
STORM WATER MANAGEMENT PLAN

Requirements and General Compliance Guidelines and
NPDES Phase II Storm Water Discharge Requirements
For Storm Water Drainage System Design For
Development and Re-Development Projects within
Carrollton Township of Saginaw County
Individual Permit MIG610165



Carrollton Township

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I. INTRODUCTION

A. The Objective of the Storm Water Management Plan

The purpose of developing this plan is to aid developers and Carrollton Township in the design of their storm water runoff collection and detention systems. The Post Construction Controls are developed for compliance with the National Pollutant Discharge Elimination System (NPDES) storm water discharge permit held by the Carrollton Township, permit MIG610165.

This Storm Water Management Plan establishes the framework through which detention measures and the design of storm water collection systems will be implemented and details the process that must be followed to gain approval for new developments or redevelopment projects. The plan requires storm water management design practices, which will help to minimize the impacts of proposed development or redevelopment projects on the existing drainage system. In addition, these guidelines will help to insure adequate drainage systems are being constructed for future development in the township.

The Post Construction Controls provide detailed information about the township's storm drainage system and explains the township's approach to managing storm water.

The Post Construction Control Plan includes:

1. A summary of the administrative procedures to be followed to comply with the plan, including meeting requirements, review procedures, inspection requirements, fee schedule, issuance of the storm water discharge permit, penalties and enforcement, and other agency requirements.
2. A summary of existing drainage conditions within the Township.
3. A description of design calculations.
4. A description of design standards and guidelines.
5. The Township's Storm Water Management Procedure.

B. Administration of the Post Construction Controls

The Post Construction Control Plan will be implemented and operated by Carrollton Township. The Township will be responsible for the review of new development and redevelopment plans and for the installation and maintenance of storm water measures on township properties to accomplish the plan. This Storm Water Management Plan applies to projects that disturb at least one or more acres, including projects less than an acre that are part of a larger common plan of development or sale and discharge into Carrollton Township's MS4. The Department of Public Works will work in conjunction with Township Administration, Planning Commission, architectural and engineering consultants, landowners, and developers within the Township. Additionally, as needed or necessary, the township will coordinate with the Saginaw County Drain Commissioner and the Saginaw County Road Commission. The Township is **NOT RESPONSIBLE** for maintenance of storm water systems, structures, or best management practices on private property, commercial, or industrial property.

C. Review and Design Criteria for Existing and Proposed Stormwater Collection

Proper sizing of storm sewers and open drains is accomplished by examining past rainfall data and projecting the amount of surface water runoff that can be expected from a rain storm. In this plan, the design rainstorm was chosen

with a recurrence frequency of 10 years (10% recurrence interval). The amount of surface water runoff to be collected in storm sewers and open drains will be estimated using the Modified Rational Method.

The plan also requires there will be best management practices (BMPs) implemented to address water quality for any storm water discharges that will enter into the township's storm water system or the county drains or other storm water systems within the jurisdictional boundary of the Carrollton Township that ultimately discharge to a county drain or the Saginaw River. Examples of BMPs are capture and slow discharge of the "First Flush" volume on site projects or retrofitting existing sites to address first flush. It should be noted that discharges directly to a storm sewer (pipe system only) or the Saginaw River will not be required to deal with "Bankfull" discharge conditions.

D. NPDES Phase II Requirements for Stormwater

Carrollton Township has a jurisdictional stormwater discharge permit (MIG610165) and must attain compliance with the National Pollutant Discharge Elimination System (NPDES) Phase II requirements as they relate to storm water discharge in the township's jurisdictional area. With the implementation of the Post Construction Controls there will be specific best management practices (BMPs) that developers may be required to implement to assure the storm water discharged from a site is clean to the maximum extent practicable.

To accomplish this goal of clean storm water discharges BMPs such as bio-swales, rain gardens, bio-infiltration, sediment forebays, catch basin inserts and other BMPs may be required on specific sites. The design engineers must make every attempt to use appropriate BMPs to clean the storm water runoff as it is collected by the storm sewer system, properly detained, and ultimately discharged into an established township storm drain, county drain, road commission drain, or natural waterway within the jurisdictional area of Carrollton Township.

Furthermore, it is the responsibility of the owners of private storm sewer systems to maintain these systems properly to assure they are discharging storm water runoff as clean and pollutant free as possible and only storm water or other authorized discharges are discharged by the private on-site storm sewer system. Storm sewer outfalls into public systems are subject to inspection and if pollutants are being discharged from a private site into a public system or waters of the state of Michigan it is the responsibility of the owner of the private system to clean up any spill or discharge from their site into a public system.

E. Tampering or Removal of Storm Water Controls or Best Management Practices

No property owner or other party shall remove or modify any storm water device or best management practice designed to restrict the flow of storm water into a storm water conveyance system or waters of the State. The removal or modification of a device or best management practice to restrict flows of storm water can only be performed if the party responsible for the removal has had a detailed hydrology & hydraulic study done that provides proof of no significant impact on neighboring properties upstream or downstream of the site. The Township Engineer must approve this study. The party removing such a restrictor will be held liable for any water damage incurred on neighboring properties.

No property owner or other party shall remove or modify a best management practice that protects, preserves, or improves storm water quality. The owner or their designee must obtain permission from the township to remove or modify a best management practice. If permission is not received in writing from the township, the owner or other party must replace the best management practice at their expense. It is the responsibility of every parcel owner to discharge the cleanest possible storm water from their site as this water drains to the Saginaw River, and we all must take care to protect this water resource to the maximum extent possible.

II. DEFINITIONS

For the purpose of this Storm Water Management Plan, the following definitions are adopted:

1. *Allowable Discharge*: The maximum flow rate that can be discharged from a site, as calculated for design criteria in accordance with this Storm Water Management Plan.
2. *Base Flood Elevation*: The 100-year flood elevation as determined from Flood Insurance Rate Maps (FIRMs) or the best available information.
3. *Bankfull or Channel Protection*: The purpose of bankfull or channel protection criteria is to prevent habitat degradation and erosion in urban streams caused by an increased frequency of bankfull and sub bankfull stormwater flows. Channel protection seeks to minimize downstream channel enlargement and incision that is a common consequence of urbanization. Typical design is not to exceed the pre-development rate and volume for all storms up to the 2-yr 24-hr storm at the site. At a minimum, pre-development is the last land use prior to the planned new development or re-development. Exclusions to this standard are the following; The Great Lakes or connecting channels of the Great Lakes; Rouge River downstream of the Turning Basin; Saginaw River; Mona Lake and Muskegon Lake (Muskegon County); and Lake Macatawa and Spring Lake (Ottawa County) and engineered county drains.
4. *Best Management Practices (BMPs)*: Structural, vegetative or managerial practices used to protect and improve the quality of surface water and groundwater.
5. *Bio-filtration*: A system comprised of native plants and amended soils with an underdrain that goes to a detention area. The system is designed to receive storm water runoff and clean it via a filtration process and slow the runoff by letting it percolate through the amended soils to reach an underdrain, which then conveys it to a detention area. The system is designed to remove sediment and pollutants from storm water before discharge.
6. *Bio-swale*: Drainage channels that divert runoff water from the storm sewer into a natural area where native wetland plants help absorb and recycle it. Plants like grasses and rushes are commonly found in bio-swales because they help to trap the water and force it to absorb, rather than flowing through the bio-swale to the other side. It should be noted that these systems are generally dry most of the time and do not have standing water in them.
7. *Conduit*: Any channel, pipe, sewer or culvert used for the conveyance or movement of water, whether open or closed.
8. *Control Elevation*: Contour lines and points of predetermined elevation used to denote a detention storm area on a plat or site drawing.
9. *Detention Facility*: A facility constructed to provide detention storage.
10. *Detention Storage*: The temporary detaining or storage of storm water in a storage basin, on rooftops, in streets, parking lots, school yards, parks, open space, or other areas under predetermined and controlled

conditions, with the rate of drainage regulated to the allowable discharge by appropriately installed devices. These detention storage areas shall not be considered regulated wetlands.

11. *Developer/Owner Engineer*: The engineering company formally designated by the Developer/Owner to act as their Engineer.
12. *Development*: The construction of a building, parking lot, structure, etc. on a piece of land or otherwise changing the use of a piece of land.
13. *Discharge*: The release or outflow of water from any source.
14. *Drainage Area*: The area from which storm water runoff is conveyed to a single outlet (i.e. a watershed or catchment area).
15. *Easement*: A parcel of land on which the owner has granted rights-of-way to make surveys, construct, maintain, operate, alter, replace, repair, and remove at any time that part of the storm drainage system located within the easement. The landowner will not be allowed to construct buildings or other structures on said easement without the written consent of the easement grantee.
16. *Emergency Overflow*: A hydraulic control structure used to control the location and flow direction of storm water which is either in excess of the required detention storage or is due to a failure in the site's storm water management system. The emergency overflow shall be directed to a public road right-of-way or to an available municipal storm drainage system. This feature must be labeled on the design plans and an elevation provided. It is the design engineer's responsibility to assure no detrimental effects to neighboring parcels.
17. *Emergency Overflow Elevation*: The elevation at which emergency overflow is activated. This elevation is recommended to be at least one foot below finished floor elevation of nearby buildings, even if on adjacent parcels. This elevation must be labeled on the design plans.
18. *Engineer*: A civil engineer that is licensed to work in the state of Michigan or a person who is working under the direct supervision of a civil engineer licensed to work in Michigan.
19. *Excess Storm Water Runoff*: The volume and rate of flow of storm water discharged from a drainage area, which is in excess of the allowable discharge.
20. *Floodplain*: The special flood hazard lands adjoining a watercourse, the surface elevation of which is lower than the Base Flood Elevation and is subject to periodic inundations determined from Flood Insurance Rate Maps (FIRMs), or the best available information. A parcel of land can be located within a floodplain without being shown on a FIRM map.
21. *First Flush*: Is the volume of one (1) inch of rain over the area of land contributing storm runoff. The first flush of a rain event typically carries the most pollutants to our storm sewer system and ultimately to our rivers, lakes and streams. The first flush volume must be discharged over an 18-24 hour period of time to settle out pollutant loads.
22. *Impervious Factor (IF)*: The percentage of impervious surface specific to a site that the existing storm drain outlet has been historically designed to convey. The **IF** is used to calculate the allowable discharge from a site. Proposed developments or redevelopments will not be allowed to discharge storm water at a rate, which is greater than the runoff that would occur from the site with the percentage of impervious surfaces defined by

the impervious factor. **IF**'s have been established for the existing drains and storm sewer systems located within the Township and are all 0%.

