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CITY OF FRANKENMUTH  
SAGINAW COUNTY, MICHIGAN



**STORM WATER MANAGEMENT PLAN**

Requirements  
for Storm Water Drainage System Design  
for Development and Redevelopment Projects  
within the City of Frankenmuth

Prepared By:



Revised February, 2008





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## TABLE OF CONTENTS

I. INTRODUCTION .....	3
A. Objective of the Storm Water Management Plan .....	3
B. Administration of the Storm Water Management Plan.....	3
C. Development or Re-development that requires a Storm Water Management Plan .....	4
II. ADMINISTRATION .....	5
A. Definitions.....	5
B. Review Procedures.....	9
1. Pre-design Meeting .....	9
2. Formal Review .....	10
C. Plan Approval/Issuance of Storm Water Permit.....	11
D. Changes to Plan after Approval .....	11
E. Inspection Requirements.....	11
F. Fee Schedule .....	12
G. Penalties and Enforcement.....	13
H. Development Exemptions.....	13
I. Appeals Process .....	13
III. STORM DRAINAGE SYSTEM WITHIN CITY OF FRANKENMUTH .....	14
A. Jurisdiction of Various Regulatory Agencies .....	14
B. Jurisdiction of City of Frankenmuth .....	15
IV. DESIGN CALCULATIONS .....	16
A. Allowable Discharge Rate (Qa).....	16
B. Discharge Restrictor Requirements .....	16
C. Storm Water Detention Requirements .....	17
D. Storm Water Conveyance Requirements .....	17
V. DESIGN STANDARDS .....	20
A. Requirements .....	20
1. General.....	20
2. Storm Sewer Piping .....	21
3. Detention / Retention .....	22
4. Rear Lot Drainage.....	24
B. General Compliance Guidelines .....	26
C. Variances from Requirements.....	26
D. Storm Water System Maintenance Plans .....	27





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## *APPENDIX A*

1. Storm Water Discharge Permit Application
2. Checklist
3. Storm Water Discharge Permit
4. Daily Inspection Report Form

## *APPENDIX B*

### Web site addresses for:

- Saginaw County Land Development Advisory Committee Meetings
- Michigan Dept. of Transportation
- Michigan Dept. of Environmental Quality
- Saginaw County Road Commission
- Saginaw County Soil Erosion and Sediment Control
- Saginaw County Public Works Commissioner

## *APPENDIX C*

1. Storm Water Management Ordinance
2. Storm Water Permit Application Fee Resolution

## *APPENDIX D*

1. Drainage District Descriptions
2. Unit Allowable Discharge Rates
3. Drainage District Map

## *APPENDIX E*

1. Sample Maintenance Plan

## *APPENDIX F*

1. Design Examples





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## I. INTRODUCTION

### A. The Objective of the Storm Water Management Plan.

The City of Frankenmuth storm water collection systems are reaching capacity in many districts due to the increasing development and redevelopment of properties. This Storm Water Management Plan will establish the framework through which storm water detention measures and the design of storm water collection systems will be implemented. This Plan will also ensure that the present storm water collection systems are able to manage the increased amounts of storm water resulting from this development and redevelopment. The Plan requires storm water management design practices that will help to minimize the impacts of proposed development or redevelopment projects on the existing drainage systems.

The Plan provides detailed information about the City of Frankenmuth's storm drainage systems and explains the City of Frankenmuth's proactive approach to managing storm water. The Storm Water Management Ordinance defines the means of implementing the Plan. This Plan will detail the process that must be followed to gain approval for new developments or redevelopment projects.

In addition, the Plan will help to insure that adequate drainage systems are being constructed for future development in the City of Frankenmuth. Finally, this Plan is intended to aid developers in the design of their storm water runoff collection and detention systems.

The Storm Water Management Plan includes:

1. A summary of the administrative procedures including meeting requirements, review procedures, inspection requirements, fee schedule, issuance of the permit, enforcement, and penalties, and other agency requirements.
2. A summary of the existing drainage conditions within the City.
3. A description of design calculations, standards, and guidelines.
4. A storm water permit application and drainage design checklist.
5. A drainage district map of the City of Frankenmuth.
6. Sample designs, details, and layout examples.
7. Website addresses for various forms or permits that may be needed for storm water construction projects.

### B. Administration of the Storm Water Management Plan.

The Storm Water Management Plan will be implemented and operated by the City of Frankenmuth Department of Public Works (DPW) Superintendent or his/her designee. The DPW Superintendent will be responsible for the review of new development and redevelopment plans and for the installation and maintenance of measures within the City of Frankenmuth to accomplish the plan. The DPW Superintendent will work in conjunction





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with the City of Frankenmuth administration, Planning Commission and other necessary regulatory agencies, as well as, architectural and engineering consultants, landowners, and developers within the City of Frankenmuth.

**C. Development or Re-development that requires a storm water management plan:**

The Storm Water Management Plan establishes the framework through which allowable discharge rates, detention measures and the design of storm water collection systems will be implemented. The Plan details the process that must be followed to gain approval for new developments and redevelopment projects. The SWMP will address storm water quality standards, best management practices (BMPs) and innovative design for the City of Frankenmuth to assure that the storm water discharged into storm water drainage systems under jurisdiction of the county or state is as clean as possible. The plan requires storm water management design practices that will help to minimize the impacts of proposed development or redevelopment projects on the existing storm drainage system. In addition, these guidelines will help ensure adequate drainage systems are being constructed for future development in the City. The following types of developments and earth changes require a Storm Water Management Plan:

1. Land development proposals subject to site plan review requirements in the City Zoning Ordinance.
2. Subdivision plat proposals.
3. Site Condominium developments pursuant to the Condominium Act, P.A. 59 of 1978 as amended; MCLA 559.101 et.seq.
4. Any development on property divided by land division in connection with which one or more public or private roads are created or extended, and/or in connection with which more than three parcels of less than one acre are created.
5. Any proposal to mine, excavate, or clear and grade or otherwise develop one acre or more of land for purposes other than routine single family residential landscaping and gardening, or any proposal within 500 feet of an inland lake, river, or stream.
6. Development or re-development within one of the City's "Priority" areas as defined on the storm water map administered by the DPW Superintendent.
7. Re-development that increases the impervious surface of a site by either 5% or 5,000 square feet.
8. Re-development of a parcel that does not have an existing storm water management plan.





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## II. ADMINISTRATION

### A. DEFINITIONS.

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

**Allowable Discharge:** The restricted discharge from a site after development or redevelopment as calculated in accordance with the Storm Water Management Plan.

**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.

**Bankfull Flood event:** studies have shown that development and cause stream flow fluctuations that can precipitate erosive events. To help alleviate this condition storm water discharges from site developments into erosive areas may have to capture and slowly discharge this event, this is the volume of the 1.5 yr 24 hour storm event or  $8170 \times \text{Contributing Area} \times \text{Weighted Runoff Coefficient}$ . There is a specific timed discharge rate for this in the design area of this plan.

**Best Management Practices (BMPs):** Structural, vegetative or managerial practices used to protect and improve the quality of surface water and groundwater.

**Bio-filtration:** is a soil filtration system. Principal components of the system (figures 1&2) include:

- a pretreatment grass filter strip,
- surface planting with woody and herbaceous plant species,
- a surface 2-3 inch thick mulch layer,
- a minimum 2 foot thick sandy loam or loamy sand soil-textured planting soil media (See specifications),
- a 6-inch thick sand layer, and
- Perforated PVC pipe under-drainage within a 15-inch thick gravel bed protected with geotextiles.

**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, rushes, native plants, other water and drought tolerant flowers and bushes are commonly found in bioswales because they help to trap the water and force it to absorb, rather than flowing through the bio-swale to the other side. It should be noted that these systems are generally dry most of the time and do not have standing water in them.

**City Engineer:** The engineering person, firm or corporation formally designated by City of Frankenmuth to act as its Engineer.

**Conduit:** Any channel, pipe, sewer or culvert used for the conveyance or movement of water whether open or closed.





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**Control Elevation:** Contour lines and points of predetermined elevation used to denote a detention storm area on a plat or site drawing.

**Complete Storm Water Discharge Permit Submittal includes:**

- a completed permit application (Appendix A),
- three sets of plans, three sets of calculations,
- a completed drainage checklist (Appendix A),
- deposit/fee for review and
- inspection in accordance with City ordinance, and
- any other supporting information for the site deemed necessary during the pre-design meeting/correspondence.
- The plans and calculations shall comply with the requirements of this Storm Water Management Plan.

**Design Discharge Rate:** Unit allowable discharge rate per acre of land proposed for development or redevelopment. Design discharge rates will vary between drainage districts based on existing drainage system capacity. The City drainage map outlines drainage district lines and design discharge rates.

**Design Imperviousness Factor (IMP):** The actual proposed percentage of impervious surface for a proposed development or redevelopment. The IMP is used to calculate the design discharge (Qd). The design discharge is used to determine storm sewer sizes and required detention volumes. A minimum IMP for various zoned land uses must be established in a pre-design meeting prior to a complete storm water discharge permit submittal. Minimum IMP's are 30% for residential, 60% for multi-family residential, 70% for commercial, 75% for industrial.

**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.

**Detention Storage:** The temporary detaining or storage of storm water in a storage basin, on rooftops, in streets, parking lots, school yards, parks, open space, or other areas under predetermined and controlled conditions, with the rate of drainage regulated by appropriately installed and designed outlet structures. These detention storage areas will not be considered regulated wetlands.

**Developer/Owner Engineer:** The engineering person, firm or corporation formally designated by the Developer/Owner to act as its Engineer.

**Development:** The construction of a building, parking lot, structure, etc. on a piece of land or otherwise changing the use of a piece of land. Typically, development occurs to property, which is vacant of any significant infrastructure or building.

**Discharge:** The release or outflow of water from any source.

**Drainage Area (also Drainage District):** The area from which storm water runoff is conveyed to a single outlet (i.e. a watershed or catchment area).





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**Easement:** A parcel of land on which the owner has granted rights-of-way to make surveys, lay, construct, maintain, operate, alter, replace, repair, and remove at any time that part of the storm drainage system located within the easement. The landowner will not be allowed to construct buildings or other structures on said easement without the written consent of the easement grantee.

**Excess Storm Water Runoff:** The volume and rate of flow of storm water discharged from a drainage area, which is in excess of the allowable discharge.

**Emergency Overflow:** A hydraulic control structure used to control the location and flow direction of storm water which is either in excess of the required detention storage or is due to a failure in the site's storm water management system. The emergency overflow shall be directed to a public road right-of-way or to an available municipal storm drainage system.

**Emergency Overflow Elevation:** The elevation at which emergency overflow is activated.

**Engineer:** A civil engineer that is licensed to work in the state of Michigan or a person who is working under the direct supervision of a civil engineer licensed to work in Michigan.

**First Flush:** The first 0.5 inch of a rain or precipitation event from the entire site or contributing watershed. By capturing and treating the first 0.5 inch of runoff, pollutants that are washed off of the land can be removed from the storm water before it leaves the site. Required by MDEQ before discharge into any waters of the State.

**Floodplain:** The special flood hazard lands adjoining a water-course, the surface elevation of which is lower than the Base Flood Elevation and is subject to periodic inundation determined from Flood Insurance Rate Maps (FIRMs) or the best available information. A parcel of land can be located within a floodplain without being shown on a FIRM map.

**Impervious Surface:** A surface, which does not easily allow the infiltration or penetration of water. During rainstorm events a large percentage of water will runoff. (i.e. rooftops, paved walks, roadways, driveways, sidewalks, gravel, etc.)

**Low Impact Design (LID):** Implementation of developmental strategies or best management practices in a manner that maintains predevelopment hydrology, or decreases runoff quantity, and improves runoff quality

**NPDES:** National Pollutant Discharge Elimination System. In 1987 the Clean Water Act was amended and required to implement a program that would address pollutants being discharged into the nation's waters. This now includes storm water discharges into waters of the nation/state.

**Peak Flow:** The maximum rate of flow of storm water runoff at a given location.

**Percent Impervious:** Percentage of total site area, which is, or is proposed to be, an impervious surface.

**Pervious Surface:** A surface, which allows infiltration or penetration of water. During rainstorm events a percentage of water will infiltrate into the surface with the remaining storm water running off. The percentage

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of runoff is dependent on the type, slope, percent saturation, etc. of the surface. (i.e. lawns, farm fields, parks, wooded areas, golf courses, etc.)

**Rain Gardens:** A 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 storm water runoff.

**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. Rear Lot systems are not the city's responsibility. The city may repair the system if necessary to prevent damage to neighboring properties, but all associated repair costs, plus a 20% administrative fee will be passed on to the owner of the property or home/condo owners association where the repair takes place.

**Redevelopment:** Altering, improving, reconstructing or otherwise changing the use of an existing developed property. A site will be considered a redevelopment for this Storm Water Management Plan when an area greater than or equal to 5% of the existing developed portion of the site (i.e. roof, gravel, & paved surfaces) or, an area greater than 5,000 square feet is constructed or reconstructed with roof, pavement, or any other impervious surface. NOTE: this percentage is cumulative. If redevelopment is 2% one year and 3% at another time, this will meet the 5% rule. Also, at times, less than 5% can create drainage problems and the Storm Water Management Plan Reviewer may require additional detention or storage based on historical or anecdotal problems on a site.

**Restrictor:** A hydraulic control structure used to restrict the storm water discharge from the site to the allowable discharge of the site as determined by this plan. Simple restrictors such as the orifice or metering line are outlined in this plan. For more complex restrictors a stage/storage/discharge relation shall be required in the complete submittal and may alter the storage requirements for the site.

**Retention Storage:** The permanent retaining 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. The only discharge of storm water from the retention storage area is by ground infiltration, evaporation, etc. An emergency overflow must be provided in the event the capacity of the retention facility is exceeded. These detention storage areas shall not be considered regulated wetlands.

**Saginaw Area Storm Water Authority (SASWA):** The SASWA was formed by the NPDES Phase II communities in Saginaw County. The Authority, of which Frankenmuth is not a member, provides communities with information on storm water education, issues and regulations. A website address is available in Appendix XX.

**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.

**Submittal:** See Complete Storm Water Discharge Permit Submittal

**Sub-Surface Detention Storage:** Detention storage that is provided in underground storage facilities such as pipes, arch systems (Cultec, Stormtech or similar), or tanks. Detention storage within aggregate bedding or backfill will not be accepted.





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**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 3.05 inches of rain in 24 hours in this area. But, brief, intense storms of 10-year design can range from 1.5 inches in 1 hour to 2.87 inches in 18 hours. (Source: Bulletin 71, Rainfall Frequency Atlas of the Midwest, F.A. Huff & J.R. Angel, 1992)

**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.

**Unit Allowable Discharge:** Unit allowable discharge rate per acre of land proposed for development or redevelopment. Design discharge rates will vary between drainage districts based on existing drainage system capacity. The City drainage map outlines drainage district lines and design discharge rates.

**Upland Area:** Land located in the upper portion of a watershed whose surface drainage flows toward the area being considered for development.

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

**Watercourse:** Any 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.

**Waters of the State:** Means any of the following: The Great Lakes bordering the State and their connecting waters, all inland lakes, Rivers, Streams, Impoundments Open Drains, and other surface bodies of water within the jurisdiction of the state, including wetlands as defined by Part 303 of PA 451 of 1994. In Frankenmuth, that would include the Cass River, Dead Creek and other streams that have a defined bed and bank, and established flow.

## **B. Review Procedure.**

A site plan will be considered in compliance when a storm water permit has been issued. The City of Frankenmuth will not accept runoff into drainage systems located within the City of Frankenmuth from newly developed or redeveloped sites unless they are in compliance with the City Ordinance and the design guidelines of this document. Only approved Storm Water Management Plans can be used for construction purposes.

