a series of control measures, as per IDEM Storm Water Quality Manual and other authoritative sources, that minimizes the discharge of the sediment.
 - b. A visible sheen and/or pollutants are present at a level that requires additional treatment and/or an alternate permit.

17. Appropriate measures must be implemented to eliminate wastes or unused building materials including, but not limited to garbage, debris, cleaning wastes, wastewater, concrete washout, mortar/masonry products, soil stabilizers, lime stabilization materials, and other substances from being carried from a project site by runoff or wind. Wastes and unused building materials must be managed and disposed of in accordance with all applicable statutes and regulations.
18. Construction and domestic waste must be managed to prevent the discharge of pollutants and windblown debris. Surplus plastic or hardened concrete/cementitious materials are not required to be placed in trash receptacles and are considered clean fill that may be reused, disposed of on-site, or recycled in accordance with applicable state and federal regulations. Management of waste materials may include, but are not limited to:
 - a. Waste containers (trash receptacles), when selected to manage waste, must be managed to reduce the discharge of pollutants and blowing of debris. Receptacles that are not appropriately managed will require alternatives that include but are not limited to:
 - i. A cover (e.g., lid, tarp, plastic sheeting, temporary roof) to minimize exposure of wastes to precipitation or
 - ii. A similarly effective method designed to minimize the discharge of pollutants.
 - b. Waste that is not disposed of in trash receptacles must be protected from exposure to the weather and/or removed at the end of the day from the site and disposed of properly.
19. Concrete and cementitious wash water areas, where cementitious fluids are permissible, must be identified for the site and the locations clearly posted. Wash water must be directed into leak-proof containers or leak-proof containment areas which are located and designed to divert runoff away from the measure and sized to prevent the discharge and/or overflow of the cementitious wash water. If not evaporated, wash water must be removed (pumped) for appropriate off-site disposal.
20. Fertilizer applications associated with the stabilization plan for the project must meet the following requirements:
 - a. Apply fertilizer at a rate and amount as determined by a soil analysis or in accordance with the Indiana Stormwater Quality Manual or similar guidance documents.
 - b. Apply fertilizer at an appropriate time of year for the project location, taking into consideration proximity to a waterbody, and preferably timed to coincide with the period of maximum vegetative uptake and growth.
 - c. Avoid applying fertilizer immediately prior to precipitation events that are anticipated to result in stormwater runoff from the application area.
21. Proper storage and handling of materials, such as fuels or hazardous wastes, and spill prevention and clean-up measures must be implemented to minimize the potential for pollutants to contaminate surface or ground water or degrade soil quality. To meet this requirement:

- a. A spill prevention and response plan, meeting the requirements in 327 IAC 2-6.1, must be completed.
- b. Proper project management and the utilization of appropriate measures including, but not limited to, eliminating a source or the exposure of materials must be completed.
- c. Manage the following activities:
 - i. Fueling and maintenance of equipment.
 - ii. Washing of equipment and vehicles.
 - iii. Storage, handling, and disposal of construction materials, products, and wastes.
 - iv. Application of pesticides, herbicides, insecticides, and fertilizers
 - v. Dispensing and utilization of diesel fuel, oil, hydraulic fluids, other petroleum products, and other chemicals.
 - vi. Handling and disposal of hazardous wastes, including, but not limited to paints, solvents, petroleum-based products, wood preservatives, additives, curing compounds, and acids.
 - vii. Washing of applicators and containers used for paint, grout, or other materials.

22. Personnel associated with the project must be informed of the terms and conditions of this permit and the requirements within the SWPPP. The permittee is required to document this process. Information must be provided through written notification, contracts, or other means (i.e., pre-construction meetings) that effectively communicates the provisions and requirements of the permit and SWPPP. Personnel may include, but are not limited to:

- a. General contractors, construction management firms, grading or excavating contractors, trade industry representatives (i.e. concrete industry) and material suppliers associated with the overall project.
- b. Contractors or individual lot operators that have primary oversight on individual building lots.
- c. Those responsible for the implementation of the SWPPP, and the installation, repair, and maintenance of stormwater measures.
- d. Those responsible for the application and storage of treatment chemicals.
- e. Those responsible for administering the self-monitoring program (SMP).

23. A notice must be posted near the main entrance of the project site or at a publicly accessible location. For linear project sites, such as a pipeline or highway, the notice must be placed in a publicly accessible location near the project field office.

The notice must be maintained in a legible condition and include:

- a. A copy of the completed IDEM NOI or a document, such as the Permit Summary Report & Notice of Sufficiency letter produced by IDEM's online ePortal system, that at a minimum contains the information referenced of the City Storm Water Management Ordinance.
- b. The NPDES permit number(s), upon receipt.
- c. The location of the construction plan/SWPPP if the project site does not have an on-site location to store the plan.

24. The use of anionic polymers (cationic polymers are not authorized for use) on the project site are authorized for sediment control provided their use is in

conformance with current State of Indiana standards and specifications and the use is identified in the stormwater pollution prevention plan (SWPPP). If use of a polymer is not in the SWPPP and is selected at a later date, notification to IDEM and the City is required. An email notification prior to the use of the polymer to the IDEM Stormwater Program is acceptable. For projects regulated by a MS4 notification must follow the local process for the use of polymers.

25. Restoration and/or clean-up may be required for those areas impacted by sediment or other pollutant discharges. These activities will be performed as directed by the inspecting authority and may require:
 - a. Development and submittal of a removal and restoration plan to ensure the methodology chosen will not result in further degradation of the resource.
 - b. Permission by a property owner when the restoration activity requires access to a property owned by another entity or individual.
 - c. Additional permits prior to initiation of the work.

Stabilization Requirements - The following stabilization requirements apply to all land-disturbing activities:

1. Un-vegetated areas that are left idle or scheduled to be left inactive must be temporarily or permanently stabilized with measures appropriate for the season to minimize erosion potential. To meet this requirement, the following apply:
 - a. Stabilization must be initiated by the end of the seventh day the area is left idle. The stabilization activity must be completed within fourteen (14) days after initiation... Initiation of stabilization includes, but is not limited to, the seeding and/or planting of the exposed area and applying mulch or other temporary surface stabilization methods where appropriate. Areas that are not accessible due to an unexpected and disruptive event that prevents construction activities are not considered idle.
 - b. Areas that have been compacted may be excluded from the stabilization requirement when the areas are intended to be impervious surfaces associated with the final land use, provided runoff from the area is directed to appropriate sediment control measures.
2. Final stabilization of a project site is achieved when:
 - a. All land-disturbing activities have been completed and a uniform (evenly distributed, without large bare areas) perennial vegetative cover with a density of seventy percent (70%) has been established on all unpaved disturbed areas, and areas not covered by permanent structures, or equivalent permanent stabilization measures have been employed. This requirement does not apply to:
 - i. Landscaping that is part of the final project plan is considered stable when the plan has been fully implemented and areas not being vegetated are stable with a non-erosive material and/or product.
 - ii. Projects or specific stormwater measures that utilize native vegetation and/or special vegetative plantings that are either required by a water quality permit/authorization or part of the design and functionality of a stormwater measure, provided the activity does not pose a threat that will result in off-site sedimentation.

- iii. Projects on land used for agricultural purposes when:
 - a) Stabilization is completed in accordance with the above Stabilization Requirements (in 1. a. and b.) as land-disturbance progresses. Land that is returned to agricultural production must be temporarily or permanently seeded upon completing land-disturbing activities. Stabilization requirements may be waived by the inspecting authority if the project site does not pose a threat of discharging sediment.
 - b) Disturbed areas, not previously used for agricultural production, such as filter strips, must be returned to their pre land disturbance use.

- b. Specific projects, due to function and/or operation may necessitate that an area remain disturbed. Only the minimum operational area is allowed to remain disturbed. This option primarily applies to off-road recreational commercial operations but may apply to other land use types upon determination by the regulating entity.

Design Requirements - The following design requirements apply to all land-disturbing activities and shall be considered in the selection, design, and implementation of all stormwater quality and management measures contained in the SWPPP:

1. Sound engineering, agronomic, and scientific principles must be utilized for measures contained in the SWPPP.
2. Appropriate measures must be planned, designed, and installed as part of an erosion and sediment control system and in accordance with the site's construction phasing plan.
3. Stormwater runoff leaving the project site must be discharged in a manner that is consistent with this ordinance, state, and federal law.
4. Collected runoff leaving the project site must be directed to an established vegetated area, when feasible and applicable, to increase pollutant removal and maximize stormwater infiltration and then either discharged directly into a well-defined, stable receiving conveyance or diffused and released without causing erosion at the point of discharge.
5. Conveyance systems must be designed taking into consideration both peak flow and total volume and must be adequately protected so that their final gradients and resultant velocities are unlikely to cause erosion at the outlet or in the receiving channel, based on known conditions of the discharge at the time of design to accommodate post-construction conditions.
6. Sediment basins, where feasible, must withdraw water from the surface of the water column unless equivalent sediment reduction can be achieved by use of alternative measures. Alternative measures include but are not limited to increasing the basin length to width ratio to 4:1 or greater, implementation of porous baffles, use of flocculants/polymers, and/or phasing of project land disturbance that also incorporates a rapid

stabilization program. During freezing conditions, the implementation of alternative withdrawal methods may be utilized.

Monitoring and Management Requirements

A trained individual, acceptable to the City shall monitor project construction and stormwater activities. These shall include:

1. A written evaluation of the entire project site, with the exception of those areas that are considered unsafe. The evaluation must be performed by a trained individual, completed and submitted to:

Field Forces Superintendent
Portage Utility Services Field Forces
5590 Old Porter Rd, Portage, IN 46368
Portage, Indiana 46388

The form to be used is included in appendix A of this Technical Standards Manual.

- a. Twenty-four (24) hours prior to a qualifying precipitation event or by the end of the next business day following each measurable storm event (excludes accumulated snow events); which is defined as a precipitation accumulation equal to, or greater than, one-half (0.50) inch of rainfall within a 24-hour period. If no rain event occurs within the work week a minimum of one inspection must occur. In the event of multiple qualifying events during the work week, no more than three (3) inspections would be required to meet the self-monitoring commitment.
 - b. At a minimum of one (1) time per month for specific areas within the project which are stabilized with permanent vegetative cover at seventy (70) percent density and/or erosion resistant armoring is installed. A reduction to once per month is also applicable for the entire project site for stabilized common areas, basins, conveyances, outfalls, and inactive building sites. Prior to reducing the monitoring to monthly, records must identify the area and the date the area became eligible for monthly monitoring. Weekly monitoring as identified in (a) above must resume if one or more of the following occurs:
 - i. The vegetative cover fails or there is evidence of erosion in the identified area.
 - ii. The City requires monitoring to resume.
2. A complete written evaluation report which must include:
 - a. Name of the individual performing the evaluation, including printed name, title, and signature (electronic signatures are acceptable).
 - b. Date of the evaluation.
 - c. Amount of precipitation, when the evaluation is conducted after a measurable storm event. Recorded rainfall may be documented

utilizing an on-site rain gauge or storm event information from a weather station that is representative of the project location.