23. *Impervious Surface*: A surface that does not easily allow the infiltration or penetration of water. During rainstorm events, a large percentage of water will runoff. (Typically considered as rooftops, paved walks, roadways, driveways, sidewalks, parking lots, etc.)
24. *Low Impact Development*: Implementation of developmental strategies or best management practices in a manner that maintains pre-development hydrology, or decreases runoff quantity, and improves runoff quality. It is recommended that the Low Impact Development Manual of Michigan be used as a design standard. This document is available for download from the following website:
<http://www.semcog.org/LowImpactDevelopment.aspx>
25. *NPDES*: National Pollutant Discharge Elimination System. In 1987 the Clean Water Act was amended and required to implement a program that would address pollutants being discharged to the nation's waters. This now includes storm water discharges into waters of the nation/state. Bridgeport Charter Township has an NPDES stormwater discharge permit as required by the State of Michigan in compliance with the CWA.
26. *Peak Flow*: The maximum rate of flow of storm water runoff at a given location.
27. *Percent Imperviousness (IMP)*: The actual proposed percentage of impervious surface for a proposed development or redevelopment. The **IMP** is used to calculate the design discharge (Q_d). The design discharge is used to determine storm sewer sizes and required detention volumes.
28. *Pervious Surface*: A surface that allows infiltration or penetration of water. During rainstorm events, a percentage of water will infiltrate into the surface with the remaining storm water running off. The percentage of runoff is dependent on the type, slope, percent saturation, etc. of the surface. (i.e. lawns, farm fields, parks, wooded areas, golf courses, etc.). Design personnel should attempt to maximize these surfaces as much as possible.
29. *Rain Gardens*: A depressed area of a size that is determined by specified engineering guidelines with amended soils and specific plants, shrubs, and trees that have a specific volume to store storm water runoff. The site can be underdrained to increase performance. Use of Michigan's Low Impact Development Design Manual is recommended for design purposes, located at: <http://www.semcog.org/LowImpactDevelopment.aspx>
30. *Rear lot drainage*: A storm water system designed to provide drainage in rear lot areas to prevent water from ponding for extended periods of time. It must be noted that these systems are not designed to convey storm water in a rapid manner. It is a deliberately designed system that can provide additional detention capabilities during severe runoff conditions. It is a system that in condo or subdivisions is the responsibility of the owner to maintain. It is not the townships responsibility. The township may repair the system if necessary to prevent damage to neighboring properties, but all associated repair costs, plus a 25% administrative fee will be passed on to the owner.
31. *Restrictor*: A hydraulic control structure used to restrict the storm water discharge from the site to the allowable discharge of the site as determined by this plan. Simple restrictors such as the orifice or metering line are outlined in this plan. For more complex restrictors a stage/storage/discharge relation shall be required in the complete submittal and may alter the storage requirements for the site.
32. *Re-development*: Altering, improving, reconstructing or otherwise changing the use of an existing developed property. A site will be considered a re-development for this Storm Water Management Plan when an area

greater than or equal to 5% of the existing developed portion of the site (i.e. roof, gravel, & paved surfaces) or, an area greater than 20,000 square feet is increased or reconstructed with roof, pavement, or any other impervious surface.

NOTE: this percentage is cumulative. If re-development is 2% one year and 3% at another time, this will meet the 5% rule. Also, at times, less than 5% can create drainage problems and the Storm Water Management Plan Reviewer may require additional detention or storage based on historical or anecdotal problems on a site.

33. *Regional Detention Areas:* A regional detention area is one that is designed to provide the required detention volume and discharge requirements for multiple parcels that are developed to a predetermined or planned imperviousness. These detention areas must institute best management practices to provide improved water quality for storm water runoff to the maximum extent practicable. For example, it is recommended that forebays or BMPs with similar objectives be used to assure water quality.
34. *Retention Storage:* The permanent retaining or storage of storm water in a storage basin, on rooftops, in streets, parking lots, schoolyards, parks, open space, or other areas under predetermined and controlled conditions. The only discharge of storm water from the retention storage area is by ground infiltration, evaporation, etc. An emergency overflow must be provided in the event the capacity of the retention facility is exceeded. These retention storage areas shall not be considered regulated wetlands.
35. *Saginaw Area Storm Water Authority (SASWA):* The SASWA was formed by the NPDES Phase II communities in Saginaw County. The Authority provides communities with information on storm water issues and regulations, more information is available at www.saswa.org
36. *Saginaw County Land Development Advisory Committee:* When a development is to be proposed in the Township and will involve the Road Commission, Saginaw County Public Works Commissioner (a county drain) and the Township it is advisable to begin the development process with this committee. The advisory committee shall include a member of the Saginaw County Road Commission, Saginaw County Public Works Commission, and Bridgeport Charter Township. The goal of the committee is to arrive at a mutual understanding of the procedures, standards, and/or requirements as they may apply to the proposed development.
37. *Storm Water Management Plan (SWMP):* Also known as post construction controls, this is a site specific storm water runoff drainage plan developed specifically for individual sites. The plan includes calculation of allowable and restricted discharge rates, detention/retention volume, restrictor sizing, size of pipes, or conveyance devices and a train of best management practices to provide for discharge of clean storm water runoff from a site.
38. *Storm Water Management Plan Reviewer:* The engineering firm or professional person formally designated by Bridgeport Charter Township to act as their plan reviewer.
39. *Storm Water Runoff:* The water from a rainstorm or snowmelt, which flows over the surface of the ground or is collected in a drainage system.
40. *Ten-Year Design Storm:* A precipitation event with a duration equal to the time of concentration, having a ten percent probability of occurring in any given year or occurring once every 10 years on average. This amounts

to approximately 3.46 inches of rain in 24 hours. But, brief, intense storms of 10-year design can range from 1.71 inches in 1 hour to 3.05 inches in 12 hours. (Source: http://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html?bkmrk=mi)

41. *Time of Concentration (T_c)*: The elapsed time for storm water runoff to flow from the most hydraulically distant point in a drainage area to the outlet or other predetermined point.
42. *Township Engineer*: The engineering firm formally designated by Bridgeport Charter Township to act as their Engineer in specified matters. Must have experience in Stormwater Reviews and with NPDES Stormwater Regulations as they pertain to Post Construction Controls (PCCs).
43. *Underdrain*: Consists of perforated drainage tile with either slot cuts or holes along the lateral haunch and covered with a sock or other means to prevent sediment from entering the pipe. These drains are placed below the grade of detention basins that have flat slopes to assure complete drainage of the detention basin or other structure. This will prevent the basin from being continuously wet and allow for mowing of the basin or care of the structure. Also used in underground storage systems to prevent ground water from taking up storage volumes. This will apply to basins that do not meet the 1% minimum slopes for the bottom of the basin.
44. *Upland Area*: Land located in the upper portion of a watershed whose surface drainage flows toward the area being considered for development.
45. *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.
46. *Urbanized Area*: An area designated by the US Census Bureau, which has specific rules and regulations concerning storm water under the NPDES Phase II regulations. This regulated area may require adherence to specific water quality standards.
47. *Watercourse*: Any natural or artificial stream, river, creek, channel, ditch, canal, conduit, culvert, drain, waterway, gully, ravine, street, roadway, swale, or wash in which water flows in a definite direction, either continuously or intermittently.
48. *Waters of the State*: Means any of the following: The Great Lakes bordering the State and their connecting waters, all inland lakes, rivers, streams, impoundments, open drains, and other surface bodies of water within the jurisdiction of the state, including wetlands as defined by Part 303 of PA 451 of 1994. In Saginaw County, that would include streams that have a defined bed and bank, and established flow, naturally established and engineered county drains, and including but not limited to, the Saginaw River, Cass River and the Tittabawassee River.

III. REVIEW PROCESS AND PROCEDURES

A. Review Procedures

Carrollton Township shall review all plans for development of subdivisions, multiple family projects, commercial, and industrial sites for compliance with the township's regulations for storm water management, as recommended in the Storm Water Management Plan and required by adoption of these design guidelines.

The Planning Commission shall designate a review Engineer who will provide the services required to assure the township that all the requirements of the plan are being met. The Township Engineer shall review the Developer's plan and submit a report to the township showing the acceptance or rejection of the proposed site drainage plans, calculations and best management practices for discharge of clean storm water.

A site will be considered in compliance with the Storm Water Runoff Regulation and Control Ordinance when an approval of the site's Storm Water Management Plan and post-construction storm water runoff BMPs has been completed. The township will not accept runoff into drainage systems located within the township from newly developed or redeveloped sites without compliance with the Post Construction Controls guidelines.

