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# **STORM WATER MANAGEMENT PLAN**

Requirements and General Compliance Guidelines  
For Storm Water Drainage System Design  
For Development and Redevelopment Projects  
And Ensure Compliance with NPDES Phase II  
Storm Water Discharge Requirements of  
General Permit MIG 610161 for  
The City of Saginaw of Saginaw County



## **CITY OF SAGINAW SAGINAW COUNTY, MICHIGAN**

**INCLUDING:  
STORM WATER DISCHARGE PERMIT APPLICATION & DESIGN  
GUIDELINES  
FOR STORM WATER DRAINAGE SYSTEM DESIGNS**

**PREPARED BY:**



**2018 – revised for NPDES Phase II**



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## I. INTRODUCTION

### **The Need for Storm Water Management in Saginaw**

The City of Saginaw has developed this Storm Water Management Plan in an effort to further reduce the risk of overloading the combined sewerage system and to reduce peak flows and pollution entering the Municipal Separated Storm Sewer System (MS4). The purpose of the Storm Water Management Plan is to establish a procedure by which the City and property owners work together to reduce the peak rate of storm water runoff. Reductions in flow and pollution entering the combined sewer system and MS4 can improve the water quality of the Saginaw River, as well as protect citizens and property.

In the past, the primary objective of the storm water drainage system in Saginaw was to remove runoff as quickly as possible to reduce flooding and ponding. As the City and surrounding areas developed, this objective led to a system that is vulnerable to localized flooding. As runoff enters the system, pipes quickly exceed full capacity and water backs up. This has led to costly and dangerous basement flooding and other problems.

The City of Saginaw has successfully pursued community-wide methods of combined sewer system management through the construction and operation of its Combined Sewer Overflow Facilities. These facilities provide temporary storage of storm water and sewerage during periods of high flows when pipe capacities are exceeded throughout the city. Through this management plan and NPDES discharge permit, additional localized methods of temporary storm water storage and flow reduction will be implemented as development or redevelopment occurs.

By temporarily detaining runoff on-site or in the city streets, the sewer system can more uniformly transport the runoff from a runoff event such as a rainstorm or rapid snowmelt. This is accomplished by restricting the flow into street catch basins and by providing for on-site detention of storm water runoff from roof drains, parking areas, and other impervious areas. This temporary detention is intended to provide relief to the sewer system, while not creating a risk to citizens or property.

Methods will be introduced in this plan to address the water quality of the runoff and best management practices (BMPs) that will enhance existing efforts to protect the combined sewer system from storm events. For example, roofs could drain to rain gardens or parking lots to modified infiltration basins.

Currently, more development and redevelopment is occurring in the City of Saginaw in areas where separated storm sewers exist or will exist. Some developments are within close proximity to the Saginaw River and may discharge directly to the river after NPDES Phase II water quality objectives are met before the discharge. Based on these situations, the existing storm water management plan is being updated to assure continued relief to the combined sewer system and address separate storm water drainage



systems as they relate to the Upper Saginaw Watershed Management Plan.

### **The Objective of the Storm Water Management Plan**

The Storm Water Management Plan establishes the framework through which detention measures and allowable discharge will be implemented. The Permit Guidelines detail the process that must be followed to gain approval for storm water drainage of new development or redevelopment within the City. This Storm Water Management Plan provides detailed information about the City Sewerage System and explains the City's proactive approach to managing storm water. The storm water management ordinance will provide the framework for enforcement of the Storm Water Management Plan and will reference the most current versions of the Plan and Permit.

The Storm Water Discharge Permit Guidelines include:

- A. A summary of the procedure to be followed for permit application, including fee schedule, description of the review procedure, and notification of other agency permits.
- B. A summary of existing drainage conditions within the City.
- C. A description of engineering calculations to be followed.
- D. A description of minimum design criteria and procedures to be followed for design of drainage systems within the City.
- E. A procedure and design criteria for retroactive installation of on-site storm water detention methods to be implemented by owners of properties which are larger than one acre and within the City.
- F. Copies of the Application for a Storm Water Discharge Permit and an example application. These are also available in PDF format for use by developers, architects, engineers, or designers.

### **Goals for Water Quality Requirements in areas with municipal separated storm sewer systems (MS4)**

The following Water Quality requirements are for those minimal areas within the City of Saginaw which are served by an actual municipal separated storm sewer system (MS4). Approximately 97% of the city is combined sewer system and NOT an MS4.



Stormwater Management Criteria	Description
<b>A. Water Quality (WQ)</b>	All site development projects are required to detain the water quality (first flush) volume. The WQ Volume is determined by the City of Saginaw’s guidelines and site applicability in the separated storm areas. Design for a minimum removal of 80% of TSS as compared to uncontrolled runoff or a discharge concentration not to exceed 80 mg/L Total Suspended Solids (TSS). This criterion is assumed to be met if extended detention time of the Channel Protection (CP) Volume is provided.
<b>B. Channel Protection (CP)</b>	The Channel Protection (CP) Criteria was developed to prevent or minimize the channel enlargement process in streams and rivers. The post construction runoff rate and volume for a site must not exceed up to the 2-yr 24-hr storm event. In areas with C/D soils, the site should be maximized for opportunities to reduce runoff (i.e., amended soils, harvesting, reuse) prior to allowing the option for extended detention. <b>HOWEVER</b> ; in Saginaw County with its high seasonal water table and the effects of Lake Huron’s water level these methods will need to be proven to work in <b>HIGH WATER</b> conditions with <b>NO ADVERSE</b> effects to neighboring properties <sup>1</sup> . Extended detention should focus on maximizing the volume reduction onsite and then detaining the remaining volume of the 2-yr 24-hr storm event with the release rate of 0.2 cfs per acre or the 1-yr 24-hr storm whichever is the lower rate. The CP is <b>NOT</b> required for the following waterbody: <ul style="list-style-type: none"> <li>• Saginaw River</li> </ul>

**Administration of the Storm Water Management Plan and Permit Applications**

The Plan and Permit will be implemented and operated by the City Engineering and Maintenance Department or their designee. They will be responsible for the review of new development and redevelopment plans and for the installation and maintenance of measures within the City to accomplish the plan. They will work in conjunction with the City Administration, the County Public Works Commissioner, the surrounding townships, architectural and engineering consultants, landowners, and developers within the City.



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## II. CITY OF SAGINAW DRAINAGE SYSTEM

### A. Description of the City of Saginaw Sewerage System

Throughout most of the City of Saginaw there is a combined sewer system of sanitary wastewater and storm water. There are buried pipes under the streets of the City to carry wastewater. Sanitary waste lines from houses and businesses connect to these pipes, as well as street catch basins, house sump lines, and other drainage pipes carrying storm water runoff. This combined wastewater and storm water runoff is carried through the City sewer system to the Wastewater Treatment Plant (WWTP) to be treated and discharged into the Saginaw River.

Sewer pipes were built as early as the 1840's when East Saginaw and Saginaw were separate cities. The sewers constructed throughout the 1800's were mostly rectangular or horseshoe shaped and made of brick. In the 1900's, the combined sewers built were mostly circular pre-cast concrete. In the 1940's, construction of the interceptor sewers and many regulator chambers enabled water to be conveyed to Saginaw's first wastewater treatment facility.

Saginaw's Combined Sewerage System (CSS) services approximately 80,000 people and has an approximate watershed area of 10,000 acres. The network of pipes beneath Saginaw that makes up the Sewerage System is over 300 miles long and pipe diameters vary from 4 inches to 132 inches. The majority of the system discharges to the Saginaw WWTP.

The Saginaw WWTP processes wastewater from residential, commercial, and industrial sites from within the City of Saginaw, parts of Saginaw Charter Township, Carrollton Township, City of Zilwaukee and Saginaw Valley State University. The facility is designed to treat up to 72 million gallons per day (GPD).

The CSS is broken into seven (7) districts within the City including: 14<sup>th</sup> Street, Fitzhugh, Emerson, Webber, Salt / Fraser, Hancock, and Weiss Districts. There is also the Wickes Pump Station Storm Sewer District within the City. The Weiss District includes areas of Saginaw Charter Township and Carrollton Township. The district boundary areas delineated as shown on the City of Saginaw Drainage District Map E-1989, which can be viewed at City Engineering, range in size from 320 acres to 2300 acres. Each district has its own Combined Sewer Overflow (CSO) Control Facility for capture of large flows to help reduce direct sewer discharges, a.k.a. overflows, to the Saginaw River.



In the past, CSO's frequently discharged wastewater directly into the Saginaw River causing a pollution problem. CSO's have occurred during rain events of as little as 0.2 inches. The CSO control facilities were implemented in the 1990's. With this storage system in place, combined sewer overflows to the Saginaw River are much less frequent. Any overflow is now a treated overflow and does not have the environmental impact of the past, pretreatment scenario.

The system contains intercepting sewers that convey flow from each side of the Saginaw River directly to the WWTP. The interceptor sewer pipes vary in size from 36 to 72 inches in diameter. Several pump stations within the system provide relief for the interceptors by pumping wastewater out of the interceptors and into the CSO control facilities.

Within the sewerage system, there are 33 flow control points called regulator chambers. Regulator chambers direct flow based on the height of wastewater. During dry weather, wastewater flows are low and are directed to the interceptor sewer for transport to the treatment plant. During wet weather, wastewater flows are much higher and can quickly fill the interceptor sewer. The regulator chambers divert the higher flows to collector sewers, which convey water to the CSO control facilities. After the high flows have passed, the stored wastewater in CSO control facilities is released back into the interceptor sewers and carried to the treatment plant.

## **B. Rainfall - Runoff Analysis**

Saginaw's annual precipitation ranges from 26 to 45 inches. The majority of Saginaw's precipitation occurs as rain in summer showers and thunderstorms. An intensity-duration-frequency (IDF) curve based on rain data collected for the Saginaw area is included in Appendix A. Rainfall intensities may be taken from the IDF curves for the calculation of expected peak runoff, or rainfall intensities may be calculated as described in Section IV, Part A of this SWMP.

## **C. Existing Conditions and Problems**

Scattered incidents of basement flooding and pollutant transport to the Saginaw River are the two major conditions or problems defined within the City. It should be noted that discharges from the CS system during rain events are treated discharges. The overflows are regulated and reported as required by the City's discharge permit.





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#### **D. Design Impervious Factors Throughout the Drainage Districts**

The design impervious factor for each of the districts has been set at 10% impervious. This is a conservative assumption that the sewers within a district have limited capacity to handle runoff from impervious surfaces. Additional runoff from impervious surfaces would be accounted for through on-site detention. This value has been selected in an attempt to simplify procedures and develop a uniform method. Adjustments to design criteria may occur if localized problems are found or if system improvements change existing conditions.

#### **E. Categories of Development**

Six (6) categories of development are being addressed through this storm water management plan. These categories have been created to define what types of development are covered by the plan and to administer permit fees and inspection fees. The categories include:

1. Site Development - sites 3 acres and larger
2. Small Site Development - sites less than 3 acres
3. Site Redevelopment
4. Site Demolition
5. Single and Double Family Dwellings on less than one acre
6. Retroactive Site Runoff Detention from existing sites

#### **F. Catch Basin Restrictor Program**

Catch basin restrictors are metal plates inserted under the grates of catch basins in the streets. The objective of this program is to provide short-term detention of runoff on the streets during high intensity rain events. The benefits of this are reduced pressure on the CSS and reduced basement flooding.

Restrictor plates have been installed throughout the Weiss and 14th Street Districts. Restrictors were installed throughout the Emerson and Hancock Districts in 1997. The remaining districts were implemented by the end of 1999.

**History:** In the Combined Sewer District in both the City of Saginaw and Saginaw Charter Township, there is a system of catch basin inlet restrictors. These restrictors were placed in the catch basins as a result of extensive hydrologic and hydraulic studies related to the NPDES program to reduce and



eventually eliminate combined sewer overflows into the Saginaw River. The intent of the restrictors is to detain storm water runoff in streets and parking lots and allow time for the combined sewer overflow (CSO) basins to react to storm events. The CSO basins and catch basin restrictors have had two effects:

1. Helped to substantially reduce the flow of untreated wastewater into the Saginaw River,
2. Significantly reduced the incidence of combined sewer back-ups into the basements in combined sewer areas.

**Therefore:** No property owner or other party shall remove or modify a catch basin restrictor or any device or best management practice that is designed to restrict the flow of storm water into a storm water conveyance system. The removal or modification of a device or best management practice (BMP) to restrict flows of storm water can only be performed if the party responsible for the removal has had a detailed hydrology and hydraulic study done that provides proof of no significant impact on neighboring properties upstream or downstream of the site. The party removing such a restrictor or best management practice will be held liable for any water damage incurred on neighboring properties.

#### **G. Retroactive On-site Detention**

On-site detention for existing developments may be considered in the future as a method to further reduce the peak rate of storm water runoff. Guidelines are included within this section of the plan. An example of possible retroactive recommendations includes:

- the installation of catch basin restrictors within existing catch basins in parking lots.
- If redevelopment occurs, such as resurfacing of a parking lot or modification of the existing building footprint,
- If no restrictors or BMPs are in place,
- If a site has had the buildings demolished and the parcel returned to open space, then is sold for new development or new land use.

Sites should come into compliance with the storm water management guidelines at the time of construction or redevelopment, along with any designated water quality BMPs.

The goal is to continue to improve the ability of the Combined Sewer System to handle storm events and provide relief to the combined system by detaining storm water runoff during storm events.



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## H. Definition of Terms

The following definitions are adopted:

1. **Base Flood Elevation:** The elevation delineating the flood level having a one-percent probability of being equaled or exceeded in any given year (also known as the 100-year flood elevation), as determined from Flood Insurance Rate Maps (FIRMs) or the best available information.
2. **Best Management Practice (BMP):** Structural, vegetative or managerial practices used to protect and improve the quality of storm water, surface water and groundwater.
3. **Bio-filtration:** is a soil filtration system. Principal components of the system (figures 1&2) include:
  - a. a pretreatment grass filter strip,
  - b. surface planting with woody and herbaceous plant species,
  - c. a surface 2 to 3-inch thick mulch layer,
  - d. a minimum 2-foot thick sandy loam or loamy sand soil-textured planting soil media (See specifications),
  - e. a 6-inch thick sand layer, and
  - f. perforated PVC pipe under-drainage within a 12-inch thick gravel bed protected with geo-textiles.
4. **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.
5. **City Engineer:** See Engineer.
6. **Combined Sewer:** A sewer system that carries both sanitary wastewater and storm water in the same piping network.
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 storage area on a plat or site drawing.
9. **Culvert:** A covered channel or large diameter pipe that directs water flow.



10. Detention Facility: A facility constructed or modified to restrict the flow of storm water to a prescribed maximum rate and to concurrently detain the excess waters that accumulate behind the outlet.
11. 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 therefrom regulated by appropriately installed devices.
12. Discharge: The rate of outflow of water from any source.
13. District: A subsystem of a watershed or sewer system that defines a catchment area.
14. Drainage Area: The area from which water is carried off by a drainage system, i.e., a watershed or catchment area.
15. Engineer: The person formally designated by the City of Saginaw as City Engineer, or the person formally designated by the City of Saginaw as their engineer
16. Excess Storm Water Runoff: The volume and rate of flow of storm water discharged from a drainage area which is, or will be, in excess of that volume and rate which represents the runoff from the property prior to the date of this ordinance.
17. Flood: A temporary rise in stream flow and stage that causes significant overflow of lands not normally covered by water.
18. 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 inundation.
19. GPD: gallons per day
20. GPM: gallons per minute
21. Hydrologic Cycle: The continuous process of water exchange between the earth and the atmosphere in various forms.
22. Impervious: A surface or layer through which little or no water will move. Examples include: pavement, roofs, and heavy clay soils.