- d. Observations of project performance in relation to:
 - i. Implementation of the stormwater pollution prevention plan.
 - ii. Assessment of existing stormwater measures based on industry standards and maintenance standards as identified in this Storm Water Technical Manual to ensure each measure is operational and functioning properly.
 - iii. Additional measures necessary in the event an existing measure fails or is not present.
 - iv. Impacts including, but not limited to, sediment discharges, erosion, discharges that results in bank erosion, and operational activities that have the potential to generate pollutants and unauthorized discharges.
- e. Documentation of an actual discharge that is visible during the assessment, the location of the discharge and a visual description of the discharge. The visual description includes, but is not limited to, color (turbidity reading is an option), odor, floatables, settled/suspended solids, foam, oil sheen, and any other visible sign that may be attributed to operations occurring on the project site.
- f. Detail of corrective action recommended and/or completed. Corrective action includes, but is not limited to:
 - i. Repairing, modifying, or replacing any stormwater management measure.
 - ii. Clean-up and proper disposal of spills, releases, or other deposits.
 - iii. Remediating a permit violation.
 - iv. Taking reasonable steps to remediate, minimize or prevent the discharge of pollutants associated with the construction activity until a permanent corrective solution is initiated.
 - v. Restoring an impacted area and/or removing accumulated sediment, provided appropriate permission and permits are obtained to conduct the activity.
- g. A timeline for which corrective action will occur to remediate the discharge of pollutants. The established corrective action, at a minimum, must be initiated:
 - i. On the day the deficiency was discovered or when it is not practical to initiate on the discovery date, no later than forty-eight (48) hours for the repair of a measure or installation of a temporary measure until a new and/or replacement measure is installed as specified in item ii) below.
 - ii. Within seven (7) days of discovery for the installation of a new (alternative) measure or replacement of an existing measure unless a shorter timeframe is required as part of a regulatory inspection. The inspecting authority may also allow additional time to take corrective action.
 - iii. If corrective action cannot be achieved within the timelines outlined in i) or ii) above, a reason for incompleteness must be provided and documented, including the anticipated completion date.

- h. Documentation of corrective action taken from the previous self-monitoring report.
- 3. Maintaining the SMP reports at the site or at an easily accessible location (refer to Project Documentation Requirements below).
- 4. Providing all reports for the project site to City within forty-eight (48) hours of a request. Electronic copies are acceptable, provided they are in a format consistent with the paper record.

Project Documentation Requirements – The following project documentation shall be developed and maintained:

- 1. Maintain a project management log that contains:
 - a. Information related to all off-site borrow sites, disposal areas, and staging areas, including the location of each activity as it is identified and/or selected.
 - b. Information related to all project activities including, but not limited to:
 - i. SMP reports.
 - ii. Regulatory inspections.
 - iii. Responses to a compliance action or enforcement action.
 - iv. Records showing the dates of all SWPPP modifications. The records must include the name of the person authorizing each change and a summary of all changes.
- 2. Ensure the SWPPP and supporting documentation associated with the SMP and project management log are accessible at the project site office or in the possession of on-site individuals with responsibility for the overall project management or associated with the management and operations of construction activities. This information must be provided to City within forty-eight (48) hours of a request.

C. COMMON CONTROL PRACTICES

All erosion control and stormwater pollution prevention measures required to comply with the Ordinance or these Technical Standards shall meet the design criteria, standards, and specifications similar to or the same as those outlined in the “Indiana Storm Water Quality Manual” (ISWQM), or other comparable and reputable references. Please note that pursuant to IC 13-18-27, MS4-designated entities may not require erosion and sediment control measures/BMPs that are more stringent than the measures/BMPs required by the IDEM general permit.

D. INDIVIDUAL LOT AND PARCEL CONTROL

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. The same is true for individual parcels of land of any size that are not associated with a larger development. 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. The standard plan includes perimeter silt fence, stabilized construction entrance, 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. Note that construction site discharge must be contained and treated within each individual lot (or a group of individual lots being constructed by one builder) and is not allowed to be discharged offsite.

Construction sequence on individual lots and parcels 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 stable construction entrance that extends from the street to the building pad.
6. Perform primary grading operations.
7. Contain erosion from any soil stockpiles created on-site with an appropriate sediment control measure around the base.
8. Establish temporary seeding and straw mulch on disturbed areas.
9. Construct the building and install utilities.
10. Install downspout extenders once the roof and gutters have been constructed. Extenders should outlet to a stabilized area.

11. Re-seed any areas disturbed by construction and utilities installation with temporary seed mix within 3 days of completion of disturbance.
12. Grade the site to final elevations.
13. 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.



Chapter Nine

POST-CONSTRUCTION STORMWATER QUALITY MANAGEMENT STANDARDS

A. INTRODUCTION

It is recognized that developed areas, as compared to undeveloped areas, generally have increased imperviousness, decreased infiltration rates, increased runoff rates, and increased concentrations of pollutants such as fertilizers, herbicides, greases, oil, salts and other pollutants. As new development and re-development continues within areas subject to City jurisdiction, measures must be taken to intercept and filter pollutants from stormwater runoff prior to reaching regional creeks, streams, and rivers. Through the use of appropriate Best Management Practices (BMPs), stormwater runoff will be filtered and harmful amounts of sediment, nutrients, and contaminants will be removed.

It is also recognized that another major source of pollution in many Indiana streams, including those within City, is the streambank erosion associated with urbanizing watersheds. Stream channels develop their shape in response to the volume and rate of runoff that they receive from their contributing watersheds. Research has shown that in hydrologically stable watersheds, the stream flow responsible for most of the shaping of the channel (called the bankfull flow) occurs between every one to two years. When land is developed, the volume and rate of runoff from that land increases for these comparatively small flooding events that are not normally addressed by the detention practices, and the stream channel will adapt by changing its shape. As the stream channel works to reach a new stable shape, excess erosion occurs. As new development and re-development continues within City, measures must be taken to minimize the impact of such development or re-development on streambank erosion. Through the use of appropriate Best Management Practices (BMPs), the volume and rate of runoff for channel-forming flows will be reduced in an attempt to minimize increased streambank erosion in the receiving streams and channels.

This Chapter establishes minimum standards for the selection and design of post-construction water quality and channel protection 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 channel protection volume (CPv), water quality volume (WQv), and for flow-through BMPs the water quality discharge rate (Qwq), as appropriate.

B. POLLUTANTS OF CONCERN AFTER CONSTRUCTION STABILIZATION

There are three major sources of pollutants for a stabilized construction site:

- Deposition of atmospheric material (including wind-eroded material and dust)
- General urban pollution (thermal pollution, litter)
- Pollutants associated with specific land uses

It should be noted that some pollutants accumulate on impervious surfaces. This accumulated material is then subject to being washed into watercourses during storm events. It is for this reason that fish kills often occur during a rain event with a substantial prior rainless period. This is also the reason that the most hazardous driving conditions are realized after the initial onset of a storm event, when deposited oil has not yet washed into adjacent conveyance systems.

Pollutants of concern include:

- **Sediment** is the major pollutant of concern during active construction. 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. After the construction is completed, other chemicals that are released to surface waters from industrial and municipal discharges and polluted runoff from urban and agricultural areas continue to accumulate to harmful levels in sediments.
- **Toxic chemicals** from illegal dumping and poor storage and handling of materials. Industrial sites pose the most highly variable source of this pollution due to the dependency of the specific process to the resulting pollution amounts and constituents. As during construction, these chemicals can pose acute (short-term) or chronic (long-term) risk to aquatic life, wildlife and the general public.
- **Bacteria** from illicit sanitary connections to storm sewer systems, combined sewers, leaking septic systems, wildlife and domestic animal waste. Bacteria pathogens pose a direct health risk to humans and aquatic life.
- **Nutrients** can be released from leaking septic systems or applied in the form of fertilizers. Golf courses, manicured landscapes and agricultural sources are the primary land uses associated with excess fertilization. Excessive nutrients in the local ecosystem are the source of algal blooms in ponds and lakes. These excessive nutrients also lead to acceleration of the eutrophication process, reducing the usable lifespan of these water bodies. Nitrogen and phosphorous are the primary nutrients of concern.
- **Oxygen demand** can be impacted by chemicals transported on sediment, by nutrients, and other pollutants (such as toxic chemicals). Reduced levels of oxygen impair or destroy aquatic life.

- **Oils and hydrocarbons** accumulate in streets from vehicles. They can also be associated with fueling stations and illicit dumping activities. Oils and hydrocarbons pose health risk to both aquatic and human health.
- **Litter, including floatables**, can result in a threat to aquatic life. The aesthetic impact can also reduce the quality of recreational use.
- **Metals** can be associated with vehicular activity (including certain brake dusts), buildings, construction material storage, and industrial activities. Metals are often toxic to aquatic life and threaten human health.
- **Chlorides** (salts) are historically associated with deicing activities. Chlorides are toxic to native aquatic life (verses saltwater aquatic life). Communities should consider a combination of cinders or sand to replace or supplement their deicing activities with chlorides. In addition, chloride stockpiles should remain covered.
- **Thermal effects** can be introduced by the removal of shade provided by riparian trees, as well as impervious channel linings, such as concrete, which release stored heat to water passing over them. Other sources of elevated temperature include effluent from power plant and industrial activities. Thermal pollution can threaten aquatic habitat, including fish species and beneficial water insects. Of particular concern are salmonid streams, due to the effect of thermal pollution on spawning for this particular species.

Innovative BMPs, including but not limited to, BMPs not previously accepted by City must be certified by a Professional Engineer licensed in State of Indiana and approved through City. New BMPs, individually or in combination, must meet the performance criteria noted in Section B of this Chapter, including the capture and removal of floatables. All innovative BMPs must have a low maintenance requirement to be considered by City. Testing to establish the pollutant removal rate must be conducted by an independent testing facility, not the BMP manufacturer. The accepted design flow rate for a Water Quality Device shall be the flow value at which the claimed removal rate for TSS is equaled or exceeded based on the unit's efficiency curve (flow rate versus removal rate graph).

Note that a single BMP measure may not be adequate to achieve the water quality requirements for a project. It is for this reason that a "treatment train", a number of BMPs in series, is often required for a project. The pollutant removal efficiency of a number of BMPs in series may be determined from the following formula:

$$E_{\text{series}} = 1 - (1-E_1)(1-E_2)(1-E_3)\dots$$

where,

E_{series} = Removal Efficiency of the BMP series combined (in decimal form)
 E_1, E_2, E_3, \dots = Removal Efficiency of Units 1, 2, 3, ..., respectively (in decimal form)

**TABLE 9-1
Pre-approved Post-Construction BMPs**

BMP ^A	Typical % Removal Efficiency ^B	Maintenance Easement Requirements
	TSS	
Bioretention	90 ^C	25 feet wide along the perimeter
Constructed Wetland	67 ^C	25 feet wide along the outer perimeter of forebay & 30 feet wide along centerline of outlet
Underground Detention	70	20 feet wide strip from access easement to tank's access shaft & 30 feet wide along centerline of inlet and outlet
Extended Detention/Dry Pond	72	25 feet wide along the outer perimeter of forebay & 30 feet wide along centerline of outlet
Infiltration Basin (including retention ponds with pretreatment)	90 ^C	25 feet wide along the perimeter
Infiltration Trench	90 ^C	25 feet wide along the perimeter
Constructed (Sand) Filter	70 ^C	25 feet wide along the perimeter
Water Quality Device	VARIABLES ^D	20 feet wide strip from access easement to chamber's access shaft
Vegetated Filter Strip	78 ^C	25 feet wide along the length on the pavement side
Vegetated Swale	81 ^C	25 feet wide along the top of bank on one side
Wet Ponds/Retention Basin	80	25 feet wide along the outer perimeter of forebay & 30 feet wide along centerline of outlet

G. SPECIAL PROVISIONS FOR “HOT SPOT” LAND USES

For all those projects involving land uses considered to be high pollutant producers or “hot spots” (see **Table 8-9** e.g., vehicle service and maintenance facilities, vehicle salvage yards and recycling facilities, vehicle and equipment cleaning facilities, fleet storage areas for buses, trucks, etc., industrial/commercial or any hazardous waste storage areas or areas that generate such wastes, industrial sites, restaurants and convenience stores, any activity involving chemical mixing or loading/unloading, outdoor liquid container storage, public works storage areas, commercial container nurseries, and some high traffic retail uses characterized by frequent vehicle turnover), additional water quality requirements may be imposed by City in addition to those included in water quality criteria in order to remove potential pollutant loadings from entering either groundwater or surface water systems. These pre-treatment options are included in **Table 8-9** and **Table 8-10**.