To comply with the City Ordinance, the following steps must be completed:

### **1. Pre-design Meeting.**

The developer/owner's licensed engineer shall be responsible for coordinating a pre-design meeting. This meeting, at a minimum, shall consist of the owner/developer's engineer and the City of Frankenmuth's engineer. The purpose of the meeting is to address the various storm water management proposals of the owner /developer. Conceptual storm water management alternatives can be discussed and potential problems

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addressed prior to the design phase of the project. The goal of the meeting is to eliminate potential problems up front and reduce the time and costs needed for the design and review of the project.

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

The owner/developer's engineer and/or the City Engineer should have in his possession or have an understanding of the following information prior to attending the pre-design meeting.

- a. The drainage district in which the proposed development is located and the corresponding unit allowable discharge. This information is included with the storm water management plan. This information also can be obtained from the City of Frankenmuth Department of Public Works Superintendent or City Engineer.
- b. A location map of the site and the applicable drainage district map(s).
- c. Location and description of activities that may impact or be impacted by the proposed development or redevelopment both on and off the site.
- d. Acreage of the total site, acreage of the lands currently draining overland the site, and acreage of land upstream of site which contribute runoff to the existing storm drain outlet.
- e. The size and location of the existing storm drain outlets for the proposed site.
- f. A conceptual layout of the proposed storm drainage system for the development or redevelopment.
- g. Knowledge of whether the proposed drainage system is going to be owned and maintained privately or publicly.

After the pre-design meeting review of preliminary information and conceptual layout of the storm drainage system, the owner/developer will provide a complete storm water discharge permit submittal to the DPW Superintendent. This action will initiate the request for a formal review process.

## **2. Formal Review.**

- a. The owner/developer or his/her representative shall submit a complete storm water discharge permit submittal. This plan must be completed by a licensed civil engineer or licensed architect with appropriate training in storm water design.

A complete Storm Water Discharge Permit Submittal includes:

- a completed permit application (Appendix A),
- three sets of plans, two sets of calculations,
- a completed drainage checklist (Appendix A),
- deposit/fee for review and





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- inspection in accordance with City ordinance, and
  - any other supporting information for the site deemed necessary during the pre-design meeting/correspondence.
  - The plans and calculations shall comply with the requirements of this Storm Water Management Plan and be sealed by a licensed professional engineer / architect.

b. An incomplete submittal will be returned to the owner/developer and the review process will not begin until a complete storm water discharge permit submittal is provided.

c. The City Engineer will review the submittal for compliance with the City Storm Water Management Ordinance. All materials will be reviewed for completeness. Calculations will be checked. The minimum design calculations and design standards outlined in this document will be used for review. The drainage plan checklist will be reviewed. The proposed drainage system will be either approved or rejected with comments and returned to the owner/developer.

d. If the proposed drainage system is rejected, a revised storm water discharge permit request will need to be re-submitted with the corrected revisions.

e. A typical review will take approximately three (3) weeks to complete from the date of submittal.

### **C. Plan Approval/Issuance of Storm Water Permit.**

When the storm water permit submittal fulfills the requirements of the City Storm Water Management Ordinance and City construction standards, the City Engineer will stamp three copies of the plans as approved. One set will be sent to the applicant, one set to the City of Frankenmuth DPW Superintendent, and one set will be kept on file with the City Engineer. A Storm Water Discharge Permit will be issued and forwarded to the City of Frankenmuth DPW Superintendent for signatures. The permit will include inspection requirements, compliance requirements, date of issuance, date of expiration, etc. A copy of a sample permit has been included in Appendix A.

If a storm water permit has not been issued, then no plan or part of any plan has been approved by the City. Furthermore, any proposed construction has not been authorized.

### **D. Changes to Plan after Approval.**

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





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4. Changes to an approved plan must be made by a licensed engineer / architect with appropriate training or demonstrated competency in storm water design.

### **E. Inspection Requirements.**

Inspection will be completed by the City. General inspection requirements are outlined below and specific inspection requirements will be outlined on the storm water management permit.

#### ***1. Small Developments/Redevelopments (Less than 3 acres).***

- a. The City Engineer or DPW Superintendent must be informed three (3) working days in advance of required inspections as outlined on the storm water discharge permit. Also, two (2) working days will be required by the City Engineer to analyze the survey inspection results.
- b. The City Engineer will complete a detailed elevation and location survey of all storm water detention facilities upon completion of construction. This includes verification of the constructed storm water detention capacity, the elevation of the emergency overflow, the location of storm water detention top of storage contour lines, and the restrictor size and location. Inspection reports will be completed and kept on file.
- c. The Owner/Developer's Engineer must provide a letter of certification indicating that construction was completed in accordance with the storm water discharge permit.

#### ***2. Large Developments/Redevelopments (3 acres and greater).***

- a. Items E(1)(a) through E(1)(c) above, as stated under small developments/redevelopments, shall also apply for large developments or redevelopments of three (3) acres and greater.
- b. The City Engineer will complete periodic site inspections during construction to verify site compliance with the storm water permit. Inspection reports will be completed and kept on file. Site inspections which indicate non-compliance with the storm water permit must be addressed immediately. Corrective measures may be necessary to insure compliance with the storm water permit.

#### ***3. Platted Developments and Condominium Projects.***

- a. Items E(1)(a) through E(1)(c) above, as stated under small developments/redevelopments, shall also apply to platted developments and condominium projects.
- b. The City Engineer will complete periodic site inspections during construction to verify site compliance with the storm water permit. Inspection reports will be completed and kept on file. Site inspections that indicate non-compliance with the storm water permit must be addressed immediately. Corrective measures may be necessary to insure compliance with the storm water permit. The City may require that their engineer complete full-time construction inspection reports or may require that daily construction inspection reports be provided for review and approval. This would only apply for the installation of storm drainage systems located within





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City rights-of-way or for systems that are to be maintained by the City. The decision to require full-time inspection will be made based on the results of the initial periodic site inspections and observed construction procedures.

An occupancy permit will not be issued by the City Building Inspector until a letter of certification has been received by the City of Frankenmuth DPW Superintendent and until a final inspection which verifies that the constructed storm water detention facilities strictly comply with the storm water discharge permit. Several inspections may be completed if requirements are not met in the initial inspection.

#### **F. Fee Schedule.**

A cash deposit is required when the owner/developer presents the Complete Storm Water Discharge Permit Submittal to the City DPW Superintendent. The amount of deposit is established by City resolution and fees will be adjusted from time-to-time.

A fee for review of the submittal, the issuance of the storm water permit, and the inspection of the storm water drainage systems will be deducted from the cash deposit. The fee amount will be based on the actual hours required by the City Engineer to complete the review and inspection process. Developments which require multiple reviews or additional inspection requirements due to non-compliance with the storm water permit will result in larger fees. It should be noted that larger developments will require larger fees.

The owner/developer will receive a refund or be billed the difference between the deposit and the actual fee for completing the review.

#### **G. Penalties/Enforcement.**

The City of Frankenmuth Building Inspector will not issue an Occupancy Certificate nor accept storm water into their drainage system without complete compliance with the storm water permit, City's Storm Water Management Plan and City Construction Standards.

NOTE: Storm water systems cannot be altered once approved and constructed unless it has been reviewed by the City or city engineer. Removing flow restrictors or creating a situation that is harmful to neighboring parcels will be the owner's liability.

Any cross connections or discharges of anything other than Storm water into a Storm water system must be disconnected from the Storm water system.

The following Non Storm Water Discharges are not authorized by the city but do not need to be prohibited by the City<sup>1</sup>, unless they are identified as significant contributors of pollutants to the separate Storm water drainage system:

- Water line flushing, discharges from potable water sources;
- Landscape irrigation runoff, lawn watering runoff, irrigation waters – unless they contain excessive fertilizer applications;

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<sup>1</sup> In accordance with Part I.A.4.b.3.a.2. of the state of Michigan NPDES permit MIG610000.





- Diverted stream flows, flows from riparian habitats and wetlands;
- Rising groundwaters, springs;
- Uncontaminated groundwater infiltration (as defined by 40 CFR 35.2005(20));
- Pumped groundwaters (except for groundwater cleanups not specifically authorized by NPDES permits), foundation drains, water from crawl space pumps, footing drains and basement sump pumps;
- Air conditioning condensates;
- Waters from non-commercial car washing
- Residual street wash waters;
- Discharges or flows from emergency fire fighting activities; and
- Residential swimming pool waters and other de-chlorinated swimming pool waters without untreated filter backwash. A swimming pool operated by the city shall not be discharged to a separate storm sewer or to surface waters of the State without specific NPDES permit authorization from the MDEQ.

## H. Development 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 5,000 sq. ft.
- There is no cumulative increase equal to, or greater than the 5% area of improvement. (For example; If the site has added 2% one year, 3% another year, and another 2% increase in imperviousness. This is a cumulative 7% increase for the site.)
- There is no significant impact or change in detention amounts that may have adverse effects on neighboring properties.
- The site is **not** in one of the designated “Priority” areas on the City’s storm water map.

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.

An exemption from a storm water permit will be coordinated with the City.

## I. Appeals Process.

If the owner/developer has a conflict with any of the reviews or inspections made by the City of Frankenmuth and/or the City Engineer, an appeal can be made to the City Manager of the City of Frankenmuth within 30 days of the review and/or inspection.

## J. Low Impact Designs.

Low Impact Design (LID) practices are innovative stormwater management practices to manage urban stormwater runoff at its source. The goal is to mimic the way water moved through an area before it was





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developed by using design techniques that infiltrate, evapotranspire, and reuse runoff close to its source. Some common LID practices include rain gardens, grassed swales, cisterns, rain barrels, permeable pavements and green roofs. LID practices increasingly are used by communities across the country to help protect and restore water quality.

LID methods are encouraged in all developments. These design methods can have a significant impact on water quality and can slow storm water runoff rates to help systems that may be exceeding their original design limits. Many areas of the country and the state are implementing these designs. The City of Frankenmuth will encourage these methods as long as these designs and best management practices do not become the responsibility of the City.

Some LID may allow a development to use smaller detention basins and have other cost saving aspects. If these types of projects and designs are being proposed the developer must meet with the City DPS superintendent and City Engineer to review the proposed conceptual design and determine any variance from the conventional storm water management plan design aspects.

### **III. STORM DRAINAGE SYSTEMS WITHIN CITY OF FRANKENMUTH**

#### **A. Jurisdiction of Various Regulatory Agencies.**

Other regulatory agencies may also have jurisdiction of storm water drainage systems located within the City of Frankenmuth. Compliance with the City of Frankenmuth storm water permit, storm water management plan and construction standards does not grant compliance with any storm water management requirements or design criteria of other regulatory agencies, and vice versa. Descriptions of the various agencies which may have jurisdiction over the storm drainage systems located in City of Frankenmuth are listed as follows:

**Saginaw County Public Works Commissioner.** The Saginaw County Public Works Commissioner has jurisdiction over established county drains. Any proposed developments which outlet directly to an established county drain, and sites needing plat approval, must be reviewed and approved by the Saginaw County Public Works Commissioner.

The Saginaw County Public Works Commissioner also issues soil erosion and sedimentation control (SESC) permits if not available through the City of Frankenmuth. A soil erosion and sedimentation control permit is required for any developments disturbing more than one acre of land. If the site disturbs more than 5 acres of soil a NPDES Construction Site Permit must be obtained from the MDEQ, see below. To obtain a SESC permit go to Appendix B for the website address.

**Saginaw County Road Commission.** The Saginaw County Road Commission has or shares the jurisdiction over drainage along those county roads and county rights-of-way within the City of Frankenmuth. Sites located along county road rights-of-way and discharging to Road Commission drainage systems must obtain a permit from the Road Commission. When a crossing is installed over a county roadside drain, a permit must be obtained from the Road Commission. See appendix B for a website to obtain a permit form.







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**Michigan Department of Transportation (M.D.O.T.).** The Michigan Department of Transportation has or shares jurisdiction over drainage along state highways and state rights-of-way within the City of Frankenmuth. Sites located along M.D.O.T. rights-of-way and discharging to M.D.O.T. drainage systems must obtain a permit from M.D.O.T. See appendix B for a website to obtain a permit form and other information.

**Michigan Department of Environmental Quality (M.D.E.Q.).** The Michigan Department of Environmental Quality has jurisdiction over proposed work within the 100-year floodplain, inland lake and stream areas, and wetland areas. A permit must be obtained for work proposed in these areas. Also, the MDEQ administers the NPDES Storm water permitting program in Michigan, for construction sites that disturb more than 5 acres must obtain a construction site permit. See Appendix B for the website.

In addition, the MDEQ is responsible for implementing the National Pollution Discharge Elimination System (NPDES) Storm Water Permitting Program for industrial sites that have specific industrial codes.

Finally, the MDEQ requires a permit to discharge directly to waters of the state of Michigan, for example the Cass River. If a development is going to discharge Storm water directly to the Cass River it must meet water quality standards established by the MDEQ. Therefore, these sites must meet all applicable requirements established by the MDEQ before they can obtain a permit to discharge from the City of Frankenmuth. The website address for this permit is located in Appendix B.

## **B. Jurisdiction of the City of Frankenmuth.**

**Allowable Discharge ( $Q_a$ )/Detention Requirements.** The peak storm water discharge from any proposed development or redevelopment within the drainage district shall be restricted to an allowable discharge ( $Q_a$ ). The allowable discharge shall be calculated based on the unit allowable discharge as indicated on the drainage district map(s) provided herein.

Excess storm water runoff must be detained on site. Equations for determining the required volume of detention storage are outlined herein. Detention storage calculations must be included in the Complete Storm Water Discharge Permit Submittal.

**10-Year Design Discharge ( $Q_{d10}$ ).** The 10-year design discharge shall be calculated based on the greater of either the anticipated imperviousness of the land's zoned use or on the actual imperviousness of the entire drainage area upstream of the design point, including the proposed development or redevelopment. The Minimum Design Imperviousness (IMP) has been determined for the various zoned land uses and is outlined by the storm water management plan by definition. If a different IMP is used, calculations showing how the proposed IMP was determined shall be submitted. Equations for determining the design discharge are outlined herein.

It must be shown that proposed property development will not significantly alter storm water flows from existing conditions upstream or downstream of the property.





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#### IV. DESIGN CALCULATIONS

##### A. ALLOWABLE DISCHARGE RATE ( $Q_a$ )

The storm water discharge rate from any proposed development or redevelopment site shall be restricted to an allowable discharge ( $Q_a$ ). The allowable discharge required by the City of Frankenmuth shall be based on the Unit Allowable Discharge as shown on the Drainage District Map provided herein.

Calculate the allowable discharge ( $Q_a$ ) in cubic feet per second (cfs):

$$Q_a = (q_a)(A_{\text{site}})$$

$Q_a$  - Allowable Discharge Rate (cfs).

$q_a$  - Unit Allowable Discharge (cfs).

$A_{\text{site}}$  - Proposed site area in acres

##### B. Discharge Restrictor Requirements

A restrictor regulates the discharge of storm water to the allowable discharge rate ( $Q_a$ ) established for a site. Restrictors may be an in-line plate restrictor or a metering line of 20 feet in length or less.

Calculate the maximum area of circular in-line plate restrictor ( $a_{\text{max}}$ ) in square feet based on the orifice formula:

$$a_{\text{max}} = Q_a / [0.62 (64.4 h)^{1/2}]$$

$a_{\text{max}}$  - maximum area of orifice (sq. ft.).

$h$  - head differential (ft) between the 8/10 line of outlet pipe and maximum water surface elevations.

Calculate the metering line based on Manning's formula:

$$Q_a = (1.49/n)(a_{\text{max}})(R^{2/3})(S^{1/2})$$

$R$  - Hydraulic Radius (ft)

$S$  - Hydraulic Slope (ft/ft) which is  $(h)/(\text{Length of metering line})$ .

$n$  - Manning's Roughness Coefficient





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### C. Storm Water Detention Requirements

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

Verify that the actual discharge rate is equal to or less than the allowable discharge rate.

$$Q_r = (0.62)(ar)[(64.4h)^{1/2}]$$

$Q_r$  - Actual discharge rate.

$ar$  - Designed restrictor area.