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23. Infiltration: The movement of water from the ground surface downward into the soil, which can eventually enter into a sewer system through defective pipes, foundation drains, pipe joints, connections, and manhole walls.
  24. Inflow: Any water that enters a sewer system by planned or unplanned means.
  25. Inlet: Any entrance into a ditch, storm sewer, or other waterway.
  26. In-Line Detention: Detention that is provided within the sewerage system.
  27. Interceptor: A pipe that carries wastewater directly to the treatment plant (generally the largest diameter pipes in the system).
  28. Lift Station: A facility within a piping system, which pumps wastewater from a lower elevation to a higher elevation.
  29. MS4 – Municipal Separate Storm Sewer System: A storm sewerage system designed and permitted to convey only storm water.
  30. Non-Point Source Pollution: Pollution that is dispersed over a large area in low concentrations often associated with agricultural activity.
  31. Ten-Year Storm, (10-Yr Design Storm): A precipitation event of 24-hour duration, having a 10% chance of occurring in any one year. This amounts to 3.46 inches of rain in a 24-hour time period for this region in Michigan. Source: NOAA Atlas 14
  32. 100-Year Flood: A flow within a watercourse of a magnitude, which would have a 1% chance of occurrence in any given year.
  33. NPDES: National Pollutant Discharge Elimination System: The effluent discharge permit process established to control the concentration of pollutants in effluent from industries and municipalities. The City of Saginaw maintains two permits: One for the Combined Sewer System and one for the discharge of storm water from the MS4.
  34. Peak Flow: The maximum rate of flow of storm water runoff at a specific point in a conduit from a storm or flood.
  35. Pervious: A surface or layer that will allow water to pass through it.



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36. Point Source Pollutants: Pollutants, which enter a water body from any defined conveyance such as a sewer pipe, culvert, or channel.
  37. Precipitation: The supply of water received from the atmosphere including: rain, snow, and hail.
  38. Rain Garden: A slightly depressed area of a size that was determined by specified engineering guidelines with amended soils and specific plants, shrubs, and trees that has a specific volume to store and treat storm water runoff.
  39. 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 city's responsibility.
  40. Restrictor: A structure, which regulates storm water discharge within a system.
  41. Retention Pond: A low area used for storm water collection, which has no outfall point for discharge. Discharge occurs by infiltration and evaporation only.
  42. Runoff: The portion of any precipitation event that does not infiltrate or evaporate but moves by overland flow to surface waters.
  43. 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](http://www.saswa.org).
  44. Sediment: Soil, sands, and minerals, which are moved from one place to another by the force of flowing water.
  45. Sewage: Wastewater from residential, commercial, and industrial facilities.
  46. Sewer: A pipe used to carry wastewater.
  47. Sewerage: The system of sewers and facilities used to transport, treat, and discharge sewage.



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48. Soil Erosion and Sediment Control (SESC) – Those practices related to Part 91 of PA 451 of 1994 that pertain to preventing soil from eroding and the transport of sediments away from a construction site. Any construction activity of 1 acre or more in area or within 500 feet of a lake, stream, river, or defined waters of the state must have a SESC permit. The site plan must show the BMPs for SESC, storm water discharged from a construction site must be clean and free of settleable sediment.
  49. Storm Water Management Plan Reviewer: The engineering firm or professional person formally designated by the City of Saginaw to act as their storm water plan reviewer.
  50. 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.
  51. 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: NOAA Atlas 14)
  52. Time of Concentration: The elapsed time for storm water runoff to flow from the most distant point in a drainage area to the outlet or other predetermined point.
  53. Upland Area: Land located in the upper portion of a watershed whose surface drainage flows toward the area being considered for development.
  54. 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.
  55. 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.
  56. Water Quality Volume: Highly polluted and concentrated runoff carried in a sewerage system as runoff begins from a rain event. The water quality volume is defined as 1.0 inches of rain over the contributing area of the parcel for which a storm water management plan is being developed. Or, the amount of runoff from a 1.0 rainfall on the site.



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57. Water Table: The level of ground below which is saturated with water.
  58. Wetlands: An area that is regularly saturated by surface or ground water and characterized by vegetation classified as hydrophilic and/or hydric soils.

### **III. CITY OF SAGINAW STORM WATER DISCHARGE PERMIT GUIDELINES**

#### **A. Requirements and Review Procedure**

A City of Saginaw storm water discharge permit will be issued to the Owner/Developer of a construction site after review and approval of the proposed storm water drainage plan. The City will not accept runoff into its combined or separated sewer system from newly developed, redeveloped, or demolished sites without a formal review and the issuance of a storm water discharge permit. The only exceptions to this storm water management plan are single family or two-family dwellings on parcels of one acre or less.

In areas with separated storm sewers, the site review process will address projects which disturb one or more acres, including projects less than an acre which are part of a larger common plan of development or sale and discharge into the City's separated MS4 system.

To apply for a storm water discharge permit, complete the following process and deliver or mail all submittals to: City of Saginaw Engineering Department, c/o STORM WATER DISCHARGE PERMIT, 1315 South Washington Avenue, Saginaw, Michigan 48601.

#### **1. Conceptual Review**

- a. Request from the City Engineer all information, such as the drainage district, existing sewer service lead locations, existing sewer diameters and conditions, suggested routing, outlet sewer diameter, etc. about the project site needed to complete the permit application and design.
- b. The Owner/Developer shall submit to the City the conceptual design and layout of the proposed project. This conceptual design, at a minimum, shall include:
  - Small location map showing the section and part of the section in which the site is situated.





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- Location and description of all activities that may impact or be impacted by the proposed development or redevelopment both on and off the site.
  - Acreage of the total site and acreage of the area being affected by the development.
  - If known, a conceptual layout of the proposed drainage system for the development or redevelopment.
- c. The City Engineer will review the conceptual design information to determine if it meets City requirements and determine if the proposed development or redevelopment will require a meeting of the Saginaw County Land Development Advisory Committee.
- d. If required, the Owner/Developer and technical consultant shall attend a land development advisory committee meeting. The intention of this meeting is to establish uniform direction and communication to minimize problems and financial losses to proprietors, developers, and consultants.
- e. If the conceptual layout of the storm drainage system is approved, the Owner/Developer shall begin completing final design plans and calculations for City review.
2. Construction Plan Review
- a. The Owner/Developer or representative shall submit 3 sets of plans, 3 sets of calculations, and any other supporting information for the site to the City. The plans and calculations shall comply with the requirements of this Storm Water Management Plan. The checklist, design requirements, and design guidelines that will be used during the review process of the drainage construction plans are established by this Storm Water Management Plan.
- b. Submit the proper deposit/fee for storm water management plan review and inspection in accordance with the current established fee schedule.
- c. The City Engineer will review all plans, calculations, and other information for compliance with the Storm Water Management Plan. All materials will be reviewed for completeness. Calculations will be checked. The minimum design requirements and guidelines as outlined in this document will be used as a reference. The drainage plan checklist will be reviewed.



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- d. Construction plan drainage 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.
  - e. If the proposed drainage system is rejected, 3 sets of plans and calculations will be resubmitted with the appropriate revisions.
3. Changes to Plan after Approval
- a. Any changes made to the approved plan shall be submitted to the City Engineer for review and approval.
  - b. Upon receipt of this information, it will be determined if additional information, such as calculations, will be required.

## **B. Inspection 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. As-built drawings will be required on all projects prior to final inspection. Descriptions of the inspection requirements are outlined below. The fees associated with this inspection are outlined below.

1. **Small Developments** (less than 3 acres) – A final inspection of the restrictor and the detention storage areas by the City Engineer will be required. This one-time inspection will be performed at the completion of construction after as-built drawings have been received by the City. A final inspection report (Appendix B) will be completed by the City Engineer. Subsequent inspections may be required if deficiencies exist.
2. **Large Developments** (3 acres and greater) – Site inspections of the storm sewer, outlet, and detention storage areas by the City Engineer will be required. These inspections will occur during construction as determined necessary by the City Engineer. The Owner/Developer and/or the Owner/Developer's Engineer will be informed at what stage of construction these inspections will be required. The City Engineer must be informed by the Owner/Developer as construction stages reach completion to schedule site inspections. At a minimum, the inspection reports will include the information shown on the sample daily inspection report included in Appendix B.

A final inspection by the City Engineer will take place at the completion



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of the project after the City has received as-built drawings. A final inspection report (Appendix B) will be completed by the City Engineer.

3. **Residential and Condominium Projects** – Full-time inspection of storm sewer and drainage system construction will be required. This inspection shall be performed by the Owner/Developer’s Engineer or the City Engineer. Daily inspection reports shall be completed for all days on which construction of the storm drainage system occurs. Copies of these reports shall be submitted to the City Engineer at the beginning of each week. At a minimum, the daily inspection reports shall include the information shown on the sample daily inspection report included in Appendix B.

A final inspection by the City Engineer will take place at the completion of the project after the City has received as-built drawings. A final inspection report (Appendix B) will be completed by the City Engineer.

4. **Small Redevelopment or Demolition Projects** (area less than or equal to 3 acres) – A final inspection of the restrictor and the detention storage areas by the City Engineer will be required. This one-time inspection will be performed at the completion of construction after the City has received as-built drawings. A final inspection report (Appendix B) will be completed by the City Engineer. Subsequent inspections may be required if deficiencies exist.

5. **Large Redevelopment or Demolition Projects** (area greater than 3 acres) – Site inspections of the storm sewer, outlet, and detention storage areas by the City Engineer will be required. These inspections will occur during construction as determined necessary by the City Engineer. The Owner/Developer and/or the Owner/Developer’s Engineer will be informed at what stage of construction these inspections will be required. At a minimum, the inspection reports will include the information shown on the sample daily inspection report included in Appendix B.

A final inspection by the City Engineer will take place at the completion of the project after the City has received as-built drawings. A final inspection report (Appendix B) will be completed by the City Engineer.

### C. Fee Schedule

The fee schedule for reviewing storm drainage submittals and performing inspection of drainage system construction is outlined below:



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<b>Area of Proposed Work</b>	<b>Fee</b>
Small Projects, (0 to 3 Acres)	As set by the City
Large Projects, (3+ Acres)	As set by the City
Review for exemption	As set by the City

The permit fee is for the first storm water review and inspection of a small development, redevelopment or demolition site plan submittal. An additional hourly fee may be required for subsequent reviews and inspections.

Small developments, redevelopments, or demolitions may require a deposit as determined by the City for review and inspection. Any difference in the final review and inspection fees will be refunded to or collected from the Owner/Developer prior to the issuance of a building permit.

Any material testing fees incurred during the construction process that are requested or required by the City Engineer must be paid by the owner / developer. Any fees or invoiced services incurred, such as video taping of storm or combined sewer systems that will be taken over by the City as a public utility must be paid by the developer / owner. All fees must be paid in full before an occupancy permit is issued for the site.

#### **D. Exemptions**

Redevelopment projects will be exempt from the requirements of the storm water management plan provided:

- There was an existing approved storm water management plan for the site.
- The area of additional roof, paved, and gravel surfaces is less than 5% of the existing improved areas of the site.
- The additional roof, paved, and gravel surface does not exceed 20,000 sq. ft.
- There is no cumulative increase equal to, or greater than the 5% area of improvement. (If the site has added 2% one year, 3% another year, and another 2% increase in imperviousness.)
- There is no significant impact or change in detention amounts that may have adverse effects on neighboring properties.

Example: Existing 1 acre site with .75 acres of improved property plans to add 3,000 square feet of paved surface to the existing development.  
 $.05 * (.75 * 43560) = 1633.5$  sq. ft..  $3,000 > 1633.5$  therefore project will need to follow storm water management plan.

**To obtain this exemption**, the contractor, developer, or developer's engineer must fill out the REQUEST FOR EXEMPTION form in Appendix B. Also, supply a site map with existing conditions (buildings, parking lots, other impervious / pervious surfaces, etc.), current storm water management plan for



the site, and proposed changes (buildings, parking lot, changes in impervious / pervious surfaces, etc.) with supporting calculations necessary for review purposes. These calculations are shown above. If the calculation is not present, the City Engineer will not review the plan.

NOTE: If no storm water management plan exists or if the site is going through and extensive rebuild, the site must come into compliance with this storm water management plan to the maximum extent practicable.

An exemption may still be granted to redevelopment projects not meeting the above requirements if approved by the City Engineer.

The City Engineer can exercise the right to have a site comply with these guidelines even if the change in impervious area is less than 5% if special circumstances exist, such as historical drainage problems effecting the area, or other concerns.

#### **E. Appeals Process**

If the developer is in disagreement with any of the reviews or inspections made by the City and/or City Engineer, an appeal can be made to the Manager within 30 days of the review and/or inspection.

Upon review of the items presented for appeal the Manager may:

1. Refer to an independent third party for an opinion / recommendation
2. Arbitrate with the Developer and City Engineer to reach an acceptable solution.
3. Over ride the City Engineer.

#### **F. Penalties/ Enforcement**

Any person, firm, or corporation convicted of disposing of storm water in a manner contrary to the provisions of an existing Storm Water Ordinance or the provisions of this design guidance plan, or failing to connect with an available storm water / combined sewer as provided herein, or in any other way violating the provisions of an existing Ordinance, shall be guilty of a misdemeanor, and subjected to a fine or imprisonment in the County Jail for a specified period of time or both such fine and imprisonment, in the discretion of the Court, together with costs of said prosecution.

#### Issuance of Water and Sanitary Sewer Permits

Construction of water and sanitary sewer utilities will not be allowed until the site



development or redevelopment is in compliance with this Storm Water Management Plan.

#### **G. Permits Required from Other Agencies**

If the site is located within the jurisdiction of other agencies, further permitting may be required. Permits related to storm water discharge control may need to be filed with the:

1. **Saginaw County Public Works Commissioner (SCPWC)**, who has jurisdiction over established county drains. Sites located in a county drainage district and also sites needing plat approval may need to be reviewed and approved by the SCPWC. The design guidelines to be followed on the site will be those contained herein. Additionally, the SCPWC is the County Enforcement Agent for Part 91 of PA 451 of 1994, Soil Erosion and Sediment Control. Permits may be obtained from the Saginaw County Public Works Commissioner's website, see Appendix C.
2. **Michigan Department of Transportation (MDOT)** that has or shares jurisdiction over drainage along state highways and state right-of-way within the City of Saginaw. Sites located along MDOT right-of-way and discharging to MDOT drainage systems must obtain a permit from MDOT. The website address for this permit application is included in Appendix C of this document.
3. **Michigan Department of Environment, Great Lakes and Energy (EGLE)** that has jurisdiction over proposed work within the 100-year floodplain, inland lake and stream areas, wetland areas, and construction sites of 5 acres or more of disturbed soils. A permit(s) must be obtained for work proposed in these areas. The website address for this EGLE Joint Permit and NDPES Storm water discharge permit from a construction site is provided in Appendix C.



#### IV. DESCRIPTION OF ENGINEERING CALCULATIONS

##### A. Allowable Discharge Rate for Runoff

The allowable discharge rate for a site is calculated using the Rational Method.

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

**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 total area of the site in acres (ac).

The rational method will be used to calculate allowable discharge (**Qa**) and 10-year design discharge (**Qd**). The allowable discharge (**Qa**) is calculated using the impervious factor (**IF**) of **10%** for all sites within the City. The 10-year design discharge (**Qd**) is calculated using the actual percentage of imperviousness (**IMP**) of the site after construction.

**Qi** is the runoff rate from the impervious surfaces of a site and **Qp** is the runoff rate from the pervious surfaces of a site. The total runoff rate for a site is the sum of **Qi** and **Qp**.

$$Q = Qi + Qp = (Ci)(Ai)(I) + (Cp)(Ap)(I)$$

$$Qa = (Ci)(I)(A)(IF/100) + (Cp)(I)(A)[(100-IF)/100]$$

$$Qd = (Ci)(I)(A)(IMP/100) + (Cp)(I)(A)[(100-IMP)/100]$$

To calculate **Qa** or **Qd** the values for **Ci**, **Cp**, **I**, **IMP**, **IF**, and **A** must be determined. The percent impervious (**IMP**) and the area (**A**) are measured from the site plan. The impervious factor (**IF**) is a design value established as 10% for all sites, but this must be obtained from the City Engineer, some sites may qualify for larger factors. The impervious area runoff coefficient (**Ci**), the pervious area runoff coefficient (**Cp**), and the rainfall intensity (**I**) are calculated values based on the time of concentration (**tc**).