**Table 9-2
Pre-Treatment options for Stormwater Hot Spots**

Stormwater Hot Spots	Minimum Pre-Treatment Options
Vehicle Maintenance and Repair Facilities	A, E, F, G
Vehicle Fueling Stations	A, D, G
Drive-through Restaurants, Pharmacies, Convenience Stores	B, C, D, I, K
Outdoor Chemical Mixing or Handling	G, H
Outdoor Storage of Liquids	G
Commercial Nursery Operations	I, J, L
Other Uses or Activities Designated by Appropriate Authority	As Required

**Table 9-3
Minimum Pre-Treatment Options**

Minimum Pre-Treatment Options	
A	Oil/Water Separators / Hydrodynamic Separators
B	Sediment Traps/Catch Basin Sumps
C	Trash/Debris Collectors in Catch Basins
D	Water Quality Inserts for Inlets (inspected and cleaned after every significant rainfall event)
E	Use of Drip Pans and/or Dry Sweep Material under Vehicles/Equipment
F	Use of Absorbent Devices to Reduce Liquid Releases
G	Spill Prevention and Response Program
H	Diversion of Stormwater away from Potential Contamination Areas
I	Vegetated Swales/Filter Strips
J	Constructed Wetlands
K	Stormwater Filters (Sand, Peat, Compost, etc.)
L	Stormwater Collection and Reuse (especially for irrigation)
M	BMPs that are a part of a Stormwater Pollution Prevention Plan (SWPPP) under a NPDES Permit

H. CONSTRUCTION SEQUENCING CONSIDERATIONS

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.

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.

I. INSPECTION AND MAINTENANCE REQUIREMENTS

Subsequent to successful installation of post-construction BMPs, they need to be inspected and maintained regularly in accordance with the Operation and Maintenance Manual. An operations and maintenance (O&M) manual for all MS4-owned or private infrastructure, including but not limited to pipes, ponds, ditches, and BMPs (when required), shall be submitted for the final plan approval process. The manual will become a maintenance guide for the drainage infrastructure once development is complete. The final O&M manual will be provided to the City in both hard copy and digital formats. The O&M manual maintenance agreement along with a site map showing the BMP locations shall be included in the final O&M Manual. The O&M manual will include the following:

1. Name, address, business phone number, home phone number, email address, cellular phone number, of owner;
2. Site drawings (8½" by 11" or 11" by 17"), showing both plan and cross-section views, showing the infrastructure and applicable features, including dimensions, easements, outlet works, forebays, signage, etc., as well as an overall site map of the development showing all structures;
3. Guidance on owner-required periodic inspections;
4. Requirement of owner to perform maintenance specified by City inspection, if any;
5. Guidance on routine maintenance, including mowing, litter removal, woody growth removal, signage, etc.;
6. Guidance on remedial maintenance; such as inlet replacement, outlet works maintenance, etc.;
7. Guidance on sediment and trash removal describing when sediment removal should occur in order to ensure that BMPs and other infrastructure remain effective as water quality and/or quantity control devices;
8. A statement that the City's representatives have the right to enter the property to inspect the infrastructure;
9. A tabular schedule showing inspection and maintenance requirements; and
10. Identification of the party responsible for all maintenance, including cost.
11. Identification of the Homeowners Association, if applicable, for eventual transfer of BMP ownership and maintenance responsibilities.



Chapter Ten

METHODOLOGY FOR DETERMINATION OF REQUIRED SIZING OF POST-CONSTRUCTION BMPs

I. Introduction

a. This Section, “Post-Construction BMP Design”, provides minimum design criteria and standards for post-construction stormwater best management practices.

2. Compliance Requirements

a. Control of stormwater quality within the City is based upon the management of Total Suspended Solids (TSS) and the control of Floatables.

b. Post-Construction Best Management Practices (BMPs) shall be designed to treat the water quality volume (WQv) for detention-based BMPs or the water quality discharge flow rate (Qwq), for flow-through BMPs.

c. BMPs, individually or in combination, must meet or exceed an 80% TSS removal rate of particles 125 microns or larger in diameter without re-entrainment. Testing to establish the TSS removal rate of a BMP must be conducted by an independent testing facility. TSS

d. Floatables

1. Floatable controls shall be incorporated to capture floating debris and remove them during routine maintenance of the BMP.
2. Standalone BMPs must include floatable control.

e. BMP Treatment Trains are required to contain at least one floatable containment component located between the last inflow point to the system and the outlet.

f. BMPs utilized in the City of Portage are required to be certified by a Professional Engineer licensed in the State of Indiana.

g. BMP Treatment Trains, a number of BMPs in series, may be utilized where a single BMP measure is not adequate to achieve the project’s water quality goals.

III. Sizing Methodology for BMPs

a. Detention BMP sizing is based upon water quality volume (WQv) of a project site.

i. Detention BMPs pond and store the WQv to be treated.

ii. WQv is equivalent to one inch of rainfall multiplied by the volumetric runoff coefficient (Rv)

multiplied by the site area:

$$WQv = (P) (Rv) (A) / 12$$

where:

WQv = water quality volume in acre-feet

P = 1 inch of rainfall

Rv = volumetric runoff coefficient

A = area in acres

Chapter 7-2

iii. The volumetric runoff coefficient (Rv) is a measure of imperviousness for the contributing areas:

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

Where:

I = percent impervious cover

b. Flow through BMP sizing is based upon water quality discharge (Qwq), which is a peak design flow rate through the BMP of a project site.

i. Flow through BMPs treat the Qwq through some form of a filtration process.

Flow through BMPs

include catch basin inserts, sand filters, grassed channels, and hydrodynamic separators.

ii. Hydrodynamic separators are required to be listed on the most current version of the City of

Indianapolis Stormwater Quality Unit (SQU) Selection Guide.

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

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

P = 1 inch of rainfall

iv. Due to the complexity of the above equation, the water quality curve number can be determined

from the chart below as a function of imperviousness.

v. CNwq is then used in conjunction with the standard calculated time of concentration and

drainage area as the basis for input for TR-55 calculations. Using the appropriate 1-inch

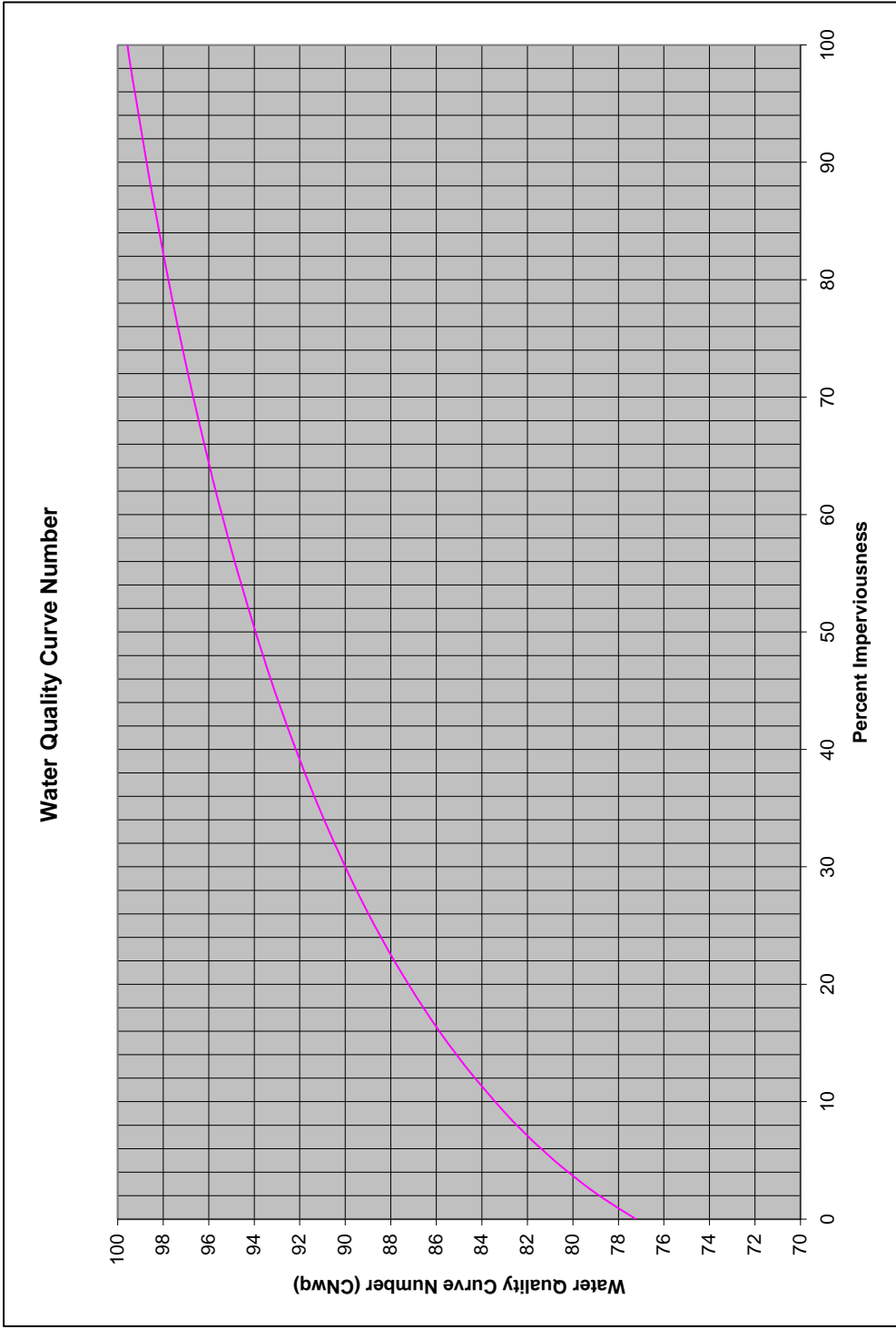
Huff rainfall distribution, the Qwq can then be calculated.

Documentation for all proposed proprietary or manufactured BMPs shall be provided clearly demonstrating the BMP will remove 80% of the particles listed below at this peak flow rate.

Runoff Particle Distribution

Particle Size (μm)	% of TSS
250	20
125	40
75	40

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





Chapter Eleven

LOT/BUILDING GRADING AND DRAINAGE STANDARDS

A. GRADING AND BUILDING PAD ELEVATIONS

Minimum Federal and State Requirements

For all structures located in the Special Flood Hazards Area (SFHA) as shown on the FEMA maps and/or that mapped by the IDNR based on Best Available Data, the Lowest Floor elevation, including basement, shall be at or above the flood protection grade (FPG) and therefore have a minimum of 2 feet of freeboard above the 100-year flood elevation.

Additional Local Requirements

FPG for all buildings located within or adjacent to SFHA shall be shown on the secondary plat.

For all structures located outside SFHA or IDNR designated floodplains that are subject to flooding from a detention/retention pond, the lowest adjacent grade (LAG) of all residential, commercial, or industrial buildings shall have a minimum of 2 feet of freeboard above the 100-year flood elevation or the emergency overflow weir elevation, or the required detention/retention pond design freeboard, whichever is higher.

For all structures located outside SFHA or IDNR designated floodplains that are subject to flooding from a stream or an open ditch or other waterway (an area along a stream with no floodplain designation or an area adjacent to a designated floodplain with ground elevation below 100-year flood elevation plus 2 feet), the LAG of all residential, commercial, or industrial buildings shall have a minimum of 2 feet of freeboard above the 100-year flood elevation of that open ditch or waterway.

For all structures fronting a flooding source other than a swale or an emergency flood route, the floor of any basements or crawl spaces (if provided) shall be a minimum of 1 foot above the normal pool level (if pond) or the 2-year flood level (if a stream or an open ditch).

For all structures adjacent to an emergency flood route (also referred to as overflow path/ponding areas), the minimum adjacent grade of the portion of the structure (the ground elevation next to the building after construction is completed that sits adjacent to the emergency flood route or may be subject to flooding by the emergency flood route) shall be a minimum of 1.5 feet above the estimated 100-year elevation of the emergency flood route assuming that all stormwater inlets and pipes are fully clogged, with no discharge into the storm sewer system. The building adjacent grade requirements (including default elevations above the overflow route bottom) for buildings adjacent to overflow path/ponding areas are further discussed in this Technical Standards Manual.