Calculate the maximum flow rate per acre of impervious surfaces ( $Q_o$ ):

$$Q_o = Q_r / A_i$$

$A_{imp}$  - total acres of proposed impervious surfaces on site.

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

$$T = [(4080/Q_o)^{1/2}] - 20$$

Calculate the maximum volume ( $V_s$ ) of storage in cubic feet per acre of impervious surface:

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

Calculate the total volume of storage ( $V_t$ ) in cubic feet required for the site ( $V_t$ ):

$$V_t = (V_s)(A_{imp})$$

### D. Storm Water Conveyance Requirements

The 10-year design discharge ( $Q_{d10}$ ) for the proposed subwatershed in which development or redevelopment is located in will be used to size the storm sewer. Land use assumptions will be in accordance with current zoning requirements.

Calculate the 10 year design discharge ( $Q_{d10}$ ) in cubic feet per second for a site using the Modified Rational Method in the following form:

$$Q_{d10} = (C_i)(A)[(I)(IMP)/100] + (C_p)(A)[(I)(100-IMP)/100]$$





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- A - Total catchment acreage (including offsite drainage)
  - $C_i$  - Impervious runoff coefficient (0.8)
  - $C_p$  - Pervious runoff coefficient (0.2)
  - I - Design Rainfall Intensity (in/hr)

When the time of concentration ( $t_c$ ) is found to be greater 30 minutes, Calculate rainfall intensities (I) according to the following equation:

$$I = 175 / (25 + t_c)$$

When the time of concentration ( $t_c$ ) is found to be less than 30 minutes, Calculate the rainfall intensities (I) according to the following equation. If  $t_c$  is calculated to be less than 15 minutes, use  $t_c$  equal to 15 minutes:

$$I = 136 / (20 + t_c)$$

The time of concentration ( $t_c$ ) 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).

Calculate the time of concentration ( $t_c$ ) in minutes:

$$t_c = [L / (v)(60)] + lag$$

L - Overland Flow Length (ft)

v - Overland Flow Velocity (1 - 2.5 ft/s)

lag - Lag Time (15 - 20 minutes)

The average velocity for overland drainage in City of Frankenmuth will range between 1.0 fps and 2.5 fps based on overland slope and land use. Lag time will range between 15 min and 20 min. When calculating time of concentration ( $t_c$ ), include all assumptions with calculations.





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## V. DESIGN STANDARDS

### A. REQUIREMENTS.

#### 1. General Requirements.

- a. Storm water detention requirements for any new construction development, redevelopment, or land use change must be in compliance with the storm water management plan and construction must be in compliance with the storm water permit.
- b. The peak runoff rate during a 10-year storm event from a developed or improved site shall not exceed the allowable discharge rate ( $Q_a$ ). This rate is determined as outlined in the design calculations section of this plan.
- c. Engineering calculations must be submitted with the storm water discharge permit application. The calculations shall follow the procedures outlined in this document.
- d. Roof drains may be connected to a storm sewer system if the flow through the outlet to the City of Frankenmuth system is properly restricted. Unrestricted runoff from the roof drain will not be accepted. There will be no exemptions.
- e. The owner/developer and City of Frankenmuth shall make a determination as to whether any or all of the facilities proposed are to become privately or publicly maintained as part of the Saginaw County drainage system, Saginaw County Road Commission drainage system, or the Michigan Department of Transportation drainage system.
- f. 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 of Frankenmuth Department of Public Works and 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.
- g. Proposed storm sewer enclosures must be designed so they will not adversely impact any adjacent properties, upstream or downstream, and must be designed to the impervious factors of the lands based upon zoning, not necessarily existing conditions.
- h. Soil erosion and sedimentation control measures, including Best Management Practices (BMPs), must be implemented.

#### 2. Storm Sewer Piping Requirements.

- a. Proposed storm sewer shall be designed to have capacity to pass 10-year design storm runoff rate ( $Q_{d10}$ ). Refer to the Design Calculations section of this document.





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- b. RCP in accordance with MDOT specifications and approved by the City of Frankenmuth must be used for storm sewers within the City rights-of-way. Plastic (HDPE) can be used outside of the right of way.
  - c. Provide a minimum of two (2) feet of cover for storm sewer within City rights-of-way.
  - d. Provide 18 inches vertical separation between all other utilities including, sanitary sewers and water mains. Provide ten (10) feet of horizontal separation from other utilities.
  - e. A minimum of four (4) inches of sand bedding is required beneath the pipe and a minimum of 12 inches of sand backfill is required above the pipe.
  - f. Manhole(s)/catch basin(s) shall be placed at a maximum distance of 400 feet from any other manhole/catch basin for access/maintenance purposes.
  - g. Provide a sump discharge outlet for each individual property/lot in all developments. Sump leads shall not be connected to rear lot drainage systems. A storm sewer lead extended to the right-of-way/property line of each lot (minimum 4 inches) shall be provided for rear lot drainage.
  - h. Minimum pipe grades must be such to produce minimum scouring velocity of 2.5 feet per second when pipe is flowing full without surcharging.
  - i. Storm sewer joints must be soil tight, but not water tight.
  - j. Minimum pipe diameter for catch basin leads is 10 inches.
  - k. Minimum pipe size for storm sewer is 12 inches within City rights-of-way and 10 inches otherwise.
  - l. When two pipes or more of different sizes come into a structure, the 8/10th flow lines shall match when possible.
  - m. Catch basins should have a minimum sump depth of 24 inches.
  - n. Inlets may be allowed if approved by the City Engineer and adequate sediment trapping measures are provided.

### **3. Detention/Retention Requirements.**

- a. Residential developments will need to provide a separate lot or parcel for detention or retention. In addition the following requirements will apply:
  - 1) This area can not be dedicated through an easement.





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- 2) The lot or parcel must have a recorded ingress/egress easement with a minimum of 20 feet abutting a City right-of-way.
  - 3) The outer limits of retention or detention areas shall be delineated on the Exhibit B drawings of a Condominium Development or listed on the Final Plat of a subdivision as stated below.
    - a) Condominium Developments - Detention or Retention areas shall be designated as general common areas.
    - b) Platted Developments - Detention or Retention areas shall be designated as a storm water detention/retention area or recreation area when appropriate. (See State Requirements).

**b. Requirements for all Detention/Retention areas.**

- 1) Ingress/egress areas must have a gravel base suitable for travel of construction equipment.
- 2) Proposed storm water detention or retention facilities shall be designed to detain/retain the 10-year design storm runoff volume ( $V_t$ ) from the entire contributing area in excess of the allowable discharge from the site (See Design Calculations, Section IV).
- 3) The maximum design storage elevation in a detention area must be a minimum of one (1) foot below the lowest ground elevation adjacent to the detention/retention area.
- 4) The design maximum storage elevation in a detention/ retention area must not exceed a depth of nine (9) inches above any paved surfaced in non-residential developments. In residential developments the maximum ponding elevation in the detention/retention basin shall not exceed the lowest rim elevation in the development.
- 5) The design maximum storage elevation in a detention or retention area must not be closer than one (1) foot below the lowest opening, window, or door of the proposed structure(s) or existing facilities.
- 6) An emergency overflow shall be provided at the detention/retention basin to insure the maximum ponding elevation does not exceed the depths outlined in items 2, 3, and 4, as mentioned above. This overflow shall be able to allow drainage from the site in the event the 10-year storm is exceeded or the restricted outlet is obstructed. The overflow should be able to pass the 10 yr design flow and direct it away from neighboring parcels.
- 7) Designs of detention/retention facilities shall incorporate safety features, particularly at inlets, outlets, on steep slopes, (three horizontal to one vertical or steeper) and at any attractive nuisances. These features may include, but not be limited to, fencing, handrails, lighting, steps, grills, signs, and other protective or warning devices so as to restrict access as required by City Engineer. It is recommended that side slopes for detention / retention basins be four horizontal to one vertical or milder slopes (e.g. 5h:1v or 6h:1v). If the detention basin is a “wet” design of more than 24 inches in depth it must be fenced.
- 8) Side slopes and the bottom of detention/retention basins shall be top soiled, to a minimum of three (3) inches, and seeded. Extra precautions should be taken to ensure that the bank top soil does not erode, in other





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words, use of erosion control blankets, mats, etc. or PAMs. Any detention basins with excessive erosion will need to be re-constructed if requested by the City or city engineer.

9) The side slopes and bottom of the basins shall be shaped with maximum slopes of three horizontal to one vertical to allow mowing of these surfaces. If side slopes are steeper than three horizontal to one vertical the basin shall be fenced.

10) Detention/retention basins with bottom slopes less than 1% shall be underdrained.

11) Detention/retention 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).

12) If a detention/retention basin is proposed in a front yard area it must be designed to be aesthetically compatible with the development (i.e. mild slopes, etc.)

### **c. Maintenance Requirements for Detention/Retention Facilities.**

1) Detention/retention basins and restrictors shall be maintained as necessary. If a detention/retention basin is found not to be maintained or a restrictor is removed or not maintained, the owner/developer will have 30 days to complete the necessary maintenance. If said maintenance is not completed, the City of Frankenmuth will take the necessary action to have the work completed and bill the owner/developer the actual cost of the maintenance and administrative time.

2) Condominium Projects - If the detention/retention facility areas are designated as a general common element, the Master Deed will set up a mechanism by which the detention/retention facilities will be maintained by the Condominium Association.

3) Maintenance shall include regular mowing of the basin bottom, side slopes, and removal of debris and sediment from the outlet to insure the basin remains functional and is aesthetically pleasing to surrounding landowners.

4) Detention ponds (wet basins) must be maintained so as not to develop into a basin full of one plant species, for example cat tails or phragmites. NOTE: any basin that develops Phragmites must eliminate the plants immediately upon discovery.

5) Dry detention basins must be mowed regularly if designed with just turf grass.

6) Low Impact Design basins or infiltration types of systems must be maintained with the plant species originally designed for the structure. If the vegetation design changes it must be reviewed and approved by the City. Any LID storm system being turned over to the city must be designed for a minimal maintenance plan that is approved by the City. Or, have an endowed maintenance fund set up to cover the costs of maintenance for 30 year project life.







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#### 4. Rear Lot Drainage Requirements.

- a. All lots within a condominium or platted development shall require that a lead be constructed to the edge of the City right-of-way for future rear lot drainage.
- b. Minimum rear lot drainage lead sizes and slopes are as follows:
  - 1) Rear lot drainage leads with contributing drainage areas up to two (2) acres shall have a minimum diameter of six (6) inches and a minimum slope of 0.5%.
  - 2) Rear lot drainage leads with contributing drainage areas greater than two (2) and less than three (3) acres shall have a minimum diameter of eight (8) inches and a minimum slope of 0.4%.
  - 3) Rear lot drainage leads with contributing drainage areas greater than three (3) and less than four (4) acres shall have a minimum diameter of ten (10) inches and a minimum slope of 0.32%.
  - 4) Rear lot drainage leads with a contributing area greater than four (4) acres shall be considered main line storm sewer and shall be designed according to corresponding storm sewer requirements (See design calculations section of this report). Calculations shall be submitted to verify the rear lot drains have capacity to pass the 10-year design storm event. Plastic pipe is acceptable for rear lot drainage systems draining more than 4 acres provided it is installed in landscaped/lawn areas.
- c. Sand backfill and bedding is required for rear lot drainage leads located under traveled areas.
- d. Rear lot drainage leads must be constructed at a depth so that two feet of cover can be provided at low upstream locations.
- e. A ten (10) foot wide easement shall be provided on each lot adjacent to rear lot drainage systems. Said easements shall be written as to permit neighboring property and/or condominium owners to maintain the rear lot drainage system as it may effect their property. NOTE: if no rear lot system exists on the property this easement should still be provided in case of future drainage problems.
- f. 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.
- g. Phased developments owned by the same proprietor may utilize proposed rear lot drainage for a current development phase on future phases provided:





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- 1) 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.
    - a) 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.
    - b) The rear lot drainage system shall be constructed to convey rear lot drainage from both the existing and proposed rear lot drainage areas.
    - c) Easements shall be provided allowing for maintenance by both abutting landowners in current and proposed phases of development.
    - h. Rear lot drainage shall be shown on the preliminary plat (subdivisions) or site plan (condominiums).
    - i. All rear lot drains shall connect to an approved storm water drainage system. They cannot connect to road underdrains.
    - 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 XX 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 XX.
  1. Homeowners and condo associations should take care not to plant trees and shrubs over rear lot drains, or in easement areas, as the roots will eventually plug the drains and render them ineffective as Storm water conveyance systems. Again, any repairs or replacements are the responsibility of the homeowner or association, these systems are NOT the responsibility of the city.

**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.**

## **B. General Compliance Guidelines.**

The following guidelines are recommended and are provided only for your reference.

1. The minimum surface slopes for overland drainage are as follows:

For bituminous paved surfaces, 1%.

For concrete paved surfaces, 0.5%.

For concrete curb and gutter, 0.32%.

For drainage swales and valley shaped ditches, 0.5%.





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For rear lot drainage swales and valley shaped ditches, 0.5%.  
Landscape grading, 2%.

2. The maximum surface slopes for overland drainage are as follows:

For bituminous, concrete paved surfaces, 5%.

For concrete curb and gutter, 5%.

For drainage swales and valley shaped ditches, 5%.

For rear lot drainage swales and valley shaped ditches, 5%.

Drainage swales and valley shaped ditches shall have maximum side slopes of 3 horizontal to 1 vertical.

Landscape grading, 4 horizontal to 1 vertical.

### **C. Variances from Requirements.**

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

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

### **A. Storm Water Management System Maintenance Plans**

It is recommended that a maintenance plan be developed for sites with a storm water management plan. The owner or lease holder should be informed how the storm water system works and how much should be budgeted to maintain the system. For more information on storm water management maintenance plans go to Appendix





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## APPENDIX A

1. City of FRANKENMUTH DRAINAGE PLAN APPLICATION & CHECKLIST
2. City of FRANKENMUTH STORM WATER MANAGEMENT SITE REVIEW AGREEMENT PROCEDURE & FORM
3. SOIL EROSION AND SEDIMENT CONTROL FOR CONSTRUCTION SITES PROCEDURE
4. CITY ENGINEER FINAL INSPECTION FORM
5. CERTIFICATION OF CONSTRUCTION FORM



# City of Frankenmuth

PROJECT NAME:

## STORM WATER DISCHARGE PERMIT APPLICATION

Property Tax Identification #:

Site Plan Review Date:

Date Applied:

Deposit Amount Submitted:

**NAME OF DEVELOPER/OWNER:**

**ENGINEER/ARCHITECT:**

Contact Person:

Contact Person:

Street Address:

Street Address:

City, State, Zip:

City, State, Zip:

Telephone:

Telephone:

Fax:

Fax:

**PROJECT LOCATION:**

Street Address:

Name of Subdivision/Plat:

Drainage District:

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

**Type of Development (Circle):** *COMMERCIAL SITE, INDUSTRIAL SITE, RESIDENTIAL PLATTED, RESIDENTIAL CONDOMINIUM, OTHER*

\*AREA OF DEVELOPMENT (acres):

\*AREA OF CONTRIBUTING DRAINAGE DISTRICT (acres):

\*AREA OF EXISTING IMPERVIOUS SURFACE (acres):

\*AREA OF PROPOSED IMPERVIOUS SURFACE (acres):

\*ALLOWABLE DISCHARGE RATE ( $Q_a$ ) (cfs):

\*TOTAL VOLUME OF STORAGE REQUIRED (cu. ft.)

\*TOTAL VOLUME OF STORAGE DESIGNED (cu. ft.)