Time of concentration (**tc**) is the time it will take for runoff from the most hydraulically distance point (i.e. high elevation) to reach the design point (i.e. low elevation such as a catch basin or an outlet sewer). The following can be used to calculate time of concentration:

$$t_c \text{ (min)} = \text{length (ft) of runoff} / \text{average velocity (fps)} * 60 \\ \text{(sec/min)} + \text{lag time (min)}$$



The average velocity for overland drainage in the City of Saginaw will range between 0.5 fps and 1.5 fps based on overland slope and land use, typically use 1.0 fps. Lag time will range between 15 minutes and 20 minutes; typically use 15 minutes. When calculating time of concentration ( $t_c$ ), include all assumptions with calculations.

When the time of concentration ( $t_c$ ) is found to be greater than 30 minutes, use the following runoff coefficients and rainfall intensity equation:

$$\begin{aligned} \text{impervious area (Ci)} &= \mathbf{0.70} \\ \text{pervious area (Cp)} &= \mathbf{0.10} \\ \mathbf{I} &= \mathbf{175 / (25 + t_c)} \end{aligned}$$

When the time of concentration ( $t_c$ ) is found to be less than 30 minutes (to a minimum time of 15 minutes), use the following runoff coefficient and rainfall intensity equation:

$$\begin{aligned} \text{impervious area (Ci)} &= \mathbf{t_c / (8 + t_c)} \\ \text{pervious area (Cp)} &= \mathbf{t_c / (80 + 4 t_c)} \\ \mathbf{I} &= \mathbf{136 / (20 + t_c)} \end{aligned}$$

If a 100-year design is required for certain designated sites, use the following intensity formula to complete calculations:

$$I_{100} = 275 / (25 + t_c)$$

## **B. Storm Water Detention Requirements**

The storm water detention storage required for a site is calculated as follows:

Calculate the maximum flow rate per acre of impervious surfaces, **Qo**.

**A<sub>imp</sub>** is the total acreage of existing and proposed impervious surfaces on the site after development, again including both existing and proposed impervious areas.

**C<sub>w</sub>** is the weighted runoff coefficient for the entire proposed site.

See tables in Appendix G for runoff coefficients.

$$\mathbf{Qo = Qa / (A_{imp} \times C_w)}$$

Calculate the storage time (**T**) in minutes at which the maximum volume of storage will occur on site for the 10-year design storm.

$$\mathbf{T = (4080/Qo)^{1/2} - 20}$$





For 100-year design storm use:

$$T_{100} = (10,312 / Q_o)^{0.5} - 25$$

Calculate the maximum volume of storage per acre of impervious surface, **Vs**. The units of **Vs** are cubic feet per acre of impervious surface (cu. ft / ac).

$$V_s = [(8160)(T) / (T + 20)] - (40)(Q_o)(T)$$

For 100-year design use:

$$V_s = [(16500)(T) / (T + 25)] - (40)(Q_o)(T)$$

Finally, calculate the total volume of storage required for the site, **Vt**. The units of **Vt** are cubic feet.

$$V_t = (V_s)(AC_w)$$

### **Water Quality Calculation**

**If discharging through a separate storm system direct to the Saginaw River this calculation must be done.**

The Water quality volume of runoff will be captured and detained for at least 24 hours or within a permanent volume (wet) detention basin. The water quality volume must be captured for any system discharging to the Saginaw River, tributary stream to the river, or waters of the state.

This volume is determined by:

$$3630 \times \text{area in acres} \times \text{the relative impervious factor } C_w$$

$$3630 \times AC_w$$

Note: A calculation must be submitted showing the detention basin time, discharge rate, orifice diameter and number of orifices.



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### C. Discharge Restrictor Requirements

Restrictors are required to regulate the discharge of storm water to the allowable discharge rate established for a site. The circular in-line restrictor is sized based on the orifice formula. Note that in some cases the City Engineer will mandate an outlet sewer diameter that is equal to or smaller than the calculated restrictor size. In such cases, no restrictor would be required.

$$\Delta h = MWE - OWE$$

$$a = Qa / [0.62 (64.4(\Delta h))^{1/2}]$$

$$d = 12(4(a)/(\pi))^{1/2}$$

a = area of restrictor orifice (sq. ft.).

$\Delta h$  = head differential in feet, (MWE - OWE).

Outlet Water Elevation, (OWE) = the center of the orifice

Maximum Water Elevation, (MWE) = the top of storage.

d = diameter of outlet restrictor orifice in inches

### D. Construction of Connections to City Sewer System

All connections to City sewers from the property line into the right-of-way are constructed by the City at the owner's / developer's expense. Contact must be made with the City Engineering Division of the Public Services Department to schedule this work.



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## V. MINIMUM DESIGN STANDARDS AND RULES FOR DRAINAGE SYSTEMS

### A. Requirements

#### 1. General Requirements

- a. Storm water detention requirements for any new construction development, redevelopment, or land use change occurring within City of Saginaw will be determined according to the storm water discharge permit procedure.
- b. A storm water discharge permit will be required for all site development, redevelopment, and demolition except residential sites for single-family or two-family dwellings on any parcel of one acre or less in size. The City may require side lot or rear lot drainage to be installed if the City determines it necessary. This activity will be regulated under the sewer permit system. Operation and maintenance of side lot or rear lot drainage systems will be the responsibility of the property owner.

In areas with separated storm sewers, the site review process will address projects which disturb one or more acres, including projects less than an acre which are part of a larger common plan of development or sale and discharge into the City's separated MS4 system.

- c. During the design process the design engineer or architect must determine if the site is in a Combined Sewer (CS) district or Separated Storm Sewer system (MS4), and whether the system will be private or public. If the site is in a CS area then *Public Utilities Series Bulletin 6 – 37 RULES AND REGULATIONS FOR THE CONSTRUCTION AND MAINTENANCE OF A SEWER SERVICE EXTENSION* must be followed, see Appendix A.
- d. Proposed storm sewer shall be designed to have capacity to pass 10-year design storm runoff rate (**Qd**). Outlet pipe diameters from a site must remain constant from the last access structure to the point of connection to the City sewer. Outlet pipe diameters are defined by the City Engineer and are typically required to be 6 inches or larger, dependent upon the restricted discharge rate. Existing outlets will be maintained as is, a site cannot increase a discharge rate unless it provides adequate documentation of no adverse upstream or downstream implications from the increased



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rate and the City Engineer approves the request.

- e. The peak runoff rate during a 10-year storm event from a developed or demolished site shall not exceed the allowable discharge rate (**Qa**). This rate is determined using the design impervious factor (**IF**) established by the City of Saginaw for the site. The impervious factor of demolished sites is 10 %. Either detention storage with a regulated discharge must be provided or all impervious surfaces must be removed from the site. A demolished site must be graded in a manner that does not allow runoff from the site to negatively impact neighboring parcels.
- f. 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.
- g. The drainage area used for computation will be the total area tributary to the site outlet, including off-site properties that drain onto the site.
- h. Engineering calculations must be submitted with the storm water discharge permit application. The calculations shall follow the procedures outlined herein.
- i. Roof drains should be directed to vegetated areas, in combined sewer areas they cannot connect to the storm sewer. In separated storm sewer areas roof drains may be connected to a separated storm drainage system if the outlet is properly restricted and proper detention is provided upstream of the outlet. Unrestricted runoff from roof drains will not be accepted; there are no exemptions. Whenever possible, the roof drains should be directed to landscaping, rain gardens, or rain barrels to limit runoff from the site.
- j. The City Engineer shall make a determination as to whether any or all of the storm water drainage facilities proposed are to become part of the City or County Drain system.
- k. The City 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 City Engineer shall make a determination as to the need for covenants to maintain responsibility for mandatory drainage facilities. All said facilities shall be located in easements dedicated to the public and shall be subject to continual inspection during the construction period, at the expense of the owner / developer.

- l. Proposed storm sewer enclosures shall be designed so they will not adversely impact any adjacent properties, upstream or downstream, and shall be designed to the impervious factor (IF) of 10%. Obtain from City Engineer.
- m. The use of infiltration BMPs will not be implemented for new development or re-development projects in areas of soil or groundwater contamination. When encountering these conditions, the SCPWC or municipality will contact and coordinate with local EGLE staff. The local EGLE must be made aware of the contamination. Any storm pipes used in these areas must have joints which prevent seepage of groundwater into the storm system.
- n. 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 re-development 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.
- o. Soil erosion and sedimentation control measures must be implemented, and a permit obtained prior to construction commencing. If the area of disturbed soils is greater than 5 acres or more in area, a NPDES Notice of Coverage for construction sites must be obtained from the EGLE.

## 2. Storm Sewer Piping Requirements

- a. Proposed storm sewer shall be designed to have capacity to pass 10-year design storm runoff rate (**Qd**).
- b. Determine if the site is in a CS or MS4 area and use either **Public Utilities Series Bulletin 6 – 37** if site is in a CS area or the following design requirements if in an MS4 area.
- c. Class III or IV concrete pipe must be used for the following:



- Combined sewers with premium joints
  - Sewers larger than 10" within City, county, and state right-of-way
- d. Provide 42-inches of minimum cover if in a separated storm sewer area. If the site is in a combined sewer area 42-inches of cover must be provided.
  - e. Provide 18" vertical separation between all other utilities, including sanitary sewers and water mains.
  - f. Provide 10' horizontal separation from other utilities, if possible.
  - g. Manhole/catch basin shall be placed at a maximum distance of 400' from any other manhole/catch basin for access/maintenance purposes.
  - h. Provide a sump discharge outlet for each individual lot in all developments. Refer to **Public Utilities Series Bulletin 6 – 37**.
  - i. An outlet for sump leads must be available for each parcel in a subdivision or plat; this may be by a rear lot drainage system, swales, and catch basins. Other access alternatives will be considered.
  - j. Minimum pipe grades must be such to produce minimum scouring velocity of 2.5 ft/sec when pipe is flowing full without surcharging.
  - k. For private storm sewer systems plastic pipe may be used. Refer to Public Utilities Series Bulletin **6 – 37**.
  - l. Minimum pipe diameter for catch basin leads is 6".
  - m. Minimum pipe size for sewer main is 12".
  - n. Pipe should be sized for a 10-year design storm without surcharging when possible, although significant storage can be achieved by surcharging and will be acceptable when site conditions limit storage options.
  - o. When two pipes or more of different sizes come into a structure, the 8/10th flow lines shall match when possible for storm water collection systems. This is not necessary for sanitary flows.



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- p. Catch basins will have a minimum sump depth of 24".
  - q. Catch basins connected to combined sewer must have water traps installed.
  - r. Connections to City of Saginaw sewers will be limited by the diameter and condition of the City's receiving sewer in addition to restrictions applied by the permit application calculations. Outlet pipe diameters from a site must remain constant from the last access structure to the point of connection to the City sewer.
  - s. The above-mentioned restriction will not impede the use of "first flush" outlet structures.

3. Detention Requirements

- a. Proposed storm sewer detention facilities shall be designed to have capacity to treat the first flush volume and detain for a 24-hour time period, and to detain the 10-year design storm runoff volume in excess of the allowable discharge from the site.
- b. The maximum design storage elevation of a detention area must be a minimum of one (1) foot below the lowest floor elevation adjacent to the detention area. A major overland flow path to the street should be provided and should be at the maximum storage elevation.
- c. The design maximum storage elevation in a parking area used for detention must not exceed a depth of 9 inches above any paved surface. An overland flow pattern should be provided or an overflow structure may need to be installed to ensure that this depth is not exceeded. Storage on paved areas is required to include water quality treatment for sediment, and oils and chemicals prior to discharge for sites serviced by the MS4.
- d. Designs of detention facilities shall incorporate features, which facilitate inspection and maintenance. The designer shall submit an Operation and Maintenance Plan for any detention facility prior to its acceptance by the City. The agreement form and a completed sample are provided in Appendix E.
- e. Designs of detention facilities shall incorporate safety features, particularly at inlets, outlets, on steep slopes, and at any attractive nuisances. These features shall include, but not be limited to,



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

- f. Side slopes and the bottom of detention basins shall be top soiled, to a minimum of 3 inches, and seeded.
- g. The side slopes of detention basins shall be shaped with slopes no steeper than 1 vertical to 4 horizontal to allow mowing of these surfaces.
- h. Detention basins shall have bottom slopes of 1% minimum or shall be under-drained.
- i. Detention basins and restrictors shall be maintained, as necessary. If a detention basin is found not to be maintained or a restrictor is removed or not maintained, the Owner will have thirty (30) days to complete the necessary maintenance.
- j. Detention basins shall be constructed with the top of banks a minimum of five (5) feet from any pedestrian walkway (i.e. public and private sidewalks/ bike paths).
- k. Detention volume requirements for redeveloped properties, where improved impervious area equals existing impervious area, will be a minimum of 50% of the calculated required volume from the permit application.
- l. Variances to the defined detention volume requirements will be considered by the City Engineer for situations where required storage is not achievable. Complete justification must be prepared and submitted to the City Engineer for consideration. Justification should detail the volume of storage achieved by the proposed design.

4. Rear Lot Drainage Requirements

- a. All lots within a condominium or platted development shall require rear lot drainage. Each lot shall be adjacent to a rear lot catch basin.
- b. 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:

- 1) Rear lot tile drains may have a contributing drainage area of up to 2 acres and a minimum diameter of 6 inches, placed at a minimum slope of 0.5 %.
  - 2) Any rear lot basin must be directly connected to the development's storm sewer system. Storm sewer services cannot be connected to a branch of a rear drainage system.
  - 3) Connections at the rear yard basin and at the storm sewer shall be soil tight and or constructed using pre-manufactured seals, joints, etc. (i.e. Kor-n-Seal).
  - 4) The rear lot system's piping shall be SDR-35 PVC piping or a dual wall HDPE piping.
  - 5) Rear lot tile drains cannot connect to road underdrains.
  - 6) Rear lot drainage systems in CS regions may require plate restrictors. If the rear lot system is restricted or goes through a detention area with a restricted outlet before discharge into a CS system the plate restrictors may not be necessary. This will be determined by the City Engineer.
- c. Sand backfill and bedding is not required for rear lot drainage systems provided dual wall pipe is used (i.e. N-12, H-1-Q, etc.) or SDR-35 PVC pipe.
  - d. Rear lot drainage tiles shall have a minimum cover of 2'. A minimum of 4 inches of sand bedding is required beneath corrugated plastic pipe and a minimum of 6 inches of sand backfill is required above corrugated plastic pipe.
  - e. Rear lot catch basins shall have a minimum diameter of 2 feet. Plastic pre-manufactured structures may be used for rear lot drainage systems. Concrete structures are required for public 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. A 10' wide easement shall be provided on every lot for all rear lot drainage systems. Said easements shall be written as to permit



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neighboring property and/or condominium owners to maintain the rear lot drainage system, as it may affect their property. This is to assure a minimum of 20' of easement for maintenance purposes. NOTE: if no rear lot system exists on the property this easement should still be provided in case of future drainage problems.

- g. Existing rear lot drainage systems abutting a proposed development may be used for the new development provided:
- 1) The existing rear lot drainage system has the capacity to convey storm water runoff from the proposed rear lot drainage areas.
  - 2) 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.
  - 3) 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:
    - a) 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.
    - b) 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.
    - c) The rear lot drainage system shall be designed to convey rear lot drainage from both the existing and proposed rear lot drainage areas.
    - d) Easements shall be provided, allowing for maintenance by both abutting landowners in current and proposed phases of development.



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- h. Rear lot drainage shall be shown on the preliminary plat (subdivisions) or site plan (condominiums).
  - i. All rear lot drains will connect to an approved storm water drainage system.
  - j. Rear lot drainage systems in platted developments are the responsibility of the homeowners and the homeowner's association. An easement is present to provide for maintenance work on rear lot drainage systems. The property must be returned to its pre-maintenance conditions after repairs or maintenance has been performed. The homeowners association should develop a preventive maintenance plan for the rear lot system to assure proper (see Appendix F for a sample) function of the system. If necessary, the homeowner may repair the rear lot system on their own if they so desire. However, the area worked on must be returned to the condition it was in prior to the repair.
  - k. Rear Lot layout examples can be found in Appendix F.