In addition to any other provisions in the Ordinance or this Technical Guide no buildings shall be placed within 50 feet from the top of the bank of any existing or proposed stream, drain, or watercourse, regardless of the contributing drainage area or the bank height.

B. LOT DRAINAGE

All lots shall be laid out to provide drainage away from all buildings, and individual lot drainage shall be coordinated with the general stormwater drainage pattern for the subdivision. Drainage shall be designed to avoid the concentration of stormwater runoff from a lot onto adjacent lots. Each lot owner shall maintain the lot grade, as it relates to stormwater drainage, in compliance with the approved construction and subdivision plans.

No part of the lot area of any lot may contain land that is utilized as retention or detention facility or drainage pond, contains a watercourse, or is within a floodway. If a subdivision contains an existing or to be developed waterbody, watercourse, or portion thereof, appropriate documentary assurances acceptable to the City shall be provided for the maintenance of such waterbody or watercourse.

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.



Chapter Twelve

RIVER CORRIDOR, BLUFFS, AND FLOODPLAIN PROTECTION STANDARDS

A. DEVELOPMENT WITHIN FLOODWAYS AND FLUVIAL EROSION HAZARD CORRIDORS

Regulatory Floodway and Fluvial Erosion Hazard (FEH) Corridor along regulated drains or any natural stream watercourse are considered Impact Drainage Areas and must be preserved to the extent possible to minimize flooding and erosion impacts within the stream system.

Basis for Establishing Floodways

The regulatory floodway along City streams are established as detailed in the latest edition of the City Floodplain Management Ordinance.

Basis for Establishing Fluvial Erosion Hazard (FEH) Corridors

The Indiana Silver Jackets Hazard Mitigation Task Force has initiated a multi-agency program to identify, study and provide mitigation planning resources for communities who would like to adopt Fluvial Erosion Hazard (FEH) avoidance strategies. The resources provided by this project enable individuals and communities to better recognize areas prone to natural stream-erosion processes and adopt strategies to avoid FEH-related risks. The FEH resources define approximate setbacks for communities to better manage river corridors. The setbacks vary based on the stream's recent migration history (actively migrating or relatively stationary).

For actively migrating and relatively stationary streams, a GIS analysis algorithm generated bankfull width values for each stream segment using regional curves that are based on drainage area within each physiographic region in Indiana. For relatively stationary streams, the analysis used these values to create buffer zones of at least one bankfull width on each side (a total corridor width of 3 times bankfull width) or 100 feet on each side of the bankfull bank, whichever is greater. For actively migrating streams, GIS generated a total corridor width of 8 times bankfull width, which was manually edited and refined to reflect the digital elevation model and stream meander evidence.

It should be noted that the FEH corridors were created at a map scale of approximately 1:10,000 to 1:15,000. The depicted areas were not meant to be accurate beyond providing an approximate boundary of potential stream migration. A data layer containing FEH Corridors along Indiana streams is currently hosted by IDNR-Division of Water on their mapping portal currently at: <https://indnr.maps.arcgis.com/apps/webappviewer/index.html?id=43e7b307a0184c7c851b5068941e2e23>. The IDNR website notes that, due to its level of detail, this data is not intended for use in project design or parcel level site analysis and that a more detailed analysis of the localized geology and fluvial mechanics is necessary for the proper evaluation of the fluvial erosion hazard.

Despite its inherent level of accuracy, the FEH corridor map created by the Indiana Silver Jackets constitutes the best available data in City and is the basis for regulating development within these corridors by City.

Special Requirements within Floodways and FEH Corridors

No disturbance (fill or excavation) associated with a new development or redevelopment is permitted within FEH corridors or regulatory floodways, unless such modifications are part of a stream-wide restoration plan or a watershed

master plan. This restriction does not apply to stormwater or tile outfalls. Any streambank stabilization effort within an FEH corridor shall require prior review by the City to safeguard against potential negative impacts on other properties or on the stream morphological system. Note that if a stream that is located within incorporated area of a community is designated as a County regulated drain, the proposed activities in the FEH corridor shall be under the County's jurisdiction.

B. ADDITIONAL CONSIDERATION FOR DEVELOPMENT WITHIN OR ADJACENT TO BLUFF ZONES AND STEEP SLOPES

In addition to riverine erosion hazards that exist due to lateral migration of streams as discussed in Section D (above), there are hazardous areas along many bluffs and steep slopes existing in City. For the purpose of these Standards, Bluff is defined as a natural topographic feature having:

- a. A slope that rises at least 25 feet and the grade of the slope averages 30 percent or greater, measured over a horizontal distance of 25 feet, from the toe of the slope to the top of the slope. Where the slope begins below the ordinary high water level, the ordinary high water level is the toe of the slope. See **Figure 12-1**; or
- b. A natural escarpment or cliff with a slope that rises at least ten feet above the ordinary high water level or toe of the slope, whichever is applicable, to the top of the slope, with a slope of 75 degrees or greater. See **Figure 12-2**.

These bluffs exist in many places and do not have to be necessarily along a permanent stream. They may be along the rivers (but sometimes outside the floodway and FEH zones) or along many headcut channels and developing ravines in City that may be tributary to various streams. To prevent buildings from damage due to natural slope adjustment next to bluffs, a minimum of 40 feet of landward setback shall be required from top of the bluff as illustrated in Figures 12-1 and 12-2. If a floodway or FEH is also present on the site, the most landward limit shall govern.

The definition of other terms shown in Figures 12-1 and 12-2 are as follows:

- Bluff impact zone: A bluff and land located within 20 feet of the bluff.
- Bluffline: A line delineating the top of the bluff. More than one bluffline may be encountered proceeding landward from the river.
- Toe of Bluff: A line along the bottom of a bluff, requiring field verification, such that the slope above the line exceeds 30 percent and the slope below the line is 30 percent or less, measured over a horizontal distance of 25 feet.
- Top of Bluff: A line along the top of a bluff, requiring field verification, such that the slope below the line exceeds 30 percent and the slope above the line is 30 percent or less, measured over a horizontal distance of 25 feet.

Where principal structures exist on the adjoining lots on both sides of a proposed building site, the minimum setback may be altered to conform to the average of the adjoining setbacks.

In addition to structure setback noted above, with the exception of erosion control practices sanctioned by or approved by the City, no land disturbance (fill or excavation) shall be allowed within a Bluff Impact Zone.

Also note that the minimum setback required in these standards is just that: a minimum, which is based on national experience. When buildings or other infrastructure is proposed near bluffs or steep slopes, the applicant is encouraged to seek a detailed geotechnical evaluation that may result in needing to have a larger setback or have special provisions even when the slopes are gentler than that regulated in these Standards.

Figure 12-1
Bluff and Bluff Impact Zone

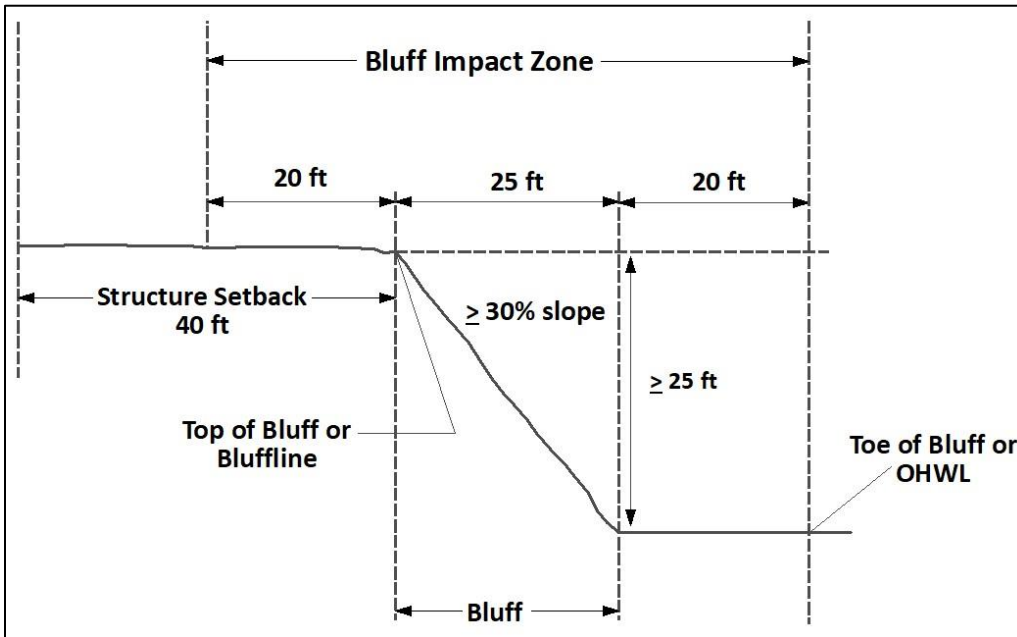
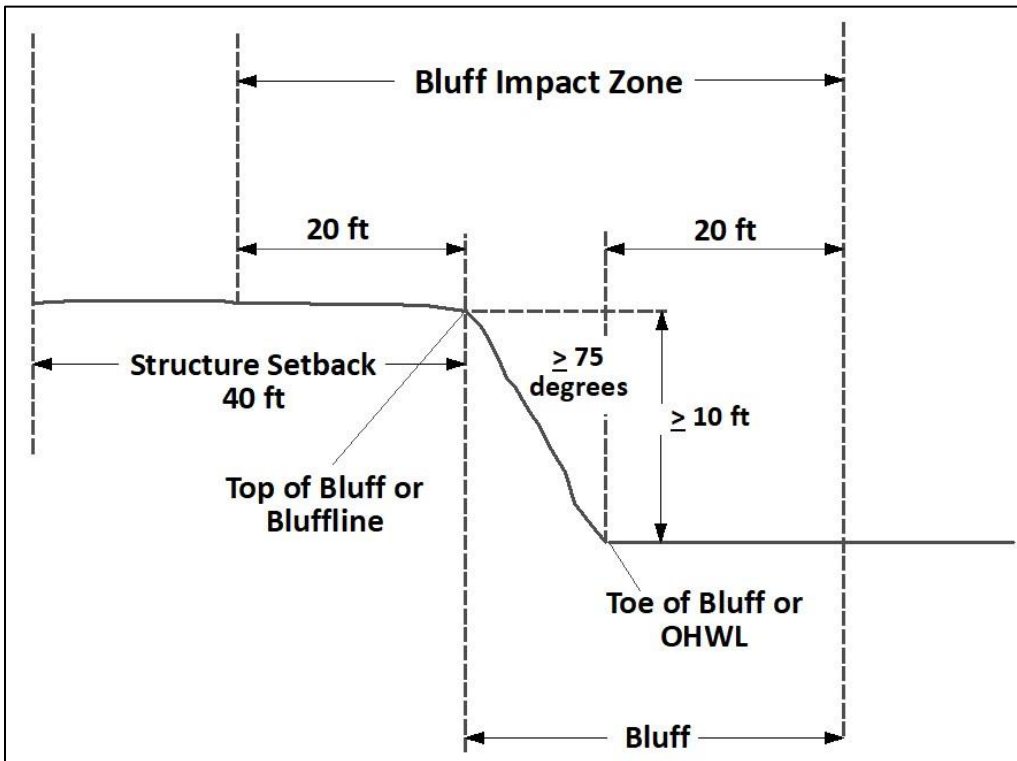


Figure 12-2
Natural Escarpment Bluff and Bluff Impact Zone



C. FLOODPLAIN AVOIDANCE / 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, floodplains are considered Impact Drainage Areas and disturbance to these areas should be avoided. When the avoidance of floodplain disturbance is not practical, the natural functions of the floodplain should be preserved to the extent possible.