10 YR DESIGN STORM WATER DETENTION STORAGE ELEVATION:

EMERGENCY OVERFLOW/MAXIMUM STORAGE ELEVATION:

LOWEST FINISHED FLOOR ELEVATION:

OUTLET DRAIN SIZE AND DESIGN FLOW CAPACITY:

OUTLET DRAIN INVERT ELEVATION:

DESIGN IMPERVIOUS FACTOR (IMP):

\*10 YEAR DESIGN DISCHARGE (cfs):

\*HEAD DIFFERENTIAL THROUGH RESTRICTOR (ft.):

\*DIAMETER OF PROPOSED RESTRICTOR (in):

\*ACTUAL RESTRICTED DISCHARGE (cfs):

AUTHORIZED SIGNATURE

DATE

PLEASE ATTACH DRAINAGE PLAN CHECKLIST TO ASSURE ALL INFORMATION IS PRESENT FOR THE REVIEW

## **DRAINAGE PLAN CHECKLIST**

In order for the Owner, Developer, or Builder to be in compliance with the Storm Water Ordinance e/she shall submit to the DPW Superintendent for review by the City Engineer, three complete sets of the site drainage and grading plan, and one copy of the calculations for allowable discharge and on-site storage requirements, as prepared by a Registered Professional Engineer or Architect. A copy of the completed checklist will be sent with all submittals.

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

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

**DRAINAGE PLAN - CHECKLIST (Continued)**

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

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

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

Revised, 2008

# City of Frankenmuth

## STORM WATER MANAGEMENT

### Certification of Storm Water System 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 water 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 water system is in compliance with the City of Frankenmuth's Storm Water Ordinance.**

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

\_\_\_\_\_  
Date

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date



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

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

### **EFFECTIVE DATE – MARCH 10, 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 MDEQ. 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 MDEQ.

<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.



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## APPENDIX B

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

1. **SAGINAW COUNTY LAND DEVELOPMENT ADVISORY COMMITTEE MEETINGS**

[http://www.saginawcounty.com/Publicworks/Koski\\_form1.pdf](http://www.saginawcounty.com/Publicworks/Koski_form1.pdf)

2. **MICHIGAN DEPARTMENT OF TRANSPORTATION PERMIT APPLICATION FOR USE OF RIGHT-OF-WAY**, is available at

[http://mdotwas1.mdot.state.mi.us/public/webforms/detail.cfm?ALLFORMS\\_FormNumber=2205](http://mdotwas1.mdot.state.mi.us/public/webforms/detail.cfm?ALLFORMS_FormNumber=2205)

3. **MICHIGAN DEPARTMENT OF TRANSPORTATION STORM WATER DISCHARGE PERMIT APPLICATION**, is available at:

[http://mdotwas1.mdot.state.mi.us/public/webforms/detail.cfm?ALLFORMS\\_FormNumber=2484](http://mdotwas1.mdot.state.mi.us/public/webforms/detail.cfm?ALLFORMS_FormNumber=2484)

4. **MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY JOINT PERMIT APPLICATION** is available at:

[http://michigan.gov/deq/0,1607,7-135-3307\\_29692\\_24403---,00.html](http://michigan.gov/deq/0,1607,7-135-3307_29692_24403---,00.html)

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

[http://michigan.gov/deq/0,1607,7-135-3313\\_3682\\_3716-23997--,00.html](http://michigan.gov/deq/0,1607,7-135-3313_3682_3716-23997--,00.html)

5. **SAGINAW COUNTY ROAD COMMISSION PERMIT APPLICATION.**

<http://www.scrs-mi.org/SCRCpermits.aspx>

6. **SAGINAW COUNTY SOIL EROSION AND SEDIMENTATION CONTROL PERMIT APPLICATION.**

[http://www.saginawcounty.com/Publicworks/permits\\_forms.htm](http://www.saginawcounty.com/Publicworks/permits_forms.htm)

7. **SAGINAW COUNTY PUBLIC WORKS FORM TO WORK IN DRAIN RIGHT-OF-WAY**

[http://www.saginawcounty.com/Publicworks/permits\\_forms.htm](http://www.saginawcounty.com/Publicworks/permits_forms.htm)

8. **SAGINAW AREA STORM WATER AUTHORITY (SASWA) – Storm Water Information**

<http://www.saswa.org>





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## APPENDIX C

1. Storm Water Management Ordinance.
2. Storm Water Permit Application Fee Resolution.



## ORDINANCE NO. 99-\_\_

AN ORDINANCE TO AMEND THE CODE OF THE CITY OF FRANKENMUTH  
BY ADDING A NEW CHAPTER, WHICH NEW CHAPTER SHALL BE DESIGNATED AS  
CHAPTER 26 OF TITLE II OF SAID CODE

An ordinance to provide for the requirement of storm water permits for construction within the City of Frankenmuth watershed; to provide for the enforcement of Unit Allowable Discharge Rates and the collection of permit fees; to provide for other matters relative to storm water drainage systems; and to provide for full compliance with the City of Frankenmuth Storm Water Management Plan.

## THE CITY OF FRANKENMUTH ORDAINS:

2.200. Definitions. For the purposes of this Chapter, the following terms or words used herein shall be defined as follows:

- (1) The term "City" shall be construed to mean the City of Frankenmuth, Saginaw County, Michigan.
- (2) The term "City Engineer" shall mean the engineering person, firm or corporation formally designated by the City of Frankenmuth to act as its engineer.
- (3) The term "improvements" shall mean platted developments and condominium projects larger than three (3) acres and all new or redeveloped commercial site developments.
- (4) The term "Storm Water Management Plan" shall mean the current plan regarding the management of storm water within the City of Frankenmuth. The Plan will be on file with the City Clerk.

Terms not defined herein shall have the meaning customarily assigned to them.

2.201. Storm Water Discharge Permit Requirements. Any parcel of real estate which discharges storm water to the City's storm water drainage systems shall be limited in the amount of storm water which may be discharged from the premises to the capacity as outlined in the City's Storm Water Management Plan or due to City authorized storm drainage improvements. Before any improvements are made, a storm water management and drainage plan shall be approved by the City Engineer in accordance with the requirements of the City's Storm Water Management Plan and a storm water discharge permit issued thereof.

2.202. Permit Requirement. No site shall be approved or any other permit issued unless the owner has complied with all requirements of the City's Storm Water Management Plan, as determined by the City Engineer.

2.203. Fee Schedule, Payment of Fees. Before initiating any activity regulated by this Chapter, an applicant shall be in compliance with the City's Storm Water Management Plan which includes the payment of the appropriate fees as established by resolution of the City Council from time-to-time.

2.204. Survey Requirement. Prior to the issuance of a certificate of occupancy, it will be necessary that a grading survey, prepared or approved by a registered civil engineer or land survey be submitted to the City Building Department attesting to the fact that the site is graded in accordance with the drainage pattern approved at the time of issuance of the building or land use permit.

2.205. Final Approval. A certificate of occupancy will not be issued until all fees owed to the City are paid, a letter of compliance from the developer's engineer is received, and the City Engineer's final inspection is completed and approved.

2.206. Enforcement. The provisions of this Chapter shall be enforceable through the initiating of appropriate action for injunction, mandamus, or otherwise, in any court having jurisdiction.

2.207. Penalties. Any person, firm or corporation violating any of the provisions of this Chapter shall be punishable as provided in Chapter 1 of this Code.

This ordinance shall take effect twenty (20) days after its adoption, as provided in the City Charter.

We, the undersigned, Mayor and Clerk of the City of Frankenmuth, Michigan do hereby certify that the above Ordinance No. 99-\_\_ of the City of Frankenmuth was introduced at a regular meeting of the City Council held on \_\_\_\_\_, 1999, and was thereafter approved at a regular session of the City Council held on \_\_\_\_\_, 1999.

Dated this \_\_\_th day of \_\_\_\_\_, 1999.

\_\_\_\_\_  
GARY C. RUPPRECHT, MAYOR

\_\_\_\_\_  
PHILLIP W. KERNS, CLERK

R E S O L U T I O N   N O .   99-\_\_\_\_\_

A RESOLUTION APPROVING  
STORM WATER PERMIT FEES

BE IT RESOLVED BY THE CITY COUNCIL OF THE CITY OF FRANKENMUTH,  
that:

Section 1.

It is deemed necessary to charge a permit deposit fee in accordance with the City's Storm Water Management Plan in order to cover the necessary costs to review construction plans and perform the necessary inspections for compliance with storm water permits issued by the City.

Section 2.

The following permit deposit fees are hereby adopted:

- A. Proposed sites under one (1) acre.....\$ 800
- B. Proposed sites one (1) to three (3) acres.....\$1,500
- C. Proposed sites over three (3) acres.....\$3,000
- D. Determination of Development Exemptions (each).....\$ 150

The project owner/developer will either receive a refund or be billed the difference between the deposit fee and the actual costs for completing the necessary review(s) and inspection(s), less a 10% City administrative fee. Said fees shall be paid in full prior to the City granting a certificate of occupancy for the site.

Section 3.

Said permit fees are hereby adopted and shall become effective on \_\_\_\_\_, 1999.

Action \_\_\_\_\_

Date \_\_\_\_\_

\_\_\_\_\_  
GARY C. RUPPRECHT, MAYOR

\_\_\_\_\_  
PHILLIP W. KERNS, CLERK



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## APPENDIX D

1. Drainage District Descriptions.
2. Unit Allowable Discharge Rates.
3. Drainage District Map.



Drainage District Number: 1  
Drainage District Name: **Dehmel Road**  
Drainage District Acreage: 553.6 acres  
Unit Allowable Discharge: 0.20 cfs/acre

Outlet:

The storm drain outlet is an open drain which is an established county drain with an established drainage district. At the downstream end of the open drain, there are a series of 48", 54" and 60" culverts.

Existing and Anticipated Future Land Use:

The existing drainage district is primarily agricultural land use, however, there is a small amount of residential land. There is the potential for significant residential development in the future.

Capacity of Existing System:

The existing drainage system does not have adequate capacity to convey the 10 year design storm under current land use.

Future Storm Water Management Recommendations:

Construction of open drain improvements and culvert improvement prior to development of the district is recommended. These improvements would significantly increase the outlet capacity and reduce the need for storm water detention basins as future developments occur. It is recommend that prior to the approval of any future development in this area, a storm water master plan for the district be approved by the city.



Drainage District Number: 2A  
Drainage District Name: **Churchgrove Road**  
Drainage District Acreage: 285.6 acres  
Unit Allowable Discharge: 0.25 cfs/acre

Outlet:

The storm drain outlet is a 48" storm sewer which outlets into an open drain near Harlan Drive.

Existing and Anticipated Future Land Use:

The existing drainage district is primarily residential developments. This drainage district has experienced a considerable amount of development in recent years. The Summergreen Meadows district (see "2B") outlets to this district via a pumped outlet and Koester Commercial Park No. 3 (see "2C") outlets to this district via a 10" in line restrictor. The Groveland Park Subdivision (see "2D") has an established discharge rate of 12 cfs.

Capacity of Existing System:

The storm drainage system does not have adequate capacity to convey the 10 year design storm under existing conditions. Subdistricts 2B, 2C and 2D have incorporated into the storm water detention capacity for the 10 year design storm.

Future Storm Water Management Recommendations:

Construction of a relief storm drain to provide an adequate outlet is the optimal solution, however, it may not be a feasible solution. As an alternative to a relief drain, it is recommended as development and redevelopment occurs, storm water be restricted and adequate detention capacity be provided. Additionally, the installation of catch basin restrictors in the streets may reduce surcharging of storm sewers and provide storm water detention. A feasibility study on the installation catch basin restrictors is highly recommended.

Drainage District Number: 2B  
Drainage District Name: **Summertime Meadows**  
Drainage District Acreage: 97.3 acres  
Unit Allowable Discharge: 1 cfs/acre

Outlet:

Woodland Acres and Summertime Meadows Subdivision's discharge storm water to the Churchgrove Road Drainage District (see 2A) through a pumped outlet.

Existing and Anticipated Future Land Use:

This district has experienced significant residential development in the past few years and at this time is mostly residential development.

Capacity of Existing System:

Storm water detention basins and storm sewers have been constructed within this district so future sites can be developed to a maximum impervious of 30%.

Future Storm Water Management Recommendations:

Maintain the established outlet, storm system and detention facilities.

Drainage District Number: 2C  
Drainage District Name: **Koester Commercial**  
Drainage District Acreage: 29 acres  
Unit Allowable Discharge: 2 cfs/acre

Outlet:

Koester Commercial Park No. 3 storm water outlets to the Churchgrove Road Drainage District through a 10" in line restrictor located in the 24" storm sewer under Franklin Street.

Existing and Anticipated Future Land Use:

Currently, the district is agricultural and commercial. The commercial development of this district has occurred in recent years and the long term land use for this district is complete commercial development.

Capacity of Existing System:

A storm water detention basin and a storm sewer outlet have been constructed in this district so future development can be done to 75% impervious.

Future Storm Water Management Recommendations:

Maintain the established outlet, storm sewer system and detention facilities.

Drainage District Number: 2D  
Drainage District Name: **Groveland Park**  
Drainage District Acreage: 24.5 acres  
Unit Allowable Discharge: 1 cfs/acre

Outlet:

Groveland Park discharges storm water to the Churchgrove Road Drainage District (see 2A) through a series of restrictors and an 18" outlet storm sewer.

Existing and Anticipated Future Land Use:

The district is agricultural and residential, however, it is anticipated that complete residential development of this district will occur very soon.

Capacity of Existing System:

On site storm water detention and storm sewers have been constructed so future sites can be developed to a maximum impervious of 30%.

Future Storm Water Management Recommendations:

Maintain the established outlet, storm system and detention facilities.

Drainage District Number: 3  
Drainage District Name: **Harlan Drain**  
Drainage District Acreage: 144.8 acres  
Unit Allowable Discharge: 0.32 cfs/acre

Outlet:

The storm drain outlet for this district is an open drain with a 54" culvert under Harlan Drive. Also, a 48" storm sewer also outlets to an open drain near Ardussi Street.

Existing and Anticipated Future Land Use:

This district is mostly developed including residential and commercial areas. The commercial areas, especially along Main Street, have experienced some redevelopment in recent years.

Capacity of Existing System:

This storm drainage system does not have adequate capacity to convey the 10 year design storm under existing conditions.

Future Storm Water Management Recommendations:

Construction of a relief storm drain to provide an adequate outlet is the optimal solution, however, it may not be a feasible solution. As an alternative to a relief drain, it is recommended as development and redevelopment occurs, storm water be restricted and adequate detention capacity be provided. Additionally, the installation of catch basin restrictors in the streets may reduce surcharging of storm sewers and provide storm water detention. A feasibility study on the installation catch basin restrictors is highly recommended.

Drainage District Number: 4A  
Drainage District Name: **Hubinger Street**  
Drainage District Acreage: 83.5 acres  
Unit Allowable Discharge: 0.4 cfs/acre

Outlet:

The storm drain outlet is a 42" storm sewer which outlet to the Cass River.

Existing and Anticipated Future Land Use:

The district is mostly developed including residential and commercial areas. The district has potential of redevelopment of commercial areas. There are two subdistricts which drain into the district, Gera Road (4B) and Haas Street (4C).

Capacity of Existing System:

The storm drain system does not have adequate capacity to convey the 10 year design storm under existing conditions.

Future Storm Water Management Recommendations:

Construction of a relief storm drain to provide an adequate outlet is the optimal solution, however, it may not be a feasible solution. As an alternative to a relief drain, it is recommended as development and redevelopment occurs, storm water be restricted and adequate detention capacity be provided. Additionally, the installation of catch basin restrictors in the streets may reduce surcharging of storm sewers and provide storm water detention. A feasibility study on the installation catch basin restrictors is highly recommended.

Drainage District Number: 4B  
Drainage District Name: **Gera Road**  
Drainage District Acreage: 152.8 acres  
Unit Allowable Discharge: 0.2 cfs/acre

Outlet:

The outlet is a 42" storm sewer located along N. Main Street (State Highway M-83).

Existing and Anticipated Future Land Use:

Currently, the district has primarily agricultural land use. There is a potential for future commercial and residential development.

Capacity of Existing System:

The storm drain outlet does not have adequate capacity to convey the 10 year design storm under existing conditions.

Future Storm Water Management Recommendations:

Construction on a relief storm drain to provide an adequate outlet is the optimal solution, however, it may not be a feasible solution. As an alternative to a relief drain, it is recommended that a regional storm water detention basin be constructed prior to development of this area. It is recommended that prior to approval of any future development a storm water master plan for this area be approved by the city.

Drainage District Number: 4C  
Drainage District Name: **Haas Street**  
Drainage District Acreage: 21.2 acres  
Unit Allowable Discharge: 0.3 cfs/acre

Outlet:

The storm drain outlet is a 24" storm sewer under Schleier Street.

Existing and Anticipated Future Land Use:

The current land use is agricultural. A plan for residential development of this area has been previously completed.

Capacity of Existing System:

The existing storm system does not adequate capacity to convey the 10 year design storm under existing conditions.

Future Storm Water Management Recommendations:

Construction on a relief storm drain to provide an adequate outlet is the optimal solution, however, it may not be a feasible solution. As an alternative to a relief drain, it is recommended that a regional storm water detention basin be constructed prior to development of this area. It is recommended that prior to approval of any future development a storm water master plan for this area be approved by the city.



Drainage District Number: 5  
Drainage District Name: **Frank Road**  
Drainage District Acreage: 348.2 acres  
Unit Allowable Discharge: 0.2 cfs/acre

Outlet:

The downstream outlet is a 48" storm sewer which outlets into an open drain near the school. The upstream outlet for agricultural areas is a 42" storm sewer.

Existing and Anticipated Future Land Use:

Currently the district has residential and agricultural land use. There is potential for future residential development in this district.

Capacity of Existing System:

The storm drain system does not have adequate capacity to convey the 10 year design storm under existing conditions.

Future Storm Water Management Recommendations:

Construction of open drain improvements and culvert improvement prior to development of the district is recommended. These improvements would significantly increase the outlet capacity and reduce the need for storm water detention basins as future developments occur. It is recommend that prior to the approval of any future development in this area, a storm water master plan for the district be approved by the city.

Drainage District Number: 6  
Drainage District Name: **Block Road**  
Drainage District Acreage: 726.5 acre  
Unit Allowable Discharge: 0.2 cfs/acre

Outlet:

The storm drain outlet is an open ditch with a series of culverts between Junction and Tuscola Road. The open drain outlets to the Cass River.

Existing and Anticipated Future Land Use:

The existing land use is mostly agricultural with some residential areas and a park area. There is a potential for future development.

Capacity of Existing System:

The storm drain system does not have adequate capacity to convey the 10 year design storm under existing conditions.

Future Storm Water Management Recommendations:

Construction of open drain improvements and culvert improvement prior to development of the district is recommended. These improvements would significantly increase the outlet capacity and reduce the need for storm water detention basins as future developments occur. It is recommend that prior to the approval of any future development in this area, a storm water master plan for the district be approved by the city.

Drainage District Number: 7A  
Drainage District Name: **Rosstal Street**  
Drainage District Acreage: 33.1 acres  
Unit Allowable Discharge: 0.75 cfs/acre

Outlet:

There are two storm sewer outlets to the Cass River, an 18" and a 36", along Rosstal Street.

Existing and Anticipated Future Land Use:

The district is mostly developed with residential land use. There is little potential for future development in this district.

Capacity of Existing System:

The storm system has been improved and a storm sewer outlet has been constructed in this district so future development can be done to 30% imperviousness.

Future Storm Water Management Recommendations:

Maintain the established outlet, storm sewer system, and detention facilities.

Drainage District Number: 7B

Drainage District Name: **Rosstal/Main Street**

Drainage District Acreage: 11.6 acres

Unit Allowable Discharge: 1.5 cfs/acre

Outlet:

The storm sewer system discharges into the Cass River.

Existing and Anticipated Future Land Use:

The district is mostly developed with commercial land use. There is little potential for future development in this district; however, redevelopment may occur.

Capacity of Existing System:

The storm sewer system has the capacity to convey the 10 year design storm under existing conditions.

Future Storm Water Management Recommendations:

Maintain the established outlet, storm sewer system, and detention facilities.

Drainage District Number: 8  
Drainage District Name: **Main Street**  
Drainage District Acreage: 18.4 acres  
Unit Allowable Discharge: 0.5 cfs/acre

Outlet:

The storm drain system outlets through storm sewers to the Cass River. Also, a storm water pumping station provides a drainage outlet if high water levels in the Cass River are experienced.

Existing and Anticipated Future Land Use:

The existing land use is mostly commercial development with potential for commercial redevelopment.

Capacity of Existing System:

The existing storm sewer system does not have adequate capacity to convey the 10 year design storm.

Future Storm Water Management Recommendations:

It is recommended that as development and redevelopment occurs, storm water be restricted and adequate detention capacity be provided. Additionally, the installation of catch basin restrictors in the streets may reduce surcharging of storm sewers and provide storm water detention.

Drainage District Number: 9A  
Drainage District Name: **The Fortress**  
Drainage District Acreage: Not Applicable  
Unit Allowable Discharge: Not Applicable

Outlet:

This district does not have a public outlet due to its proximity to the Cass River. The West Jefferson District (see 9B) outlets to this district via a culvert under West Jefferson Street. The discharge flows overland to the Cass River.

Existing and Anticipated Future Land Use:

The existing land use consists of a commercial golf course.

Capacity of Existing System:

Not Applicable

Future Storm Water Management Recommendations:

Review adequacy of future development. Maintain the existing storm water outlet for the West Jefferson (9B) district.

Drainage District Number: 9B  
Drainage District Name: **West Jefferson**  
Drainage District Acreage: 56.3 acres  
Unit Allowable Discharge: 0.30 cfs/acre

Outlet:

The storm drain outlet culvert under West Jefferson Street which discharges to an overland flow path through the golf course.

Existing and Anticipated Future Land Use:

Current land use is agricultural. There is potential for future development.

Capacity of Existing System:

There is no established drainage system, the existing culvert under Jefferson Street does have adequate capacity to convey the 10 year design storm for existing conditions.

Future Storm Water Management Recommendations:

Outlet discharge rate for this district cannot be increased without installation of improved drainage system to Cass River. Without improve storm drain outlet, storm water detention must be provided as development occurs.

Drainage District Number: 10  
Drainage District Name: **Flint Street**  
Drainage District Acreage: 33.9 acres  
Unit Allowable Discharge: 0.30 cfs/acre

Outlet:

The outlet is a 27" storm sewer which outlets to the Cass River.

Existing and Anticipated Future Land Use:

The current land use is residential and agricultural. There is potential for future residential development.

Capacity of Existing System:

The storm drainage system does have adequate capacity to convey the 10 year design storm under existing conditions, but does not have capacity for additional development.

Future Storm Water Management Recommendations:

Construction on a relief storm drain to provide an adequate outlet is the optimal solution, however, it may not be a feasible solution. As an alternative to a relief drain, it is recommended that a regional storm water detention basin be constructed prior to development of this area. It is recommended that prior to approval of any future development a storm water master plan for this area be approved by the city.



Drainage District Number: 11  
Drainage District Name: **South Main Street**  
Drainage District Acreage: 35.8 acres  
Unit Allowable Discharge: 0.20 cfs/acre

Outlet:

The outlet is a 18" storm sewer which outlets to the Cass River.

Existing and Anticipated Future Land Use:

Current land use is primarily of commercial and residential. There is potential for future commercial development and redevelopment.

Capacity of Existing System:

The existing storm system does not have adequate capacity to convey the 10 year design storm for existing conditions.

Future Storm Water Management Recommendations:

The drain is substantially undersized and improvements to existing storm sewer system should be considered. Without improvements to existing systems as future development occurs, storm water should be restricted and on site storm water detention capacity be provided.

Drainage District Number: 12A  
Drainage District Name: **Brewery**  
Drainage District Acreage: 19.2 acres  
Unit Allowable Discharge: 0.60 cfs/acre

Outlet:

The outlet is a 42" storm sewer which outlets to the Cass River.

Existing and Anticipated Future Land Use:

Current land use is commercial/industrial. There is high potential for commercial/industrial redevelopment. Subdistricts 12B and 12C drain into this district.

Capacity of Existing System:

The existing storm system does not have adequate capacity to convey the 10 year design storm under existing conditions.

Future Storm Water Management Recommendations:

The drain is substantially undersized and improvements to existing storm sewer system should be considered. Without improvements to existing systems as future development occurs, storm water should be restricted and on site storm water detention capacity be provided.

Drainage District Number: 12B  
Drainage District Name: **East Jefferson**  
Drainage District Acreage: 101.0 acres  
Unit Allowable Discharge: 0.30 cfs/acre

Outlet:

The outlet is an open drain with 36" culverts and outlets to the Brewery subdistrict which has a 42" storm drain outlet.

Existing and Anticipated Future Land Use:

The current land use is a mix of residential, commercial and agricultural. There is potential for future residential and commercial development.

Capacity of Existing System:

The storm drain system does have adequate capacity to convey the 10 year design storm under existing conditions. The system does not have capacity for future growth.

Future Storm Water Management Recommendations:

Construction of open drain, storm sewer and culvert improvement prior to development of the district is recommended. These improvements would significantly increase the outlet capacity and reduce the need for storm water detention basins as future developments occur. It is recommend that prior to the approval of any future development in this area, a storm water master plan for the district be approved by the city.

Drainage District Number: 12C  
Drainage District Name: **Pine Street**  
Drainage District Acreage: 16.7 acres  
Unit Allowable Discharge: 0.15 cfs/acre

Outlet:

The storm drain outlet is a 12" storm sewer which outlets to the Brewery subdistrict which has a 42" storm drain outlet.

Existing and Anticipated Future Land Use:

The current land use is commercial and residential with same potential for redevelopment.

Capacity of Existing System:

The existing storm system does not have adequate capacity to convey the 10 year design storm for existing conditions. This system is severely under sized.

Future Storm Water Management Recommendations:

This storm drainage system should be replaced with a larger storm sewer outlet.

Drainage District Number: 13A  
Drainage District Name: **Bronners**  
Drainage District Acreage: 36.7 acres  
Unit Allowable Discharge: 0.60 cfs/acre

Outlet:

The storm drain outlet is a 42" storm sewer which outlets to an open drain on the southwest side of South Main Street (M-83).

Existing and Anticipated Future Land Use:

The current land use is primarily commercial with some residential. There is limited potential for redevelopment. Also, subdistrict 13B drain into this system.

Capacity of Existing System:

The existing storm system does have adequate capacity to convey the 10 year design storm for existing conditions.

Future Storm Water Management Recommendations:

It is recommended that as future development occurs, storm water be restricted and on site detention capacity be provided.

Drainage District Number: 13B  
Drainage District Name: **State Highway**  
Drainage District Acreage: 14.4 acres  
Unit Allowable Discharge: 0.25 cfs/acre

Outlet:

The storm drain outlet is a swale ditch with small culverts which outlets to a 42" storm sewer.

Existing and Anticipated Future Land Use:

Currently the district is residential, commercial and open. There is a potential for future development.

Capacity of Existing System:

The storm drain system does not have capacity to convey a 10 year design storm.

Future Storm Water Management Recommendations:

Construction of open drain improvements and culvert improvement prior to development of the district is recommended. These improvements would significantly increase the outlet capacity and reduce the need for storm water detention basins as future developments occur. It is recommend that prior to the approval of any future development in this area, a storm water master plan for the district be approved by the city.

Drainage District Number: 14  
Drainage District Name: **Weiss Street**  
Drainage District Acreage: 187.2 acres  
Unit Allowable Discharge: 0.20 cfs/acre

Outlet:

The storm drain outlet is a 36" storm sewer which discharges to the Dead Creek County Drain.

Existing and Anticipated Future Land Use:

The current land use consists of recent commercial and industrial development. There is potential for future development.

Capacity of Existing System:

The existing storm system does not have adequate capacity to convey the 10 year design storm under existing conditions.

Future Storm Water Management Recommendations:

Construction of a relief storm drain to provide an adequate outlet is the optimal solution, however, it may not be a feasible solution. As an alternative to a relief drain, it is recommended as development and redevelopment occurs, storm water be restricted and adequate detention capacity be provided. Additionally, the installation of catch basin restrictors in the streets may reduce surcharging of storm sewers and provide storm water detention. A feasibility study on the installation catch basin restrictors is highly recommended.

Drainage District Number: 15  
Drainage District Name: **Mission Ridge**  
Drainage District Acreage: 97 acres  
Unit Allowable Discharge: 1 cfs/acre

Outlet:

The storm drain system outlets to an open drain which outlets to the Cass River.

Existing and Anticipated Future Land Use:

The district is mostly residential development.

Capacity of Existing System:

The storm drain outlet does have capacity to convey the 10 year design storm.

Future Storm Water Management Recommendations:

Maintain existing drainage system.



Drainage District Number: 16  
Drainage District Name: **Bavarian Motor Lodge**  
Drainage District Acreage: Not Applicable  
Unit Allowable Discharge: Not Applicable

Outlet:  
A public outlet is not present in this district due to its proximity to the Cass River.

Existing and Anticipated Future Land Use:  
The existing land use consists of commercial areas.

Capacity of Existing System:  
Not Applicable

Future Storm Water Management Recommendations:  
Review adequacy of future development.

Drainage District Number: 17  
Drainage District Name: **Galester Drain**  
Drainage District Acreage: \*1015 acres  
Unit Allowable Discharge: 0.20 cfs/acre

Outlet:

The Galester Drain is an open ditch which outlets to the Cass River. The downstream most culvert is a 90" cnp under East Tuscola Road.

Existing and Anticipated Future Land Use:

The existing land use is mostly agricultural. There is potential for a small amount of residential development in this district, but for the most part the land will remain of agricultural use.

Capacity of Existing System:

The outlet of this drain does have adequate capacity to convey the 10 year design storm under existing conditions.

Future Storm Water Management Recommendations:

If the district is not developed, then general maintenance of the outlet is recommended. As development occurs, it is recommended to replace the culvert under East Tuscola Road with a larger tube and improve upland drainage so that stormwater detention is not required. If improvements to the outlet are not constructed, then storm detention must be provided for new development. It is recommended that prior to the approval of any future development in this area, a stormwater master plan for the district be approved by the city.

\* Not all district area 15 shown on map.

Drainage District Number: 18  
Drainage District Name: **East Tuscola**  
Drainage District Acreage: 26 acres  
Unit Allowable Discharge: 0.70 cfs/acre

Outlet:

This area outlets to the Cass River through a 12” culvert under East Tuscola Road.

Existing and Anticipated Future Land Use:

This existing land is agricultural and residential. There is potential for future development in this area.

Capacity of Existing System:

The system is adequate for the 10 year design storm under existing conditions.

Future Storm Water Management Recommendations:

This is a small district and it is recommended to maintain the existing drainage system. As development occurs it is recommended that a larger culvert be installed to increase the outlet capacity to the Cass River and avoid stormwater detention.

Drainage District Number: 19  
Drainage District Name: **Ayre Lane**  
Drainage District Acreage: 10 acres  
Unit Allowable Discharge: 0.20 cfs/acre

Outlet:

This district outlets to the Cass River through a 12" storm sewer.

Existing and Anticipated Future Land Use:

This is a residential area. The district is developed and future land use changes are not anticipated.

Capacity of Existing System:

The storm sewer outlet does not have capacity to convey the 10 years storm. However, areas of the district slope naturally to the Cass River.

Future Storm Water Management Recommendations:

This is a small district and it is recommended to maintain the existing drainage system. Should problems arise in the area or improvements to the road be constructed, it is recommended to improvement outlet capacity to the Cass River.

Drainage District Number: \*

Drainage District Name: **Cass River**

Unit Allowable Discharge: 1.0 cfs/acre

Outlet:

This drainage district outlets in many places to the Cass River. In several areas, storm sewer outlets have not been constructed because the land has not yet developed.

Existing and Anticipated Future Land Use:

There is agricultural, residential and commercial land use along the river. There is potential for future development.

Capacity of Existing System:

For the most part this area drains overland to the Cass River, therefore is adequate to convey the 10 year design storm.

Future Storm Water Management Recommendations:

If development does not occur, then improvements are not needed. As development occurs, each development should construct a storm drain outlet to the Cass River. This outlet should convey the 10 year design storm so stormwater detention is not required.

Drainage District Number: \*\*

Drainage District Name: **Dead Creek Drain**

Unit Allowable Discharge: 0.2 cfs/acre

Outlet:

The ultimate outlet for this area is the Dead Creek Drain. For the most part stormwater flows overland to various road side drains and county drains and eventually to the Dead Creek Drain.

Existing and Anticipated Future Land Use:

Presently, the district is agricultural land use. It has potential for future development.

Capacity of Existing System:

The Dead Creek Drain was constructed to drain agricultural land for the 10 year design storm.

Future Storm Water Management Recommendations:

If development does not occur, simply maintain the existing drainage system. As developments occur, new storm drain outlets to the Dead Creek must be constructed and stormwater detention must be provided so peak runoff does not increase. As an alternative, the entire capacity of the Dead Creek Drain could be increased.

PLOTTING SCALE: 1=1  
 WORKORDER NO.: 104645.02

RET. DESIGNED BY: BTR

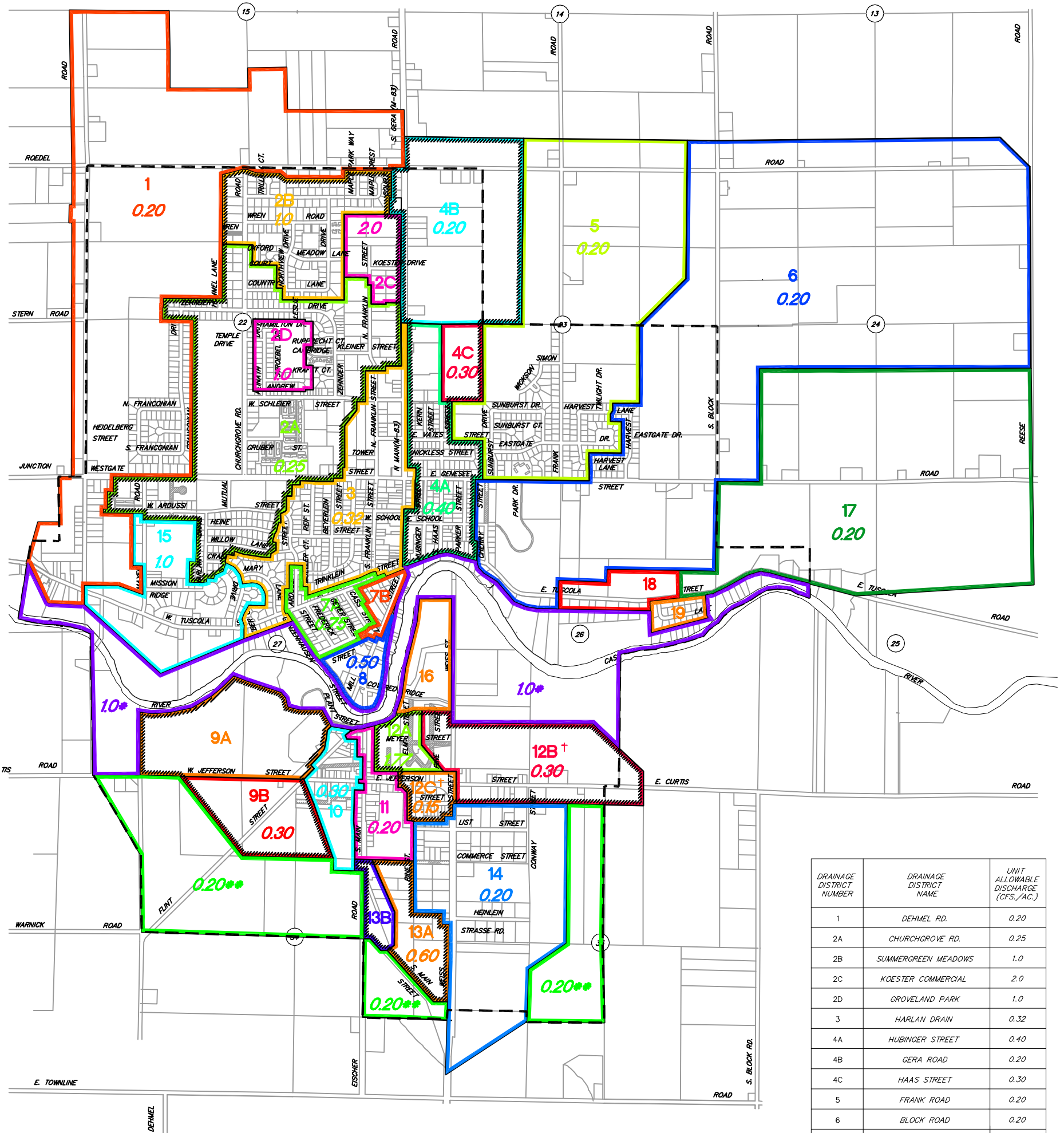
F.B. PG.

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CHECKED BY: DSV

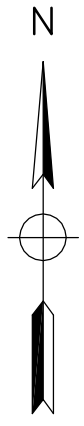
APPROVED BY:

REVISED BTR 4/29/02



DRAINAGE DISTRICT NUMBER	DRAINAGE DISTRICT NAME	UNIT ALLOWABLE DISCHARGE (CFS./AC.)
1	DEHMEL RD.	0.20
2A	CHURCHGROVE RD.	0.25
2B	SUMMERGREEN MEADOWS	1.0
2C	KOESTER COMMERCIAL	2.0
2D	GROVELAND PARK	1.0
3	HARLAN DRAIN	0.32
4A	HUBINGER STREET	0.40
4B	GERA ROAD	0.20
4C	HAAS STREET	0.30
5	FRANK ROAD	0.20
6	BLOCK ROAD	0.20
7A	ROSSTAL STREET	0.75
7B	ROSSTAL/MAIN	1.5
8	MAIN STREET	0.50
9A	THE FORTRRESS	--
9B	W. JEFFERSON	0.30
10	FLINT STREET	0.30
11	S. MAIN STREET	0.20
12A	BREWERY	1.77
12B	E. JEFFERSON	0.30 (0.85)***
12C	PINE STREET	0.15 (1.57)***
13A	BRONNERS	0.60
13B	STATE HIGHWAY	0.25
14	WEISS STREET	0.20
15	MISSION RIDGE	1.0
16	BAVARIAN MOTER LODGE	--
17	GALSTERER DISTRICT	0.20
18	EAST TUSCOLA	0.20
19	AYRE LANE	0.20
*	CASS RIVER	1.0*
**	DEAD CREEK DRAIN	0.20**
†	ALLOWABLE DISCHARGE RATE IF OUTLET IS IMPROVED TO 12A	

SEE STORM WATER MANAGEMENT DRAINAGE PLAN FOR ADDITIONAL INFORMATION



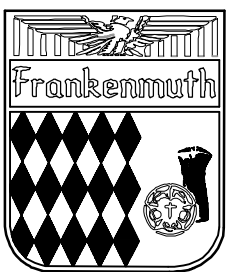
LEGEND

- DISTRICT LINES
- SUB-DISTRICT LINES
- PUD LIMITS LINE
- ROAD RIGHT-OF-WAY
- 6**  
**0.30** DISTRICT NUMBER  
UNIT ALLOWABLE DISCHARGE (CFS. PER/ACRE)

CITY OF FRANKENMUTH  
 T.11N.-R.6E.  
 SAGINAW COUNTY, MICHIGAN

DRAINAGE MAP

CITY OF FRANKENMUTH



F-1011



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## APPENDIX E

1. Recommendations for Maintenance Plans
2. Sample Maintenance Plan





## Storm Water Management System Maintenance Plans

1. Maintenance plans are required to be submitted with all construction plans and included in the subdivision agreement or master deed documents of all businesses, subdivisions and site condominiums. These plans shall include the following information:
  - a. The first annual maintenance budget itemized by task, must be submitted to the City. The financing mechanism shall also be described. After the first year it is the responsibility of the association or commercial owner to develop the budget. However, it does not need to be submitted to the City.
  - b. A copy of the final approved drainage plan for the development that delineates the facilities and all easements, maintenance access, and buffer areas.
  - c. A listing of appropriate tasks defined for each component of the system described, and a schedule for their implementation. The following areas will be covered:
    - i. Maintenance of facilities such as pipes, channels, outflow control structures, infiltration devices, and other structures.
    - ii. Debris removal from catch basins, channels, and basins.
    - iii. Dredging operations for both channels and basins to remove sediment accumulation. Storm water system maintenance plans shall require that sediment be removed when sediment reaches a depth of equal to 50% of the depth of the forebay or 12 inches, whichever is less.
  - d. The maintenance personnel or contractor responsible for performing each of the various maintenance activities described which will be recorded with final approved plans and plats.
  - e. A detailed description of the procedure for both preventive and corrective maintenance activities. The preventative maintenance component will include:
    - i. Periodic inspections, adjustments, and replacements.
    - ii. Record-keeping of operations and expenditures.
  - f. Provision for the routine and non-routine inspection of all components within the system described:
    - i. We recommend scheduled wet weather inspections of structural

elements and inspection for sediment accumulation in detention basins shall be conducted annually, with as-built plans in hand. These should be carried out under the direction of a professional engineer reporting to the responsible agency or owner.

- ii. Housekeeping inspections, such as checking for trash removal, should take place at least monthly.
  - iii. We recommend emergency inspections on an as-needed basis, upon identification of problems; contracted maintenance people should conduct these inspections.
- g. A description of ongoing landscape maintenance needs. Landscaping shall consist of low maintenance and/or native plant species. The proprietor will monitor the viability of plantings for at least two years after establishment and plantings will be replaced as needed. Subsequent monitoring shall be conducted by the landowner or development association. The City of Frankenmuth is not responsible for landscape maintenance.
- h. 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 perform the needed maintenance and assess the costs 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 notification 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 48 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.

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 follows on the next page.



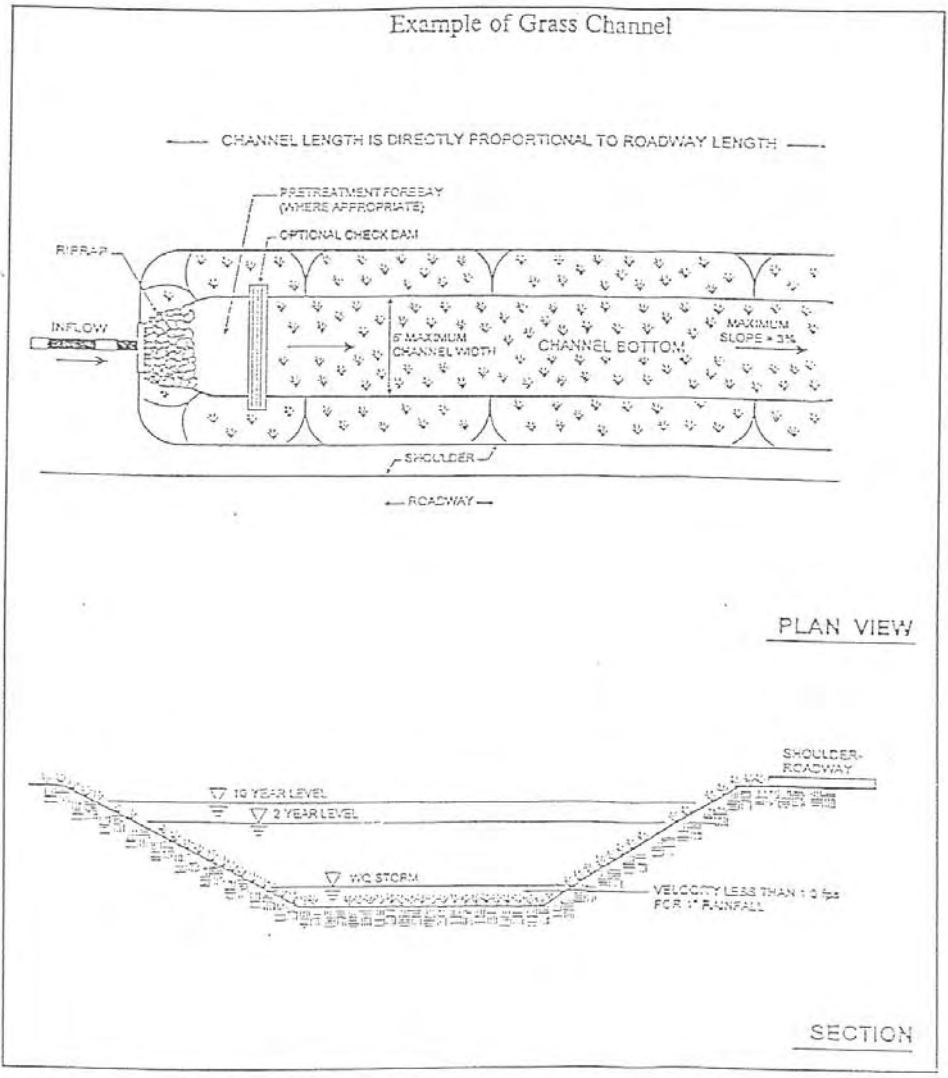
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## APPENDIX F

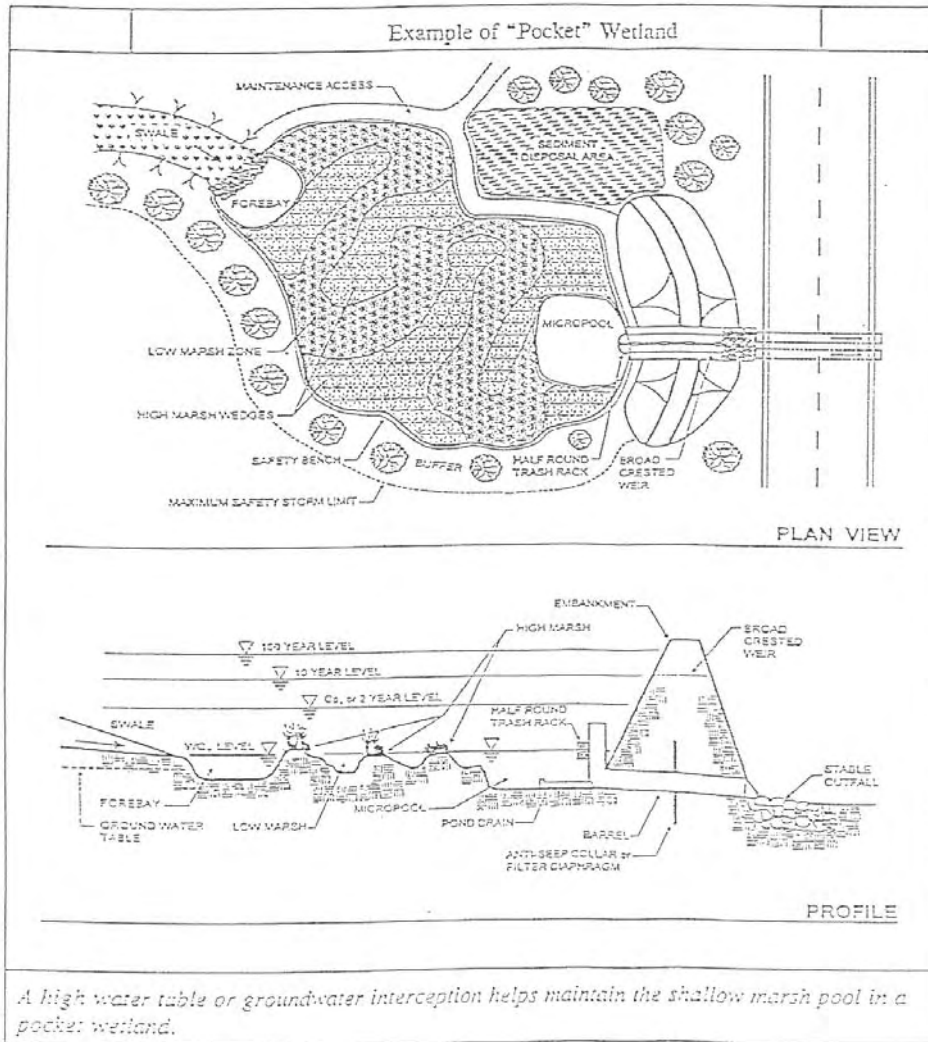
### 1. Design Examples

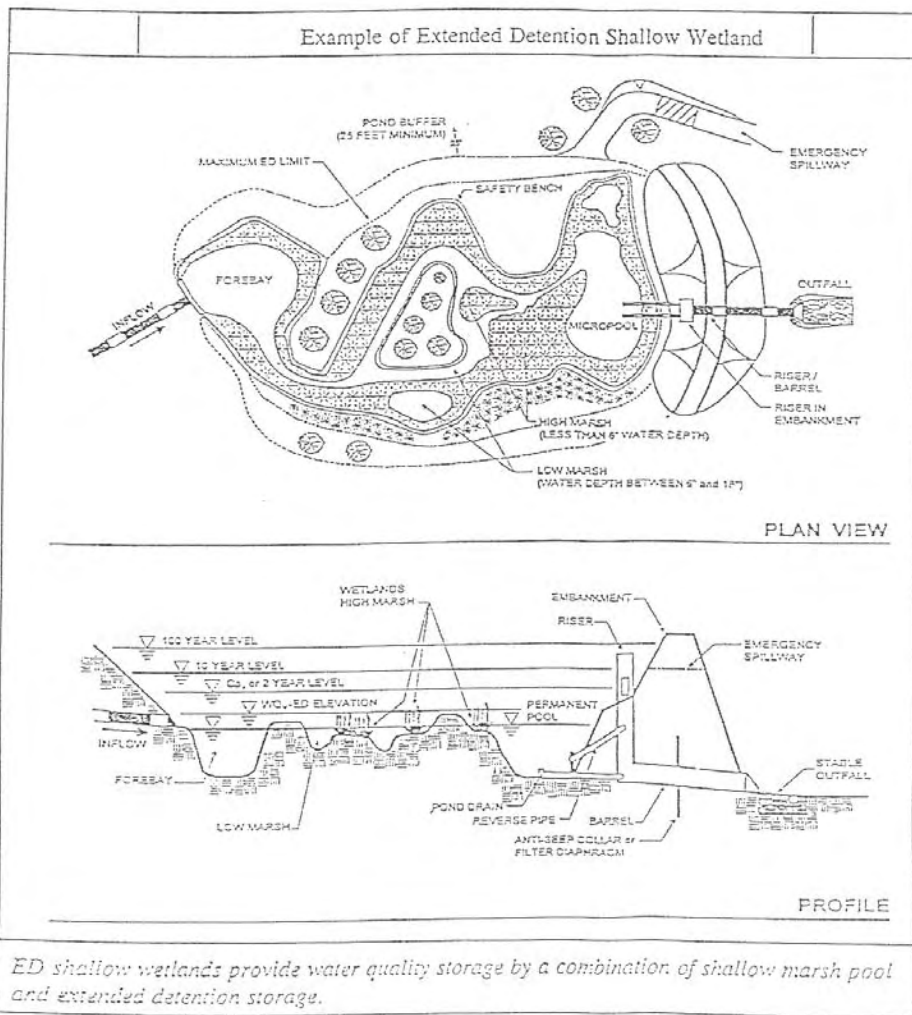


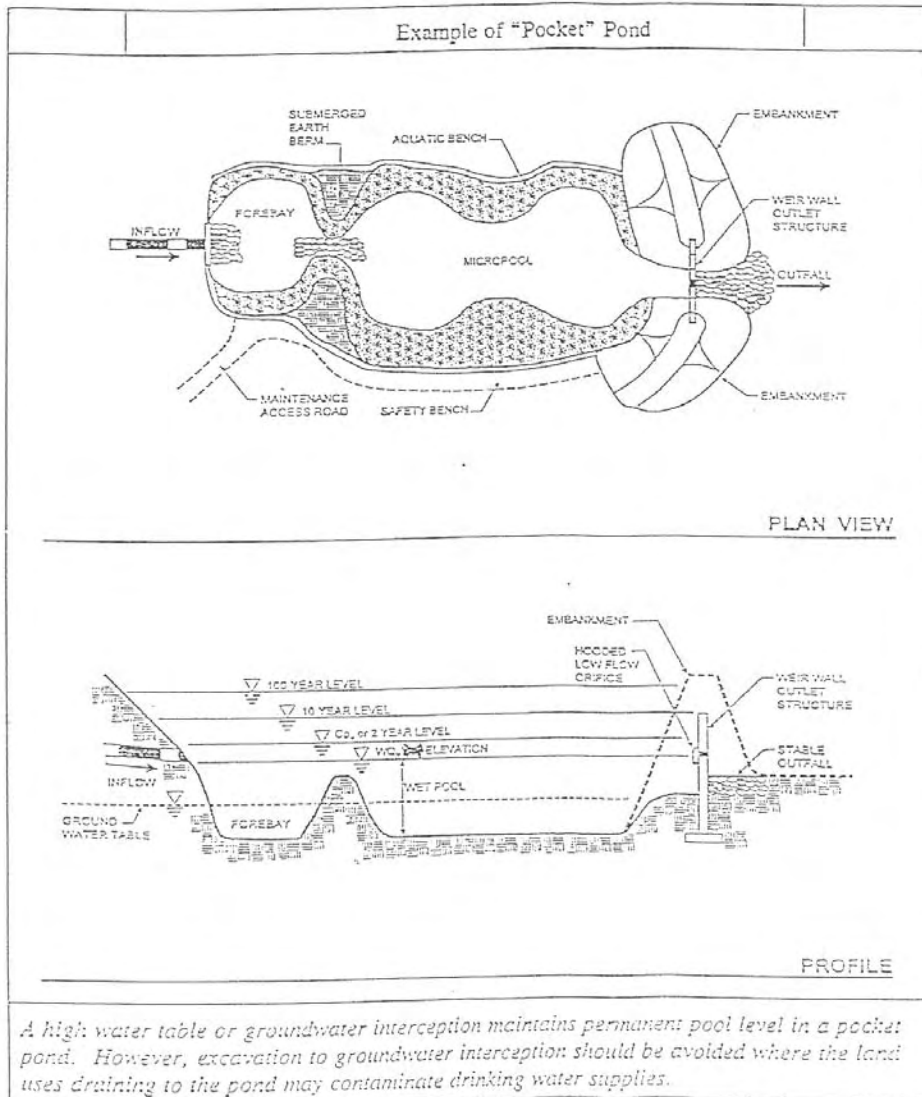
### Example of Grass Channel



Source: State of Maryland, 1998

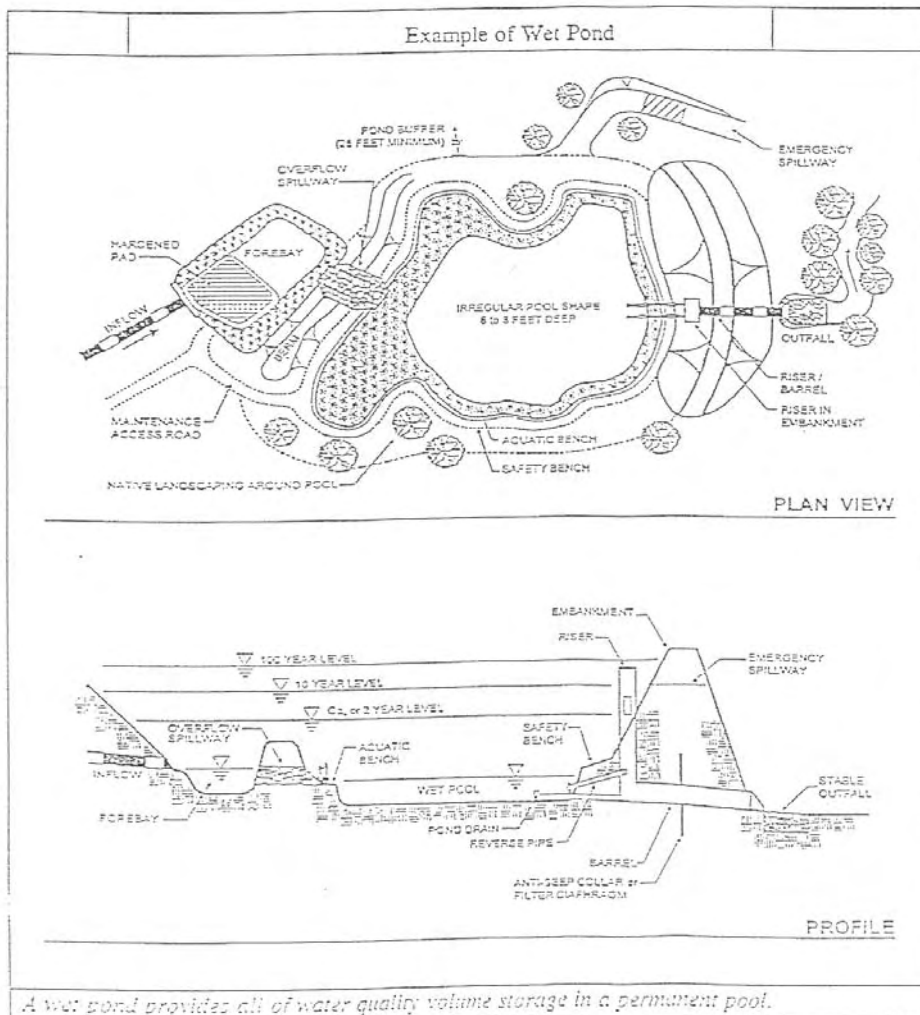


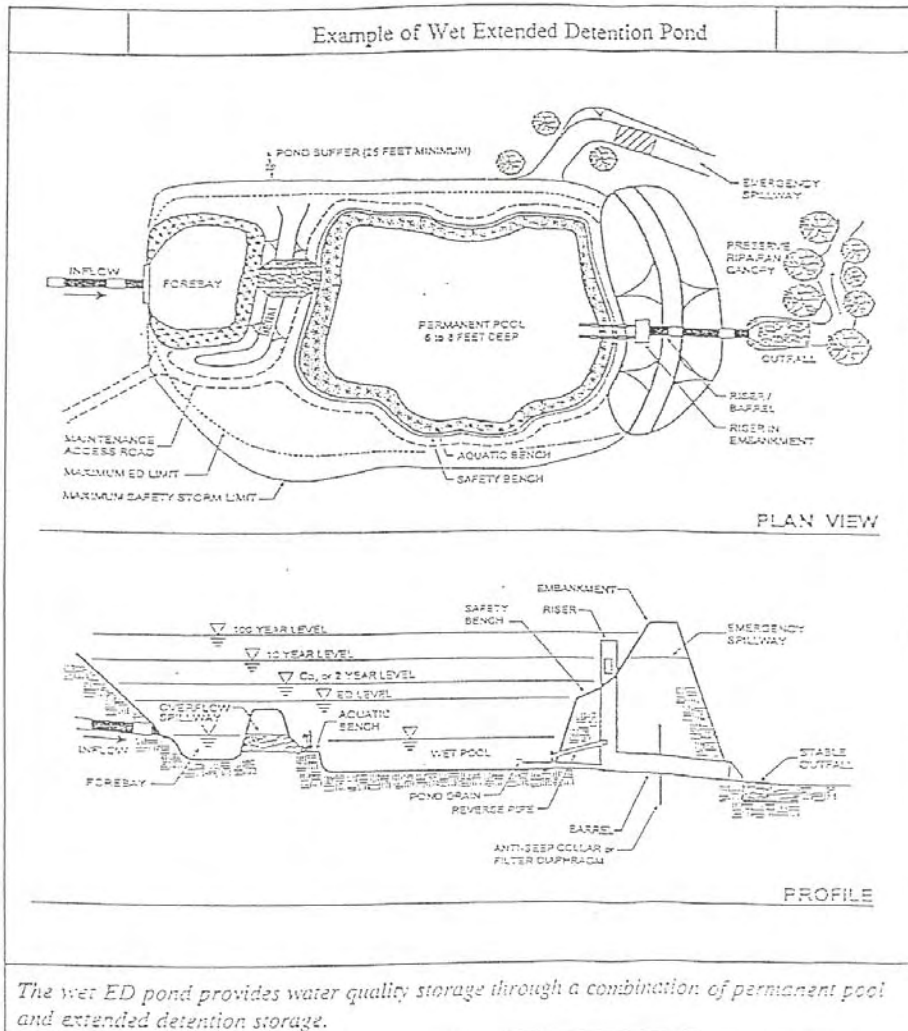


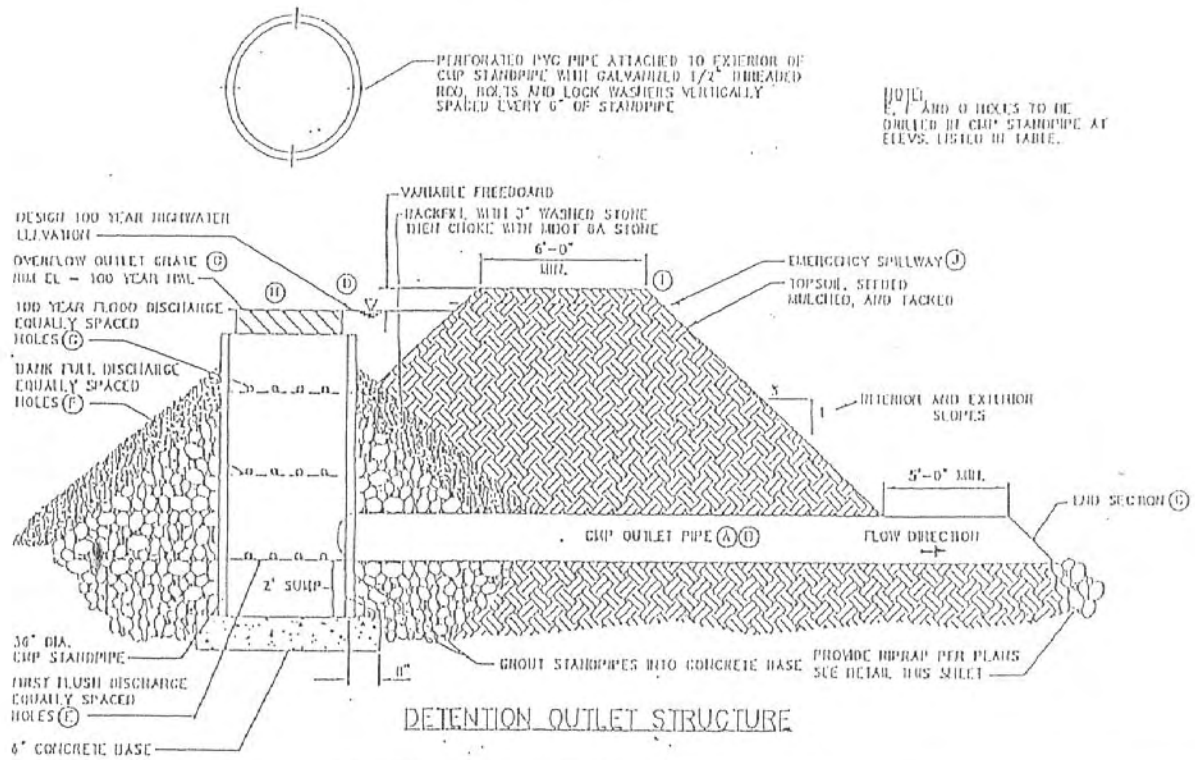


Source: State of Maryland, 1998









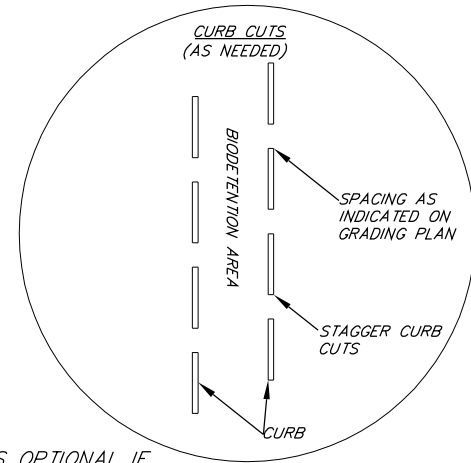
HOLES (G) AND (F) HOLES TO BE  
DRILLED IN CIP STANDPIPE AT  
ELEV. LISTED IN TABLE.

DETENTION OUTLET SCHEDULE									
OUTLET PIPE LENGTH (A)	OUTLET PIPE SLOPE (B)	END SECTION INVERT (C)	100-YEAR HWM (D)	FIRST FLUSH DISCHARGE HWT/ORIFICE SIZE (E)	DARK FULL DISCHARGE HWT/ORIFICE SIZE (F)	100 YEAR FLOOD DISCHARGE HWT/ORIFICE SIZE (G)	TOP OF STAND PIPE ELEVATION (H)	EMERGENCY SPILLWAY ELEVATION (I)	EMERGENCY SPILLWAY ELEVATION (J)



**TYPICAL BIODETENTION  
SYSTEM CROSS SECTION**

(NOT TO SCALE)



PLANT WITH NATIVE PLANTS WHICH CAN WITHSTAND MOIST TO WET CONDITIONS, AS WELL AS TOLERATE PERIODIC DROUGHT.

2 SQ. YDS. PLAIN RIPRAP WITH GEOTEXTILE SPILLWAY AT CURBCUTS.

NOTE: CB OUTLET IS OPTIONAL IF OVERFLOW CAN BE DIRECTED BY SITE GRADING.

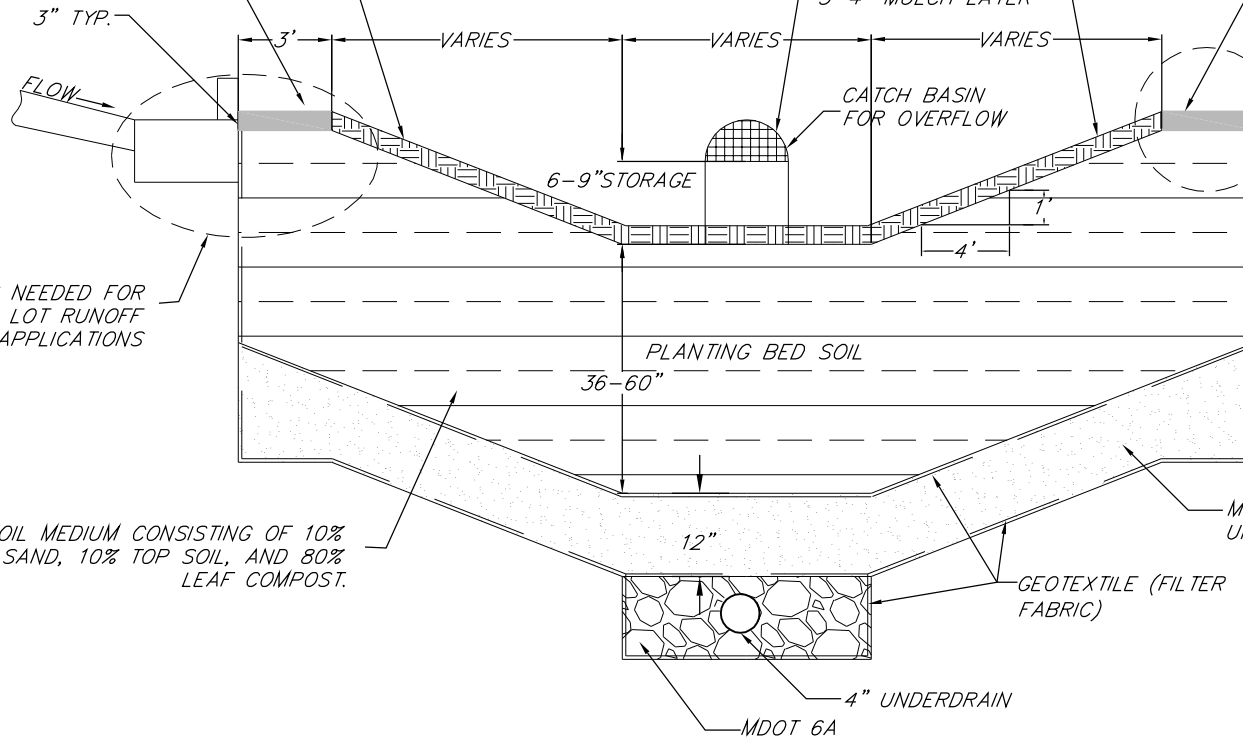
1 SQ. YD. COBBLE SPLASH PAD AT DOWNSPOUT OUTLET.

AS NEEDED FOR PARKING LOT RUNOFF APPLICATIONS

AS NEEDED FOR DOWNSPOUTS DIRECTED TO BIODETENTION.

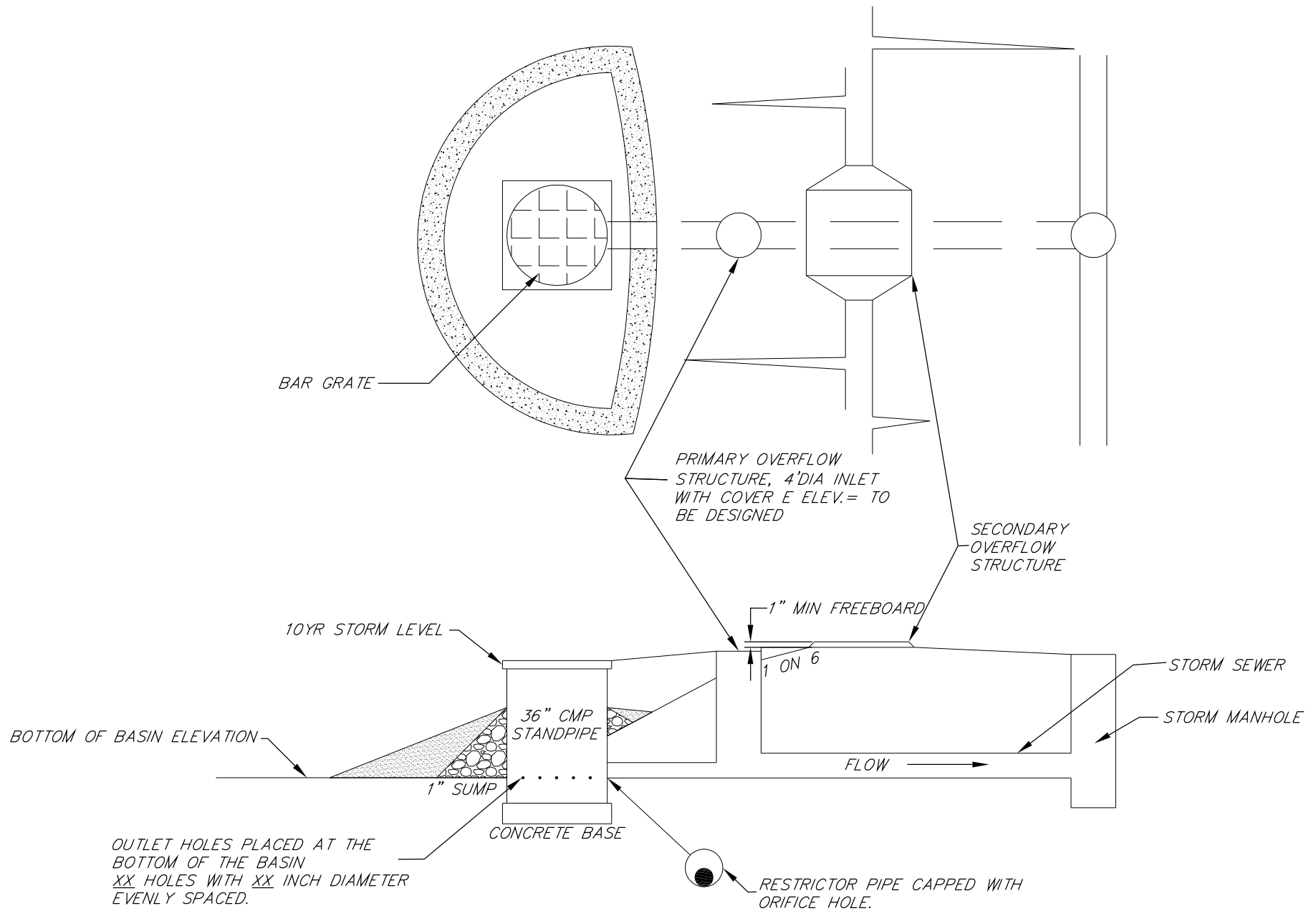
SOIL MEDIUM CONSISTING OF 10% SAND, 10% TOP SOIL, AND 80% LEAF COMPOST.

MDOT CLASS 2A SAND UNCOMPACTED

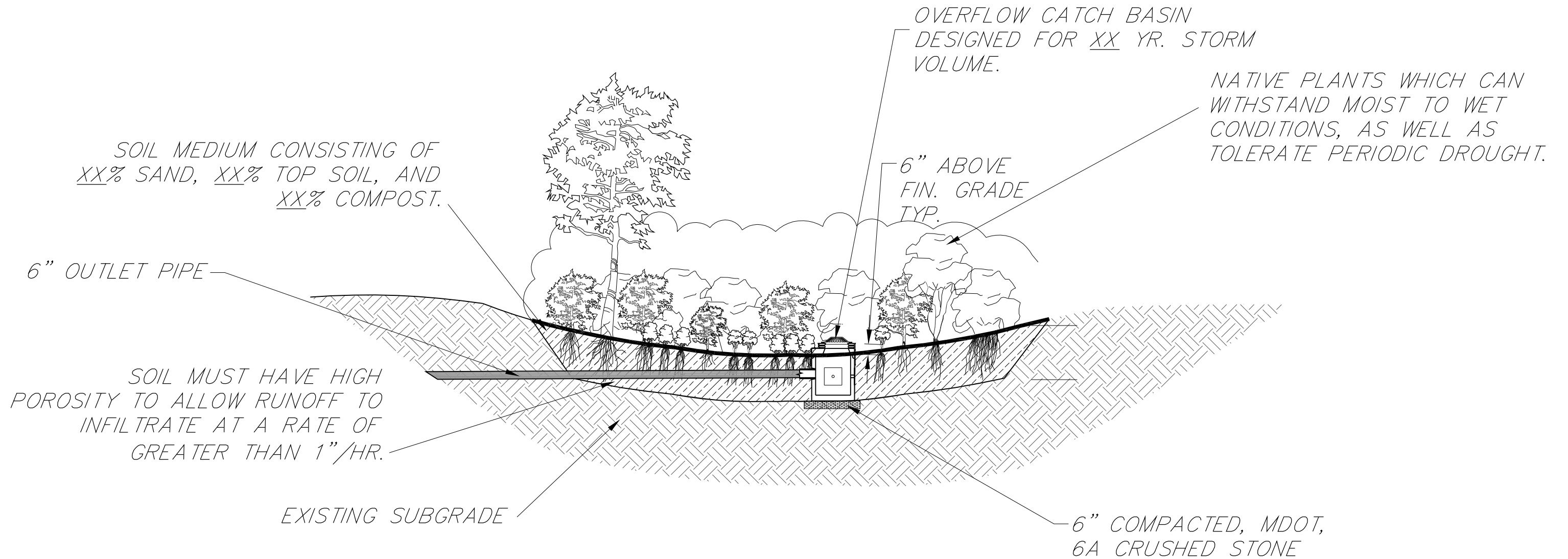


GEOTEXTILE (FILTER FABRIC)

4" UNDERDRAIN  
MDOT 6A

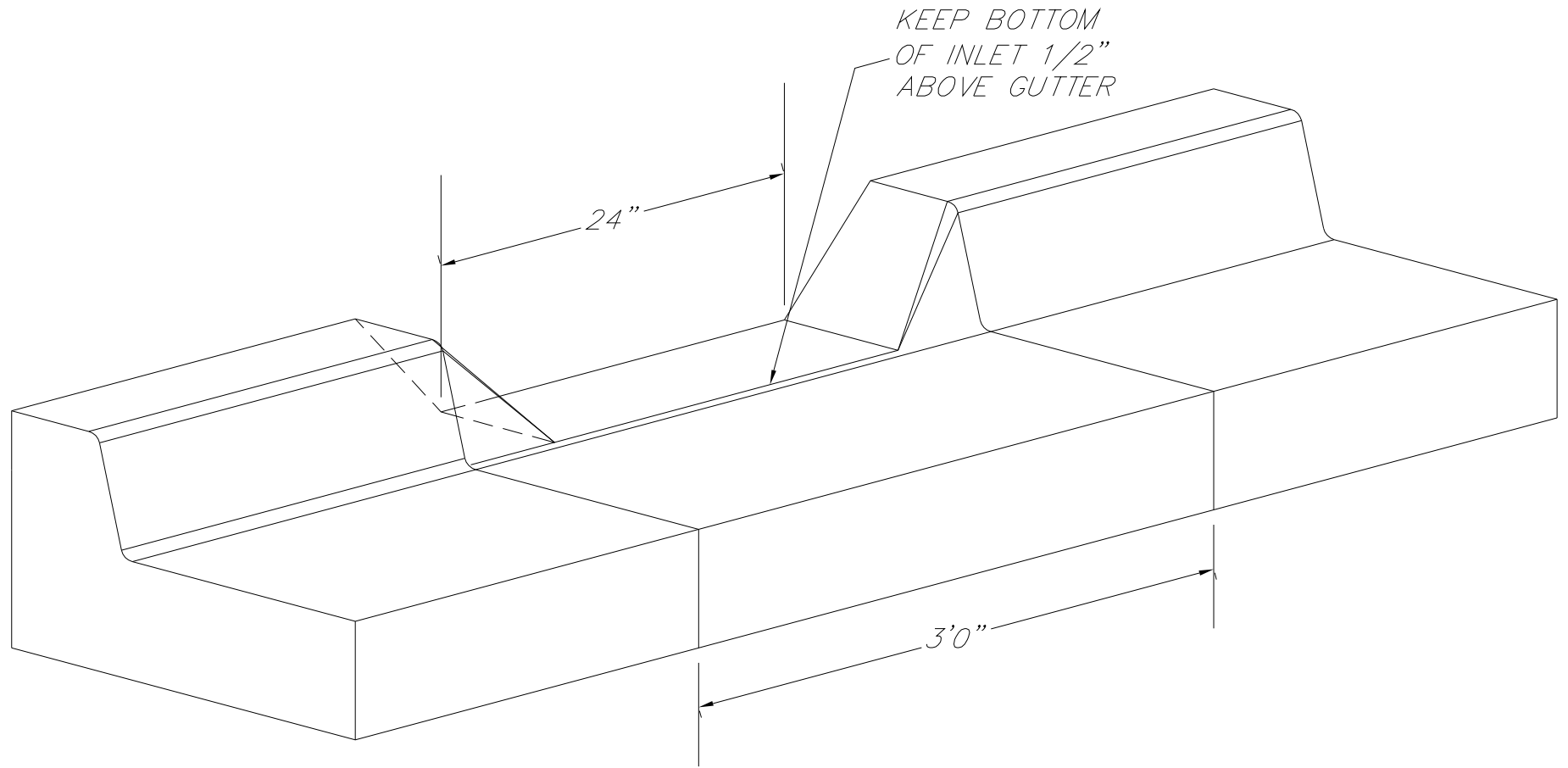


**DETENTION BASIN OUTLET FILTER**  
 (NOT TO SCALE)



NOTE: RAIN GARDENS TYPICALLY DO NOT REQUIRE A CATCH BASIN HOWEVER EACH SITE MUST BE ASSESSED FOR ABILITY TO INFILTRATE RUNOFF. SEE BIODETENTION DETAIL FOR FURTHER SPECIFICATIONS.

TYPICAL RAIN GARDEN WITH DRAIN  
(NOT TO SCALE)



CURB INLET DETAIL