## **B. General Compliance Guidelines**

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

1. The minimum surface slopes for overland drainage are as follows:
  - a. For bituminous parking lot surfaces, 1%.
  - b. For concrete paved surfaces, 0.5%.
  - c. For concrete curb and gutter, 0.32%.
  - d. For drainage swales and valley shaped ditches, 1.0%.
  - e. For rear lot drainage swales and valley shaped ditches, 0.5%.
2. The maximum surface slopes for overland drainage are as follows:
  - a. For bituminous, concrete paved surfaces, 5%.
  - b. For concrete curb and gutter, 5%.
  - c. For drainage swales and valley shaped ditches, 5%.
  - d. For rear lot drainage swales and valley shaped ditches, 5%.
  - e. Drainage swales and valley shaped ditches shall have side slopes no steeper than 3 horizontal to 1 vertical to accommodate mowing.
  - f. Landscape grading, 4 horizontal to 1 vertical.



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### **C. Variations from Requirements**

The City may issue a storm water discharge permit that waives allowable discharge requirements and or detention requirements. Variation from these requirements shall require the approval of the City, whose actions shall be conditioned upon the following:

1. The submittal of a petition to the City Engineer describing in detail the rationale for the proposed design changes, including hydraulic and or hydrologic computations.
2. The existence of special circumstances or conditions 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 or deny a justifiable right of a proprietor over the domain of his land.
3. The 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.

### **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 owner's association. These plans are not to be construed as a responsibility of the city, nor will the city 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) Maintenance of facilities such as pipes, channels, outflow control structures, infiltration devices, and other structures.
  - 2) Debris and sediment removal from catch basins, channels, and basins.
  - 3) 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) The city 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.
  - 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 City 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



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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.). The City of Saginaw and the Saginaw County Public Works Commissioner are not responsible for landscape maintenance.

- i. 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.
2. 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.
3. 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, see example in Appendix E.
4. 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.

5. 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.
6. A sample maintenance plan and annual budget is illustrated in Appendix E.

#### **E. Operation & Maintenance Plans (O & M) Tracking**

O & M Plans must have a provision in them to allow representatives from the local municipality to enter the property to inspect structural and vegetative BMPs which are not being maintained as stated in the O & M Plan. If the O & M plan is not being maintained to meet minimal performance requirements described in the Operation and Maintenance Plan for Stormwater Drainage Systems, Structural and Vegetative Best Management Practices (BMPs) document in the Appendix Section, then the local municipality has the option to obtain a contractor to complete the work and charge the owner / developer for costs incurred plus a 25% surcharge for administrative fees.

Additionally, the property owner / developer will provide an email address of the designated person responsible for assuring the O & M Plan is implemented. This email address must be updated when changed or when a new person assumes the maintenance responsibility position. This responsible party must annually inform the local municipality, if they have an NPDES MS4 Permit, that the O & M Plan has been carried out as described in the plan. All reports on this performance objective must be received by the local NPDES MS4 municipal permit holder or their designee (SASWA) on or before December 31<sup>st</sup> of each year. Failure to report will be construed as non-compliance with the design requirements. An email will be sent to the owner / developer for follow up response to determine compliance. No answer to this email within **five (5) business days** will result in further administrative action up to and including fines.

Those site developments with approved O&M plans in the CSO districts will be monitored by the City's Code Enforcement staff.

#### **F. Evaluation of Cost – Effective structural and non-structural BMPs**

1. To meet the City of Saginaw's NPDES Phase II regulatory requirements for storm water, the City may request, and the developer must supply the following:



- 
- a. Either preliminary or actual constructed cost of a best management practice.
  - b. Projected or actual maintenance costs of a best management practice
  - c. 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.

**G. BMPs To Minimize Post Construction Impacts on Water Quality**

1. The City of Saginaw requires that BMPs be utilized on all new or redevelopment sites improve storm water runoff quality in the post construction phase. The BMPs used on a site must be reviewed and approved by the City Engineer.
2. 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.
3. The list of approved BMPs can be found in Appendix I of this document. The Saginaw Area Storm Water Authority at times will approve BMPs for addition to this Appendix and the City will consider placing these approved BMPs in this plan after a review process.
4. A signed Operation and Maintenance Plan must be provided.





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## **APPENDIX A**

**RULES AND REGULATIONS FOR THE CONSTRUCTION AND MAINTENANCE OF A  
SEWER SERVICE EXTENSION**

**RAINFALL IDF CURVE FOR SAGINAW COUNTY**

**RULES AND REGULATIONS**  
**For the Construction and Maintenance of a**  
**SEWER SERVICE EXTENSION**

Definition: Sewer Service Extension – Shall mean that portion of the sewer line from the property line tip to within five (5) feet of the building wall.

Section I: Extension Permit – No person shall construct, alter, or repair a sewer extension without first obtaining a written permit from the Engineering Division of the Department of Public Services, 1435 S. Washington Avenue.

Section 2: Construction Material – Sewer extensions shall be constructed of either double strength vitrified clay sewer pipe, concrete sewer pipe A.S.T.M. C-14-3, P.V.C. pipe – standards A.S.T.M. 3034, SDR 26, or ADS N12, ProLink SJ or equal (no hinged split couplers allowed). The type of sewer pipe selected shall be used for the entire length of the sewer. Sewer extensions to a single-family residence may be four (4) inches in diameter. Extensions to multiple family residences commercial or industrial shall not be less than six (6) inches. The type of sewer pipe selected shall be used for the entire length of the sewer extension. (No slotted or sock pipe allowed.) If pre-existing conditions do not meet the above specs. Field Operations Manager or his Designee can approve variances.

Section 3: Pipe Joint Construction – All joints constructed in sewer extensions shall be made tight so as to exclude infiltration/exfiltration and growing roots. Joints in vitrified clay or concrete sewer pipe to have bell and spigot ends and sealed with a premium joint approved rubber compression type seal. All joints shall be constructed in such a manner as to maintain smooth alignment of the inside barrel of the pipe.

Sewer pipe joints connecting pipes of dissimilar material or pipes of different sizes shall be made with a Fernco flexible coupling or Fernco donut or approved equal. O-ring connections of different size pipes will not be allowed.

Every 100' of sewer extension at the buiding and every 100' thereafter, per plumbing code. No tees or 90's allowed 45's must be separated by at least 1' of pipe. Sanitary wyes are required for clean outs.

Section 4: Repairs – Any repair over half the length of the existing extension will require replacement of the extension.

Section 5: Depth of Extension – Where the depth of the sewer connection permits, all sewer extensions shall be constructed with not less than six (6) feet of cover to the finished grade at any point, and at a slope of not less than 1/8 inch per foot. The sewer extension and the water extension may occupy the same trench when the

top of the sewer pipe is at least twelve (12) inches below the bottom of the water pipe. In cases when the sewer extension cannot be constructed twelve (12) inches below the water extension, or when the water extension exceeds two (2) inches in diameter, then the water extension and sewer extension shall be laid in separate trenches and separated by five (5) feet of undisturbed or compacted earth. In this instance the minimum depth of the sewer is 42" at building foundation. All open trench excavation shall meet competent person requirements.

- Section 6: Bedding of Extension – Bell holes shall be excavated at each point where bell and spigot pipe is used to insure full bearing for the body of the pipe. A minimum of three (3) inches granulated material shall be used to provide uniform support for all sewer pipe for the entire length of the extension.
- Section 7: Backfill of Trench – All sewer extension trenches shall be backfilled with sand or other approved granular material to a point at least three (3) inches above the pipe, properly tamped or water flushed into place. The remainder of the trench may be backfilled with excavated materials, excluding there from stones exceeding three (3) inches in diameter, masonry, rubble or other extraneous material.
- Section 8: Protection of Excavation – Any trench which may create a real or potential hazard to the public shall be protected by adequate barricades, signs, lights or other protective devices.
- Section 9: Inspection of Extension – All sewer extensions, before being covered, shall be inspected and approved by authorized inspectors assigned by the Maintenance and Service Division of the Department of Public Services. Those not inspected shall be re-excavated.
- Section 10: Extension Responsibility – It is the responsibility of the person making a sewer extension to check and make certain that said sewer connection is open and free of obstructions before beginning said sewer extension. The elevation of the sewer connection shall determine the elevation of the sewer extension. No new extension shall be allowed to any connections over 50 years old.
- Section 11: Private and Subdivision Rear Lot Drainage – A separate private sewer extension is allowed to drain rear lots. A single six (6) inch connection will be allowed with an approved drainage structure, which shall include a restrictor to allow no more than a three (3) inch opening. A drawing for approval and a shop drawing provided with list of material to be used must be submitted.

#### Single Family Private rear lot drainage

Single - family private rear lot drainage shall consist of a 6" sewer connection sewer extension to the property line within 5' of property line an in-line-P-trap will be installed, all 6" pipes and pads will be backfilled with 3" of sand above

and below pipe. After the 6" pipe P-trap owner/contractor is allowed to transition to 4" pvc pipe continuing to the private catch basins at a minimum depth of bury of 18" to the top of the 4" pvc pipe. Private rear lot catch basins shall typically be made of pvc and contain a minimum of an 18" sump to allow solids to settle and have a sufficient opening to drain, such opening to have a slotted cover to prevent plugging of catch basin or tile from debris. Backfill of 4" pipe will be accomplished using native materials. Pipe materials allowed are the same as for sanitary connections.

Section 12: Sidewalk and Driveway Repairs – It shall be the responsibility of the property owner to repair any sidewalk or driveway removed while in the process of repairing or replacing a sewer service extension.

Permanent restoration of sidewalks or driveways shall be made immediately following pipe repairs, weather permitting. In any case, the disturbed area shall be maintained so as to prevent injury to pedestrian or vehicular traffic until permanent repairs can be made.

Section 13: Catch Basins and Manholes – All sewer extension must be approved by Utilities Field Operations Manager or his designee.

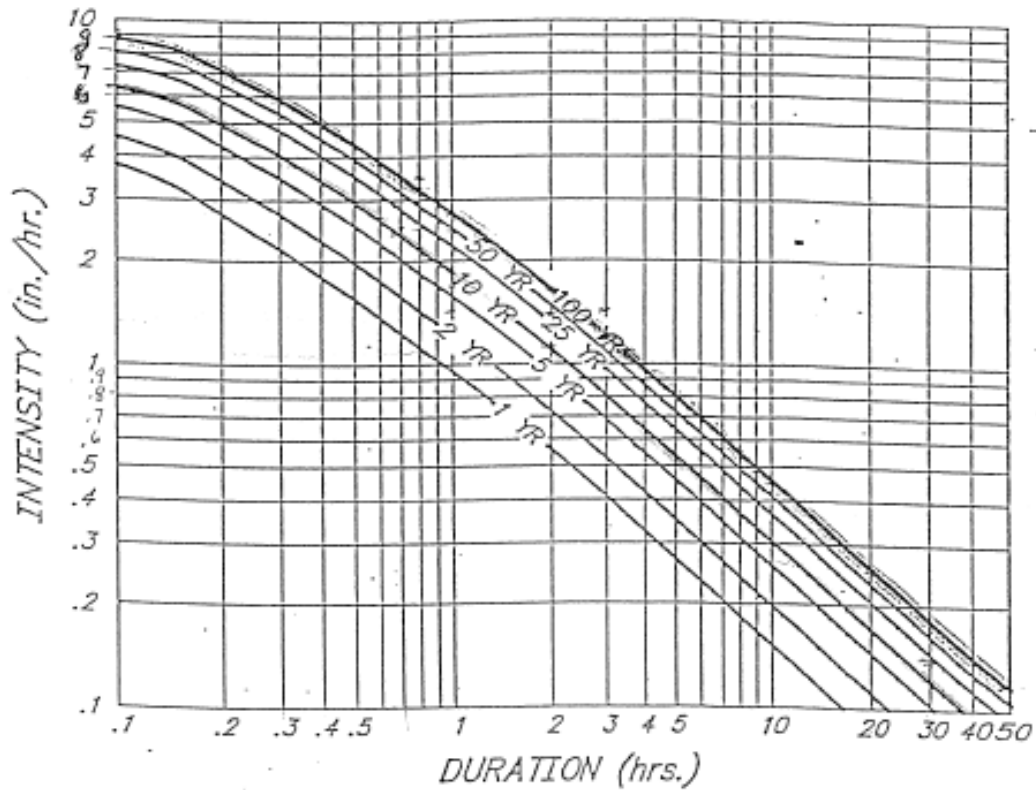
Catch Basins – Minimum 3'. Shall be trapped at the initial sewer extension with a 6" PVC trap (Sch 40) and will have a 2' sump.

Manholes – Minimum 4' diameter. All manholes shall have thoughts constructed of the same pipe material used for the extension to provide for smooth laminar flow throughout. (Concrete formed troughs are not acceptable).

Sanitary and storm sewer joined in the same manhole is allowed provided the storm inlet is one foot above the sanitary inlet.

Section 14: Effective Date – The effective date of this regulation shall be\_\_\_\_\_

This regulation supersedes Water Series Bulletin No. 3-17 dated April 4, 2005, and is issued under the authority granted by provisions of Section 52.19, Regulatory Authority, Water Distribution System, of Chapter 52, Water, of Title V, Public Works of the Saginaw Code of Ordinance.



RAINFALL INTENSITY-DURATION-FREQUENCY FOR  
SAGINAW, MICHIGAN



PREPARED BY:  
SPICER ENGINEERING COMPANY  
1258 SOUTH WASHINGTON AVENUE  
P.O. BOX 1689  
SAGINAW, MICHIGAN 48605-1689  
TEL A/C 517-754-4717  
DESIGNED BY: SEC  
DRAWN BY: GLE  
DATE: 12/9/92  
JOB NUMBER: 91153  
DRAWING NUMBER: A17314



## **APPENDIX B**

### **CITY OF SAGINAW STORM WATER DISCHARGE PERMIT APPLICATION AND CHECKLIST**

**SAMPLE STORM WATER DISCHARGE PERMIT**

**SESC / NPDES PERMIT PROCEDURE**

**DAILY INSPECTION REPORT FORM**

**FINAL INSPECTION REPORT FORM**

**ENGINEER'S CERTIFICATION FORM**

**CONTRACTOR'S CERTIFICATION OF STORM SEWER CONSTRUCTION**

**REQUEST FOR EXEMPTION**



## CITY OF SAGINAW STORM WATER DISCHARGE PERMIT APPLICATION

<b>PROJECT NAME:</b>	
Property Tax Identification #:	
Site Plan Review Date:	
Date Applied:	
Deposit Amount Submitted:	
<b>NAME OF DEVELOPER/OWNER:</b>	<b>ENGINEER/ARCHITECT:</b>
Contact Person:	Contact Person:
Street Address:	Street Address:
City, State, Zip:	City, State, Zip:
Telephone:	Telephone:
Fax:	Fax:
<b>PROJECT LOCATION:</b>	
Street Address:	
Name of Subdivision/Plat:	
Drainage District:	
<b>STORM WATER DESIGN INFORMATION (*Calculation must be submitted for verification. Calculations must have clearly labeled headings, clearly labeled formulas, and clearly labeled units.)</b>	
<b>Type of Development (Circle):</b> <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 <sub>a</sub> ) (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 REFER TO BACK FOR ADDITIONAL PERMIT APPLICATION INFORMATION

The Owner/Developer must provide a Complete Storm Water Permit Submittal to City of Saginaw for review by the City of Saginaw Storm Water Management Plan Reviewer. This includes a completed permit application with calculations, three complete sets of the site drainage and grading plan, one copy of the calculations for allowable discharge and on-site storage requirements, as prepared by a Registered Professional Engineer or Architect, any other supporting information, and completion of the drainage checklist outlined below.