In an attempt to strike a balance between the legitimate need for economic development within the City jurisdictional area and the ever-increasing importance of and the need to preserve the natural functions of floodplains to the extent possible (especially given the ongoing and projected climate change impacts), compensatory excavation equivalent to the floodplain storage lost shall be required for all activities within area inundated by the 100-year flood elevation plus 2 feet along floodplain of streams located in City where drainage area of the stream is equal to or larger than one square mile. The City 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:

- Be provided regardless of whether the flooding source is mapped or whether flood elevations are published or not. When flood elevations are not available for a flooding source that has a drainage area equal to or larger than one (1) square mile (640 acres), the applicant is to determine the 10-year and 100-year flood elevations at the site and get them approved by the IDNR prior to use for floodplain compensation calculations.
- Equal at least 1 times the volume of flood storage lost below the 10-year elevation and storage lost between 10-year and 100-year plus 2 feet 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 practical;
- Be provided in such a way to mimic as close as possible the function provided by the lost floodplain storage. If the floodplain storage is to be lost outside the active flow conveyance path, then it must be compensated for outside the flow conveyance path (e.g., a flood conveyance shelf/2-stage ditch, while improving conveyance and erosion, is not an appropriate compensation for floodplain storage lost in the floodway fringe area).
- 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 floodplain storage/conveyance capacity lost within the floodway shall be compensated for within the floodway;
- All floodplain storage lost within the floodway fringe shall be compensated for within the floodway fringe;
- All floodplain storage lost below the existing 10-year flood elevation shall be compensated for below the proposed 10-year flood elevation; and
- All floodplain storage lost above the existing 10-year flood elevation shall be compensated for above the proposed 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 plus 2 feet events. Storage lost between the existing ground and the existing 10-year flood elevation must be compensated by providing 1 time 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 plus 2 feet elevation must be compensated by providing 1 time the amount lost and be placed between the proposed 10-year elevation and proposed 100-year plus 2 feet elevation.

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 City 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 on **Figures 12-3, Figure 12-4, and Table 12-1**, respectively.

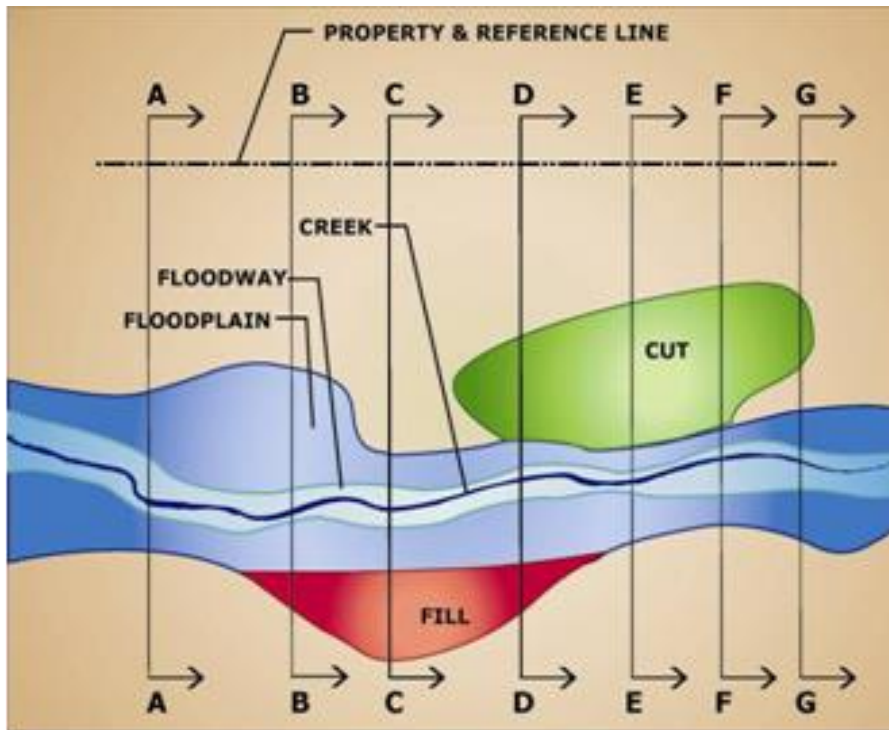
Volume of Fill between cross sections are calculated by finding the average fill cross sectional area and multiplying it by the distance between the two cross sections. For example, the fill volume between cross sections A and B is calculated as follows:

$$\begin{aligned} \text{Average Fill Area} &= (\text{Fill Area "A"} + \text{Fill Area "B"})/2 = (0 \text{ ft}^2 + 100 \text{ ft}^2)/2 = 50 \text{ ft}^2 \\ \text{Volume of Fill} &= (\text{Average Fill Area}) \times (\text{Distance}) = (50 \text{ ft}^2) \times (150 \text{ ft}) = 7,500 \text{ ft}^3 \end{aligned}$$

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:

$$\text{Required Compensatory Storage} = (1) \times (\text{Total Volume of Fill}) = (1) \times (36,250 \text{ ft}^3) = 36,250 \text{ ft}^3$$

Figure 12-3- Example Compensatory Storage Grading Plan



* Not to Scale & Topography not shown for clarity.

Figure 12-4 – Example Cross Section D-D

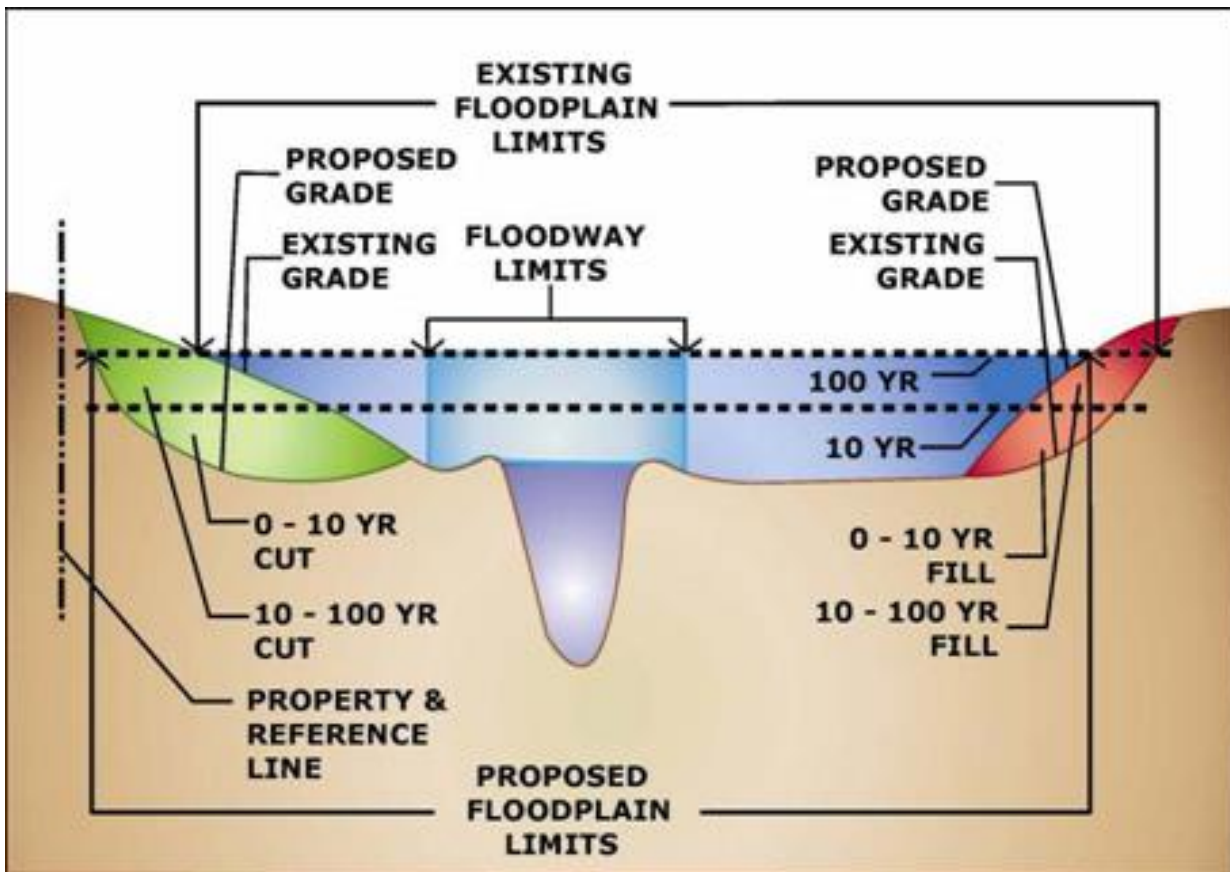


Table 12-1 - Example Compensatory Storage Calculations for 0-10 year event

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 flood storage between the 10-year and 100-year plus 2 feet flood elevation in a similar manner to determine whether the design meets the compensatory storage requirement for the area above the 10-year flood elevation.

Location of Compensatory Storage

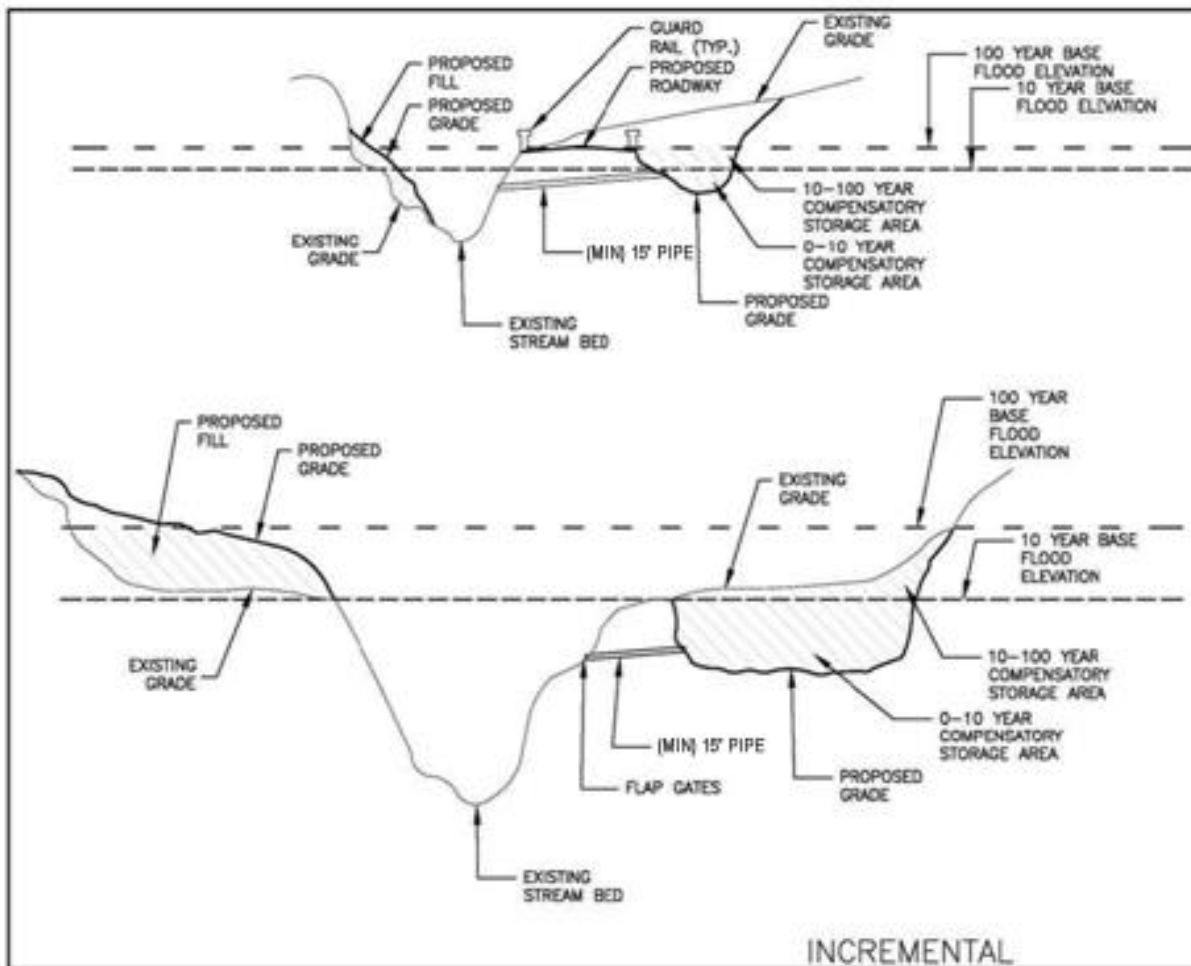
Compensatory storage must be located on-site and adjacent to or opposite the areas filled or occupied by a structure. In those rare instances when compensatory storage cannot be located adjacent to or opposite to the areas filled or occupied, engineering computations demonstrating that hydraulically equivalent compensatory storage has been provided in a nearby area in the watershed 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 12-5**.