To comply with the Post Construction Controls, complete the following process and deliver or mail all submittals to Carrollton Township Planning Commission.

A complete submittal package for a storm water review consists of the following:

- A completed Drainage Checklist
- Three (3) sets of Site Plans
- Two (2) sets of calculations
- A maintenance plan and maintenance agreement for the storm water management system, if applicable

1. Pre-Design Meeting

This meeting, at a minimum, shall consist of the Developer's Engineer and the township's Engineer. The purpose of the meeting is to address the various storm water management proposals of the developer. Conceptual storm water management alternatives can be discussed and potential problems addressed prior to the design phase of the project. The goal of the meeting is to eliminate potential problems up front and reduce the time and costs needed for the design and review of the project.

This meeting will be required for all platted developments, condominium projects, and site developments larger than three (3) acres. It is recommended other site development projects have this meeting or at a minimum correspond with the township's Engineer by phone, e-mail, and/or facsimile regarding conceptual design alternatives prior to submitting for formal review.

The Developer's Engineer and/or Township's Engineers should have in his/her possession or have an understanding of the following information prior to attending the pre-design meeting:

- a. The drainage district or area in which the proposed development is located and the outlet condition for the proposed development. This information can be obtained from the Township Engineer or public works staff.
- b. Small location map showing where the site is situated.
- c. Location and description of activities that may impact or be impacted by the proposed development or redevelopment both on and off the site.
- d. Acreage of the total site and an estimate of the area tributary to the proposed storm drainage system, including offsite runoff

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- e. The size and location of the proposed storm drainage outlet and information on contributing area.
 - f. If known, a conceptual layout of the proposed storm drainage system for the development or redevelopment.

If required, the Owner/Developer and his/her technical consultant shall attend a land development advisory committee meeting. The intention of this meeting is to obtain uniform direction and communication to minimize misdirection of early construction and minimize financial losses to proprietors, developers, and consultants.

If the conceptual layout of the storm drainage system is agreed upon by the township's Engineer and the Developer's Engineer, the Owner/Developer shall begin completing plans and calculations for formal review by the township.

2. Formal Review

- a. The Owner/Developer or representative shall submit three sets of plans, three sets of calculations, a copy of the completed checklist (Appendix A), a **maintenance plan** and **maintenance agreement** for the storm water management plan, if applicable, and any other supporting information for the site to the Township Engineer. The plans and calculations shall comply with the requirements of this Storm Water Management Plan. The checklist, design calculations, and design standards that will be used during the formal review process are established by this Storm Water Management Plan
- b. Submit deposit/fee for storm water management plan review and inspection to the Planning Commission in accordance with the current fee schedule established by the township.
- c. Formal review and approval will not begin until all items required for application have been received. The proposed drainage system will be either approved or rejected with reason and returned to the owner/developer.
- d. The Township Engineer will review all plans, calculations, and other information for compliance with the township's design guidelines. All materials will be reviewed for completeness. Calculations will be checked. The minimum design calculations and design requirements outlined in this document and additional supporting documents pertaining to required calculations will be used for review. The drainage plan checklist will be reviewed.
- e. Furthermore, the Township Engineer will review how the developer meets the performance standards and ensures long-term operation and maintenance of BMPs based on the signed maintenance plans submitted with all construction plans in accordance with Section VI, Sub-Section D. Storm Water Management System Maintenance Plans, below. The Township Engineer will review the submitted evaluation of cost-effective structural and non-structural BMPs, if applicable, and the BMPs utilized on all new or re-development sites to minimize post construction impacts on water quality. *(Please refer to Section VI, Sub-Sections D-F for additional requirements for long-term operation and maintenance of BMPs.)*
- f. A typical review will take approximately two (2) weeks to complete from the date the plan is submitted in complete form.
- g. If the proposed drainage system is rejected, one (1) set of plans and calculations will need to be resubmitted with the appropriate revisions. A completed checklist will also have to be resubmitted.

B. Plan Approval

Once the storm water management plan has been recommended for approval by the Township Engineer a recommendation for approval letter will be sent to the township. A copy of the letter will be forwarded to the Developer. Three sets of plans will be stamped approved: one set will be forwarded each to the township and the applicant, and one set will be kept on file with the Township Engineer. The approval letter will include, if necessary, inspection and compliance requirements

C. Changes to Plan after Approval

1. Any changes made to the approved plan after issuance of the storm water permit shall require three sets of plans are submitted to the township for review and approval.
2. Upon receipt of this information, it will be determined if additional information, such as calculations, revised checklist, etc. will be required.
3. The fee for review of any changes to the plan after approval will be billed on an hourly basis. An occupancy permit will not be issued until all changes have been approved and the township has received all review fees.

D. Inspection and Letter of Certification Requirements

Inspection of storm sewer systems and/or detention facilities will be required on all development and redevelopment projects. The extent of the inspection will depend on the size and type of the development or redevelopment. Descriptions of these inspection requirements are outlined below.

Specific inspection requirements, including the frequency of inspections, will be outlined on the approval letter. The fees associated with this inspection are included in the original deposit.

1. Small Developments and Re-developments

(Between 1 and 5 acres, or less than 1 acre if site is part of a larger plan of development) – A general site inspection of the restrictor and the detention storage areas by the Township Engineer will be required. This one-time inspection will be performed at the completion of the project. Subsequent inspections may be required if deficiencies exist. The fees for subsequent inspections will be based on an hourly basis.

A letter of certification will have to be completed by the developer's engineer indicating the storm drainage system has been constructed as shown on the approved storm water management plans. An occupancy permit will not be issued until a letter of certification has been received by the township and the final approved inspection of the site has been completed by the township Engineer or designee.

2. Large Developments and Redevelopments

(5 acres and greater) - Periodic Site inspections of the storm sewer, outlet, restrictors, and detention storage areas may be required by the Township Engineer. Specific items needing inspection prior to the completion of the project will be identified in the approval letter (i.e. installation of restrictors, restricting pipes, etc.). The Township Engineer or designee shall be informed 24 hours in advance of the placement of items requiring inspection as outlined on the storm water management permit.

A final inspection of the restrictor and the detention storage areas by the Township Engineer or designee will be required. This one-time inspection will be performed at the completion of the project. Subsequent inspections may be required if deficiencies exist.

A letter of certification will have to be completed by the developer's engineer indicating the storm drainage system has been inspected during construction and the drainage system was constructed as shown on the approved storm water management plans. An occupancy permit will not be issued until the township has received a letter of certification and the Township Engineer or designee has completed the final approved inspection of the site.

3. Single Family, Two Family, or Multi-Family Development Projects

Daily inspections of the storm sewer and drainage system construction will be required. This inspection shall be performed by the Owner/Developers Engineer or by the Township Engineer or designee. Daily Inspection reports shall be completed for all days on which construction of the storm drainage system occurs. At a minimum, the daily inspection reports shall include the information shown on the sample daily inspection report included in Appendix A. These daily inspection reports do not have to be submitted to the township. However, they should be on file with the design engineer and made available upon request.

A final inspection of the restrictor and the detention storage areas by the Township Engineer or designee will be required. This one-time inspection will be performed at the completion of the project. Subsequent inspections may be required if deficiencies exist.

A letter of certification will have to be completed by the developer's engineer indicating the storm drainage system has been constructed as shown on the approved storm water management plans. An occupancy permit will not be issued until the township has received a letter of certification and the Township Engineer or designee has completed the final approved inspection of the site.

E. Fee Schedule

The fee schedule for reviewing storm drainage submittals and performing inspections of drainage system construction shall conform to the current Carrollton Township Resolution Regarding Fees. This resolution will be reviewed on an annual basis and fees may be adjusted if determined necessary.

IV. STORM DRAINAGE SYSTEMS WITHIN CARROLLTON TOWNSHIP

Within the Township there are drains that fall under several different agencies' jurisdictions. These include the following:

1. Established County Drains

Work done directly on or connected to these drains falls under the jurisdiction of Saginaw County Public Works Commissioner. Preliminary and final plat approval requires a signature and review from the Public Works Commissioner. However, many site plan developments, condominiums, etc. that impact established county drains are not submitted for review to the Public Works Commissioner. There are no established county drains within the jurisdiction of Carrollton Township

2. County Roadside Drains

There are many drains that fall under the jurisdiction of Carrollton Township County Road Commission. When a crossing is installed over a county roadside drain, a permit or permission must be obtained from the County Road Commission.

3. Michigan Department of Environmental Quality (MDEQ)

The DNRE regulates any work done within the 100-year floodplain and/or any inland lakes or streams. There are several wetland areas within the Township that are regulated by the MDEQ. A copy of the Joint Permit application for a site to discharge to the Saginaw River or within 500 feet of inland lakes or streams, as well as wetlands, is provided from a website address that can be found in Appendix B.

4. Carrollton Township Drains

There are several areas within the township that have drainage swales, open channel drains and/or tile drains that are not regulated by any of the above referenced agencies. In these areas, it is the sole responsibility of the township to manage the storm water. This storm water management plan will provide for the management of those areas. Proposed storm water management in these areas is explained in more detail later in this section.

Each of the agencies listed previously have their own design criteria for reviewing proposed developments and drainage improvements. These criteria are not always consistent with the storm water requirements of the township as a whole. For example, the Saginaw County Road Commission is concerned about the proper drainage of the roadway and sub-base of the road; a permit may be obtained to discharge a large quantity of water to a road side drain not causing a problem now but may not leave any additional storm water outlet capacity for future development upstream. For these reasons, it is very important that the township review all proposed developments/ improvements to assure that the proposed storm water management is consistent with the future plans of the township.