Complete the drainage checklist by checking each of the following items after you have verified they are clearly indicated on the plan:

- Total acres of site.
- Total acres of watershed draining through the site outlet.
- Drainage District and impervious factor. Drainage district lines, including sub district lines, contributing to individual storm sewers and rear lot drainage systems, showing all land to be drained through proposed drainage system, including rear lot drainage systems.
- Location of site, including dimension to nearest intersection, road, or section line.
- Existing and proposed ground elevations at maximum 50 foot centers, including shots on perimeter of site and 50 feet beyond or contour lines at one (1) foot intervals extending 50 feet beyond the site limits.
- Existing and proposed elevations at edge of pavement or buildings within 50 feet of site.
- Existing and proposed elevations of top of curb, gutter, ditch line, and centerline of road at maximum 50 feet intervals within 50 feet of site.
- Rim and invert elevations of existing catch basins, manholes, sewers, and culverts.
- Location of all existing and proposed utilities, water main, storm drains, sanitary sewer, and corresponding right-of-ways.
- Horizontal control of all storm water drainage facilities and building locations.
- Location of proposed lawn/landscape areas, paved areas, and building locations.
- Location, size, length, slope, and type of proposed storm sewer and rear lot drains.
- Rim and invert elevations(s) of proposed manholes and catch basins, including rear lot drainage.
- Location of on-site storage showing contour line for top of storage elevation.
- Provide sufficient dimensions, cross-sections, profiles, tie downs, and horizontal controls to determine the location and size of proposed storm sewers and detention/retention areas. This information will be used for verifying proposed detention/retention volume calculations in grassed and paved areas.
- Location and elevation of emergency overflow.
- Proposed grades for bituminous and concrete paving comply with storm water management plan.
- Storm sewer material, sizes, and minimum grades comply with storm water management plan.
- Rear lot drainages comply with storm water management plan.
- Location, size, and detail of proposed restrictor.
- Trench detail, manhole detail, catch basin detail, restrictor detail, curb detail, pavement detail, storm water detention basin detail, and top soil and seeding detail.
- Detailed hydrology and hydraulic calculations used for sizing storm sewer (can be submitted on separate form). Calculations must show there will be no adverse impacts upstream or downstream of proposed development.
- Calculations of maximum allowable discharge on-site storage, storage volume, and size of restrictor.

Beyond City of Saginaw requirements, the Developer must submit applications for permits with all agencies that regulate storm water within the area of development. These may include Michigan Department of Transportation, Michigan department of Environment, Great Lakes and Energy,environment Saginaw County Public Works Commissioner, Saginaw Road Commission, and others.



## CITY OF SAGINAW STORM WATER DISCHARGE PERMIT

<b>PROJECT NAME:</b>		JOE DEVELOPMENT COMPLEX	
Property Tax Identification #:		400-30-765-01	
Site Plan Review Date:		234	
Date Issued:		08/28/03	
Expiration Date:		08/28/05	
<b>NAME OF DEVELOPER/OWNER:</b>		<b>ENGINEER/ARCHITECT:</b>	Engineering, Inc.
Developing, Inc.		Contact Person:	JANE ENGINEER
Contact Person:	JOE DEVELOPMENT	Contact Person:	JANE ENGINEER
Street Address:	1234 Any Street	Street Address:	4321 Some Street
City, State, Zip:	Any City, MI 22222	City, State, Zip:	Any City, MI 22222
Telephone:	(989) 555-5555	Telephone:	(989) 555-6666
Fax:	(989) 555-5556	Fax:	(989) 555-6667
<b>PROJECT LOCATION:</b>		County:	County
Street Address:	Address	Town – Range, Section:	Town – Range, Section
Village/City, State Zip:	City, State, Zip	Name of Subdivision/Plat:	Name of Subdivision/Plat
		Lot No:	No.
<b>TYPE OF DEVELOPMENT:</b>		Commercial	
AREA OF DEVELOPMENT (ACRES):		3.0 acres	
AREA OF CONTRIBUTING DRAINAGE DISTRICT (ACRES):		3.2 acres	
AREA OF EXISTING ROOF AND PAVED (ACRES):		0 acre	
TOTAL ROOF AND PAVED AFTER DEVELOPMENT (ACRES):		2.2 acres	
OUTLET DRAIN:			
DESIGN IMPERVIOUS FACTOR (IF NEEDED):		0%	
MAXIMUM ALLOWABLE DISCHARGE FROM SITE (CFS):		0.6 cfs	
ACTUAL RESTRICTED DISCHARGE (CFS):		0.58 cfs	
REQUIRED ON-SITE STORAGE (CUBIC FEET):		9,650 cubic feet	
STORAGE PROVIDED (CUBIC FEET):		10,000 cubic feet	
RESTRICTOR'S SIZE AND LOCATION:		4.75 inch orifice in outlet pipe	
<b>INSPECTION REQUIREMENTS:</b>			
One final inspection upon construction completion.			
SAMPLE			
<b>COMMENTS/COMPLIANCE REQUIREMENTS:</b>			
<b>ATTACHMENTS:</b> Approved Plans			
cc: City of Saginaw		PLEASE REFER TO BACK FOR ADDITIONAL INFORMATION REGARDING THIS PERMIT	

**CHANGES TO PLANS AFTER APPROVAL:**

1. Any changes made to the approved plan after issuance of the storm water permit shall require three sets of plans to be submitted to the City 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 City of Saginaw has received all review fees.

**FEE SCHEDULE:**

The fee schedule for reviewing storm drainage submittals not going through normal PLANNING REVIEW PROCESS and performing inspection of drainage system construction is outlined below:

<b>Type of review</b>	<b>A. Fee</b>	<b>Collection of Fees</b>
Small Developments and Redevelopment (0 to 3 Acres)	As Determined	Fees added to Building Permit Fee If applicable
Large Developments and Redevelopments (3+ Acres)	As Determined	Fees added to Building Permit Fee If applicable
All Condominium, Apartment, and Platted Developments	As Determined	A deposit may be collected Prior to initiation of the review
Determination if redevelopment project is exempt from compliance.	As Determined	Fees added to Building Permit Fee If applicable

- These permit fees include:
- a) Pre-design meeting, if necessary
  - b) Initial formal review
  - c) Review of requested changes made during first review.
  - d) First inspection of site upon completion.

An additional fee will be required for subsequent reviews beyond the first formal review and subsequent inspections beyond the first site inspection. The fee will be based on the actual hours needed to complete the subsequent reviews and inspection.

Condominium projects and Platted developments will receive a refund or be billed the difference between the deposit and the actual cost.

**INSPECTION/LETTER OF CERTIFICATION REQUIREMENTS:**

Refer to Section II.E of the Storm Water Management Plan and this permit for minimum inspection and Letter of Certification requirements.

**PENALTIES/ENFORCEMENT:**

The City of Saginaw will not award any contracts for the installation of the water or sanitary sewer utilities until such time as the storm water management plan has been approved by the City of Saginaw Storm Water Management Plan Reviewer.

**APPEALS PROCESS:**

If the developer is in disagreement with any of these reviews or inspections made by the City of Saginaw and/or City of Saginaw Storm Water Management Plan Reviewer, an appeal can be made with the City of Saginaw within thirty (30) days of the review and/or inspection.



**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, 2003**

**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 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 EGLE. The rules are at the following site:

<http://www.deq.state.mi.us/documents/deq-swq-stormwater-nocrules.doc>.

**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 EGLE.

<http://www.deq.state.mi.us/documents/deq-swq-nocform.doc>.

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.deq.state.mi.us/documents/deq-swq-notform.doc>.

**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.



# DAILY INSPECTION REPORT FORM

FOR SUBDIVISIONS and CONDO DEVELOPMENTS ONLY

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: \_\_\_\_\_



**CITY OF SAGINAW  
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 <sup>3</sup> ):	
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.



**CITY OF SAGINAW**  
***STORM WATER MANAGEMENT***

**Engineer's Certification of Storm Sewer Construction for Platted Developments and Condominium Projects, or Large Developments/Redevelopments (5 acres or greater)**

PROJECT NO.: \_\_\_\_\_  
PROJECT NAME: \_\_\_\_\_  
SITE ADDRESS: \_\_\_\_\_  
CONTRACTOR NAME: \_\_\_\_\_  
ADDRESS: \_\_\_\_\_  
CITY: \_\_\_\_\_ STATE: \_\_\_\_\_ ZIP: \_\_\_\_\_  
MICHIGAN LICENSE NO.: \_\_\_\_\_

**I hereby certify that the storm sewer system installed has been inspected during construction and is in general conformance to the approved plans and specifications. In my professional opinion, this site's storm sewer system is in compliance with City of Saginaw Storm Water Management Plan design guidelines.**

\_\_\_\_\_  
Printed Name and Title Date

\_\_\_\_\_  
Signature Date

WITNESSES:  
\_\_\_\_\_  
Date

STATE OF MICHIGAN        )  
  ) ss.  
COUNTY OF \_\_\_\_\_ )

Subscribed and sworn to before me on the \_\_\_\_\_ day of \_\_\_\_\_, 201\_\_, by

\_\_\_\_\_  
Notary Public  
\_\_\_\_\_ County, Michigan  
My Commission Expires: \_\_\_\_\_



**CITY OF SAGINAW  
STORM WATER MANAGEMENT**

**Contractor's Certification of Storm Sewer Construction**

PROJECT NO: \_\_\_\_\_  
PROJECT NAME: \_\_\_\_\_  
SITE ADDRESS: \_\_\_\_\_  
CONTRACTOR NAME: \_\_\_\_\_  
ADDRESS: \_\_\_\_\_  
CITY: \_\_\_\_\_ STATE: \_\_\_\_\_ ZIP: \_\_\_\_\_  
MICHIGAN LICENSE NO: \_\_\_\_\_

**I hereby certify that I am a licensed contractor in the State of Michigan. To the best of my knowledge, information, and belief, the storm sewer system has been constructed in general conformance to the approved plans and specifications delivered to me by the Design Engineer. In my professional opinion, this site's storm sewer system is in compliance with the City of Saginaw Storm Water Management Plan design guidelines.**

\_\_\_\_\_  
Printed Name and Title

\_\_\_\_\_  
Date

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

WITNESSES:

\_\_\_\_\_

\_\_\_\_\_  
Date

STATE OF MICHIGAN     )  
  ) ss.  
COUNTY OF \_\_\_\_\_ )

Subscribed and sworn to before me on the \_\_\_\_\_ day of \_\_\_\_\_, 201\_\_, by

\_\_\_\_\_  
Notary Public  
\_\_\_\_\_ County, Michigan  
My Commission Expires: \_\_\_\_\_



**REQUEST FOR EXEMPTION  
CITY OF SAGINAW  
STORM WATER MANAGEMENT PLAN**

Development Name: \_\_\_\_\_

Development Location: \_\_\_\_\_

Total Area of Site: \_\_\_\_\_ Acre(s)

Existing Impervious Area: \_\_\_\_\_ Acre(s)

Proposed Impervious Area: \_\_\_\_\_ Acre(s)      % Change in Impervious Area \_\_\_\_\_ %

Has this site had a previous exemption?      Yes \_\_\_\_\_      No \_\_\_\_\_

Is any existing impervious area being removed?      Yes \_\_\_\_\_      No \_\_\_\_\_

Is any existing storm sewer being removed?      Yes \_\_\_\_\_      No \_\_\_\_\_

Is any existing detention storage area being disturbed?      Yes \_\_\_\_\_      No \_\_\_\_\_

Developer:

Name: \_\_\_\_\_

Contact Person: \_\_\_\_\_

Telephone: \_\_\_\_\_

Fax: \_\_\_\_\_

Engineer:

Name: \_\_\_\_\_

Contact Person: \_\_\_\_\_

Telephone: \_\_\_\_\_

Fax: \_\_\_\_\_

**Note: A site plan, including the existing site features, proposed site features, and a location map must be included with this request form.**





## **APPENDIX C**

EGLE JOINT PERMIT APPLICATION

SAGINAW COUNTY ROAD COMMISSION PERMIT APPLICATION

SAGINAW COUNTY SOIL EROSION AND SEDIMENTATION CONTROL PERMIT  
APPLICATION

EGLE NPDES NOTICE OF COVERAGE AND NOTICE OF TERMINATION



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## EGLE JOINT PERMIT APPLICATION

*Click on*



<https://miwaters.deq.state.mi.us/miwaters/external/home>



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## SAGINAW COUNTY ROAD COMMISSION PERMIT APPLICATION

Information regarding permits available at the following website:

<http://www.ssrc-mi.org>

The Saginaw County Road Commission office is located as follows:

**Saginaw County Road Commission  
3020 Sheridan Avenue  
Saginaw, MI 48601**

**(989) 752-6140**



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## SAGINAW COUNTY SOIL EROSION AND SEDIMENTATION CONTROL PERMIT APPLICATION

*Click on*



<http://www.saginawcounty.com/PublicWorks/Permits-and-Forms.aspx>



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EGLE  
NPDES NOTICE OF COVERAGE  
AND  
NOTICE OF TERMINATION

*Click on*



<https://miwaters.deq.state.mi.us/miwaters/#/external/home>

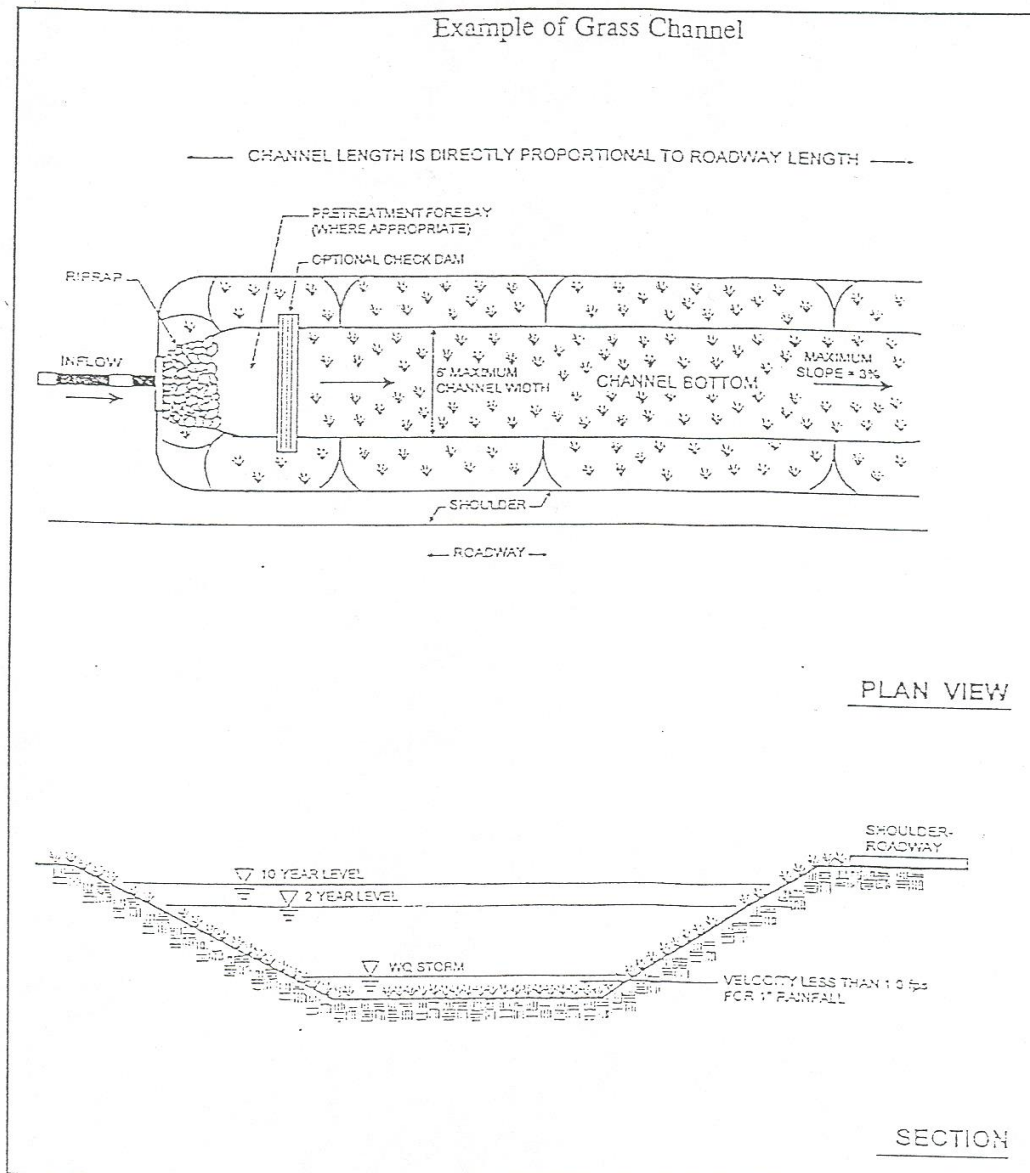


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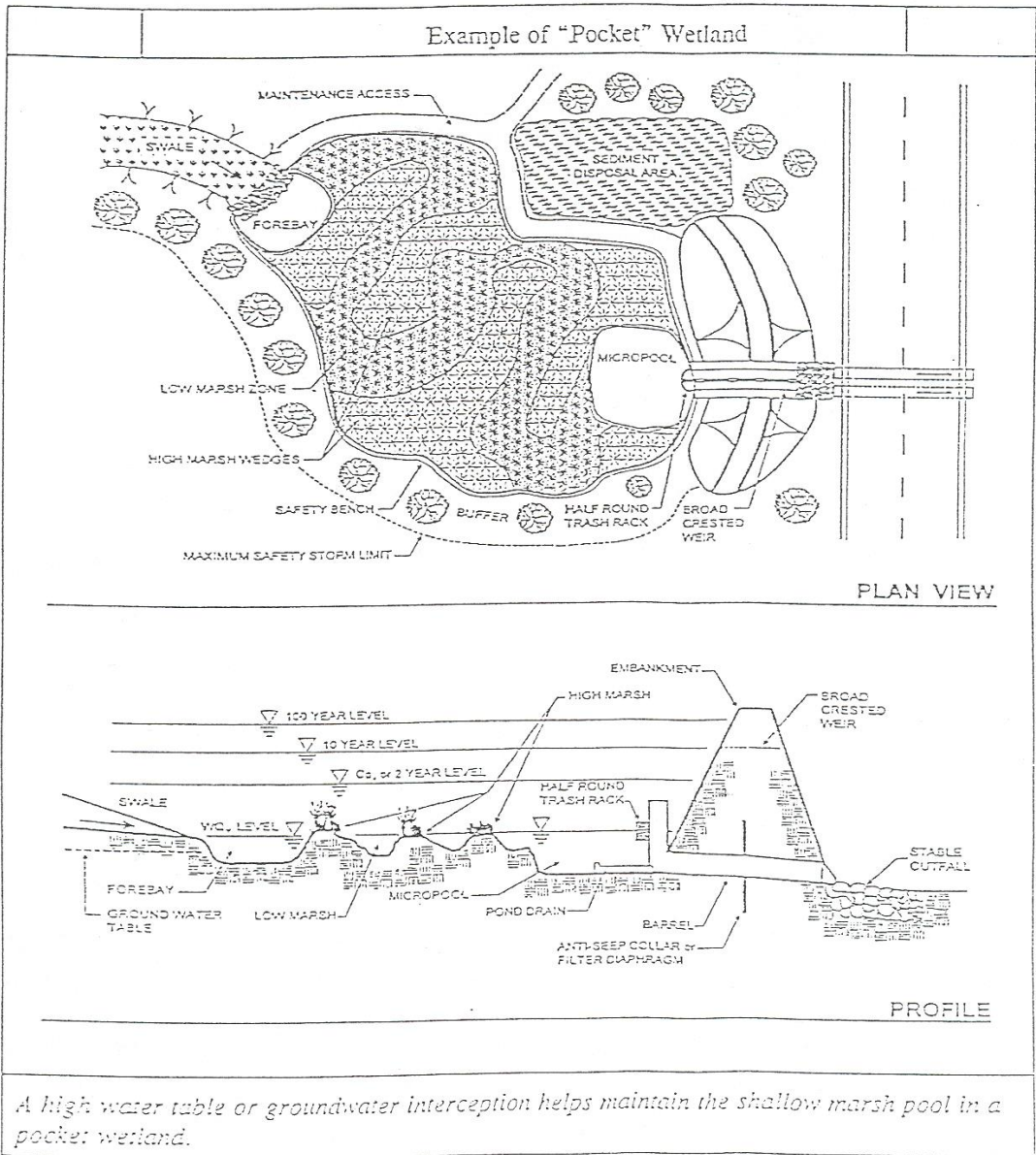
# **APPENDIX D**

## DESIGN EXAMPLES

### Example of Grass Channel



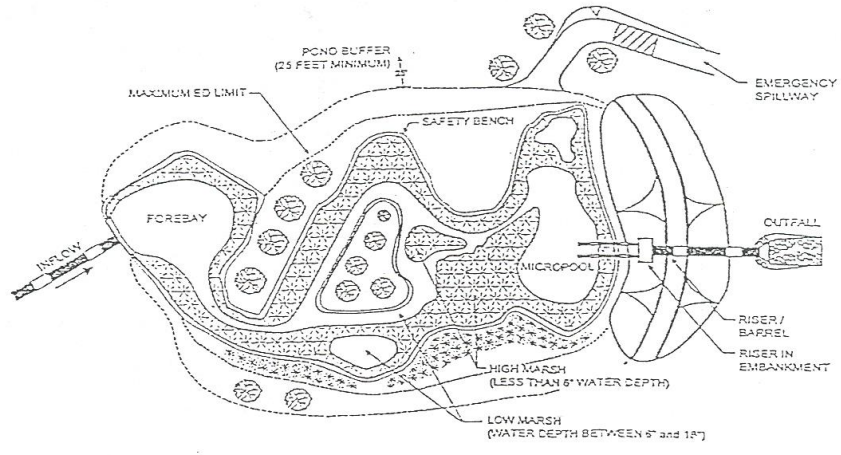
Source: State of Maryland, 1998



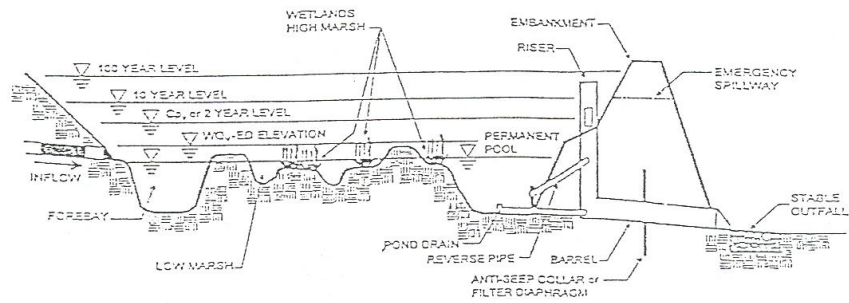
Source: State of Maryland, 1998



Example of Extended Detention Shallow Wetland



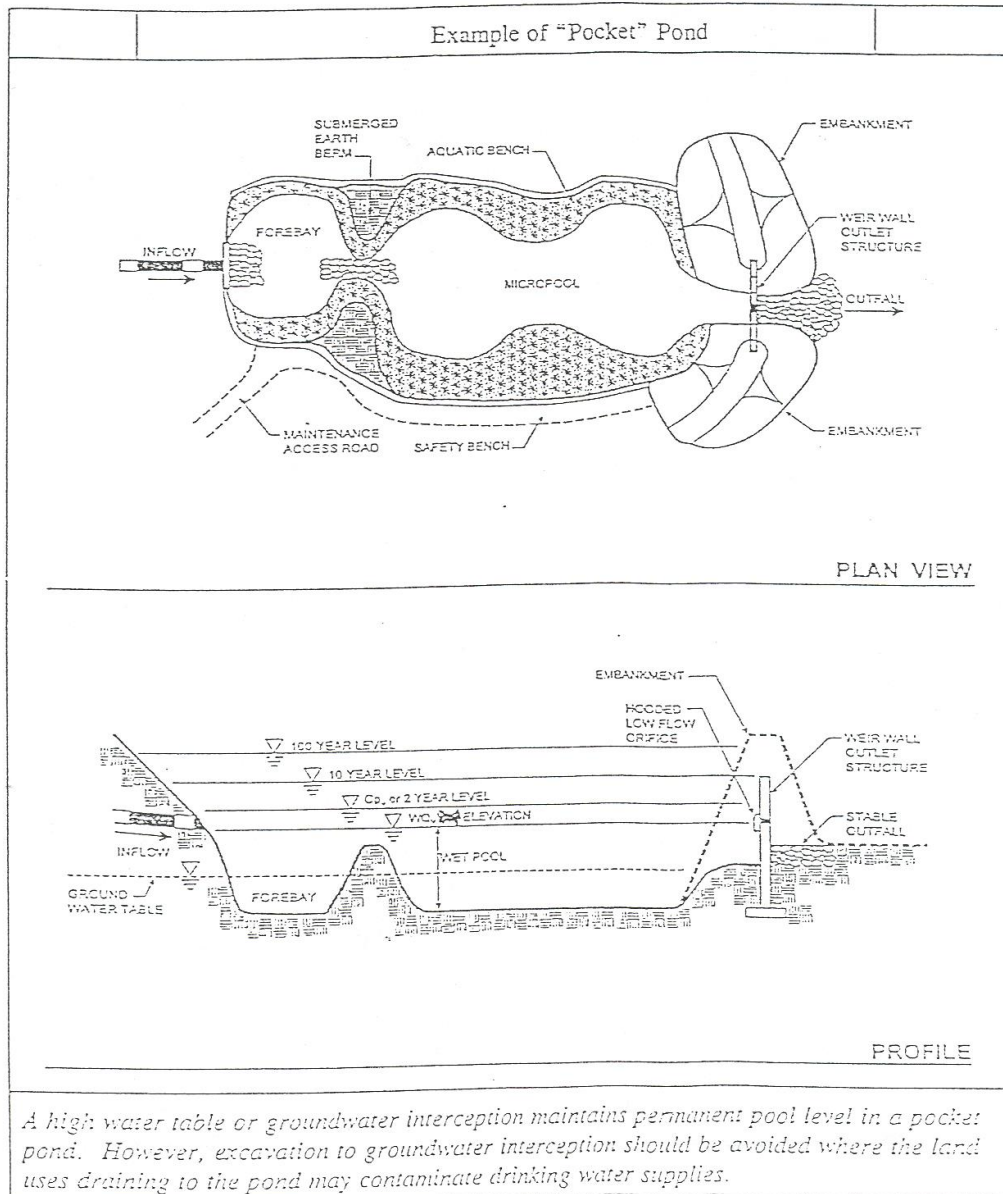
PLAN VIEW



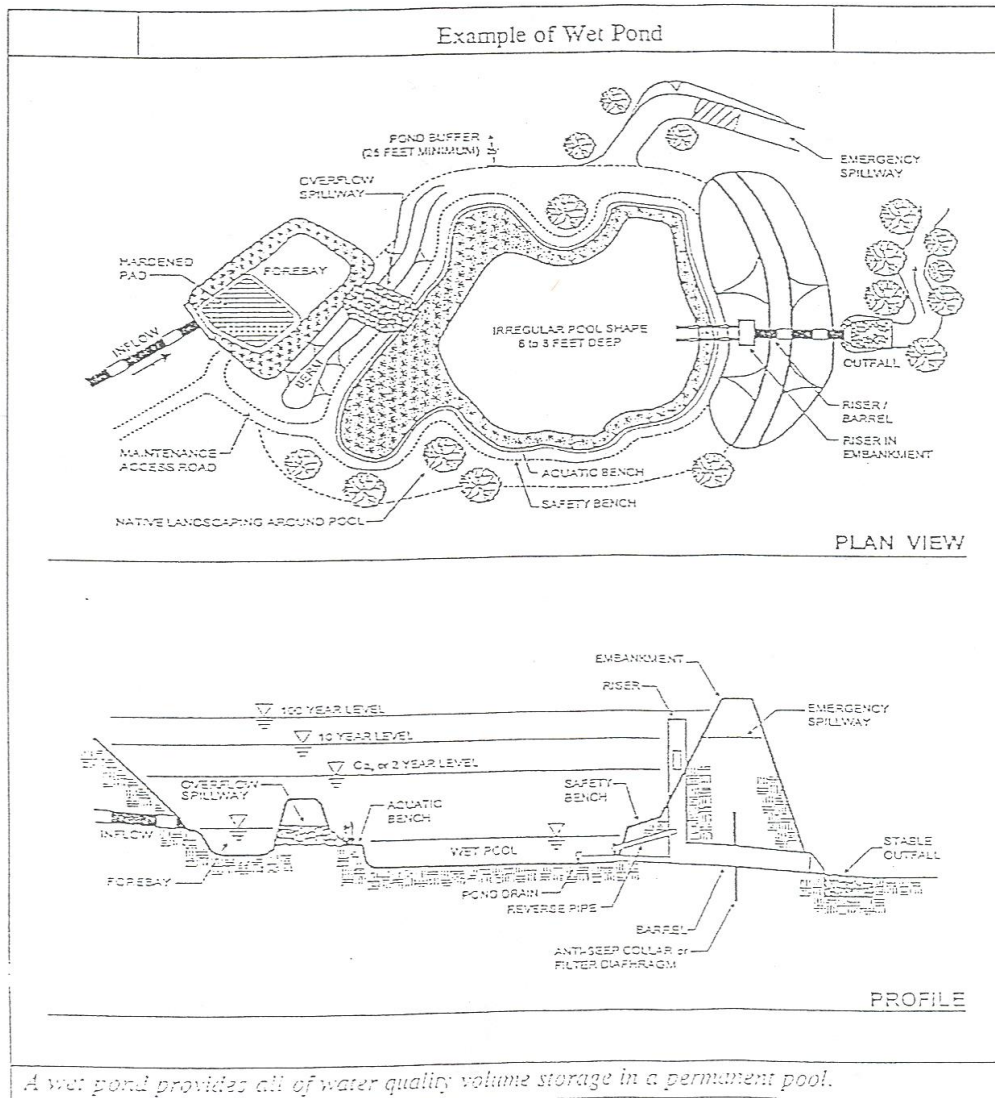
PROFILE

*ED shallow wetlands provide water quality storage by a combination of shallow marsh pool and extended detention storage.*

Source: State of Maryland, 1998



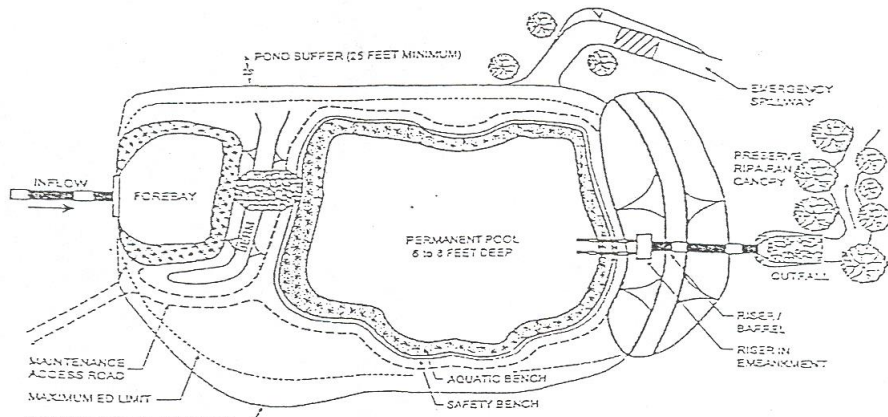
Source: State of Maryland, 1998



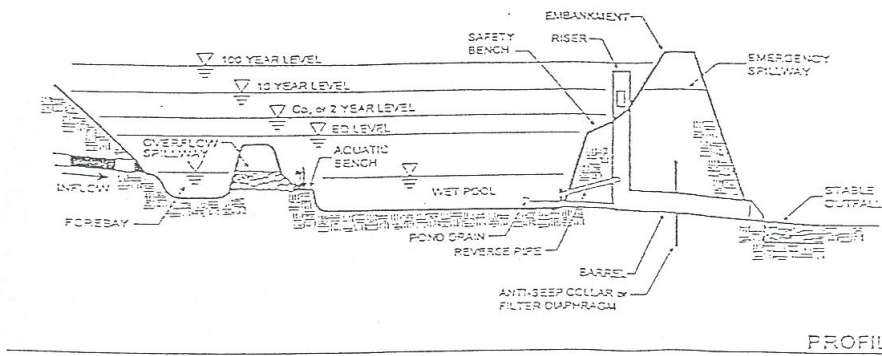
*A wet pond provides all of water quality volume storage in a permanent pool.*