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 plus 2 feet 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 12-5**.

The use of pipes in compensatory storage will require approval by the County. 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 compensatory storage is proposed to be combined with detention, it must be demonstrated the compensatory storage and detention do not interfere with one another.

Figure 12-5 – Example of Compensatory Storage Connection to Stream through Pipe



Compensatory Storage in the Regulatory Floodway

Only fill associated with appropriate uses of the regulatory floodway may be allowed to be placed within the limits of the floodway. When in rare circumstances, fill is allowed, all provisions discussed above relating to compensatory storage must be met in addition to the items discussed below.

- Any fill placed within the existing floodway must be compensated for within the proposed floodway.
- All floodway storage lost below the existing 10-year base flood elevation shall be replaced below the proposed 10-year base flood elevation.
- All floodway storage lost between the existing 10-year flood elevation and the existing 100-year plus 2 feet flood elevation shall be replaced between the proposed 10-year and proposed 100-year plus 2 feet flood elevation.

Should excavation within a floodway be allowed in special circumstances, there shall be no reduction in floodway surface area as a result of a floodway modification, unless such modification is part of a stream-wide plan or necessary to reduce flooding at an existing structure.



Chapter Thirteen

STANDARDS ASSOCIATED WITH DAMS AND LEVEES

A. POLICY ON DAMS AND LEVEES

Dams and levees have the potential for significant, sometimes catastrophic consequences should they fail. In order to minimize the potential for loss of life and public safety, decrease the potential for increased flood damage and disaster costs, and safeguard the downstream property rights, the following shall be required by the City for any proposed new or improvements to any existing dam or levee. These requirements are in addition to what is normally required for other development subject to this Ordinance and/or that required by State or Federal agencies.

1. Design of dams shall follow the requirements of the latest edition of IDNR-Division of Water "General Guidelines for New Dams and Improvements to Existing Dams in Indiana" as well as principles provided in the latest edition of "Indiana Dam Safety Inspection Manual".
2. Design of levee/floodwalls shall follow the FEMA requirements and guidelines provided in 44 CFR Section 65.10 and USACE Engineer Manual 1110-2-193, Design and Construction of Levees.
3. An Incident and Emergency Action Plan (IEAP), including a detailed dam breach inundation map, shall be developed in accordance with the template provided in the latest edition of "Indiana Dam Safety Inspection Manual" and submitted to the City. The detailed dam breach inundation map referenced in this paragraph shall be developed for both "Sunny Day Breach" Scenario (breach during normal loading conditions) and for maximum loading condition with breach assumed to occur as the spillway system is passing the Spillway Design Flood associated with the dam ("SDF + Breach" Scenario).
4. Unless the "Sunny Day Breach Inundation Area" is entirely contained within the applicant's property and/ or contained within the existing 100-year floodplain, a copy of recorded flood inundation easement or a recorded written consent for every property within the potential "Sunny Day Breach Inundation Area" shall be submitted to the City. Also required is the ownership or recorded easement of all property around the lake with an elevation below the top of the dam. In addition, all the affected property owners whose properties are located within the "SDF + Breach Inundation Area" must be notified of a hearing relevant to the proposed added flooding risk, should such a man-made structure suffer a

catastrophic failure. Notification of the time and place of the hearing shall be made in person or by certified mail at least five (5) to ten (10) days prior to the hearing. Proof of notice to each landowner shall be filed by affidavit with the City prior to the hearing.

5. A copy of a Management and Maintenance Plan for the proposed dam or levee developed in accordance with the latest edition of "Indiana Dam Safety Inspection Manual" shall be submitted to the City.
6. Unless the dam is subject to and regulated by IDNR, following the permitting and construction of the dam or levee, a copy of a formal periodic inspection report prepared in accordance with the recommendations contained in the latest edition of "Indiana Dam Safety Inspection Manual" shall be submitted to the City along with evidence that the identified maintenance deficiencies have been corrected. The inspection report has to be submitted as it gets completed in accordance with the inspection frequency recommended in the latest edition of "Indiana Dam Safety Inspection Manual".

B. REQUIREMENTS ASSOCIATED WITH PROPOSED DEVELOPMENTS DOWNSTREAM OF DAMS

As indicated in the previous section, dams have the potential for significant, sometimes catastrophic consequences should they fail. Placing new development downstream of an existing dam does not only expose the future residents or users of the newly developed areas to a potential new significant risk, but could also have an impact on the hazard rating of the dam itself, which can in turn make the dam non-compliant with the state and federal standards. In order to minimize the potential for loss of life and public safety, decrease the potential for increased flood damage and disaster costs, and safeguard the upstream dam owner's rights, the following shall be required by the City for any proposed new development or redevelopment downstream of an existing dam. These requirements are in addition to what is normally required for new development or redevelopment subject to these Standards.

1. Dam breach inundation maps have been created for several existing dams within the State of Indiana by the dam owners, IDNR, or others as part of development of individual IEAPs for these dams. When the development location is suspected by the applicant or the City to be within an existing dam's breach inundation zone, the applicant is required to include a copy of the breach inundation mapping associated with that dam as part of its stormwater management permit application. To locate such a mapping, the applicant should contact the dam owner, IDNR- Division of Water, City, or other agencies to obtain the breach inundation map for the dam, if available. If no dam breach inundation map can be located for the dam, it will be the applicant's responsibility to produce a City-acceptable dam breach mapping either through directly contracting with a qualified engineer or through funding the production of such a map by the City review consultant in accordance with standards and guidelines established by the IDNR-Division of Water.
2. If the location of the proposed development falls within the dam breach inundation zone on the map discussed under Item i (above), additional requirements as determined by City may be imposed before a permit is issued

and the development is allowed to occur. The noted additional requirements depend on several variables and are expected to vary case by case. Typical requirements could include relocating a portion or all of the proposed development to areas outside of the dam breach inundation zone, cost-sharing with the dam owner in necessary upgrades to the dam as a result of a potential hazard classification increase, addition of structural protection measures (such as flood protection levees), additional freeboard requirements, development and periodic exercise of warning and evacuation plans, and other measures considered necessary by City to minimize the potential for loss of life and public safety, decrease the potential for increased flood damage and disaster costs, and safeguard the upstream dam owner's rights.

APPENDIX A

ABBREVIATIONS AND DEFINITIONS



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
FEH	Fluvial Erosion Hazard
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
LID	Low Impact Development
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 Pollutant 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
TN	Total Nitrogen
TP	Total Phosphorus
TSS	Total Suspended Solids
USCS	Unified Soil Classification System
USDA	United States Department of Agriculture

DEFINITIONS

Acre-Foot (AF). A measure of water volume equal to the inundation of a flat one-acre area to a depth 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.

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.

Construction Support Activities. Include but are not limited to the following: concrete or asphalt batch plants, equipment staging yards, material storage areas, excavated material disposal areas, borrow areas. Such activities must not support multiple, unrelated projects, be a commercial/industrial operation, or continue to operate beyond the completion of the construction activity for the project it supports.

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 storage 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. In the context of water quantity provisions, usually the rate of water flow, i.e., 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. In the context of water quality provisions, the discharge means any addition of liquids or solids to a water body or a flow conveyance facility.

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

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

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.

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 or these Standards.

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.

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 non-erosive 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 FIRM 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 regulatory or 100-year flood plus two (2) feet of freeboard if the flooding source is a lake, pond, stream, or an open channel/ditch (or 1 foot of freeboard if the flooding source is an overflow path/ponding area provided that the elevation of the overflow path/ponding area is calculated based on the assumption of fully plugged storm pipe system).

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.

Fluvial Erosion Hazard (FEH) Corridor. Fluvial (riverine) Erosion Hazard corridors represent the areas along the streams (including the channel and immediate overbanks areas) that are believed to be subject to stream movement or streambank erosion. These corridors have been delineated for most actively migrating and relatively stationary streams in Indiana through an Indiana Silver Jackets initiative, with data for City currently contained on the City GIS website. More detailed mapping than that used as part of the Indiana Silver Jackets erosion hazard mapping program may be provided by the applicant if it is based on detailed field assessment acceptable to the City.

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

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.

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 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.

Intermittent Stream. A stream which carries water a considerable portion of the time, but which ceases to flow occasionally or seasonally because bed seepage and evapotranspiration exceed the available water supply.

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 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.

Low Impact Development. LID is a land planning and engineering design approach with a goal of replicating the pre-development hydrologic regime of urban and developing watersheds. The primary goal of LID is to mimic a site's predevelopment hydrology by reducing the impervious surface, infiltrating, filtering, storing, evaporating, and detaining runoff close to its source.

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 Sewers. An MS4 meets all the following criteria: (1) is a conveyance or system of conveyances owned by the state, county, City, 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 United 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 lakebed 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, nematocides, 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 required to comply with the terms of the ordinance or these Technical Standards, 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 citing of structures and facilities that shall be subject to almost no risk of flooding. The probable maximum flood is usually much larger than 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 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 is disturbances of one (1) acre or more of land. The term does not include such activities as exterior remodeling.

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. Area under the stormwater regulatory jurisdiction of the City.

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 Water. A water body in need of priority protection or remediation base on its:

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).

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.

Silvicultural. the practice of controlling the establishment, growth, composition, health, and quality of forests to meet diverse needs and values.

1. Nonpoint activities include source silvicultural activities such as nursery operations, site preparation, reforestation and subsequent cultural treatment, thinning, prescribed burning, pest and fire control, harvesting operations, surface drainage, or road construction and maintenance from which there is natural runoff. Some of these activities (such as stream crossing for roads) may involve the placement of dredged or fill material which may require a CWA section 404 permit and a 401 Water Quality Certification.
2. Point source activities include any discernible, confined and discrete conveyance related to rock crushing, gravel washing, log sorting, or log storage facilities which are operated in connection with silvicultural activities and from which pollutants are discharged into waters of the United States or the State.

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 or these Technical Standards 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 "percent". Slopes given in percent are always expressed as $(100 \times V/H)$ --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.

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 intermittent 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 floods behave, (e.g., dams, dikes, levees, channel enlargements and diversions).

Subarea/Sub-basin. Portion of a watershed divided into homogenous drainage units which can be modeled for purposes of determining runoff rates. The subareas/sub-basins 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 the 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 into primary drainage channels and may provide some groundwater recharge.

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 give 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 (such as CESSWI and/or CPESC certification), or other documented and applicable experience or coursework as deemed sufficient by the City 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.

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 falling with the season or from other conditions such as water withdrawal.

Waterbody. Any accumulation of water, surface, or underground, natural or artificial.

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.