V. DESIGN CALCULATIONS

A. Allowable Discharge Rate (Q_a) and 10-Year Design Discharge (Q_{d10})

The NPDES Phase II program requires that the post-construction runoff rate and volume of discharges do not exceed the pre-development rate and volume for all storms up to the 2-year, 24-hour storm for the site. The peak storm water discharge from any proposed development or re-development as required in these Design Requirements shall be restricted to an allowable discharge (Q_a). The allowable discharge from the proposed area of development or re-development cannot exceed the calculated discharge from the proposed site based on methods listed within Bridgeport Charter Township's excel calculation spreadsheets. The method resulting in the lowest allowable discharge from the site shall be used in determining the required detention. If it is determined the existing runoff from the drainage district is at or exceeding the capacity of the downstream storm sewer or drain the proposed development or re-development will, at a minimum, have to be restricted to existing conditions. The allowable discharge (Q_a) from the site shall not exceed the runoff from the site during the 10-year storm event (Q_{d10}) under existing conditions. This discharge can be determined using the rational method.

$$Q = (C) \times (I) \times (A)$$

Q is the runoff rate in cubic feet per second (cfs).

- C is the coefficient of runoff.
- I is the intensity of rainfall in inches per hour (in. / hr.).
- A is the area of the site in acres (acres).

Please refer to the excel spreadsheet for the required design calculations that must be submitted for review to Carrollton Township, or appointed designee. This is available at <http://www.saswa.org>.

B. Storm Water Detention Requirements

The storm water detention storage required for a site is to be calculated using the Bridgeport Charter Township’s excel spreadsheet; this can be obtained at the following websites: <http://www.saswa.org>.

In order to meet the storm water quality discharge requirements of Phase II of Section 10 of the Clean Water Act and to meet the Environmental Protection Agency’s storm water guidelines, designs must provide for storm water treatment. This can be accomplished by implementation of one of the following measures:

1. On systems that utilize a storm water detention basin, a sediment forebay retention area can be utilized within the detention facility. This retention area is required in addition to the storm water detention requirements equal to 1.0 inch of runoff from the site area (see the calculation spreadsheet). The forebay must be designed to remove a minimum 80% of total suspended solids.
2. Rain gardens or an equivalent low impact design approach can be utilized that provides a soil or media filter for the water prior to entering the storm drainage system or storm detention system. The utilization of this type of treatment measure does not require the additional capture of 0.5 inches of runoff above the detention requirement for the site.

Mechanical treatment devices designed to remove suspended solids and other debris. Mechanical treatment devices include specially designed treatment units that will remove 80% of the total suspended solids for a 2-year 24-hour storm event.

C. Discharge Restrictor Requirements

A restrictor regulates the discharge of storm water to the allowable discharge rate (Q_a) established for a site. Restrictors may be a circular in-line plate restrictor or a metering line. The circular in-line plate restrictor is based on the orifice formula.

$$a = \frac{Q_a}{0.62 * (64.4 * \Delta h)^{\frac{1}{2}}}$$

a = area of orifice (sq. ft.)

Δh = head differential from center of orifice to Hydraulic Grade Line of detention pond at maximum capacity, (ft.).

D. First Flush Requirements

All site development projects are required to detain the first flush volume, which is defined as 1.0 inch of runoff over the impervious area of the site first contributing storm runoff (A_i) for new development or re-development. This volume will be calculated as:

$$V_{ff} = 3630 * A_i * C$$

C = 0.9 for all calculations

This volume must be held for more than 18 hours but not more than 24 hours. The average allowable release rate for runoff resulting from 1.0 inch of rain in 24 hours is calculated as follows:

$$Q_{ff} = \frac{\text{Volume}}{(24\text{hr}) * \left(\frac{3600\text{sec}}{1\text{hour}}\right)} = \frac{V}{86,400\text{sec}}$$

It will also be acceptable for site development projects to calculate the runoff generated by the 90 percent annual non-exceedance storm. *If this method is chosen, please contact the Township Engineer, or other appointed designee for guidance.*

Please refer to the excel spreadsheet for the required design calculations that must be submitted for review to Carrollton Township Engineer, or appointed designee. This is available at the following websites:
<http://www.saswa.org>.

E. Bank Full Flood Requirements

The purpose of bank full or channel protection criteria is to prevent habitat degradation and erosion in urban streams caused by an increased frequency of bank full and sub-bank full stormwater flows. Channel protection seeks to minimize downstream channel enlargement and incision that is a common consequence of urbanization. Typical design is not to exceed the pre-development rate and volume for all storms up to the 2-yr, 24-hr storm at the site. At a minimum, pre-development is the last land use prior to the planned new development or re-development. Waterbodies excluded to this channel protection performance standard are the following; The Great Lakes or connecting channels of the Great Lakes; Rouge River downstream of the Turning Basin; Saginaw River; Mona Lake and Muskegon Lake (Muskegon County); and Lake Macatawa and Spring Lake (Ottawa County) and engineered county drains. Contact the Saginaw County Public Works Commissioner's Engineer upon determination of bank full flood requirements when dealing with Saginaw County drains.

Please refer to the excel spreadsheet for the required design calculations that must be submitted for review to **Carrollton Township Engineer**, or appointed designee. This is available at the following websites:
<http://www.saswa.org>.

VI. DESIGN STANDARDS

A. Requirements

1. General Requirements

- a. Storm water detention requirements for any new construction development, redevelopment, or land use change occurring within Carrollton Township will be determined according to this storm water management plan.

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- b. The peak runoff rate during a 10-year storm event from a developed or improved site shall not exceed the allowable discharge rate (**Qa**). This rate is determined as outlined in the design calculations section of this plan.
 - c. There shall be no detrimental effect on the floodway or the floodplain elevation during a 10-year design storm upstream or downstream of the proposed development area as a result of the proposed development.
 - d. Engineering calculations must be submitted with the proposed storm drainage system plans. The calculations shall follow the procedures outlined in this document and the additional supporting documents pertaining to calculation requirements.
 - e. Roof drains may be connected to a storm sewer system if the flow through the outlet to the storm system is properly restricted. Unrestricted runoff from a roof drain will not be accepted, there are no exemptions.
 - f. The developer, Township Engineer and/or Township Department of Public Works staff shall make a determination as to whether any or all of the facilities proposed are to become private or part of the township Drainage system or part of any other regulating agencies storm sewer system.
 - g. The Township Engineer shall in the case of a proposed subdivision, make a determination as to those control elevations that shall be entered on the final plat or make a determination as to the necessity for deed restrictions on any particular lot in said subdivision requiring the preservation of mandatory drainage facilities. Where a non- subdivided parcel of land is proposed for development, the Township Engineer shall make a determination as to the need for covenants to maintain responsibility for mandatory drainage facilities. All the said facilities shall be located in easements dedicated to the public, and shall be subject to continual inspection during the construction period.
 - h. Proposed storm sewer enclosures must be designed so they will not adversely impact any adjacent properties, upstream or downstream, and must be designed to the impervious factors of the lands based upon zoning, not necessarily existing conditions.
 - i. Soil erosion and sedimentation control measures must be implemented per Part 91 of Public Act 451 of 1994 (NREPA).
 - j. The use of infiltration BMPs to not exacerbate existing conditions will not be implemented to meet the water quality treatment and channel protection standards for new development or redevelopment projects in areas of soil or groundwater contamination. Coordination with the MDEQ staff will be done when deemed necessary.
 - k. Best Management Practices will be implemented to address the associated pollutants in potential hot spots as part of meeting the water quality treatment and channel protection standards for new development or redevelopment projects. These hot spots include areas with the potential for significant pollutant loading such as gas stations, commercial vehicle maintenance and repair, auto recyclers, recycling centers, and scrap yards, whether existing currently or throughout the duration of the five year permit. Hot spots also include areas with the potential for contaminating public water supply intakes.

2. Storm Sewer Piping Requirements

- a. Proposed storm sewer shall be designed to have capacity to pass 10-year design storm runoff rate (Qd). Please refer to the Design Calculations section of this document along with the additional supporting documents pertaining to calculation requirements.
- b. Class III or IV concrete pipe must be used for the following:
 - i. Combined sewers (Combined sewers must have premium joints)
 - ii. Storm Sewers within Township, county, and state right-of-way
- c. Provide 2' minimum cover, with minimum 5' cover in M.D.O.T. R.O.W.
- d. Provide 18" Vertical separation between all other utilities including, sanitary sewers and water mains. Provide 10' Horizontal separation from other utilities.
- e. A minimum of four inches of sand bedding is required beneath the pipe and a minimum of 6 inches of sand backfill is required above the pipe.

-
- f. Manhole/catch basin shall be placed at a maximum distance of 300' from any other manhole/catch basin for access/maintenance purposes.
 - g. Provide a sump discharge outlet for each individual property/lot in all developments. Sump leads shall not be connected to rear lot drainage systems. This outlet shall be a catch basin (minimum 3' diameter) or a storm sewer lead extended to the Right-of-Way/Property line of each lot (minimum 6").
 - h. Place a catch basin (minimum 3' diameter) between each pair of driveways, if curb and gutter, driveway culverts, and/or valley shaped ditches are not proposed.
 - i. Minimum pipe grades must be such to produce minimum scouring velocity of 2.5 ft. /sec when pipe is flowing full without surcharging.
 - j. Concrete pipe (C-76-III, IV) shall have fabric wrapped joints.
 - k. For private storm sewer systems Plastic pipe may be used. This plastic pipe shall be either smooth walled HDPE or SDR 35 P.V.C. Pipe. If pipe is perforated a manufacturer's "Sock" shall be used over the pipe.
 - l. Minimum pipe diameter for catch basin leads is 10".
 - m. Minimum pipe size for sewer main is 12".
 - n. When two pipes or more of different sizes come into a structure, the 8/10th flow lines shall match when possible.
 - o. Catch basins should have a minimum sump depth of 18".

3. Detention and Retention Requirements

- a. If a separate lot or parcel is used for detention or retention the outer limits shall be delineated on the Exhibit B drawings of a Condominium Development or on the Final Plat.
 - i. Condominium Developments - Detention or Retention areas shall be designated as general common areas.
 - ii. Platted Developments - Detention or Retention areas shall be designated as a storm water detention/retention area. (See State Requirements).
- b. Requirements for all Detention / Retention Areas
 - i. Proposed storm water detention facilities shall be designed to detain the 10-year design storm runoff volume from the entire contributing area in excess of the allowable discharge from the site (See the Design Calculations Section along with additional supporting documents pertaining to design calculation requirements).
 - ii. The maximum design storage elevation in a detention area must be a minimum of one (1) foot below the lowest ground elevation adjacent to the detention area.
 - iii. The design maximum storage elevation in a detention area must not exceed a depth of nine (9) inches above any paved surfaced in non-residential developments. In residential developments the maximum ponding elevation in the detention pond shall not exceed the lowest rim elevation in the development.
 - iv. The design maximum storage elevation in a detention area must not be closer than one (1) foot below the minimum finish floor elevation of the proposed structure(s) or existing facilities.
 - v. An emergency overflow shall be provided at the detention basin to insure the maximum ponding elevation does not exceed the depths outlined in items iii and iv above. This overflow shall be able to allow drainage from the site in the event the 10-year storm is exceeded or the restricted outlet is obstructed.
 - vi. Designs of detention facilities shall incorporate safety features, particularly at inlets, outlets, on steep slopes, and at any attractive nuisances. These features may include, but not be limited to,

fencing, handrails, lighting, steps, grills, signs, and other protective or warning devices so as to restrict access as required by township engineer.

- vii. Side slopes and the bottom of detention basins shall be top soiled, to a minimum of 3 inches, and seeded.
- viii. The side slopes and bottom of the basins shall be shaped with maximum slopes of 1 vertical to 4 horizontal to allow mowing of these surfaces.
- ix. Detention basins with bottom slopes less than 1% shall be underdrained.
- x. Detention basins shall be constructed with the top of banks a minimum of 5 feet from any pedestrian walkway (i.e. public and private sidewalks/ bike paths).
- xi. If a “Wet” detention pond is proposed the bottom of the pond shall be a minimum of 5 feet below the proposed pond’s outlet elevation. Item ix. Shall not apply to “Wet” detention facilities.

4. Rear Lot Drainage Requirements

- a. Minimum rear lot tile drain sizes and slopes have been determined assuming ponding will occur in rear yards for a duration 4 times the duration of a given 10-year design storm event. This time may range from 4 to 24 hours depending on drainage conditions. The following minimum pipe sizes and slopes apply:
 - i. Rear lot tile drains with contributing drainage areas up to 2 acres will have a minimum diameter of 6 inches and a minimum slope of 0.5%
 - ii. Rear lot tile drains with contributing drainage areas greater than 2 and less than 3 acres shall have a minimum diameter of 8 inches and a minimum slope of 0.4%
 - iii. Rear lot tile drains with contributing drainage areas greater than 3 and less than 4 acres shall have a minimum diameter of 10 inches and a minimum slope of 0.32%
- b. Rear lot tile drains with a contributing area greater than 4 acres shall be considered main line storm sewer and shall be designed according to corresponding storm sewer requirements (See the Design Calculations Section of these requirements along with additional supporting documents pertaining to design calculation requirements). Calculations shall be submitted to verify that rear lot drains have the capacity to pass the 10-year design storm event. Plastic pipe is acceptable for rear lot drainage systems draining more than 4 acres provided it is installed in landscaped/ lawn areas.
- c. Rear lot tile drains cannot connect to road underdrains
- d. Rear lot drainage tiles shall have a minimum cover of 2 feet. A minimum of four inches of sand bedding is required beneath the pipe and a minimum of 6 inches of sand backfill is required above the pipe.
- e. Rear lot catch basins shall have a minimum diameter of 2 feet. Plastic structures may be used for rear lot drainage systems. Concrete structures are required for storm sewer systems. The catch basins shall not be placed at spacing greater than 300 feet. Any bends, turns, or dead ends shall require a structure.
- f. If pipe is perforated, a manufacturer’s “Sock” shall be used over the pipe.
- g. A 20-foot easement will be required for all rear lot drainage systems. This easement should be centered along lot lines to allow for a 10-foot easement along adjacent lots and to provide access to the rear lot drainage system from either adjacent property owners. Said easements shall be written as to permit neighboring property and/or condominium owners to maintain the rear lot drainage system as it may affect their property.
- h. Rear lot drainage shall be large enough to convey all contributing area to the rear lot system, including off site drainage if it is not diverted around the development.
- i. Existing rear lot drainage systems abutting a proposed development may be used for the new development provided.
 - i. The existing rear lot drainage system has the capacity to convey storm water runoff from the proposed rear lot drainage areas.

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- ii. A signed agreement is obtained from property owners located within the existing subdivision allowing the proposed subdivision's rear lot storm water runoff to pass through their existing system.
 - j. Phased developments owned by the same proprietor may utilize proposed rear lot drainage for a current development phase on future phases of the development provided:
 - i. Covenants shall be recorded into the deeds of the property owners affected in the current phase allowing for future phases of the development to drain into the current phase's rear lot drainage system.
 - ii. If covenants are not made as outlined above, future phases will require separate rear lot drainage systems or agreements from the current land owners allowing for the use of their rear lot drainage system.
 - iii. The rear lot drainage system shall be constructed to convey rear lot drainage from both the existing and proposed rear lot drainage areas.
 - iv. Easements shall be provided allowing for maintenance by both abutting landowners in current and proposed phases of development.
 - k. Rear lot drainage shall be shown on the preliminary plat (subdivisions) or site plan (condominiums).
 - l. All rear lot drains shall connect to an approved storm water drainage system.

B. General Compliance Guidelines

The following guidelines are recommended, but are not a requirement of this plan. These guidelines are provided for reference.

The minimum surface slopes for overland drainage are as follows:

- a. For bituminous paved surfaces, 1.0 %
- b. For concrete paved surfaces, 0.5 %
- c. For concrete curb and gutter, 0.32 %
- d. For drainage swales and valley shaped ditches, 0.50 %
- e. For rear lot drainage swales and valley shaped ditches, 0.50 %
- f. Landscape grading, 2.0 %

The maximum surface slopes for overland drainage are as follows:

- a. For bituminous, concrete paved surfaces, 5.0 %
- b. For concrete curb and gutter, 5.0 %
- c. For drainage swales and valley shaped ditches, 5.0 %
- d. For rear lot drainage swales and valley shaped ditches, 5.0 %
- e. Drainage swales and valley shaped ditches shall have maximum side slopes of 3 horizontal to 1 vertical
- f. Landscape grading, 4 horizontal to 1 vertical

C. Variances from Requirements

The Township may waive allowable discharge requirements and or detention requirements. All variances will be reviewed under the appeal procedures established in the current storm water management ordinance. Variances from these requirements shall require the approval of Carrollton Township whose actions shall be conditioned upon the following:

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1. A petition shall be submitted describing in detail the rationale for the proposed design changes including hydraulic and or hydrologic computations.
 2. Special circumstances or conditions exist which will affect the property under consideration such that strict compliance with the provisions of the storm water discharge permit would deprive the applicant of the reasonable use of their land.
 3. A variance is necessary for the preservation and enjoyment of a substantial property right of the proprietor.
 4. Granting of the variance will not be detrimental to the public health, safety or welfare, or injurious to other property in the territory in which said property is located.
 5. An affirmative recommendation must be received from the Township Engineer supporting such variance. In the event that the Township Engineer does not submit an affirmative recommendation, a recommendation shall be received from Carrollton Township.

D. Storm Water Management System Maintenance Plans

1. Signed maintenance plans will be submitted with all construction plans and included in the subdivision agreement or master deed documents of all businesses, subdivisions, and site condominiums. These maintenance plans are the responsibility of the private owner or home/condo owners association. These plans are not to be construed as a responsibility of the township, nor will the township be responsible for maintenance of private systems. The plans shall include, at minimum, the following:
 - a. A projected annual maintenance budget itemized by task.
 - b. Proposed mechanism to finance maintenance.
 - c. A copy of the final approved drainage plan for the development that delineates the facilities and all easements, maintenance access, and buffer areas
 - d. A listing of appropriate tasks defined for each component of the system, and a schedule for their implementation. The listing shall include, at minimum, the following (or explain why they do not apply):
 1. Long-term operation and maintenance of all structural and vegetative BMPs installed and implemented to meet the performance standards.
 2. Maintenance of facilities such as pipes, channels, outflow control structures, infiltration devices, and other structures.
 3. Debris and sediment removal from catch basins, channels, and basins.
 4. Dredging operations for both channels and basins to remove sediment accumulation.
Storm water system maintenance plans shall require that sediment be removed when depth equal to 50% of a pond's forebay or 12" of sediment accumulates, whichever is less.
 - e. The party responsible for performing each of the various maintenance activities described. This will be recorded with final approved plans and plats.
 - f. A detailed description of the procedure for both preventative and corrective maintenance activities. Preventative maintenance shall include, but not be limited to, the following:
 1. Periodic inspections, adjustments, and replacements.
 2. Record keeping of operations, inspections, expenditures, and associated activities.
 - g. Provision for the routine and non-routine inspection of all components within the system described:
 1. Carrollton Township recommends regularly scheduled wet-weather inspections of structural elements. Inspection for sediment accumulation in detention basins shall be conducted annually, with as-built plans in-hand for comparison. These inspections should be performed by a professional engineer reporting to the responsible agency or owner.

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2. Housekeeping inspections, such as checking for trash removal, should take place at least twice annually.
 3. Emergency inspections shall be completed on an as-needed basis. Upon identification of problems the Township Engineer or a professional engineer shall be contacted for inspection.
- h. A description of ongoing landscape maintenance needs shall be included in the plan. Landscaping shall consist of low maintenance, regionally native species. The proprietor will monitor the viability of plantings for at least two (2) years after establishment and replace plantings, as needed. Subsequent monitoring shall be the responsibility of the landowner, development association, or appointed designee (such as a landscaping company, lawn care provider, etc.). Carrollton Township and the Saginaw County Public Works Commissioner are not responsible for landscape maintenance.
2. Provision for the maintenance of vegetative buffers by landowner, development associations, conservation groups, or public agencies. Buffers must be inspected annually for evidence of erosion or concentrated flows through or around the buffer.
 3. Property deed restrictions or condominium master deed documents will specify the time frame for action to address needed maintenance of storm water management facilities. These restrictions or documents will also specify that, should the private entity fail to act within this time frame, the responsible governmental entity may take action against the property owners within the subdivision or condominium association, in accordance with Act 288 of the Public Acts of 1967.
 - a. Routine maintenance of storm water management facilities will be completed per the schedule submitted with the construction plans or within 30 days of receipt of written modification by the responsible governmental entity that action is required, unless other acceptable arrangements are made with the supervising governmental entity.
 - b. Emergency maintenance will be completed within 36 hours of written notification unless threat to public health, safety and welfare requires immediate action.
 4. The proprietor may fulfill the obligation to ensure that a governmental entity will be responsible for drainage system maintenance by establishing a county drainage district, or any other similar mechanism approved by the Public Works Commissioner, to provide for the permanent maintenance of storm water management facilities and necessary funding. Or, a Resolution of Intent may be completed to provide a mechanism for funding maintenance on the drainage system.
 5. If a County Drain is not established, the proprietor will submit evidence of a legally binding agreement with another governmental agency responsible for maintenance oversight.
 6. A legally binding maintenance agreement will be executed before final project approval is granted. The agreement shall be included in the property deed restrictions or condominium master deed documents so that it is binding on all subsequent property owners.
 7. A sample maintenance plan and annual budget is illustrated in Appendix F.

E. Evaluation of Cost-Effective Structural and Non-Structural Best Management Practices (BMPs)

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1. To meet Carrollton Township's NPDES Phase II regulatory requirements for storm water, the Township may request and the developer must supply the following:
 - a. Either preliminary or actual constructed cost of best management practices.
 - b. Projected or actual maintenance costs of best management practices.
 - c. A maintenance agreement from the developer, owner, or operator responsible for the long-term maintenance of structural and vegetative BMPs installed and implemented to meet the performance standards. Please see an example of a maintenance agreement in the Appendix section.
 - d. Any other pertinent information deemed necessary to meet NPDES Phase II regulations.
 2. If the requested information is not provided in a timely manner the final occupancy permit will be held until compliance is attained and the information received in the requested format.
 3. The information requested will be in a concise formatted manner.

F. BMPs to Minimize Post Construction Impacts on Water Quality

1. Carrollton Township requires that BMPs be utilized on all new or redevelopment sites improve storm water runoff quality in the post construction phase.
2. Carrollton Township requires BMPs to be designed on a site-specific basis to reduce post-development total suspended solids loadings by 80 percent or achieve a discharge concentration of total suspended solids not to exceed 80 milligram per liter.
3. The BMPs used on a site must be reviewed and approved by the Township Engineer during the site plan review and approval process.
4. The site Designer, Engineer, or Architect must supply a list of BMPs being used on a site that will improve water quality of the runoff being discharged from a site for the review process.
5. The list of approved BMPs can be found in Appendix G of this document. The Saginaw Area Storm Water Authority at times will approve BMPs for addition to this Appendix and the Township will consider placing these approved BMPs in this plan after a review process.

APPENDIX A

- A. Carrollton Township Storm Water Permit Application and Checklist*
- B. Typical Daily Inspection Report Form*
- C. NPDES Soil Erosion and Sediment Control for Construction Sites Procedure*
- D. Carrollton Township Engineer Final Inspection Form*
- E. Site Visit and Inspection Report Procedure*
- F. Storm Water Management Site Review Agreement*

CARROLLTON TOWNSHIP STORM WATER DISCHARGE PERMIT APPLICATION

PROJECT NAME:	
Property Tax Identification #:	
Site Plan Review Date:	
Date Applied:	
Deposit Amount Submitted:	

NAME OF DEVELOPER/OWNER:		ENGINEER/ARCHITECT:	
Contact Person:		Contact Person:	
Street Address:		Street Address:	
City, State, Zip:		City, State, Zip:	
Telephone:		Telephone:	
Email:		Email:	
Fax:		Fax:	

PROJECT LOCATION:	
Street Address:	
Name of Subdivision/Plat:	
Drainage District:	

STORM WATER DESIGN INFORMATION (*Calculations must be submitted for verification. Calculations must have clearly labeled headings, clearly labeled formulas, and clearly labeled units.)

Type of Development (Circle): <i>COMMERCIAL SITE, INDUSTRIAL SITE, RESIDENTIAL PLATTED, RESIDENTIAL CONDOMINIUM, OTHER</i>
*AREA OF DEVELOPMENT (acres):
*AREA OF CONTRIBUTING DRAINAGE DISTRICT (acres):
*AREA OF EXISTING IMPERVIOUS SURFACE (acres):
*AREA OF PROPOSED IMPERVIOUS SURFACE (acres):
*ALLOWABLE DISCHARGE RATE (Q _a) (cfs):
*TOTAL VOLUME OF STORAGE REQUIRED (cu. ft.)
*TOTAL VOLUME OF STORAGE DESIGNED (cu. ft.)
10 YR DESIGN STORM WATER DETENTION STORAGE ELEVATION:
EMERGENCY OVERFLOW/MAXIMUM STORAGE ELEVATION:
LOWEST FINISHED FLOOR ELEVATION:
OUTLET DRAIN SIZE AND DESIGN FLOW CAPACITY:
OUTLET DRAIN INVERT ELEVATION:
DESIGN IMPERVIOUS FACTOR (IMP):
*10 YEAR DESIGN DISCHARGE (cfs):
*HEAD DIFFERENTIAL THROUGH RESTRICTOR (ft.):
*DIAMETER OF PROPOSED RESTRICTOR (in):
*ACTUAL RESTRICTED DISCHARGE (cfs):

AUTHORIZED SIGNATURE _____ DATE _____	PLEASE DRAINAGE PLAN CHECKLIST TO ASSURE ALL INFORMATION IS PRESENT FOR REVIEW
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DRAINAGE PLAN CHECKLIST

In order for the Owner, Developer, or Builder to be in compliance with these guidelines he/she shall for review by Bridgeport Charter Township's Engineer or designee, three (2) complete sets of the site drainage and grading plan, and two (2) copies of the calculations for allowable discharge and on-site storage requirements, as prepared by a Registered Professional Engineer or Architect. A copy of the completed checklist will be sent with all submittals.

Each of the following items shall be included on the plan:

- _____ Total acres of site.
- _____ Total acres of watershed draining through the site outlet.
- _____ Drainage district lines including sub-district lines contributing to individual storm sewers and rear lot drainage systems.
- _____ Location of site including dimension to nearest intersection road or section line.
- _____ Existing ground elevations at maximum 50' centers, including shots on perimeter of site and 50' beyond or contour lines at 1 foot intervals extending 50 feet beyond the site limits.
- _____ Elevations of ground, edge of pavement, and buildings within 50' of site.
- _____ Top of curb, gutter, ditch line, and centerline of road elevation at maximum 50' intervals.
- _____ Existing storm catch basins, manholes, sewers, and culverts showing rim and invert elevation(s).
- _____ Proposed elevations showing parking lot grades and control and building elevations.
- _____ Lawn/landscape areas.
- _____ Location, size, length, slope, and type of proposed storm sewer and rear lot drains.
- _____ Rim and invert elevation(s) of proposed manholes and catch basins, including rear lot drainage.
- _____ Location of on-site storage showing contour line for the top of storage elevation.
- _____ Provide sufficient dimensions, cross-sections, profiles, tie downs, etc. to determine the location and size of proposed storm sewers and detention areas. This information will be used for verifying proposed detention volume calculations in grassed and paved areas.
- _____ Location of restrictor and proposed restrictor detail(s).
- _____ Location and elevation of the Emergency Overflow.

DRAINAGE PLAN CHECKLIST

DRAINAGE PLAN - CHECKLIST (Continued)

Each of the following items shall be included in the submitted calculations:

- _____ Drainage District and impervious factor (if applicable and already established for the location of the site).
- _____ Calculation of maximum allowable discharge (Obtain impervious factor from the <municipality type> Engineer).
- _____ Calculation of on-site storage required.
- _____ Calculation of storage volume provided.
- _____ Calculation of restrictor size.
- _____ Hydrologic & Hydraulic Calculations for sizing storm sewer systems, which will be maintained by a public agency.
- _____ Hydrologic and Hydraulic calculations showing there will be no adverse impacts upstream or downstream of the proposed development.

Beyond the Carrollton Township requirements, the Developer must submit applications for permit appropriate or required with all agencies that regulate storm water within the area of development. These may include Michigan Department of Transportation, Michigan Department of Environmental Quality, Saginaw County Public Works, or the Saginaw County Road Commission.

Developed July, 2012

DAILY INSPECTION REPORT FORM

PROJECT NAME:	WORK ORDER NO.:	
CONTRACTOR:	REPORT NO.:	
SUPERINTENDENT:	DATE:	
WEATHER (CLEAR, CLOUDY, RAIN, SNOW):	TEMPERATURE:	INSPECTOR:
WORK FORCE ON SITE:	NUMBER:	TRADE:
	NUMBER:	TRADE:
EQUIPMENT IN USE (Number and Type):		
WORK DONE (Location, Amount, and Type): (Be Specific)		
TYPE OF UTILITY INSTALLED (Water, Sewer, Pavement, size, Class, Description, Source):		
GROUND CONDITIONS ENCOUNTERED (Clay, Sand, Wet, Dry, Good Poor, or Other & Detail Further):		
BACKFILL INSTALLED:		
EXISTING UTILITIES ENCOUNTERED:		
RELOCATION OF PROPOSED UTILITIES AND REASON NECESSARY:		
MATERIAL DELIVERED TO SITE (Size, Class, Description, Source):		
VISITORS TO WORK SITE (Name, Affiliation):		
REMARKS:		

NOTE: Complete in ink each day. Use reverse side if necessary.

By: _____ Date: _____

A general procedure for Soil Erosion and Sediment Control (SESC) and NPDES permits to discharge storm water from construction sites:

There have been changes in the permitting for construction sites for contractors, developers, municipalities, and other public agencies. These rules took effect at the date listed below; everyone must adhere to these changes and be aware of them.

EFFECTIVE DATE – MARCH 10, 200

General procedure to follow:

Site has a soil disturbance of 1 to <5 acres:

Apply for Soil Erosion Sediment Control permit from either the county enforcement agency (CEA) or municipal enforcement agency (MEA). The Saginaw County Public Works Commissioner is the County Enforcement Agency. The following site offers a direct link to the Soil Erosion and Sedimentation Control Permit:

http://www.saginawcounty.com/Docs/publicworks/FillInForms/Permit_Application_SESC.pdf

The NPDES discharge permit for this site is covered by the “permit by rule”; no permit or application needs to be filled out for the state.

Note: If client is an APA (authorized public agency for soil erosion and sediment control) they still must follow the permit by rule, they do not need a SESC Permit as they have procedures approved by MDEQ. The rules are at the following site:

https://www.michigan.gov/documents/deq/wb-stormwater-nocrules_248578_7.pdf

Site has a soil disturbance of 5 or more acres:

Apply for Soil Erosion Sediment Control permit from either the county enforcement agency (CEA) or municipal agency (MEA) first.

Then fill out the NPDES Notice of Coverage form for discharges from the construction site, attached the proper fee, and send it to the State at the address listed on the form.

Once the state receives the form, the site is covered.

Note: If client is an APA (authorized public agency for soil erosion and sediment control) they still must obtain and fill out the NPDES Notice of Coverage to discharge storm water from a construction site; they do not need SESC Permit as they have procedures approved by MDEQ.

http://www.michigan.gov/documents/deq/water-stormwater-NOCform_384894_7.pdf

Once the project site is stabilized and has good vegetative cover, remember to fill out a project termination form, this can be found at:

http://www.michigan.gov/documents/deq/wb-stormwater-NOTform_248588_7.doc?20140314160505

Determine inspection responsibilities:

Make sure that SESC issues are an agenda item at the pre-bid meeting and at the pre-construction meeting. Do not just put a note on the plans that SESC is the contractor’s responsibility; make sure they are fully aware of their site responsibilities. Remember that the owner of the project is ultimately the responsible party, the DEQ or enforcing agency will be fining them. If the owner is a municipality that we are doing a service for, we must protect them as best we can.

**CARROLLTON TOWNSHIP
DETENTION AND RESTRICTION
FINAL INSPECTION REPORT FORM**

Name of Site Development:	
Planning Commission Approval Number:	
Location:	
Type of Development:*	
Size of Restrictor:	
Type of Restrictor:**	
Location of Restrictor:	
Required Detention (ft ³):	
Type of Detention:***	
Location of Detention:	
Do As-builts Conform To Present Site Conditions?	
Inspection Comments:	
Date of Inspection:	
Inspector's Name and Affiliation:	

* - Residential, Commercial, Subdivision, Etc.

** - Orifice in Outlet Pipe, Metering Outlet Pipe, Square Orifice, Etc.

*** - Parking Lot Ponding, Detention Basin, Etc.

Carrollton Township Storm Water Management Plan Site Report Visits Procedure & Deposit

All site development projects are subject to a storm water management plan site visits after construction has been completed. There are two distinct types of Site Visits:

1. Commercial / Business sites
2. Subdivision, Condominium, Manufactured home sites

COMMERCIAL & BUSINESS SITES

For **Commercial / Business sites** the following inspection procedure will be in place to assure compliance with the approved storm water management plan for the site and to assure that all best management practices for water quality related to storm water are in place and functioning properly.

One visit will take place as soon as site construction is completed. The storm sewer system will be inspected for pipe sizes, structure layout, detention basin / area, and flow restrictor as it relates to the approved storm water management plan. A letter report will be generated to document the visit and sent to the owner and the township.

Second visit will take place no sooner than 6-12 months after occupancy to assure that any best management practices are functioning and are being maintained properly. A letter report will be generated to document the visit and sent to the owner and the township.

A cash deposit for these site visits will be required and established by the township. Any costs incurred by the township associated with inspections or administrative efforts for repair, replacement, or deficiency reconciliation will be deducted from this deposit. Any remaining deposit balance after successful completion of the site visit and report process will be refunded to the owner/developer who paid the deposit.

SUBDIVISIONS, CONDOMINIUMS & MANUFACTURED HOME SITES

For **Subdivision, Condominium, & Manufactured Home sites** the following procedure will be in place for inspections and deposit. The site must conform to the original reviewed plans that have been stamped "Approved" by the township engineer. Any changes that are necessary based on field conditions during construction that change the approved plan must be documented in a letter and a copy provided to the township and the township's engineer. This will assure that the site visits are as efficient as possible.

A review deposit will be in a suitable or acceptable deposit payable to the Carrollton Township. The developer will be responsible for any additional fees above and beyond the deposited fee.

The deposit will be returned to the proprietor provided that all storm water facilities and best management practices are clean, unobstructed and in good working order and that the township's Planning Commission has received all required documents, certificates, copies of covenants, maintenance plans, and as-built drawings. It is the proprietor's responsibility to request final site visit.

The site will be inspected to assure compliance with the approved storm water management plan. Any costs incurred by the township associated with subsequent visits or township administrative efforts for repair, replacement, or deficiency reconciliation will be deducted from this deposit. Any remaining balance after successful completion of the site visit process will be refunded to the owner/developer who paid the deposit.

Carrollton Township Storm Water Management Plan Site Report Visits Procedure & Deposit

To assure compliance there will be **two site visits**:

One visit will take place as soon as site construction is completed. The storm sewer system will be inspected for pipe sizes, structure layout, detention basin / area, and flow restrictor as it relates to the approved storm water management plan.

Second visit will take place after 50% of the lots or units have been sold or built upon to assure the storm sewer system and any best management practices are functioning and are being maintained properly.

Storm water and rear lot drainage can be problematical in many developments in Saginaw County. To alleviate some of these problems the following will occur:

- Developer will meet with the township and complete a Storm Water Management Site Review Agreement that:
 1. reflects the amount of the fees placed in an account for site visits of the developments storm sewer system
 2. has a responsibility statement
 3. has a checklist of items to be covered
- The site must have a storm water system maintenance plan. This plan must have a plat/site layout (11" x 17"), a list of homeowner/association responsibilities for the storm sewer, rear lot drainage and detention area.
- Developer must provide proof to the Carrollton Township that each homeowner or lot owner will get copies of the aforementioned information (e.g., make part of Master Deed or covenants on deeds).
- Developer must provide proof that they have communicated information to the homeowners association or condo association about their responsibility for storm water quality, quantity, and drainage issues that develop.

MAINTENANCE

- A. All stormwater runoff control structures, measures, systems and facilities shall be maintained by the property owner or homeowners association. (For example, property owners will be individually responsible for rear lot drainage structures or best management practices (BMPs) on their parcels. Associations will be responsible for common use facilities, measures, systems and structures.)
- B. The person or association responsible for maintenance of storm water systems shall be designated in the Stormwater Maintenance Plan for a subdivision, condominium, commercial property, et cetera must be communicated to the Carrollton's Planning Commission or their designee. Options include:
 - Name of property owner
 - Property owners association or other nonprofit organization provided that provisions for financing necessary maintenance are included in deed restrictions or other contractual agreements
 - Saginaw County Public Works Commissioner in accordance with provisions of the Michigan Drain Code (Public Act 40 of 1956, as amended)
- C. Maintenance agreements shall specify responsibilities for financing maintenance and emergency repairs, including but not limited to the maintenance and repair of:

Carrollton Township Storm Water Management Plan Site Report Visits Procedure & Deposit

- Detention / Retention basins (wet or dry)
 - Best Management Practices implemented on the site to address water quality.
 - Flow restriction structures
 - Rear Lot drainage systems
 - Storm sewer structures, pipes as required by type of system and ownership of such a system. (For example if the system is under control of the MDOT, they will maintain the system, if a private owner or association, then they have responsibility.)
- D. If necessary to protect public health, safety, welfare, or water resources, including rivers, protected wetlands, county drains or other receiving bodies of water, Carrollton Township may initiate emergency action to abate imminent and substantial danger and risk. Any costs incurred will be the responsibility of the owner or association responsible for maintenance of the storm water system, an additional 20% administrative fee, payable to Carrollton Township.

**CARROLTON TOWNSHIP
STORM WATER MANAGEMENT SITE REVIEW AGREEMENT**

**DEVELOPER'S/CONTRACTOR'S SITE REVIEW AGREEMENT for
STORM WATER MANAGEMENT**

PROJECT NAME: _____

SITE ADDRESS / LOCATION: _____

CONTACT PERSON: _____

COMPANY: _____

ADDRESS: _____

CITY: _____ **STATE:** _____ **ZIP CODE:** _____

For **Subdivision, Condominium, & Manufactured Home Sites** the following procedure will be in place for site inspections and deposit. The site must conform to the original plans reviewed and stamped "Approved" by the township engineer. Any changes that are necessary based on field conditions during construction that change the approved plan must be documented in a letter and a copy provided to Carrollton Township and the Carrollton Township's engineer.

The site will be inspected to assure compliance with the approved storm water management plan. All costs associated with re-inspections or repair, replacement, deficiency reconciliation above the fee paid will be invoiced to the owner/developer and must be paid by them. No refunds will be given from unused fees paid.

A unit is defined as a dwelling or residential apartment, condo or site for mobile/manufactured home. For example a parcel may contain a condominium that can house 4 individual families, which will be construed as 4 units, a duplex will be two units, et cetera.

To assure compliance with design guidelines there will be **two inspections**.

CARROLTON TOWNSHIP STORM WATER MANAGEMENT SITE REVIEW AGREEMENT

I hereby certify that to the best of my knowledge, information and belief, the storm water system will be constructed in general conformance to the approved plans and specifications delivered to me by the design engineer. I accept the responsibility that the storm water system will be in compliance with the design guidelines of Carrollton Township’s Storm Water Management Plan. I understand that if deficiencies are discovered during inspections that I am responsible for correction of those deficiencies within a prescribed time frame.

Printed Name

Signature

Date

Items to cover:

- Review of SWMP inspection procedure and copy to developer / contractor
- Deposit of funds for inspections of storm water system
- Developer / Contractor to notify Township Planner (or Engineer) for first inspection
- Developer / Contractor to notify Township Planner (or Engineer) for second inspection
- Developer / Contractor has a set of plans marked “Approved” by the Township Engineer from the storm water review process
- Engineer from the storm water review process
- Developer / Contractor provides documentation that homeowners association, condo association, or property owners have a copy of maintenance plan, easements, plat layout, and property owner’s responsibility for rear lot drainage.

APPENDIX B

To assure that all agency forms are as up to date as possible Carrollton Township has provided the following web site addresses that various forms may be attained at for use by developers and design engineers.

1. Michigan Department of Transportation Permit Application for use of Right-of-way, is available at:

<http://mdotcf.state.mi.us/public/webforms/public/2490.pdf>

2. Michigan Department of Environmental Quality Storm Water Discharge Permit Application, is available at:

http://www.michigan.gov/documents/deq/wrd-stormwater-MS4-Application_402858_7.doc

3. Department of Natural Resources & Environmental Joint Permit Application, is available at:

http://www.michigan.gov/deq/0,1607,7-135-3307_29692_24403---,00.html

DNRE Notice of Coverage and Notice of Termination forms for Construction sites of 5 acres or more in size.

http://www.michigan.gov/documents/deq/water-stormwater-NOCform_384894_7.pdf

http://www.michigan.gov/documents/deq/wb-stormwater-NOTform_248588_7.doc?20140314160505

4. Saginaw County Public Works Commissioner, is available at:

<http://www.saginawcounty.com/PublicWorks/Default.aspx>

Saginaw County Soil Erosion and Sediment Control Permit Application, is available at:

http://www.saginawcounty.com/Docs/SESC_Permit.pdf

Saginaw County Permit to perform work on county drain, is available at:

http://www.saginawcounty.com/Docs/publicworks/FillInForms/Permit_Application_ROW.pdf

APPENDIX C

A. Runoff Coefficients

TABLE 1. Runoff Coefficients

Urban areas The use of average coefficients for various surface types, which are assumed not to vary through the duration of the storm, is common. The range of coefficients, classified with respect to the general character of the tributary reported in use is:

Description of area	Runoff coefficients
Business	
Downtown areas	0.70 to 0.95
Neighborhood areas	0.50 to 0.70
Residential	
Single-family areas	0.30 to 0.50
Multi-units, detached	0.40 to 0.60
Multi-units, attached	0.60 to 0.75
Residential (suburban)	0.25 to 0.40
Apartment dwelling areas	0.50 to 0.70
Industrial	
Light areas	0.50 to 0.80
Heavy areas	0.60 to 0.90
Parks, cemeteries	0.10 to 0.25
Playgrounds	0.20 to 0.35
Railroad yard areas	0.20 to 0.35
Unimproved areas	0.10 to 0.30

Note: It is often desirable to develop a composite runoff coefficient based on the percentage of different types of surface in the drainage area. This procedure is often applied to typical 'sample' blocks as a guide to selection of reasonable values of the coefficient for an entire area. Coefficients with respect to surface type currently in use are:

Character of surface	Runoff coefficients
Streets	
Asphaltic and concrete	0.70 to 0.95
Brick	0.70 to 0.85
Roofs	0.75 to 0.95
Lawns, sandy soil	
Flat, 2%	0.05 to 0.10
Average, 2 to 7%	0.10 to 0.15
Steep, 7%	0.15 to 0.20
Lawns, heavy soil	
Flat, 2%	0.13 to 0.17
Average, 2 to 7%	0.18 to 0.22
Steep, 7%	0.25 to 0.35

Note: The coefficients in these two tabulations are applicable for storms of 5-year to 10-year frequencies. Less frequent higher intensity storms will require the use of higher coefficients because infiltration and other losses have a proportionally smaller effect on runoff. The coefficients are based on the assumption that the design storm does not occur when the ground surface is frozen.

Rural areas			
Topography and Vegetation	Soil texture		
	Open sandy loam	Clay and silt loam	Tight clay
Woodland			
Flat 0-5% slope	0.10	0.30	0.40
Rolling 5-10% slope	0.25	0.35	0.50
Hilly 10-30% slope	0.30	0.50	0.60
Pasture			
Flat	0.10	0.30	0.40
Rolling	0.16	0.36	0.55
Hilly	0.22	0.42	0.60
Cultivated			
Flat	0.30	0.50	0.60
Rolling	0.40	0.60	0.70
Hilly	0.52	0.72	0.82

Source: C.T. Haan, B.J. Barfield, J.C. Hayes, *Design Hydrology and Sedimentology for Small Catchments*, Academic Press, Inc. (1994).

APPENDIX D

A. Rearlot Design Examples

APPENDIX E

A. Detention Details (Examples)

APPENDIX F

A. Maintenance Plan and Budget

B. Maintenance Plan and Budget Sample

C. Maintenance Agreement

Maintenance Plan and Budget

Sample Maintenance Plan and Budget

“XYZ” Leasing Company

Storm Water Management System Maintenance Plan

I. Responsibility for Maintenance

- A. During construction, it is the developer’s responsibility to perform the maintenance.**
- B. Following construction, it will be the responsibility of “XYZ” Leasing Company to perform the maintenance.**
- C. The Master Deed will specify that routine maintenance of the storm water facilities must be completed within ___ days of receipt of written notification that action is required, unless other acceptable arrangements are made with the (Township of _____), (Saginaw County Public Works Commissioner) or successors. Emergency maintenance (i.e. when there is endangerment to public health, safety or welfare) shall be performed immediately upon receipt of written notice. Should “XYZ” Leasing Company fail to act within these time frames, the (Township), (County), or successors may perform the needed maintenance and assess the costs against “XYZ” Company.**

II. Source of Funding

- A. “XYZ” Leasing Company is required to pay all maintenance activities on a continuing basis.**

III. Maintenance Tasks and Schedule

- A. See the charts on the next two pages: The first describes maintenance tasks during construction to be performed by the developer. The second describes maintenance tasks to be performed by “XYZ” Leasing Company.**
- B. Immediately following construction, the developer will have the storm water management system inspected by an engineer to verify grades of the detention and filtration areas and make recommendations for any necessary sediment removal**

Maintenance Plan Budget (example)

Annual inspection for sediment accumulation	\$ 100.00
Removal of sediment accumulation every 2 years as needed	\$ 500.00
Inspect for floatables and debris annually and after major storms	\$ 100.00
Removal of floatables and debris annually and after major storms	\$ 150.00
Inspect system for erosion annually and after major storms	\$ 100.00
Re-establish permanent vegetation on eroded slopes as needed	\$ 350.00
Replacement of stone	\$ 100.00
Mowing 0-2 times per year	\$ 400.00
Inspect structural elements during wet weather and compare to as-built plans every 2 years	\$ 150.00
Make structural adjustments or replacements as determined by inspection as needed	\$ 400.00
Have professional engineer carry out emergency inspections upon identification of several problems	\$ 200.00
Budget	\$ 2,550.00

NOTE: Maintenance Plans and budgets vary widely due to the size and unique characteristics of each storm water management system proposed. The budget is intended for use as a starting point in the development of an appropriate maintenance plan specific to the size and components of each system.

APPENDIX F

A. Best Management Practices – Rules and Regulations