Source: State of Maryland, 1998

Example of Wet Extended Detention Pond



PLAN VIEW



PROFILE

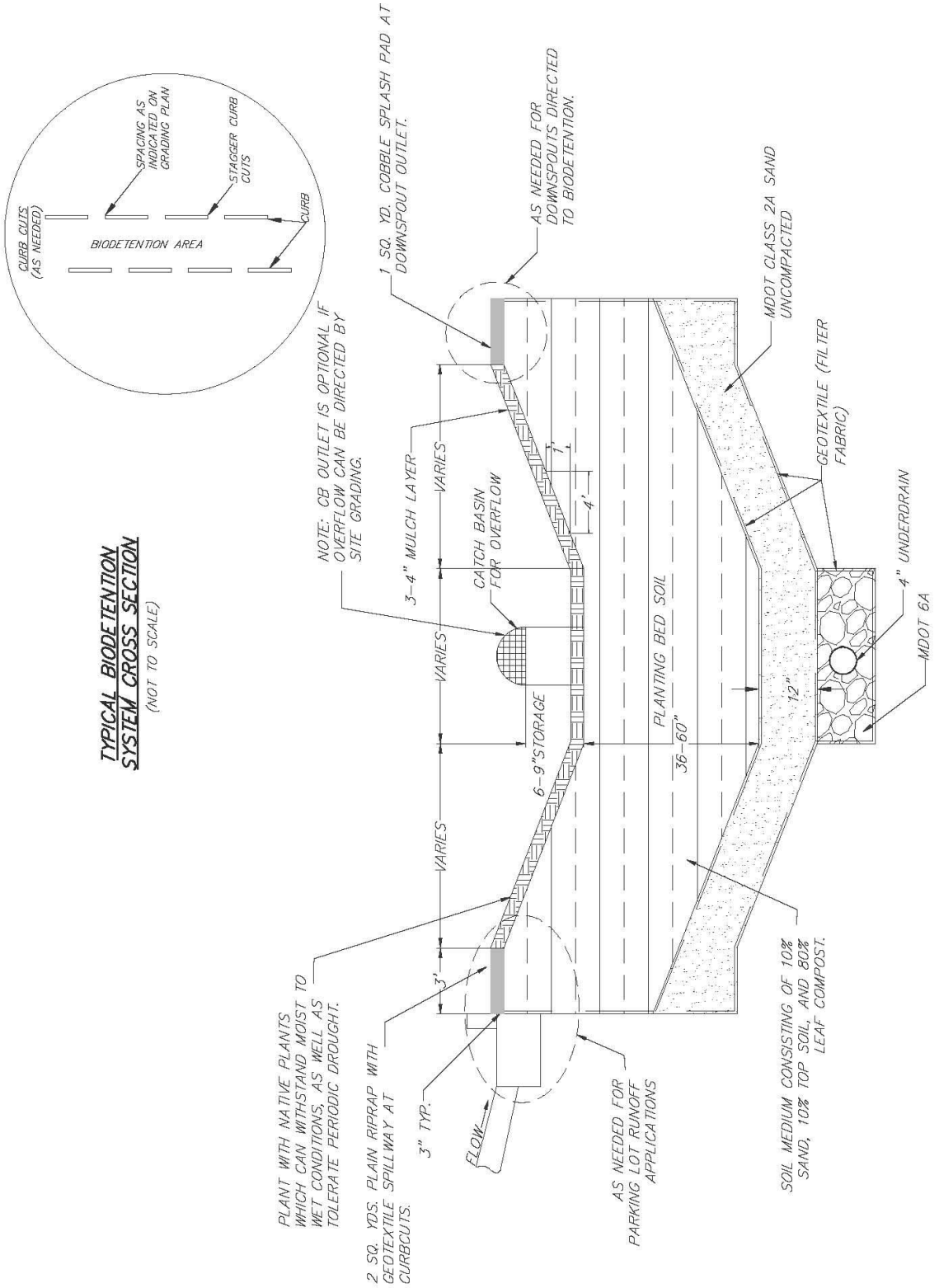
*The wet ED pond provides water quality storage through a combination of permanent pool and extended detention storage.*

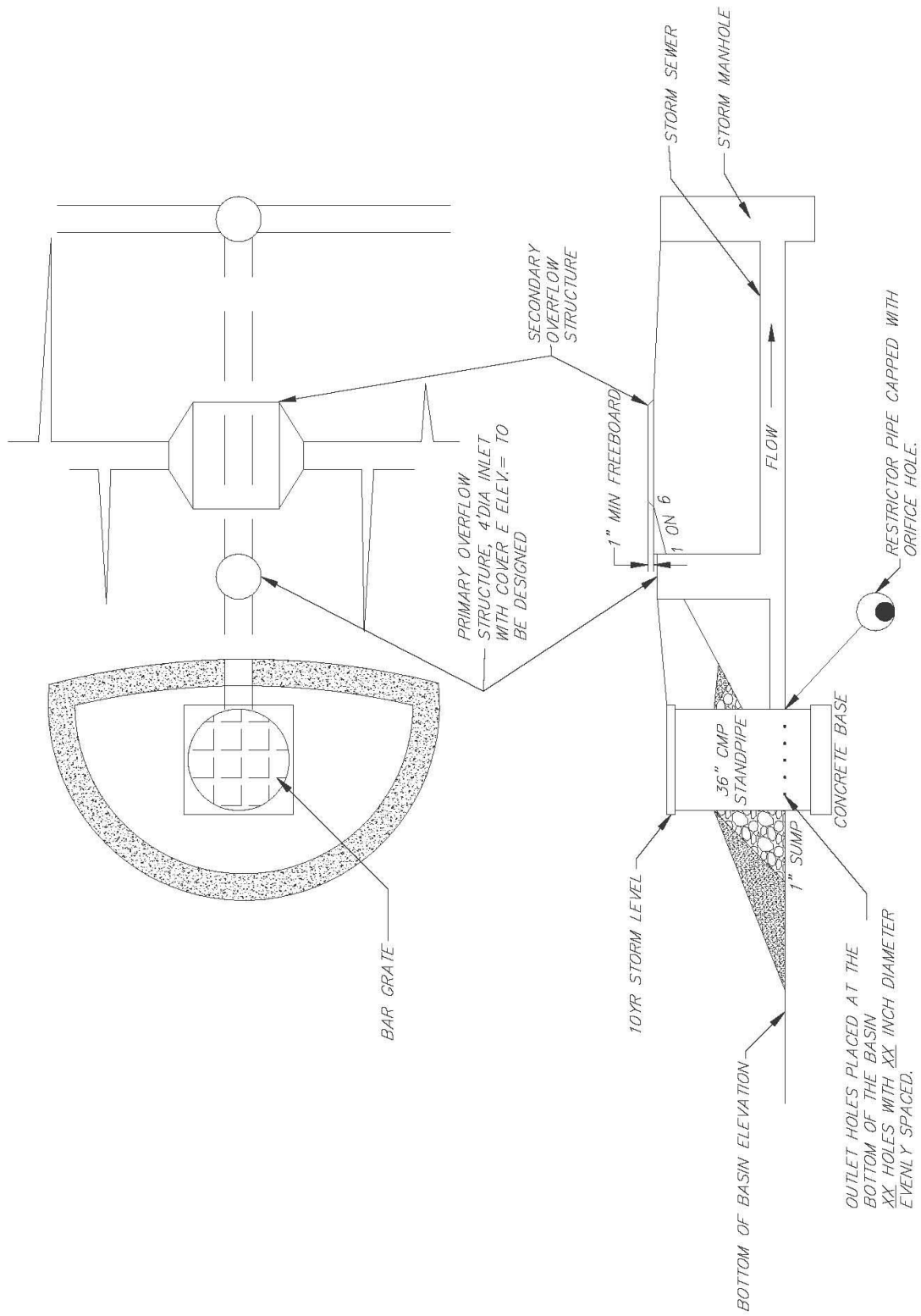
Source: State of Maryland, 1996





**TYPICAL BIODETENTION  
SYSTEM CROSS SECTION**  
(NOT TO SCALE)





**DETENTION BASIN OUTLET FILTER**

(NOT TO SCALE)





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## **APPENDIX E**

MAINTENANCE PLAN AND BUDGET

MAINTENANCE PLAN AND BUDGET SAMPLE



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## 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
<b>Budget</b>	<b>\$ 2,550.00</b>

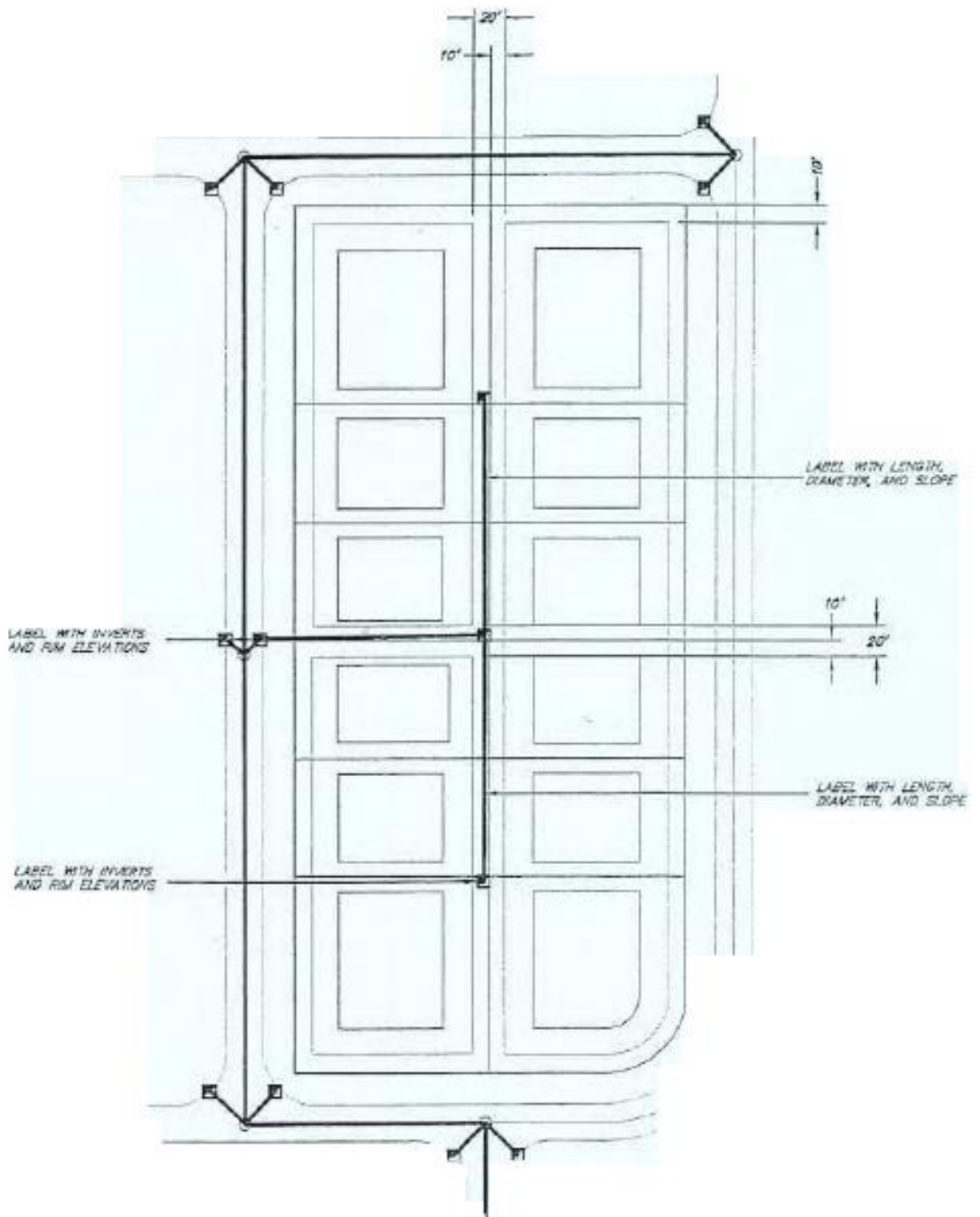
**NOTE:** Maintenance Plans and budgets vary widely due to the size and unique characteristics of each storm water management system proposed. The budget is intended for use as a starting point in the development of an appropriate maintenance plan specific to the size and components of each system.

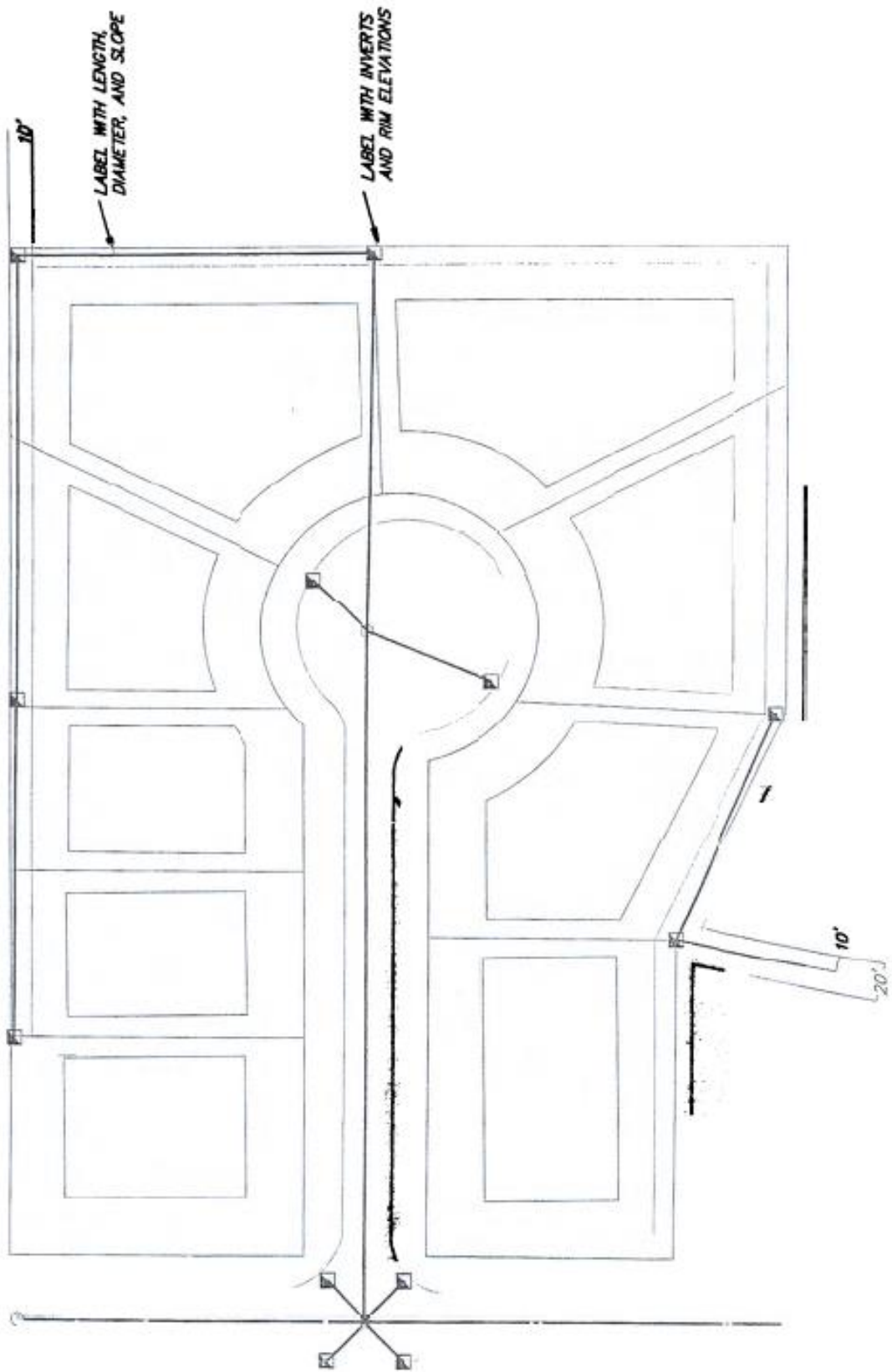


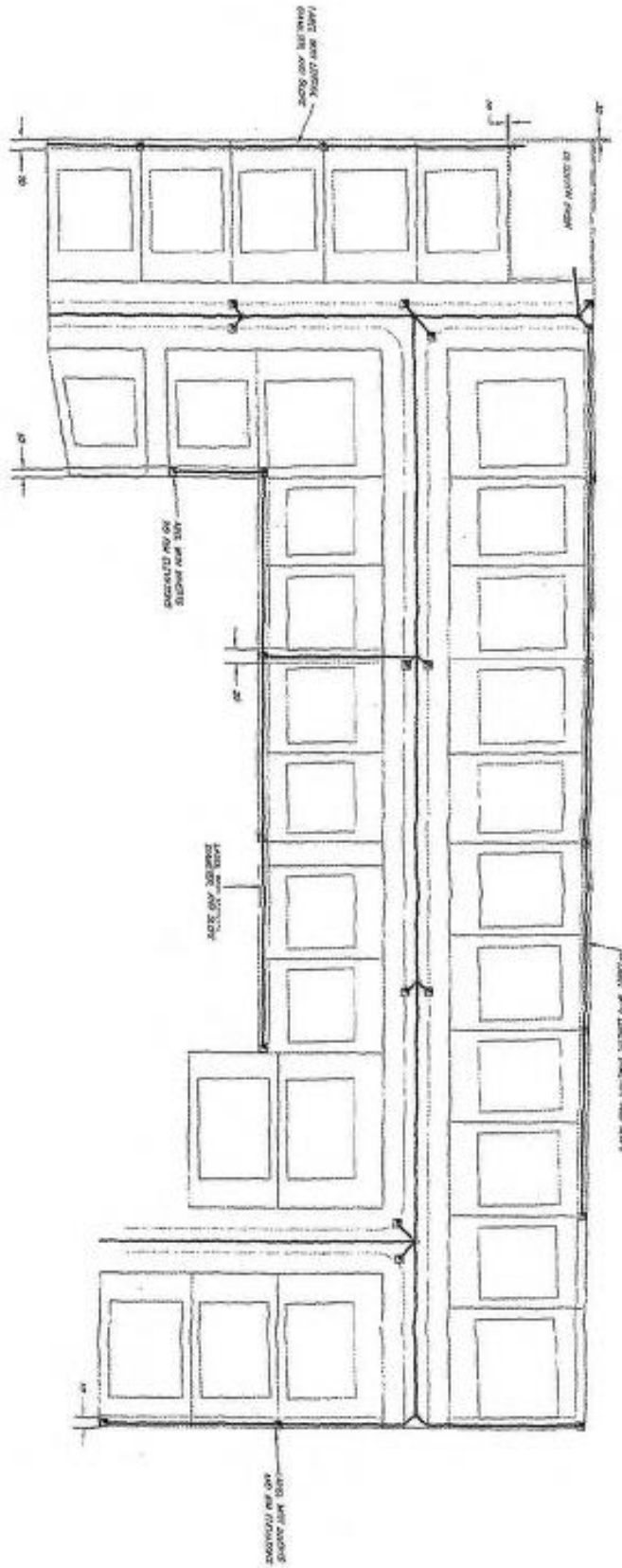
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## **APPENDIX F**

REAR LOT DESIGN EXAMPLE









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## **APPENDIX G**

### **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:

<b>Description of area</b>	<b>Runoff coefficients</b>
Business	
Downtown areas	0.85
Neighborhood areas	0.6
Residential	
Single-family areas	0.4
Multi-units, detached	0.5
Multi-units, attached	0.7
Residential (suburban)	0.35
Apartment dwelling areas	0.6
Industrial	
Light areas	0.7
Heavy areas	0.9
Parks, cemeteries	0.2
Playgrounds	0.3
Railroad yard areas	0.3
Unimproved areas	0.2

*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:

<b>Character of surface</b>	<b>Runoff coefficients</b>
Streets	
Asphaltic and concrete	0.9
Brick	0.8
Roofs	0.9
Lawns, sandy soil	
Flat, 2%	0.10
Average, 2 to 7%	0.15



Steep, 7%	0.20
Lawns, heavy soil	
Flat, 2%	0.17
Average, 2 to 7%	0.22
Steep, 7%	0.3

*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).



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## **APPENDIX H**

### **BEST MANAGEMENT PRACTICES – RULES AND REGULATIONS**

## Best Management Practices

### Regulations and Requirements

#### Requirement to Prevent, Control, and Reduce Storm Water Pollutants:

- (a) Authorization to Adopt and Impose Best Management Practices. The City will adopt requirements identifying Best Management Practices for any activity, operation, or facility, which may cause or contribute to pollution or contamination of storm water, the storm drain system, or waters of the State as a separate *BMP Guidance Series*. Where Best Management Practices requirements are promulgated by the County or any federal, State of Michigan, or regional agency for any activity, operation, or facility which would otherwise cause the discharge of pollutants to the storm drain system or water of the State, every person undertaking such activity or operation, or owning or operating such facility shall comply with such requirements.
- (b) Responsibility to Implement Best Management Practices. Notwithstanding the presence or absence of requirements promulgated pursuant to subsections (a), any person engaged in activities or operations, or owning facilities or property which will or may result in pollutants entering storm water, the storm drain system, or waters of the State shall implement Best Management Practices to the extent they are technologically achievable to prevent and reduce such pollutants. The owner or operator of a commercial or industrial establishment shall provide reasonable protection from accidental discharge of prohibited materials or other wastes into the county or municipal storm drain system or watercourses. Facilities to prevent accidental discharge of prohibited materials or other wastes shall be provided and maintained at the owner or operator's expense.

Best Management Practices required by the City can be obtained from the City Engineer by requesting the BMP manual appropriate to a commercial or industrial activity from the *BMP Guidance Series*.

The standard BMP Guidance series to utilize within the City of Saginaw can be found in the following sources:

- Guidebook of Best Management Practices for Michigan Watersheds, published by the Michigan Department of Environmental Quality – Water Division.  
[http://www.michigan.gov/documents/deq/deq-wb-nps-Intro\\_250601\\_7.pdf](http://www.michigan.gov/documents/deq/deq-wb-nps-Intro_250601_7.pdf)
- Soil Erosion and Sedimentation Control Guidebook, February 2003, from the Michigan Department of Management and Budget's – Infrastructure Services Design and Construction Division.
- Michigan Department of Transportation – Drainage Manual, Chapter 9 – Best Management Practices found at the following web site.  
<http://www.michigan.gov/stormwatermgmt/0,1607,7-205--93193--,00.html>

- Any recommended or required BMPs that are established in Watershed Management Plans written for the Upper Saginaw, Lower Tittabawassee, Lower Cass Rivers, or Swan Creek. This will be maintained by SASWA

If a BMP is to be utilized and its specifications are not found in the above resources, the proposed BMP with appropriate references can be submitted to the SASWA for review. If the BMP review board deems it acceptable and it meets the goals and objectives of similar BMPs, and is approved by the City it may be utilized.

**LIST OF BEST MANAGEMENT PRACTICES:**

**BMP NAME:**

ARMORING  
 BOARDWALKS  
 BREAKWALLS  
 BRIDGES (BRIDGE CROSSINGS)  
 BUFFER AREA  
 BULKHEADS  
 CART PATHS  
 CATCH BASIN INLET PROTECTION  
 CHUTES  
 COMPOSTING  
 CONCRETE PAVERS  
 CONSTRUCTION SEQUENCE  
 CONTOUR GRADING  
 CRITICAL AREA SEEDING  
 CULVERTS (CULVERT CROSSING)  
 DEBRIS BASIN  
 DECKING  
 DE-ICING CHEMICAL USE  
 DEWATERING BASIN  
 DETENTION BASIN WET DET. BASIN;  
  
 DOWNDRAINS  
 DRAINAGE TILE  
 DRIVEWAY  
 DROP BOXES  
 DROP CONTROL  
  
 DROP INLET SPILLWAYS  
 DROP PIPES  
 DUAL PURPOSE BASIN  
 EARTH EMBANKMENT STRUCTURES  
 EGRESS ROAD  
 EMBANKMENT POND  
 ENERGY DISSIPATORS  
 EROSION CONTROL BLANKETS  
 EXCAVATED PONDS  
 EXCELSIOR BLANKETS  
 EXFILTRATION BASIN  
 FENCES  
 FILL PATHS  
 FILTER FENCES  
 FINDAMS

**BMP CLASSIFICATION OR ALTERNATE NAME:**

STREAM BANK STABILIZATION;RIPRAP  
 WETLAND CROSSINGS  
 SLOPE/SHORELINE STABILIZATION  
 WATERCOURSE CROSSINGS  
 BUFFER/FILTER STRIP  
 SLOPE/SHORELINE STABILIZATION  
 WETLAND CROSSINGS  
 FILTER  
 GRADE STABILIZATION STRUCTURE  
 ORGANIC DEBRIS DISPOSAL  
 MODULAR PAVEMENT  
 STAGING & SCHEDULING  
 GRADING PRACTICES  
 CRITICAL AREA STABILIZATION  
 WATERCOURSE CROSSINGS  
 SEDIMENT BASIN  
 WETLAND CROSSINGS  
 WINTER ROAD MANAGEMENT  
 SEDIMENT BASIN  
 EXTENDED DET. BASIN;  
 PARKING LOT STORAGE; ROOFTOP STORAGE  
 GRADE STABILIZATION STRUCTURES  
 SUBSURFACE DRAIN  
 ACCESS ROAD  
 GRADE STABILIZATION STRUCTURES  
 STRUCTURES GRADE STABILIZATION  
 STRUCTURES  
 GRADE STABILIZATION STRUCTURES  
 GRADE STABILIZATION STRUCTURES  
 EXTENDED DETENTION BASIN  
 GRADE STABILIZATION STRUCTURES  
 ACCESS ROAD  
 POND CONSTRUCTION AND MGT.  
 STABILIZED OUTLETS; RIPRAP  
 MULCHING  
 POND CONSTRUCTION AND MGT.  
 MULCHING  
 INFILTRATION BASIN  
 CONSTRUCTION BARRIERS  
 WETLAND CROSSINGS  
 FILTERS  
 ROOFTOP STORAGE

FLUMES	GRADE STABILIZATION STRUCTURES
FOOTPATH	WETLAND CROSSINGS
GABIONS	SLOPE/SHORELINE STABILIZATION
GEOTEXTILE FABRIC FILTERS;	MULCHING
GRASSED CHANNEL	GRASSED WATERWAY
GROINS	SLOPE/SHORELINE STABILIZATION
GRUBBING	LAND CLEARING
HAUL ROAD	ACCESS ROAD
HIGH RISK EROSION AREAS	CRITICAL AREA STABILIZATION
HYDROSEEDING	SEEDING
INGRESS ROAD	ACCESS ROAD
INFILTRATION POND	INFILTRATION BASIN
IN-CHANNEL ENERGY DISSIPATOR	CHECK DAM
INTEGRATED PEST MANAGEMENT PESTICIDE MGT.; LAWN MAINTENANCE	
INTEGRATED TURF MANAGEMENT PESTICIDE MGT.; LAWN MAINTENANCE	
INTERCEPTORS	DIVERSIONS
INTERCEPTOR DRAIN	SUBSURFACE DRAIN
LANDSCAPE PLANTING	TREES, SHRUBS & GROUND COVERS
LANDSCAPING	TREES, SHRUBS & GROUND COVERS
LAND SMOOTHING	GRADING PRACTICES
LATERAL DRAIN	SUBSURFACE DRAIN
LATTICE CONCRETE BLOCKS	MODULAR PAVEMENT
LIMING	SOIL MANAGEMENT
LOG JAM STRUCTURES	STREAM BANK STABILIZATION
MONOSLAB CONCRETE BLOCKS	MODULAR PAVEMENT
MODULAR BRICK	MODULAR PAVEMENT
NATURAL AREA	BUFFER/FILTER STRIP
NUTRIENT MANAGEMENT	FERTILIZER MANAGEMENT
NITROGEN/PHOSPHORUS MGT.	FERTILIZER MANAGEMENT
OIL/GRIT TRAPS	OIL/GRIT SEPARATORS
OUTLETS	STABILIZED OUTLET
OUTLET PROTECTION	STABILIZED OUTLET
PALMITER METHOD	STREAM BANK STABILIZATION
PERFORATED PAVERS	MODULAR PAVEMENT
PERVIOUS PAVEMENT	POROUS ASPHALT PAVEMENT
PERMEABLE PAVEMENT	POROUS ASPHALT PAVEMENT
PHASING	STAGING & SCHEDULING
PLATFORMS	WETLAND CROSSINGS
PRE-CAST CONCRETE	MODULAR PAVEMENT
PUMPING	DEWATERING
RELIEF DRAIN	SUBSURFACE DRAIN
RETAINING WALLS	SLOPE/SHORELINE STABILIZATION
REVTMENTS	SLOPE/SHORELINE STABILIZATION;
	STREAMBANK STABILIZATION; RIPRAP
ROADWAYS (HAUL ROAD)	ACCESS ROAD
ROADWAYS (SECONDARY ROAD)	ACCESS ROAD
ROADWAY (INGRESS/EGRESS)	ACCESS ROAD
ROOFTOP DETENTION BARRIERS	ROOFTOP STORAGE
ROUGH GRADING	GRADING PRACTICES
RURAL LAWN CARE	LAWN MAINTENANCE
SALT PILES	WINTER ROAD MANAGEMENT
SEAWALLS	SLOPE/SHORELINE STABILIZATION
SEEPAGE BASIN	INFILTRATION BASIN
SEQUENCING	STAGING & SCHEDULING
SERVICE AREA EQUIPMENT	MAINTENANCE/STORAGE AREA

SETTLING BASIN  
SHOP AREA  
SILT FENCES  
SILT FLOATATION CURTAINS  
SINGLE STAGE DETENTION BASIN  
SOD WATERWAY  
SOIL ADDITIVES/AMENDMENTS  
SOIL CONDITIONING  
SOIL PILES  
SOIL TEST  
SPECIAL GRADING PRACTICES  
SPILLWAYS  
SPRIGGING

STABILIZED CONSTR. ENTRANCE  
STOCK PILES  
STORAGE PILES  
STORM DRAIN INLET PROTECTION  
STRAIGHT-PIPES  
STREAM CROSSINGS  
STREAM BANK PROTECTION  
SUMP  
SWALE  
TACKING  
TEMPORARY CROSSING  
TILE  
TOEWALLS  
TREE PRESERVATION  
TREE REMOVAL  
TURBIDITY CURTAIN  
TURF ESTABLISHMENT  
TWO-STAGE DETENTION BASIN  
UNDERGROUND DRAIN  
URBAN LAWN CARE  
USED OIL DISPOSAL  
UTILITY CROSSINGS

VEGETATIVE SWALES  
VEGETATIVE ESTABLISHMENT  
WATER QUALITY INLETS  
WET POND  
WOOD CHIP PATHS  
YARD WASTE MANAGEMENT

SEDIMENT BASIN  
EQUIPMENT MAINTENANCE/STORAGE AREA  
FILTERS  
FILTERS  
EXTENDED DETENTION BASIN  
GRASSED WATERWAY  
SOIL MANAGEMENT  
SOIL MANAGEMENT  
SPOIL PILES  
SOIL MANAGEMENT  
GRADING PRACTICES  
GRADE STABILIZATION STRUCTURES  
TREES, SHRUBS & GROUND COVERS;  
DUNE/SAND STABILIZATION  
ACCESS ROAD  
SPOIL PILES  
SPOIL PILES  
FILTERS  
GRADE STABILIZATION STRUCTURES  
WATERCOURSE CROSSINGS  
STREAM BANK STABILIZATION; RIPRAP  
SEDIMENT BASIN  
GRASSED WATERWAY  
MULCHING  
WATERCOURSE CROSSINGS  
SUBSURFACE DRAIN  
GRADE STABILIZATION STRUCTURES  
TREE PROTECTION  
LAND CLEARING  
FILTERS  
SEEDING; SODDING  
EXTENDED DETENTION BASIN  
SUBSURFACE DRAIN  
LAWN MAINTENANCE  
HOUSEHOLD HAZARDOUS WASTE DISPOSAL  
WATERCOURSE CROSSINGS; WETLAND  
CROSSINGS  
GRASSED WATERWAYS  
SEEDING; SODDING  
OIL/GRIT SEPARATORS  
WET DETENTION BASIN  
WETLAND CROSSING  
ORGANIC DEBRIS DISPOSAL