APPENDIX B

APPLICATIONS, FORMS AND MISCELLANEOUS SHEETS REQUIRED TO COMPLY WITH THE CITY STORMWATER MANAGEMENT ORDINANCE AND TECHNICAL STANDARDS

B1 –Stormwater Application Forms

Application/Checklist for Stormwater SWPPP Approval
Construction/SWPPP Technical Review Form
Statement of Financial Responsibility
BMP Maintenance Agreement

B2 – Construction Inspection/Completion Forms

Construction Self-Monitoring Report
Certification of Completion & Compliance
Termination Inspection Checklist

B1 –Stormwater Permit Forms

Application/Checklist for Stormwater Permit
Construction/SWPPP Technical Review Form
Statement of Financial Responsibility
BMP Maintenance Agreement

Permit No: _____

Portage Utility Service

Drainage and Stormwater Management Application

(Stormwater Designs and SWPP plans should comply with the City of Portage [Stormwater Technical Guide](#))

Land Alternation / Project Name: _____

Location of Project: _____

Owner Information:

Name: _____ Contact: _____
Address: _____ Phone: _____
Fax: _____ Email: _____

Developer Information (If not Owner):

Name: _____ Contact: _____
Address: _____ Phone: _____
Fax: _____ Email: _____

Engineer Information:

Name: _____ Contact: _____
Address: _____ Phone: _____
Fax: _____ Email: _____

Contractor Information:

Name: _____ Contact: _____
Address: _____ Phone: _____
Fax: _____ Email: _____

Submitted By: _____ Date: _____



Portage Utility Services
Stormwater Pollution Prevention Plan (SWPPP) Submittal Checklist

Indiana Administrative Code (IAC) 15-5-6.5 stipulates the requirements of the Construction Plan associated with land disturbing activities. The plan elements are divided into three categories: Basic Plan Elements, Active Construction Component and Post-Construction Component. This SWPPP Submittal Checklist contains a summary of the items of a SWPPP that is in accordance with IAC 15-5-6.5. Individuals or entities submitting a SWPPP for review by Portage Utility Services must submit this completed checklist along with the SWPPP. For each of the SWPPP items identified in the checklist, identify the page or drawing number that the information can be found to facilitate the review by Portage Utility Services staff. For additional guidance, see the IDEM Guidance for Construction Plan/Storm Water Pollution Plan Development at <https://www.in.gov/idem/stormwater/2378.htm>.

Project Name:		
General Location:		
Owner:		
Developer:		
Engineer:		
Total Project Area (Acre):		Total Disturbed Area (Acres):
Required Construction Plan/SWPPP Items		Page/Sheet #
Section A -- Basic Plan Elements: Identify the location of the following SWPPP elements		
A1	An index indicating the location, in the construction plans, of all information required by this subsection (can use this application form as index).	
A2	An 11x17 inch plat showing building lot numbers/boundaries and road layout/names.	
A3	Narrative description of the nature and purpose of the project.	
A4	Vicinity map depicting the project site location in relationship to recognizable local landmarks, towns, and major roads, such as a USGS topographic quadrangle map, or county or municipal road map.	
A5	Legal description of the project site.	
A6	Location of all lots and proposed site improvements.	

A7	14-Digit Watershed Hydrologic Unit Code.	
A8	Identification of any other state or federal water quality permits that are required for construction activities associated with the owner's project site ((DNR, IDEM, USACE, etc.).	

Required Construction Plan/SWPPP Items		Page/Sheet #
A9	Specific points/locations where storm water discharge will leave the site (outfalls).	
A10	Location and name of all wetlands, lakes, and water courses on and adjacent to the site.	
A11	Identification of and 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.	
A12	Locations where storm water may be potentially directly discharged to groundwater, such as abandoned wells or sinkholes. Please note if none exists.	
A13	Identification of 100-year floodplains, floodways and floodway fringes. Please note if none exists.	
A14	Pre-construction and post-construction estimate of peak discharge.	
A15	Identification of adjacent land use, including upstream watershed.	
A16	Locations and approximate boundaries of all disturbed areas.	
A17	Identification and delineation of vegetative cover such as grass, weeds, brush, and trees on the project site.	
A18	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. A soil legend must be included with the soil map, along with the identification of 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.	
A19	Locations, size and dimensions of proposed storm water systems.	
A20	Delineation of and plan for all proposed land disturbing activities for any off-site construction activities associated with this project, including off-site activities that will provide services to the project site (sanitary sewers, water lines or other utilities, roads, etc.) which are off the project site but are necessary to provide service(s) to the project.	

A21	Information and locations of any off-site borrow, stockpile, or disposal areas that are associated with a project site, and under the control of the project site owner.	
A22	Existing site topography at an interval appropriate to show detailed drainage patterns.	
A23	Proposed final topography at an interval appropriate to show detailed drainage patterns.	
Section B -- Active Construction Component: Identify the location of the following SWPPP elements		
B1	Description of potential pollutant sources associated with the project's construction activities.	
B2	The sequence describing storm water quality measure implementation relative to the project's land-disturbing activities.	
B3	Identification of the locations of stable construction entrance(s) and specifications regarding the construction and maintenance of construction entrances.	
Required Construction Plan/SWPPP Items		Page/Sheet #
B4	Sediment control measures for sheet flow areas.	
B5	Sediment control measures for concentrated flow areas.	
B6	Storm sewer inlet protection measure locations and specifications for installation and maintenance.	
B7	Runoff control measures for items such as diversions, rock check dams, slope drains, etc.	
B8	Storm sewer outlet protection specifications that prevent scour erosion.	
B9	Grade stabilization structure locations and specifications.	
B10	Location, dimensions, specifications and construction details of each storm water quality measure.	
B11	Temporary surface stabilization methods appropriate for each season.	
B12	Permanent surface stabilization specifications.	
B13	Material handling and spill prevention plan.	
B14	Monitoring and maintenance guidelines for each proposed pollution prevention measure.	

B15	Erosion and sediment control specifications for individual building lots.	
Section C -- Post-Construction Component: Identify the location of the following SWPPP elements		
C1	A description of potential pollutant sources from the proposed land use, which may reasonably be expected to add a significant amount of pollutants to storm water discharges.	
C2	Sequence describing storm water quality measure implementation.	
C3	A description of post-construction storm water quality measures that will be installed to control pollutants in storm water 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 storm water retention and detention ponds.	
C4	Location, dimensions, specifications and construction details of each storm water quality measure.	
C5	A narrative description of the maintenance guidelines for all post-construction storm water quality measures to facilitate their proper long-term function. This narrative description shall be made available to future parties who will assume responsibility for the operation and maintenance of the post-construction storm water quality measures.	

Stormwater Management BMPs Maintenance Agreement

THIS AGREEMENT is made this _____ day of _____, 20____, by _____ [Owner Name] of _____ [Company Name] with principal offices located _____ [Owner/Company Address], hereinafter "Owner".

In accordance with *Jurisdiction Entity* Stormwater Ordinance and Technical Standards, the Owner agrees to install and maintain stormwater management practice(s) (also known as BMPs) on the subject property, known as _____ [Property's Common Name] located at _____ [Property's Address], hereinafter "Property" in accordance with Exhibit A. The Owner further agrees to the terms stated in this document to ensure that the stormwater management practice(s) continues serving the intended function in perpetuity. This Agreement includes the following exhibit:

Exhibit A: BMP Operation and Maintenance Manual ("Manual").

Note: This agreement and all Exhibits shall be recorded with the deed of property by the Owner at the *Jurisdiction Entity* Recorder's Office and two (2) copies of the recorded document provided to *Jurisdiction Entity*'s Office, hereinafter "Community".

Through this Agreement, the Owner hereby subjects the Property to the following covenants, conditions, and restrictions:

1. The Owner shall be solely responsible for the installation, maintenance, and repair of the stormwater management practices, drainage easements, and associated landscaping identified in the Manual.
2. No alterations or changes to the stormwater management practice(s) identified in the Manual shall be permitted unless they are deemed to comply with this Agreement and are approved in writing by the Community.
3. The Owner shall retain the services of a qualified individual or company to operate and ensure the maintenance of the stormwater management practice(s) identified in the Manual.
4. The Owner shall annually, by December 30th, provide to the Community records of inspections, maintenance, and repair of the stormwater management practices in accordance with the Manual.
5. The Community or its designee is authorized to access the property as necessary to conduct inspections of the stormwater management practices or drainage easements to ascertain compliance with the intent of this Agreement and the activities prescribed in the Manual. Upon written notification by the Community or its designee of required maintenance or repairs, the Owner shall complete the specified maintenance or repairs within a reasonable time frame determined by the Community. The Owner(s) shall be liable for the failure to undertake any maintenance or repairs so that the public health, safety and welfare shall not be endangered nor the road improvement damaged.
6. If the Owner fails to properly maintain the stormwater management practice(s) in accordance with the Manual and this Agreement, the Community is authorized, but not required, to perform the specified inspections, maintenance, or repairs in order to preserve the intended functions of the practice(s) and prevent the practice(s) from becoming a threat to public health, safety, general welfare or the environment. In the case of an emergency, as determined by the Community, no notice shall be required prior to the Community performing emergency maintenance or repairs. The

Community may levy the costs and expenses of such inspections, maintenance, or repairs plus a ten percent (10%) administrative fee against the Owner. The Community at the time of entering upon said stormwater management practice for the purpose of maintenance or repair may file a notice of lien in the office of the Register of Deeds of City of Portage upon the property affected by the lien. If said costs and expenses are not paid by the Owner, the Community may pursue the collection of same through appropriate court actions and in such a case, the Owner shall pay in addition to said costs and expenses all costs of litigation, including attorney fees.

7. The Owner hereby conveys to the Community an easement over, on, and in the Property or otherwise grants perpetual access rights for the purpose of access to the stormwater management practice for the inspection, maintenance, and repair thereof, should the Owner fail to properly inspect, maintain, and repair the practice(s).
8. The Owner agrees that this Agreement shall be recorded and that the Property shall be subject to the covenants and obligations contained herein, and this Agreement shall bind all current and future owners of the property.
9. The Owner agrees in the event that the Property is sold, transferred, or leased to provide information to the new owner, operator, or lessee regarding proper inspection, maintenance, and repair of the stormwater management practice(s). The information shall accompany the first deed transfer and include this Agreement and all Exhibits. The transfer of this information shall also be required with any subsequent sale, transfer, or lease of the Property.
10. The Owner agrees that the rights, obligations, and responsibilities hereunder shall commence upon execution of the Agreement.
11. The Owner whose signatures appear below hereby represent and warrant that they have the authority and capacity to sign this agreement and bind the respective parties hereto.
12. The Owner, its agents, representatives, successors, and assigns shall defend, indemnify and hold the Community harmless from and against any claims, demands, actions, damages, injuries, costs or expenses of any nature whatsoever, hereinafter "Claims", fixed or contingent, known or unknown, arising out of or in any way connected with the design, construction, use, maintenance, repair or operation (or omissions in such regard) of the stormwater management practice(s) referred to in Exhibit A which are the subject of this Agreement. This indemnity and hold harmless shall include any costs, expenses, and attorney fees incurred by the Community in connection with such Claims or the enforcement of this Agreement.

IN WITNESS WHEREOF, the Owner has executed this Agreement on the day and year first above written.

Owner Signature

Date

Printed Name

Company

Title

STATE OF INDIANA)
)
COUNTY OF xxx)

SS:

BEFORE ME, the undersigned, a Notary Public in and for said County and State, personally appeared _____ Owner subscribed and sworn before this _____ day of _____, 20 ____.

Commission Expiration Date

County of Residence

Signature

Printed Name

WHEN RECORDED, RETURN FILE STAMPED COPY TO:

Jurisdiction Entity Name and Address

.....

Accepted by ***Jurisdiction Entity***:

Signature: _____

Date: _____

Printed Name: _____

Title: _____

B2 – Construction Inspection/Completion Forms

Construction Site Observation Report
Certification of Completion & Compliance
Termination Inspection Checklist

Self-Monitoring Report (To Be Completed by Permittee's Trained Individual)

PART A: INSPECTION INFORMATION

Project Name: CSGP Project # Number: Permit # Assigned by MS4: Name of MS4: County: Name of Evaluator: Title of Evaluator: Affiliation: Email/Phone Number:	Inspection Type <input type="checkbox"/> 24 hr (after >.5" rain) <input type="checkbox"/> 24 hr (before >.5" rain) <input type="checkbox"/> Weekly <input type="checkbox"/> Monthly <i>(only applies to areas permanently stabilized)</i>	Inspection Date and Time Click here to enter a date. Date of Last or Forecasted (circle one) Precipitation: Click here to enter a date. Amount of Last or Forecasted (circle one) Precipitation: Click here to enter a date.
--	---	--

PART B: SITE CONDITIONS

Current Site Information (check all that apply): Clearing Grubbing Grading Building Construction
 Installation of Infrastructure Utility Work Vegetative Establishment Other:

Soil Conditions: Dry Moist Wet Muddy Partial Snow Cover Snow Cover Frozen Freeze/Thaw
 Other:

PART C: PROJECT MANAGEMENT

(1) Was the SWP3 accessible at the time of the inspection?	<input type="checkbox"/> Yes <input type="checkbox"/> No
(2) Is the SWP3 current and/or updated to reflect the current stage of development?	<input type="checkbox"/> Yes <input type="checkbox"/> No
(3) Have all action items identified on the preceding reports been resolved? (a) If not identify which items require repair and provide a resolution timeline:	<input type="checkbox"/> Yes <input type="checkbox"/> No
(4) Is the project posting information posted in accordance with the CSGP Section 3.7?	<input type="checkbox"/> Yes <input type="checkbox"/> No

PART D: GUIDANCE FOR COMPLETION OF FORM

- Identify all areas of the site that currently have an erosion/sediment control measure in place. Using Part E, evaluate the current condition of the measure and using the middle column, determine what action needs to be taken.
- Identify all areas of the site where stormwater run-off leaves site or where any discharge occurs. In each location where run-off leave the site, evaluate:
 - If an erosion/sediment control measure is in place: evaluate each action step required in Part E
 - If no erosion/sediment control measure is in place or a measure is required, use Part E to include specifics about the location and type of measure to be implemented.
- For any area of the site where there is run-off, or a discharge provide a description and location using Part F.
 - If any sedimentation is occurring note where it is discharging: Off site, to a waterbody (on or off-site) or other sensitive area
- For Part H in the Evaluation of sheet flow and concentrated run-off:
 - Identify location of discharge/run-off and check any visual descriptions that apply to the discharge. If the discharge/run-off will resolve with the repair of a sediment or erosion control measure or good housekeeping practices, you do not need to list an action in the observations/notes section. If the discharge/run-off will not be solved with repair/replacement of a sediment control measure or good housekeeping practices, you will need to list the action taken to resolve the run-off and any additional pollutants visible in the discharge.
 - Print out additional pages for Parts E and F.

PART E: SEDIMENT CONTROL AND RUN-OFF MANAGEMENT

Measure: Location(s):	<input type="checkbox"/> No Action Required <input type="checkbox"/> Maintenance Required <input type="checkbox"/> Repair Measure <input type="checkbox"/> Temporary Measure <input type="checkbox"/> Replace Measure <input type="checkbox"/> Alternative Measure <input type="checkbox"/> Additional Measure	Observations/Notes:
Action Initiated Date: Click here to enter a date. Initials:		Action Completed Date: Click here to enter a date. Initials
Measure: Location(s):	<input type="checkbox"/> No Action Required <input type="checkbox"/> Maintenance Required <input type="checkbox"/> Repair Measure <input type="checkbox"/> Temporary Measure <input type="checkbox"/> Replace Measure <input type="checkbox"/> Alternative Measure <input type="checkbox"/> Additional Measure	Observations/Notes:
Action Initiated Date: Click here to enter a date. Initials:		Action Completed Date: Click here to enter a date. Initials
Measure: Location(s):	<input type="checkbox"/> No Action Required <input type="checkbox"/> Maintenance Required <input type="checkbox"/> Repair Measure <input type="checkbox"/> Temporary Measure <input type="checkbox"/> Replace Measure <input type="checkbox"/> Alternative Measure <input type="checkbox"/> Additional Measure	Observations/Notes:
Action Initiated Date: Click here to enter a date. Initials:		Action Completed Date: Click here to enter a date. Initials
Measure: Location(s):	<input type="checkbox"/> No Action Required <input type="checkbox"/> Maintenance Required <input type="checkbox"/> Repair Measure <input type="checkbox"/> Temporary Measure <input type="checkbox"/> Replace Measure <input type="checkbox"/> Alternative Measure <input type="checkbox"/> Additional Measure	Observations/Notes:
Action Initiated Date: Click here to enter a date. Initials:		Action Completed Date: Click here to enter a date. Initials
Measure: Location(s):	<input type="checkbox"/> No Action Required <input type="checkbox"/> Maintenance Required <input type="checkbox"/> Repair Measure <input type="checkbox"/> Temporary Measure <input type="checkbox"/> Replace Measure <input type="checkbox"/> Alternative Measure <input type="checkbox"/> Additional Measure	Observations/Notes:
Action Initiated Date: Click here to enter a date. Initials:		Action Completed Date: Click here to enter a date. Initials

PART F: SURFACE STABILIZATION

Location(s):	<input type="checkbox"/> Permanent Vegetative Cover: <input type="checkbox"/> Continue to Monitor <input type="checkbox"/> 70 Percent Density Achieved <input type="checkbox"/> Perform Seeding/Reseed <input type="checkbox"/> Temporary <input type="checkbox"/> Permanent <input type="checkbox"/> Apply straw mulch and anchor <input type="checkbox"/> Install Erosion Control Blanket <input type="checkbox"/> Repair Erosion <input type="checkbox"/> Utilize Alternative Stabilization Method	Observations/Notes:
Action Initiated Date: Click here to enter a date. Initials:		Action Completed Date: Click here to enter a date. Initials
Location(s):	<input type="checkbox"/> Permanent Vegetative Cover: <input type="checkbox"/> Continue to Monitor <input type="checkbox"/> 70 Percent Density Achieved <input type="checkbox"/> Perform Seeding/Reseed <input type="checkbox"/> Temporary <input type="checkbox"/> Permanent <input type="checkbox"/> Apply straw mulch and anchor <input type="checkbox"/> Install Erosion Control Blanket <input type="checkbox"/> Repair Erosion <input type="checkbox"/> Utilize Alternative Stabilization Method	Observations/Notes:
Action Initiated Date: Click here to enter a date. Initials:		Action Completed Date: Click here to enter a date. Initials
Location(s):	<input type="checkbox"/> Permanent Vegetative Cover: <input type="checkbox"/> Continue to Monitor <input type="checkbox"/> 70 Percent Density Achieved <input type="checkbox"/> Perform Seeding/Reseed <input type="checkbox"/> Temporary <input type="checkbox"/> Permanent <input type="checkbox"/> Apply straw mulch and anchor <input type="checkbox"/> Install Erosion Control Blanket <input type="checkbox"/> Repair Erosion <input type="checkbox"/> Utilize Alternative Stabilization Method	Observations/Notes:
Action Initiated Date: Click here to enter a date. Initials:		Action Completed Date: Click here to enter a date. Initials
Location(s):	<input type="checkbox"/> Permanent Vegetative Cover: <input type="checkbox"/> Continue to Monitor <input type="checkbox"/> 70 Percent Density Achieved <input type="checkbox"/> Perform Seeding/Reseed <input type="checkbox"/> Temporary <input type="checkbox"/> Permanent <input type="checkbox"/> Apply straw mulch and anchor <input type="checkbox"/> Install Erosion Control Blanket <input type="checkbox"/> Repair Erosion <input type="checkbox"/> Utilize Alternative Stabilization Method	Observations/Notes:
Action Initiated Date: Click here to enter a date. Initials:		Action Completed Date: Click here to enter a date. Initials

PART G: GOOD HOUSEKEEPING

Site Ingress/Egress Location(s):	<input type="checkbox"/> Maintain Construction Entrance <input type="checkbox"/> Remove Tracked Sediment (do not flush sediment) <input type="checkbox"/> Install Additional Measures	Observations/Notes:
Action Initiated Date: Click here to enter a date. Initials:		Action Completed Date: Click here to enter a date. Initials
Trash Location(s):	<input type="checkbox"/> Continue to Monitor and Manage <input type="checkbox"/> Cover Trash Receptacles <input type="checkbox"/> Clean Up Wind-blown Trash <input type="checkbox"/> Other	Observations/Notes:
Action Initiated Date: Click here to enter a date. Initials:		Action Completed Date: Click here to enter a date. Initials
Spills or Leaks Location(s):	Type of Leak/Spill <input type="checkbox"/> Concrete and/or Cementitious Washout <input type="checkbox"/> Fuel <input type="checkbox"/> Other	Observations/Notes/Action Taken:
Action Initiated Date: Click here to enter a date. Initials:		Action Completed Date: Click here to enter a date. Initials

PART H: EVALUATION OF SHEET FLOW AND CONCENTRATED RUN-OFF (DISCHARGES)

Location(s):	<input type="checkbox"/> Sediment <input type="checkbox"/> Oil Sheen <input type="checkbox"/> Odor <input type="checkbox"/> Floatables/Trash <input type="checkbox"/> Foam <input type="checkbox"/> Color/Turbid Discharge <input type="checkbox"/> Other	Observations/Notes:
Action Initiated Date: Click here to enter a date. Initials:		Action Completed Date: Click here to enter a date. Initials
Location(s):	<input type="checkbox"/> Sediment <input type="checkbox"/> Oil Sheen <input type="checkbox"/> Odor <input type="checkbox"/> Floatables/Trash <input type="checkbox"/> Foam <input type="checkbox"/> Color/Turbid Discharge <input type="checkbox"/> Other	Observations/Notes:
Action Initiated Date: Click here to enter a date. Initials:		Action Completed Date: Click here to enter a date. Initials

PART I: CHANGES TO SWPPP

Does the corrective action based on this inspection require modification to the SWPPP? <input type="checkbox"/> Yes <input type="checkbox"/> No	
Date of SWPPP update:	
Brief description of the changes:	
Action Initiated Date: Click here to enter a date. Initials:	Action Completed Date: Click here to enter a date. Initials

PART J: TRAINED INDIVIDUAL CERTIFICATION

I certify that Part A-I of this evaluation were evaluated by me as a trained individual. To the best of my knowledge and belief, the information documented in the report is true, accurate, and complete.

Evaluator Name and Title:

Signature and Date: _____

CERTIFICATE OF COMPLETION & COMPLIANCE

Name of project: _____

Address of premises on which land alteration was accomplished: _____

Inspection Date(s): _____ Stormwater 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 Stormwater Management Ordinance of City of Portage, Indiana); 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: _____

SURVEYOR

ENGINEER

(circle one)

Indiana Registration No. _____

TERMINATION INSPECTION CHECKLIST

(To Be Completed by City of Portage, Indiana)

1. Compliance Requirements

All construction sites shall undergo a final inspection by the City of Portage, Indiana prior to submittal of a Notice of Termination (NOT) to IDEM by the project owner to document the site is stabilized, temporary BMPs have been removed and no future land disturbance will occur within the permitted boundaries. A completed copy of this form confirming compliance with project termination requirements, signed by the City of Portage, Indiana representative, is required to be sent by the applicant to IDEM along with the NOT.

2. Inspection Details

Project Name:	
Address/Lot #:	
IDEM Permit No. ("INR" followed by 6 digits):	
Inspection Performed By:	Date:

3. Notice of Termination (NOT) Verification Inspection Items

ITEM	YES	NO	N/A
A. Have all earth disturbing activities been completed?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B. Are all soils stabilized as appropriate?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
C. Are all drainageways stabilized with either vegetation, rip rap, or other armament?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
D. Have all temporary erosion and sediment control measures been removed?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E. Has all construction waste, trash, and debris been removed from the site?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
F. Has all construction equipment and material been removed from the site?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
G. Are all the permanent BMPs free of sediment accumulation resulting from construction activities?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

4. Corrective Actions Required (If Applicable) 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.

Attach additional sheet(s) if needed

5. Compliance Assessment

<input type="checkbox"/> DEFICIENT – Applicant must schedule a re-inspection by City of Portage after deficiencies are addressed.
<input type="checkbox"/> COMPLIANT – Applicant must upload a signed copy to IDEM along with the IDEM NOT online submittal.

6. Certification and Signature

Inspector Name and Title:	Phone:
Inspector Signature:	Date:

