

# **GUIDELINES FOR STORM WATER MANAGEMENT BERRIEN COUNTY, MICHIGAN**



**REQUIREMENTS AND GENERAL COMPLIANCE GUIDELINES  
FOR STORM WATER DRAINAGE SYSTEM DESIGN  
FOR DEVELOPMENT AND REDEVELOPMENTS  
WITHIN BERRIEN COUNTY**

**BERRIEN COUNTY DRAIN COMMISSIONER**

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## TABLE OF CONTENTS

I.	INTRODUCTION.....	1
II.	ADMINISTRATIVE GUIDELINES .....	2
	A.    Definitions .....	2
	B.    Application, Review and Approval Procedure.....	7
	C.    Inspection Requirements .....	11
	D.    Fee Schedule .....	13
III.	STORM DRAINAGE SYSTEMS WITHIN BERRIEN COUNTY .....	13
	A.    Allowable Discharge (Qa)/Detention Requirements.....	13
	B.    Storm Water Detention Requirements.....	14
	C.    Discharge Restrictor Requirements.....	14
	D.    Storm Water Retention Requirements.....	15
IV.	MINIMUM DESIGN REQUIREMENTS AND GUIDELINES FOR STORM DRAINAGE SYSTEMS.....	15
	A.    Requirements.....	15
	B.    General Compliance Guidelines.....	18
	C.    Variations from Requirements .....	19
	APPENDIX .....	20
	STORM WATER REVIEW APPLICATION .....	PA - 1
	CONCEPTUAL REVIEW CHECKLIST .....	CR - 1
	DRAINAGE PLAN CHECKLIST .....	DP 1 - 2
	STORM WATER DETENTION REQUIREMENTS.....	DR 1 - 2
	CHART FOR C FACTORS .....	CF - 1
	MAINTENANCE AGREEMENT .....	MA 1 - 4
	INSPECTION DAILY REPORT .....	IDR 1 - 2
	DETENTION AND RESTRICTION, FINAL INSPECTION REPORT.....	FIR - 1
	ENGINEER’S CERTIFICATE OF OUTLET .....	ECO 1 - 2
	ENGINEER’S CERTIFICATE OF CONSTRUCTION .....	ECC 1 - 2
	SAMPLE DETAILS.....	SD 1 - 9A

## **I. INTRODUCTION**

The purpose of these Guidelines is to establish requirements and general compliance guidelines for storm water management practices in Berrien County. The Guidelines establish the framework through which detention and/or retention measures will be implemented, and details the process that must be followed to gain approval for new developments or redevelopment drainage systems. The purpose of these Guidelines is to accomplish the following objectives, which include but are not limited to:

1. To reduce artificially induced flood damage;
2. To minimize increase in storm water runoff rates and volumes from identified new land development;
3. To minimize the deterioration of existing watercourses, culverts and bridges, and other structures;
4. To encourage water recharge into the ground where geologically favorable conditions exist;
5. To prevent an increase in non-point source pollution;
6. To maintain the integrity of stream channels for their biological functions, as well as for drainage and other purposes;
7. To minimize the impact of development upon stream bank and stream bed stability;
8. To reduce erosion from development or construction projects;
9. To preserve and protect water supply facilities and water resources by means of controlling increased flood discharges, stream erosion, and runoff pollution;
10. To reduce storm water runoff rates and volumes, soil erosion, and non-point source pollution, wherever practicable, from lands that were developed without storm water management controls meeting the purposes and standards of these Guidelines; and
11. To reduce the adverse impact of changing land use on water bodies by establishing minimum standards to protect water bodies from degradation resulting from changing land use.

The Guidelines include:

1. A summary of the procedures including requirements, review procedures, inspection requirements, fee schedule and other agency requirements;
2. A description of design requirements and engineering calculations; and
3. A description of minimum design criteria and rules to be followed for design of new drainage systems within Berrien County.

## II. ADMINISTRATIVE GUIDELINES

### A. Definitions

1. Allowable Discharge: The restricted discharge from a site after development or redevelopment as calculated in accordance with these Guidelines.
2. Base Flood: A flood having a one percent (1%) chance of being equaled or exceeded in any given year.
3. 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.
4. Base Floodplain: The area inundated by the Base Flood.
5. Best Management Practices (BMPs): A practice, or combination of practices and design criteria that comply with the Michigan Department of Environmental Quality's Guidebook of BMPs for Michigan Watersheds (including, but not limited to minimizing storm water runoff and preventing the discharge of pollutants into storm water) as determined by the Drain Commissioner and/or designee, and where appropriate, the standards of the Berrien County Drain Commissioner.
6. Bioretention Areas: Areas designed to use soil and plant material to mimic natural processes and store, filter and infiltrate storm water into the ground. These areas may be used anywhere to achieve a degree of storm water treatment.
7. Building Opening: Any opening of a solid wall such as a window or door, through which floodwaters could penetrate.
8. Clean Water Act: The Federal Water Pollution Control Act, 33 USC Sec 1251 et seq., as amended, and the applicable regulations promulgated thereunder.
9. Conduit: Any channel, pipe, drainage or culvert used for the conveyance or movement of water, whether open or closed.
10. Construction Site Storm Water Runoff: Storm water runoff from a development site following an earth change.
11. Control Elevation: Contour lines and points of predetermined elevation used to denote a detention storm area on a plat or site drawing.
12. Designee: The engineering firm formally designated by Berrien County to act as their Engineer.
13. Design Engineer: Registered and licensed professional engineer retained by Owner/Developer responsible for the design of a drainage plan.
14. Detention: A system which is designed to capture storm water and release it over a given period of time through an outlet structure at a controlled rate.

15. 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.
16. 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 devices.
17. Developed or Development: The installation or construction of impervious surfaces on a development site that require, pursuant to state law or local ordinance, the Drain Commissioner or his designee's approval of a site plan, plat, site condominium, special land use, planned unit development, rezoning of land, land division approval, private road approval or other approvals required for the development of land or the erection of buildings or structures; provided, however, developed or development shall not include the actual construction of, or an addition, extension or modification to, an individual single-family or a two-family detached dwelling.
18. Developer: Any person proposing or implementing the development of land.
19. Developer/Owner Engineer: The engineering company formally designated by the Developer/Owner to act as their Engineer.
20. Development Site: Any land that is being or has been developed, or that a developer proposes for development.
21. Discharge: The release or outflow of water from any source.
22. Discharger: Any person or entity that directly or indirectly discharges storm water from any property. Discharger also means any employee, officer, director, partner, contractor, or other person who participates in, or is legally or factually responsible for, any act or omission that is or results in a violation of the storm water guidelines.
23. Drain: Any drain as defined in and established under the Drain Code of 1956, as amended, being MCL 280.1 *et seq.*
24. Drainage: The collection, conveyance, or discharge of ground water and/or surface water.
25. Drainage Area: The area from which storm water runoff is conveyed to a single outlet (i.e. a watershed or catchment area).
26. Drainageway: The area within which surface water or ground water is carried from one part of a lot or parcel to another part of the lot or parcel or to adjacent land.
27. Drain Commissioner: The Berrien County Drain Commissioner or his designee.
28. Drainage District/Watershed: All drainage areas contributing surface water runoff upstream of a discharge location of the proposed development.

29. Drains (Privately-Owned): Those drains under private ownership and not under the control of the Drain Commissioner's office or any other public entity.
30. Earth Change: Any human activity, which removes ground cover, changes the slope or contours of the land, or exposes the soil surface to the actions of wind and rain. Earth change includes, but is not limited to, any excavating, surface grading, filling, landscaping, or removal of vegetative roots.
31. EPA: The United States Environmental Protection Agency.
32. Erosion: The process by which the ground surface is worn away by action of wind, water, gravity or a combination thereof.
33. 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.
34. Exempted Discharges: Discharges other than storm water.
35. Federal Emergency Management Agency (FEMA): The agency of the federal government charged with emergency management.
36. Flood or Flooding: A general and temporary condition of partial or complete inundation of normally dry land areas resulting from the overflow of water bodies or the unusual and rapid accumulation of surface water runoff from any source.
37. Flood Proofing: Any structural and/or non-structural additions, changes, or adjustments to structures or property that reduce or eliminate flood damage to land, or improvements utilities and structures.
38. Flood Protection Elevation (FPE): The Base Flood Elevation plus one (1) foot at any given location.
39. 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.
40. Floodway: The channel of any watercourse and the adjacent land areas that must be reserved to carry and discharge a base flood without cumulatively increasing the water surface elevation more than one-tenth (1/10) of a foot due to the loss of flood conveyance or storage.
41. Forebay: These are man-made surface waters used as pretreatment systems. They are designed to temporarily store the first flush of runoff from a storm event and provide for pollutant removal through settling. A forebay or other pretreatment system is recommended at each inlet to a detention system or retention basin.
42. Forebay Outlets: Outlets that convey flow from a forebay into detention systems and retention basins. They must include a flow restrictor for restricted flow and a weir for unrestricted flow.
43. Freeboard: A volume of additional storage designed within a detention basin. A "Safety Factor" within a storm water detention system that is based on 1.0 foot detention volume

above the proposed high water elevation of a detention pond. This volume provides additional storm water detention in the event that a storm exceeds the design capacity.

44. Grading: Any stripping, excavating, filling, and stockpiling of soil or any combination thereof and the land in its excavated or filled condition.
45. Green Roofs: These roofs are constructed of a lightweight soil medium, layered over a drainage layer and a waterproofing membrane. The soil is planted with a specialized mix of plants that can thrive in a roof environment. These types of roofs are also known as vegetated roof covers, eco-roofs, or nature roofs.
46. Illicit Connection: Any method or means for conveying an illicit discharge into water bodies or the County's storm water system.
47. Illicit Discharge: Any discharge to water bodies that does not consist entirely of storm water, discharges pursuant to the terms of an NPDES permit, or exempted discharges as defined in the Storm Water Guidelines.
48. Impervious Surface: Surface that does not allow storm water runoff to slowly percolate into the ground.
49. Infiltration: A process whereby precipitation seeps into the ground.
50. Infiltration Trench: This type of trench is not considered a preferred means of discharging storm water.
51. Leaching Basin: This type of basin is not considered an effective means of controlling and treating storm water runoff.
52. Low-Impact Design (LID): A storm water management strategy that aims to control water, both rainfall and storm water runoff, at the source.
53. Lowest Floor: The lowest floor or the lowest enclosed area (including a basement), but not including an unfinished or flood-resistant enclosure that is usable solely for parking of vehicles or building access.
54. MDEQ: Michigan Department of Environmental Quality.
55. NPDES: National Pollution Discharge Elimination System.
56. NREPA: Natural Resources and Environmental Protection Act, Act 451.
57. O&M Plan: Operations and Maintenance Plan describes resource organization, responsibilities, policies, and general procedures.
58. Overland Flow-way: Surface area that conveys a concentrated flow of storm water runoff.
59. Owner: Any person or entity having legal or equitable title to property or any person or entity having or exercising care, custody, or control over any property.
60. Peak Discharge: The maximum rate of flow of storm water runoff at a given location.

61. Person: An individual, firm, partnership, association, public or private corporation, public agency, instrumentality, or any other legal entity.
62. Pervious Pavement: A unique environmental friendly porous pavement that allows rainwater to pass directly through into the soil naturally.
63. Plan: Written narratives, specifications, drawings, sketches, written standards, operating procedures, or any combination thereof containing information pursuant to these Guidelines.
64. Pollutant: A substance discharged which includes, but is not limited to the following: any dredged spoil, solid waste, vehicle fluids, yard wastes, animal wastes, agricultural waste products, sediment, incinerator residue, sewage, garbage, sewage sludge, munitions, chemical wastes, biological wastes, radioactive materials, heat, wrecked or discharged equipment, rock, sand, cellar dirt, and industrial, municipal, commercial and agricultural waste, or any other contaminant or other substance defined as a pollutant under the Clean Water Act.
65. Property Owner: Any person having legal or equitable title to property or any person having or exercising care, custody, or control over any property.
66. Rain Garden: A landscaping feature planted with perennial native plants. It is a bowl-shaped or saucer-shaped garden, designed to absorb storm water runoff from impervious surfaces such as roofs and parking lots.
67. Redevelopment: Altering, improving, or otherwise changing the use of an existing developed property. A site will be considered a redevelopment under these Guidelines when an area greater than or equal to five percent (5%) of the existing developed site or an area greater than 20,000 square feet is increased with additional roof, pavement, or any other impervious surface.
68. Retention: A system which is designed to capture storm water and contain it until it infiltrates the soil or evaporates.
69. Soil Erosion: The stripping of soil and weathered rock from land creating sediment for transportation by water, wind or ice, and enabling formation of new sedimentary deposits.
70. State of Michigan Water Quality Standards: All applicable State rules, regulations, and laws pertaining to water quality, including the provisions of Section 3106 of Part 31 of 1994 PA 451, as amended.
71. Storm Drain: A system of open or enclosed conduits and appurtenant structures intended to convey or manage storm water runoff, ground water and drainage.
72. Storm Water Runoff: The water from a rain storm, snow melt or other natural event or process, which flows over the surface of the ground or is collected in a drainage system.
73. Storm Water Runoff Facility: The method, structure, area, system, or other equipment of measures which are designed to receive, control, store, or convey storm water.

74. Stream: A river, stream or creek which may or may not be serving as a drain, or any other water body that has definite banks, a bed, and visible evidence of a continued flow or continued occurrence of water.
75. 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.
76. Twenty-five Year Design Storm: A precipitation event with a duration equal to the time of concentration, having a four percent (4%) chance of occurring in any one year.
77. Underground Detention Systems: An underground system consisting of one or more underground pipes or structures that are designed to provide the required volumes for storage for a development project, including bankfull flood and flood control volumes.
78. Upland Area: Land located in the upper portion of a watershed whose surface drainage flows toward the area being considered for development.
79. 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.
80. USACE: United States Army Corps of Engineers is responsible for investigating, developing and maintaining the nation's water and related resources.
81. Vegetated Swales: Channels that are broad and shallow lined with vegetation that slow and filter storm water runoff and promote infiltration.
82. Water Body: A river, lake, stream, creek or other watercourse or wetlands.
83. 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.
84. Watershed: A region draining into a water body.
85. Wetlands: Land characterized by the presence of water at a frequency and duration sufficient to support wetland vegetation or aquatic life.
86. Weir: A weir is a notch of regular form through which water flows. The term is also applied to the structure containing such a notch. A weir may be a depression in the side of a tank, reservoir, or channel, or it may be an overflow dam or other similar structure.

## **B. Application, Review and Approval Procedure**

### **1. Conceptual Review and Application**

- a. Contact the Drain Commissioner's Office and/or Berrien County Web site ([www.berriencounty.org](http://www.berriencounty.org)) to obtain the latest version of the Administrative Guidelines.
- b. The Owner/Developer shall submit to the Drain Commissioner or his designee the conceptual design and layout of the proposed development. The Developer/Owner shall

also submit copies of the conceptual design and layout to the Township where the development is proposed for preliminary review and comment. This conceptual design and layout, at a minimum, shall include:

- i. Small location map showing the section and part of the section in which the site is situated;
- ii. Location and description of all activities that may impact or be impacted by the proposed development or redevelopment both on and off the site;
- iii. Acreage of the total site and acreage of the area being effected by the development; and
- iv. If known, a conceptual layout of the proposed drainage system for the development or redevelopment.

The Owner/Developer or the Design Engineer shall submit information including a description of the drainage district/watershed, allowable discharge, impervious factor, etc. with the conceptual design and layout of the proposed development.

- c. The Drain Commissioner or his designee and/or the Township or municipality where the development is located will review the conceptual design information to determine if it is consistent with these Guidelines.
- d. The Owner/Developer and the Design Engineer must coordinate with the Drain Commissioner or his designee, the Berrien County Road Commission and the Township or municipality where the project is proposed. The intention of these meetings is to obtain uniform direction and communication to minimize misdirection of early construction and minimize financial losses to proprietors, developers, and consultants.
- e. If the conceptual layout of the storm drainage system is approved, the Owner/Developer shall begin completing final design plans and calculations for application submittal under these Guidelines.

## 2. Application Submittal

Applications shall be submitted to the Drain Commissioner by the Owner/Developer or the Design Engineer on behalf of the Owner/Developer. Application for a review shall be made prior to the start of any work on the proposed development requiring a review under these Guidelines. Soil test borings, vegetative cutting solely for land surveys, percolation tests, and normal maintenance shall not be considered a start of work under these Guidelines.

## 3. Sequential Applications

For projects on a site which are so large or complex that a plan encompassing all phases of the project cannot reasonably be prepared prior to initial work, applications on successive major construction activities may be allowed. Requests for sequential applications shall be approved by the Drain Commissioner prior to submittal of the initial application.

## 4. Application Submittal Requirements

- a. The Owner/Developer or Design Engineer shall submit two sets of plans, two sets of calculations, and any other supporting information for the site to the Drain Commissioner or his designee with the application. Alternatively, applicant may submit information via

email to Anne Hendrix, Berrien County Deputy Drain Commissioner at [ahendrix@berriencounty.org](mailto:ahendrix@berriencounty.org). The plans and calculations shall comply with the requirements of these Guidelines. The checklist, design requirements, and design guidelines that will be used during the review process of the drainage construction plans are established by these Guidelines. The application submittal shall include:

- i. The location of the development site and water bodies that will receive storm water runoff;
  - ii. The existing and proposed topography, if required, of the development site, including the alignment and boundary of the natural drainage courses, with contours having a maximum interval of one (1) foot (using NAD 27 or NAD 83). The information shall be superimposed on the pertinent Berrien County soil map;
  - iii. The development tributary area to each point of discharge from the development;
  - iv. Calculations for the final peak discharge rates;
  - v. Calculations for any facility or structures size and configuration;
  - vi. A drawing showing all proposed storm water runoff facilities with existing and final grades;
  - vii. The sizes and locations of immediately upstream and immediately downstream culverts serving the major drainage routes flowing into and out of the development site. Any significant off-site and on-site drainage outlet restrictions other than culverts should be noted on the drainage map;
  - viii. An implementation plan for construction and inspection of all storm water runoff facilities necessary to the overall drainage plan, including a schedule of the estimated dates of completing construction of the storm water runoff facilities shown on the plan and an identification of the proposed inspection procedures to ensure that the storm water runoff facilities are constructed in accordance with the approved drainage plan (when known);
  - ix. A plan to ensure the effective control of construction site storm water runoff and sediment track-out onto roadways;
  - x. Drawings, profiles, and specifications for the construction of the storm water runoff facilities reasonably necessary to ensure that storm water runoff will be drained, stored, or otherwise controlled in accordance with these Guidelines.
  - xi. The name of the engineering firm and the Design Engineer that will inspect final construction of the storm water runoff facilities;
  - xii. Deposit/fee for plan review and inspection in accordance with the fee schedule provided herein.
  - xiii. **No meeting will be considered until a deposit for review has been received by the Drain Commissioner's office.**
- b. A maintenance agreement, in form and substance acceptable to the Drain Commissioner, shall be required for ensuring maintenance of any privately-owned storm water runoff facilities (i.e. those facilities that will not be turned over as an established County Drainage System). The maintenance agreement shall include the owner/developer's written commitment to provide routine, emergency, and long-term maintenance of the facilities and, in the event that the facilities are not maintained in accordance with the approved drainage plan, the agreement shall authorize the Drain Commissioner to maintain any on-site storm water runoff facility as reasonably necessary, at the developer's/owner's expense. The completed, signed, notarized recordable maintenance agreement shall be submitted to the Drain Commissioner's office along with the applicable recording fees to complete the review and approval process.

## 5. Storm Water Site Plan Review

The Drain Commissioner or his designee will review all plans, calculations, and other information for compliance with these Guidelines. All materials will be reviewed for completeness. Calculations will be checked. The minimum design requirements and guidelines as outlined in these Guidelines will be used as a reference. The drainage plan checklist will be reviewed. The Drain Commissioner shall approve, approve with conditions, or disapprove an application within 30 days. The review period begins upon the receipt of a completed application, plan and fees. Copies of the approval, approval with conditions, or disapproval will be provided to the Township or municipality where the proposed development is located.

- a. Approval or Approval with Conditions. Upon a determination by the Drain Commissioner or his designee that the application has met all of the requirements of these Guidelines, the Drain Commissioner or his designee will issue a letter specifying the work approved. The Drain Commissioner or his representative shall notify the Owner/Developer or authorized representative of the approval or approval with conditions via email. If original copies are required, please respond to email approval and original hard copies will be mailed by USPS first class mail.
- b. Disapproval. If the proposed drainage system is disapproved, two sets of plans and calculations may be resubmitted with the appropriate revisions.
- c. Multiple-Phase Projects. When additional phases are planned, an approval with conditions will be given addressing the overall storm water requirements of the site. The Drain Commissioner encourages submittal of all phases of a multi-phased project at the onset of a proposed project.

## 6. Changes to Plan after Approval

- a. Any proposed changes made to the approved plan shall be submitted to the Drain Commissioner and/or his designee for review and approval. Changes made without approval may result in revocation of approval. Revocation of the SESC plan may also be considered.
- b. Upon receipt of this information, the Drain Commissioner will be determined whether additional information, such as calculations, will be required or whether modifications to the submittal and approval will be necessary.

## 7. Approval Expiration

Approval shall expire automatically upon the project completion date or one year from issuance date of the approval. Approval shall also terminate automatically if construction has not commenced within one year of the date of issuance. The Drain Commissioner may extend an approval for a period not to exceed one year upon the request of the Owner/Developer if there are valid reasons to support such an extension.

## 8. Approval Revocation

Any approval issued by the Drain Commissioner under these Guidelines may be revoked or suspended if there is a violation of the conditions of the approval or if there is a misrepresentation or failure to disclose relevant facts in the application submittal. The Drain

Commissioner will provide the Owner/Developer notice of any revocation of the approval via email followed by an original copy by USPS first class mail.

9. Permits and Approvals by Other Governmental Agencies

Approvals under these Guidelines shall not relieve Owner/Developer of the need to obtain other applicable permits or approvals as required by federal, state, county and local agencies. Examples of other permits or approvals, which may be required, include:

- Soil Erosion and Sedimentation Control Permit – Part 91 of NREPA. The Berrien County Drain Commissioner's Office is the County Enforcing Agent for Berrien County, (269) 983-7111 ext. 8261 and 8633, and a permit must be obtained when applicable for Soil Erosion and Sedimentation Control (SESC).
- Site Plan Approvals. Municipalities and/or townships may have an ordinance(s) in place; check with local authorities. All site plans must meet local zoning ordinances.
- Berrien County Road Commission which has or shares jurisdiction over drainage along county roads and county rights-of-way within Berrien County. 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. An application is included in the Appendix.
- Michigan Department of Transportation (MDOT) which has or shares jurisdiction over drainage along state highways and state rights-of-way within Berrien County. Sites located along MDOT rights-of-way and discharging to MDOT drainage systems must obtain a permit from MDOT.
- Michigan Department of Environmental Quality (MDEQ) (Joint permit with the USACE) which has jurisdiction over proposed work within the 100-year floodplain, inland lake and stream areas, navigable waterways, critical dunes and wetland areas. A permit must be obtained for work proposed in these areas. In addition, the MDEQ is responsible for implementing the National Pollution Discharge Elimination System (NPDES) Storm Water Permitting Program.

**C. Inspection Requirements**

Inspection of storm drainage systems and/or detention facilities is required on all development and redevelopment projects. As-built drawings will be required on all projects prior to final inspection. Descriptions of the inspection requirements are outlined below. The fees associated with this inspection are outlined in Section II.D. It is not the intent of these Guidelines to review single-family residential development.

1. *Developments* - Site inspections of the storm drainage, outlet, and detention storage areas will be required. These inspections will occur during construction as determined necessary by the Drain Commissioner or his designee. The Owner/Developer and/or the Design Engineer will be informed at what stage of construction these inspections will be required. The Drain Commissioner or his designee shall be informed 24 hours in advance for these site inspections. Daily inspection reports will be completed by the Design Engineer as needed.

At a minimum, the inspection reports will include the information shown on the sample daily inspection report included in the Appendix.

A final inspection by the Drain Commissioner or his designee will take place at the completion of the project after as-built drawings have been received by the Drain Commissioner or his designee. A final inspection report (See Appendix) will be completed by the Drain Commissioner or his designee. Subsequent inspections may be required if deficiencies exist.

2. *Residential and Condominium Projects* - Inspection of storm drainage and drainage system construction will be required. This inspection shall be performed by the Design Engineer or the Drain Commissioner or his designee as determined by the Drain Commissioner. Daily Inspection reports shall be completed for all days on which construction of the storm drainage system occurs. Copies of these reports shall be submitted to the Drain Commissioner at the beginning of each week. At a minimum, the daily inspection reports shall include the information shown on the sample daily inspection report included in the Appendix. Subsequent inspections may be required if deficiencies exist.

A final inspection by the Drain Commissioner or his designee will take place at the completion of the project after as-built drawings have been received by the Drain Commissioner or his designee. A final inspection report (See Appendix) will be completed by the Drain Commissioner or his designee. Subsequent inspections may be required if deficiencies exist.

3. *Redevelopment Projects* - Site inspections of the storm drainage, outlet, and detention storage areas will be required. These inspections will occur during construction as determined necessary by the Drain Commissioner or his designee. The Owner/Developer and/or the Design Engineer will be informed at what stage of construction these inspections will be required. The Drain Commissioner or his designee shall be informed 24 hours in advance for these site inspections. Daily inspection reports will be completed as needed. At a minimum, the inspection reports will include the information shown on the sample daily inspection report included in the Appendix.

A final inspection by the Drain Commissioner or his designee will take place at the completion of the project after as-built drawings have been received by the Drain Commissioner. A final inspection report (See Appendix) will be completed by the Drain Commissioner or his designee. Subsequent inspections may be required if deficiencies exist.

4. Any infrastructure that would come under the jurisdiction of the Berrien County Drain Commissioner must be inspected at the time of installation.

If a take-over of an existing storm water system is requested, as-built drawings must be accompanied by recent video documentation and reviewed, accepted and submitted by a licensed Professional Engineer (P.E.), registered in the State of Michigan.

#### D. Fee Schedule

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

##### REVIEW FEES:

<i>Application Review and Inspection:</i> Developments and Redevelopments	<u>Fee</u> \$1,000 review and Inspection
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*Re-Review Fees:* The review fee is for the first storm water review and inspection of the site plan submittal. An additional hourly fee will be required for subsequent reviews and/or inspections.

*Deposits:* Deposits must be received by the Drain Commissioner prior to the review of the storm drainage plans. Any difference in the final review and inspection fees will be collected from the Owner/Developer prior to the issuance of a building permit.

*Re-Inspection/Additional Inspection Fees:* Hourly, based upon the time required

*Residential Subdivisions and Condominiums:* Full-time inspection of the installation of the storm water drainage and construction of the storm water detention facilities. Developer's licensed engineer shall complete this work on behalf of the Drain Commissioner providing daily inspection reports and preparation of as-built drawings. The Drain Commissioner reserves the right to provide inspection services at an hourly rate if a licensed engineer is not available for such inspection.

### III. STORM DRAINAGE SYSTEMS WITHIN BERRIEN COUNTY

The County Drain Commissioner encourages the use of Low Impact Design (LID) approaches to manage storm water. Such approaches may include pervious pavement, rain gardens, green roofs, etc. Some of the following requirements can and will be waived if a LID approach is taken. For example, the requirement for a 1.0 foot of freeboard may be reduced to 0.5 feet if a proposed detention basin is designed and constructed as a wetland complex, rain garden or other LID approach. The proposed type of site development should be reviewed at the design concept review meeting with the Municipality and the Drain Commissioner to evaluate the design options.

The County Drain Commissioner encourages the implementation of regional storm water detention basins and/or the sharing of detention basins between two or more developments.

#### A. Allowable Discharge (Qa)/ Detention Requirements

The peak storm water discharge from any proposed development or redevelopment as required in these Guidelines shall be restricted to an allowable discharge (Qa). The allowable discharge from the proposed area of development or redevelopment cannot exceed the calculated discharge from the proposed site based on one of the following methods. The method resulting in the lowest allowable discharge from the site shall be used in determining the required detention.

- a. 0.15 cubic feet per second per acre of contributing area. <i.e. 0.15 cfs/acre\*10 acre site = 1.5 cfs Qa

- b. The existing discharge from the site calculated under the existing design storm for the 10-year recurrent interval as calculated with the Rational Method.  $Q_a = CIA$
- c. The percentage of capacity available in the downstream receiving storm drainage and/or water course, i.e. capacity of outlet storm drainage is 10 cfs, there is a total of 100 acres within the contributing district, the proposed site has 20 acres (20 acres of site/100 acres of contributing watershed \* 10 cfs, capacity =  $Q_a$  of 2 cfs).

Excess storm water runoff must be detained on site. Equations for determining the required volume of detention storage are outlined in Section IV. Detention storage calculations must be included with review submittals.

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

The storm water detention storage required for a site is to be calculated using the Berrien County Storm Water Management Guidelines Spreadsheet. The allowable discharge is a maximum of 0.15 cfs per acre unless there is a restricted outlet condition based upon the above referenced allowable discharge requirements.

If there are known existing flooding problem areas that will be impacted by a proposed development, the required detention volume will be 6.15 inches of runoff (100-year storm event).

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

1. On systems that utilize a storm water detention basin a sediment forebay retention area can be utilized within the detention facility this retention area is required in addition to the storm water detention requirements equal to 0.5 inches of runoff from the site area (See the calculation spreadsheet in the Appendix). The forebay must be designed to remove a minimum 80% of total suspended solids.
2. Rain gardens or an equivalent low impact design approach can be utilized that provides a soil or media filter for the water prior to entering the storm drainage system or storm detention system. The utilization of this type of treatment measure does not require the additional capture of 0.5 inches of runoff above the detention requirement for the site. (See the Sample Details in the Appendix of acceptable rain garden treatment systems).
3. Mechanical treatment devices designed to remove suspended solids and other debris. Mechanical treatment devices include specially designed treatment units that will remove 80% of the total suspended solids for a 2-year 24-hour storm event.

## **C. Discharge Restrictor Requirements**

Restrictors are required to regulate the discharge of storm water to the allowable discharge rate established for a site. The circular in-line restrictor is sized based on the orifice formula.

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

$$a = \text{area of orifice (sq. ft.)}$$

$$\Delta h = \text{head differential from center of orifice to Hydraulic Grade Line of detention facility at maximum capacity (ft).}$$

#### **D. Storm Water Retention Requirements**

Storm water retention basins/systems must be designed to store runoff of the 100-year 24-hour storm event. The rainfall amount for the 100-year storm is 6.15 inches. Retention calculations must be completed using the Berrien County Storm Water Management Guidelines Spreadsheet.

One soil boring must be provided for each 5,000 square foot of retention basin proposed, unless otherwise determined by the Drain Commissioner based upon known/presented conditions. A practicing soils engineer must evaluate the borings to assure that there is adequate hydraulic capacity of the soils to receive the proposed storm water. The capacity of the site soils must be a minimum of 0.15 cfs X the contribution acreage (i.e. contributing area 10 acres X 0.15 cfs = 1.5 cfs.). Reduction in the retention volume for systems with higher infiltration capacities will not be allowed. The existing seasonally high water table must be below the bottom of the proposed basin/system to assure that there is an adequate hydraulic outlet.

#### **IV. MINIMUM DESIGN REQUIREMENTS AND GUIDELINES FOR STORM DRAINAGE SYSTEMS**

The following is an outline of requirements for the design of storm water management systems. Engineering judgment must be utilized to accomplish the overall goals of these Guidelines.

##### **A. Requirements**

###### **1. General Requirements**

- a. Storm water detention requirements for any new construction development, redevelopment, or land use change occurring within Berrien County will be determined according to the procedure outlined in these Guidelines.
- b. A review will be required for all site development and redevelopment, except residential sites for single-family or two-family dwellings. The Drain Commissioner or his designee may require side lot or rear lot drainage to be installed if the Drain Commissioner or his designee determines it necessary.
- c. The peak runoff rate during a 10-year storm event from a developed or improved site shall not exceed the allowable discharge rate (Qa). This rate is determined using the design impervious factor (IF) established by the Drain Commissioner for the site. The impervious factor of redeveloped sites is assumed zero percent (0%). Either detention storage with a regulated discharge must be provided or all impervious surfaces must be removed from the site.
- d. There shall be no detrimental effect on the floodway or the floodplain elevation during a 25-year design storm upstream or downstream of the proposed development area as a result of the proposed development.
- e. The drainage area used for computation will be the total area tributary to the site outlet, including off-site properties that drain onto the site.
- f. Engineering calculations must be submitted with the application. The calculations shall follow the procedures outlined in these Guidelines.

- g. Roof drains may be connected to a drainage system if the flow through the outlet to the drainage system is properly treated and restricted. Unrestricted runoff from roof drains will not be accepted. Roof drain runoff will not be allowed to drain across sidewalks or parking areas.
- h. The Drain Commissioner shall make a determination as to whether any or all of the facilities proposed are to remain private or should be established as a county Drain, unless otherwise provided in these Guidelines.
- i. The Drain Commissioner or his designee 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 the subdivision requiring the preservation of mandatory drainage facilities. Where a non-subdivided parcel of land is proposed for development, the Drain Commissioner or his designee shall make a determination as to the need for covenants to maintain responsibility for mandatory drainage facilities. All the facilities in the subdivision shall be located in easements dedicated to the public, and shall be subject to continual inspection during the construction period. All drainage systems and detention facilities within proposed subdivision or condominium developments shall be established as county drains under the Drain Code of 1956, MCL 280.1 *et seq.*, as amended.
- j. Proposed storm drainage 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 future land use, not necessarily existing conditions.

2. Storm Drainage Piping Requirements

- a. Proposed storm drainage shall be designed to have minimum capacity to pass 10-year design storm runoff rate (Qd).
- b. All storm drainage materials must comply with the authority having jurisdiction over the storm drainage system.
- c. Provide two (2) feet minimum cover or comply with the authority having jurisdiction over the storm drainage system.
- d. Provide twelve (12) inch vertical separation between all other public utilities including sanitary drainages and water mains.
- e. Provide ten (10) feet horizontal separation from other public utilities.
- f. Manholes/catch basins shall be placed at a maximum distance of four hundred (400) feet from any other manholes/catch basins for access/maintenance purposes.
- g. Provide a sump discharge outlet for each individual lot or all developments. This outlet shall be a catch basin (minimum four (4) feet diameter) and/or provide a storm water lead to each lot. Manufactured tees or cored and booted leads, six (6) inch minimum to each lot are acceptable.

- h. Minimum pipe grades must be such to produce minimum scouring velocity of 2.5 ft/sec when pipe is flowing full without surcharging.
  - i. For storm drainage systems, plastic pipe may be used. This plastic pipe shall be either schedule 80 PVC, smooth walled HDPE, or SDR 35. If pipe is perforated a manufacturer's "Sock" shall be used over the pipe.
  - j. Minimum pipe diameter for catch basin leads is twelve (12) inches.
  - k. Minimum pipe size for storm drainage is twelve (12) inches.
  - l. Pipe should be sized for a 10-year design storm without surcharging when possible.
  - m. When two pipes or more of different sizes come into a structure, the 8/10th flow lines shall match when possible.
  - n. Catch basins should have a minimum sump depth of twenty-four (24) inches.
  - o. Minimum diameter of catch basins shall be four (4) feet.
3. Detention Requirements
- a. Proposed storm drainage detention facilities shall be designed to have capacity to detain at minimum the 25-year recurrence interval design storm runoff volume in excess of the allowable discharge from the site. The detention requirements must be reviewed with the Drain Commissioner or his designee. The outlet conditions may dictate a larger detention facility than that which is required for the 25-year recurrence interval.
  - b. The maximum design storage elevation in a detention area must be a minimum of one (1) foot below the lowest ground elevation adjacent to the detention area.
  - c. The design maximum storage elevation in a detention area must not exceed a depth of nine (9) inches above any paved surfaced. **No water storage will be accepted in parking lots and/or any areas with pedestrian traffic.**
  - d. The design maximum storage elevation in a detention area must not be closer than twelve (12) inches below the minimum finish floor elevation of the proposed structure(s) or existing facilities.
  - e. Designs of detention facilities will incorporate features which facilitate their inspection and maintenance. The Owner/Developer shall submit an Operation and Maintenance (O&M) Plan and/or provide a maintenance agreement, as necessary, for a detention facility with prior approval required by the Drain Commissioner.
  - f. Designs of detention facilities shall incorporate safety features, particularly at inlets, outlets, on steep slopes, and at any attractive nuisances. These features may include, but not be limited to, fencing, handrails, lighting, steps, grills, signs, and other protective or warning devices so as to restrict access. If the Owner/Developer does not implement recommended safety features, liability for the detention facilities will be the responsibility of the Owner/Developer.

- g. Side slopes and the bottom of detention basins shall be top soiled, to a minimum of three (3) inches, and seeded. Soil erosion control blankets must be installed to protect slopes if adequate vegetation does not exist between September 1<sup>st</sup> to May 1<sup>st</sup>.
- h. The side slopes and bottom of detention basins shall be shaped with maximum slopes of one (1) vertical to four (4) horizontal to allow mowing of these surfaces.
- i. Detention basins and restrictors shall be maintained as necessary. If a detention basin is found not to be maintained or a restrictor is removed or not maintained, Owner/Developer will have 30 days to complete the necessary maintenance. If this maintenance is not completed, the Drain Commissioner may take all actions necessary to perform necessary maintenance at the Owner's/Developer's expense unless other arrangements have been agreed to in writing in an executed Maintenance Agreement.
- j. Detention basins shall be constructed with the top of banks a minimum of five (5) feet from any pedestrian walkway (i.e. public and private sidewalks/bike paths).

4. Rear Lot Drainage Requirements

- a. Rear lot tile drains with contributing drainage areas up to 1/2 acre shall have a minimum diameter of six (6) inches and a minimum pipe slope of 0.5%.
- b. Rear lot tile drains with contributing drainage areas greater than 1/2 acre and less than 1 acre shall have a minimum diameter of eight (8) inches and a minimum pipe slope of 0.3%.
- c. Rear lot tile drains with a contributing area greater than one (1) acre shall be considered main line storm drainage and shall be designed according to corresponding requirements. Calculations shall be submitted to the Drain Commissioner or his designee to verify the rear lot drains have the capacity to pass the 10-year design storm event.
- d. All lots must be provided with rear lot drainage.
- e. Rear lot drainage tiles shall have a minimum cover of two (2) feet.
- f. Rear lot drainage tile and catch basin material shall be approved by the Drain Commissioner or his designee. The minimum diameter of a rear lot catch basin shall be two (2) feet.

**B. General Compliance Guidelines**

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

1. The minimum surface slopes for overland drainage are as follows:
  - For bituminous paved surfaces, 1%.
  - For concrete paved surfaces, 0.5%.
  - For concrete curb and gutter, 0.5%.
  - For drainage swales and valley shaped ditches, 0.5%.

- 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, 6%.
  - For concrete curb and gutter, 6%.
  - For drainage swales and valley shaped ditches, 6%.
  - 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. Variations from Requirements**

The Drain Commissioner may issue an approval that waives allowable discharge requirements and/or detention requirements. Variation from these requirements shall require the approval of Drain Commissioner, whose actions shall be conditioned upon the following:

1. The Owner/Developer shall provide evidence in writing outlining in detail the rationale for the proposed design changes including hydraulic and/or hydrologic computations. This document must be signed and sealed by a licensed Professional Engineer (P.E.), registered in the State of Michigan.
2. Special circumstances or conditions exist which will affect the property under consideration such that strict compliance with the provisions of the approval would deprive the Owner/Developer of the reasonable use of their land provided there is no other prudent or feasible alternative.
3. A variance is necessary for the preservation and enjoyment of a substantial property right of the Owner/Developer.
4. The Drain Commissioner reserves the right to approve or disapprove variances from these Guidelines as he deems in the best interest of the County.

**APPENDIX**

**STORM WATER REVIEW APPLICATION..... PA - 1**  
(Word Fill-in Document)

**CONCEPTUAL REVIEW CHECKLIST.....CR - 1**  
(Word Fill-in Document)

**DRAINAGE PLAN CHECKLIST..... DP 1 – 2**  
(Word Fill-in Document)

**STORM WATER DETENTION REQUIREMENTS.....DR 1 – 2**  
(Excel Spreadsheet)

**CHART FOR C FACTORS ..... CF - 1**  
(Example: Used by Drain Commissioner’s Office)

**MAINTENANCE AGREEMENT ..... MA 1 – 4**  
(Example: Used by Drain Commissioner’s Office)

**INSPECTION DAILY REPORT..... IDR 1 – 2**  
(Example: Used by Drain Commissioner’s Office)

**DETENTION AND RESTRICTION, FINAL INSPECTION REPORT.....FIR - 1**  
(Example: Used by Drain Commissioner’s Office)

**ENGINEER’S CERTIFICATE OF OUTLET ..... ECO 1 – 2**  
(Example: Used by Drain Commissioner’s Office)

**ENGINEER’S CERTIFICATE OF CONSTRUCTION ..... ECC 1 – 2**  
(Example: Used by Drain Commissioner’s Office)

**SAMPLE DETAILS.....SD 1 – 9A**



**COUNTY OF BERRIEN  
OFFICE OF THE DRAIN COMMISSIONER  
ROGER H. ZILKE**

Berrien County Administration Center – 701 Main Street – St. Joseph, MI 49085-1316  
Telephone: 269/983-7111, Ext. 8261 – Fax: 269/982-8658

**STORM WATER REVIEW APPLICATION  
FOR SUB-DIVISIONS, SITE DEVELOPMENTS,  
SITE RE-DEVELOPMENTS, AND PRIVATE WORK ON COUNTY DRAINS**

Project Name : \_\_\_\_\_  
Date : \_\_\_\_\_  
Description of Work: \_\_\_\_\_

<i>Owner:</i>		<i>Designer:</i>	
Company Name:		Company Name:	
Contact Person:		Contact Person:	
Address:		Address:	
Telephone No:		Telephone No:	
Fax No:		Fax No:	
Email Address:		Email Address:	

FOR INTERNAL USE ONLY

Date Application Received: \_\_\_\_\_ Date Final Plans Received: \_\_\_\_\_  
Date of Pre-Design Meeting: \_\_\_\_\_ Date Project Approved: \_\_\_\_\_

## CONCEPTUAL REVIEW CHECKLIST

Prior to the storm water review, the Owner/Developer shall submit to the Drain Commissioner or his designee the conceptual design and layout of the proposed development. The Developer/Owner shall also submit copies of the conceptual design and layout to the Township where the development is proposed for preliminary review and comment. This conceptual design and layout, at a minimum, shall include:

Each of the following items shall be included:

\_\_\_\_\_ Small location map showing the section and part of the section in which the site is situated.

\_\_\_\_\_ Location and description of all activities that may impact or be impacted by the proposed development or redevelopment both on and off the site.

\_\_\_\_\_ Acreage of the total site and acreage of the area being effected by the development.

\_\_\_\_\_ If known, a conceptual layout of the proposed drainage system for the development or redevelopment.

## DRAINAGE PLAN CHECKLIST

No site plan or building shall be approved or any other permit issued unless the Owner has provided that the storm water runoff is within the capacities as provided for within the Administrative Guidelines for Storm Water Management, Berrien County, Michigan.

In order for the Owner, Developer, or Builder to be in compliance with the guidelines he/she shall submit to the Berrien County Drain Commissioner for review by the Drain Commissioner's designee, two complete sets of the site drainage and grading plan and two copies of the calculations for allowable discharge and on-site storage requirements, as prepared by a Registered Professional Engineer.

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 foot centers, including shots on perimeter of site and 50 foot beyond (suggested, may not be required on all sites).
- \_\_\_\_\_ Elevations of ground, edge of pavement, and buildings within 50 foot of site.
- \_\_\_\_\_ Top of curb, gutter, ditch line, and centerline of road elevation at maximum 50 foot 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 top of storage elevation.
- \_\_\_\_\_ Cross Sections, dimensions, and/or details defining the shape of proposed detention basins in non-paved areas.

**DRAINAGE PLAN - CHECKLIST (Continued)**

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

- \_\_\_\_\_ Drainage District size in acres and impervious factor.
- \_\_\_\_\_ Calculation of maximum allowable discharge (using Design Pond Design Calculation spreadsheet).
- \_\_\_\_\_ Calculation of on-site storage required.
- \_\_\_\_\_ Calculation of storage volume provided.
- \_\_\_\_\_ Calculation of size of restrictor.
- \_\_\_\_\_ 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.
- \_\_\_\_\_ The sizes and locations of immediately upstream and immediately downstream culverts serving the major drainage routes flowing into and out of the development site. Any significant off-site and on-site drainage outlet restrictions other than culverts should be noted on the drainage map.
- \_\_\_\_\_ A maintenance agreement, in form and substance acceptable to the County, for ensuring maintenance of any privately owned storm water runoff facilities. The maintenance agreement shall include the developer’s written commitment to provide routine, emergency, and long-term maintenance of the facilities and, in the event that the facilities are not maintained in accordance with the approved drainage plan, the agreement shall authorize the County to maintain any on-site storm water run-off facility as reasonably necessary, at the developer’s expense.
- \_\_\_\_\_ The name of the engineering firm and the registered professional engineer that designed the drainage plan and that will inspect final construction of the storm water run-off facilities.

Beyond the Berrien County requirements, the Developer must submit applications for review/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, Berrien County Road Commission, local agencies with zoning ordinances.

**BERRIEN COUNTY DETENTION POND DESIGN CALCULATION SPREADSHEET**

Project Name: \_\_\_\_\_ Proposed Percent Imperviousness: **70%** (K)  
 Project Location: \_\_\_\_\_ Proposed Runoff "C" Value: 0.69  
 Maximum Allowable Outflow (CFS): 0.00 (G)  
 Cont. Drainage Area (Acres): \_\_\_\_\_ (L) Storm Recurrence Interval (Yrs): 25

A	B	C	D	E	F	G	H	I	J
Duration (Minutes)	Duration (Hours)	25-Year Total Rainfall (Inches)	25-Year Rainfall Intensity (Inch/Hr)	Proposed Runoff Flowrate (CFS)	Proposed Runoff Volume (CFT)	Maximum Allowable Outflow (CFS)	Required Detention Storage (CFT)	Required Retention Storage (CFT)	Total Required Storage (CFT)
5	0.08	0.53	6.36	0.00	0	0.00	0	0	0
10	0.17	0.93	5.58	0.00	0	0.00	0	0	0
15	0.25	1.20	4.80	0.00	0	0.00	0	0	0
20	0.33	1.35	4.05	0.00	0	0.00	0	0	0
30	0.50	1.65	3.30	0.00	0	0.00	0	0	0
40	0.67	1.8	2.70	0.00	0	0.00	0	0	0
50	0.83	1.95	2.34	0.00	0	0.00	0	0	0
60	1.00	2.09	2.09	0.00	0	0.00	0	0	0
90	1.50	2.35	1.57	0.00	0	0.00	0	0	0
120	2.00	2.58	1.29	0.00	0	0.00	0	0	0
180	3.00	2.85	0.95	0.00	0	0.00	0	0	0
360	6.00	3.34	0.56	0.00	0	0.00	0	0	0
720	12.00	3.87	0.32	0.00	0	0.00	0	0	0
1080	18.00	4.18	0.23	0.00	0	0.00	0	0	0
1440	24.00	4.45	0.19	0.00	0	0.00	0	0	0

**Total Storage Detention and Retention Required Storage (CFT): 0**

**RETENTION POND DESIGN CALCULATION**

Retain the 100-Year 24-Hour Storm event from the Entire Contributing Area (6.15 Inches of total Rainfall).

**0 CFT**

- A) Duration of the storm event in minutes.
- B) Duration of the storm event in hours.
- C) Total amount of rainfall during a 25-year recurrence storm event for the given duration in Column A & B (ref.: midwestern climatological center rainfall Atlas-Bulletin 71).
- D) Average rainfall intensity during the 25-year recurrence storm event. Calculated by dividing Column C by Column B.
- E) The unrestricted 25-year recurrence discharge flowrate from the proposed site under fully developed conditions. Calculated by multiplying Intensity (D) and Drainage Area (L).
- F) The unrestricted storm event for the given duration in Column A and B. Calculated by multiplying the Proposed Runoff Flowrate (E) by the Storm Duration (A) and by 60 seconds/minute.
- G) The maximum allowable discharge from the site is determined by multiplying the drainage area by 0.15 cfs per acre or if the proposed outlet is restrictive by determining the sites share of the existing outlets capacity on a contributing area basis.
- H) The required detention storage is determined by multiplying the differentiation flowrate (Inflow (E) - Outflow (G), by the corresponding duration (A) and by 60 seconds/minute. The calculated maximum release rate only occurs when the pond is full. As the pond dewater the actual release rate from the pond will decrease from the maximum allowed release rate to 0. Therefore, an average release rate equal to 50% of the maximum rate is used in calculating the required storage volume. The amount of storage required for various storm durations will vary based on rainfall intensity, the size of the drainage area, and the allowable discharge. The maximum volume of storage for the various storm durations will be the required detention storage volume. This volume of storage will be determined above the required retention volume calculated in Column I.
- I) The required retention storage is determined by multiplying the drainage area (L) by 0.5 inches of rain.
- J) Total required storage is the sum of Column H and I.
- K) Proposed percent imperviousness. This assumption will be used to determine the proposed runoff coefficient. Impervious surface will be assumed to have a value of 0.9 and pervious a value of 0.2.
- L) Contributing Drainage to the proposed detention or retention system.

Calculation By: \_\_\_\_\_  
 Date: \_\_\_\_\_

**BERRIEN COUNTY DISCHARGE CALCULATION SPREADSHEET**

Project Name:   
 Project Location:

Restrictors are required to regulate the discharge of storm water to the allowable discharge rate established for the site. Restrictors are typically in the form of an orifice. The outlet pipe however should be checked as a metering line to verify that its capacity is not restricting the discharge.

**ORIFICE**

The circular in-line restrictor is sized based on the orifice formula.

**FORMULA**

**a** =  $Q_o / [0.62 (64.4(h))^{1/2}]$

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

**Q<sub>o</sub>** = Maximum Allowable Outflow (cfs)

**h** = head differential from center of orifice to hydraulic grade line of detention facility at maximum capacity (ft).

**CALCULATION**

**Q<sub>o</sub>** =  cfs

**h** =  ft.

**a** =  $\frac{\#DIV/0!}{\#DIV/0!}$  sq. ft.

**Orifice Dia.** =  $\frac{\#DIV/0!}{\#DIV/0!}$  ft.

**Orifice Dia.** =  $\frac{\#DIV/0!}{\#DIV/0!}$  in.

**METERING LINE**

The metering line calculation is based on the manning's equation.

**FORMULA**

**Q<sub>m</sub>** =  $a(1.49/N) R^{2/3} S^{1/2}$

**a** = area of pipe (sq. ft)

**N** = Manning's roughness coefficient

**R** = hydraulic radius = area/wetted perimeter

**S** = hydraulic grade line slope (ft/ft)

**CALCULATION**

**Pipe Dia.** =  in.

**Pipe Dia.** =  ft.

**a** =  0.00 sq. ft.

**N** =

**R** =  $\frac{\#DIV/0!}{\#DIV/0!}$

**S** =  ft/ft.

**Q<sub>m</sub>** =  $\frac{\#DIV/0!}{\#DIV/0!}$  cfs

If Q<sub>m</sub> is less than Q<sub>o</sub> discharge is limited by outlet pipe and should be re-evaluated

If Q<sub>o</sub> is less than Q<sub>m</sub> discharge is limited by orifice

Calculation By:   
 Date:

**Table 3-1 Runoff Coefficients for Rational Formula**

<b>Type of Drainage Area</b>	<b>Runoff Coefficient, C*</b>
Concrete or Asphalt Pavement	0.8 – 0.9
Commercial and Industrial	0.8 – 0.9
Gravel Roadways and Shoulders	0.8 – 0.9
Residential – Urban	0.5 – 0.7
Residential – Suburban	0.3 – 0.5
Undeveloped	0.15 – 0.3
Berms	0.15 – 0.3
Agricultural – Cultivated Fields	0.15 – 0.4
Agricultural – Pastures	0.15 – 0.4
Agricultural – Forested Areas	0.15 – 0.4

For flat slopes or permeable soil, lower values shall be used. For steep slopes or impermeable soil, higher values shall be used. Steep slopes are 2:1 or steeper.

From Michigan State Administrative Rules R 280.9.

## **MAINTENANCE AGREEMENT**

This Agreement entered into the Week Day day of Date, 20Year, by and between Roger H. Zilke, Berrien County Drain Commissioner (“Drain Commissioner”), 701 Main, St. Joseph, Michigan and Enter Landowner/Developer Name and Address (“Landowner/Developer”).

**WHEREAS**, Landowner/Developer is the owner of certain real property as legally described in Exhibit A attached hereto (the “Property”); and

**WHEREAS**, Landowner/Developer proposes the construction of a storm water management system (the “System”) to serve all or a portion of the properties to be developed on the Property; and

**WHEREAS**, the Drain Commissioner has reviewed the plans and specifications for the System on the Property; and

**WHEREAS**, the Drain Commissioner and Landowner/Developer wish to enter into this Agreement to ensure the continuing maintenance of the System so as to prevent drainage issues on the Property and surrounding parcels resulting from any lack of appropriate operation, maintenance or repair to the System.

### **NOW, THEREFORE, IT IS HEREBY AGREED:**

1. Landowner/Developer shall be responsible for the operation, maintenance and repair of the System on the Property at Landowner/Developer’s sole cost, and shall take steps to periodically inspect the System to ensure that the System is in proper working order.
2. Landowner/Developer shall operate and maintain the System in compliance with all federal, state and local statutes, laws, ordinances, authorizations, rules, regulations and permits. If required by law, Landowner/Developer shall retain the services of a licensed operator for the System and pay all costs attendant thereto.

3. Landowner/Developer hereby grants and conveys to the Drain Commissioner the right of entry onto the Property for purposes of inspection of the System to determine the need for any maintenance or repair.
4. In the event that an inspection by the Drain Commissioner reveals the need for maintenance or repair of the System, the Drain Commissioner shall notify Landowner/Developer in writing of the need for said maintenance or repair to any part of the System. This paragraph does not alleviate any responsibilities of the Landowner/Developer to inspect, operate, maintain, and repair the System as otherwise provided in this Agreement.
5. Upon written notice as provided herein, Landowner/Developer, shall cause said maintenance or repair to be completed within 30 days, or such other time period as may otherwise be specified by the Drain Commissioner, and shall provide the Drain Commissioner with notice that the maintenance or repairs are complete.
6. In the event that the work specified by the Drain Commissioner is not completed in a timely fashion, the Drain Commissioner shall cause the work to be performed. Landowner/Developer shall be responsible for all costs incurred by the Drain Commissioner for the maintenance or repair of the System under this paragraph, including inspection and engineering costs, administration costs, and attorneys' fees and costs. Payment shall be made by Landowner/Developer within 30 days of invoice from the Drain Commissioner.
7. If payment is not made, the Drain Commissioner is authorized to seek collection by all means allowed under law or may levy special assessment against the Property where the System is located, which special assessment will be a lien against the lands until paid or collected as allowed for the collection of taxes and assessments under the laws of the State of Michigan. Landowner/Developer shall be responsible for all actual costs and attorney fees incurred by the Drain Commissioner relating to the collection of unpaid invoices under this Agreement.
8. This Agreement shall inure to the benefit of and shall be binding upon the parties hereto, their respective successors, assignees and legal representatives. Landowner/Developer shall immediately notify the Drain Commissioner in writing of the name, address and telephone number of any assigned or successors in interest.
9. Landowner/Developer agrees to hold harmless, defend and indemnify the Drain Commissioner, his employees, agents and contractors and the County of Berrien from any and all liability or enforcement action arising out of the operation, maintenance or repair of the System including any and all claims for damages or injury to person or property and any and all civil and criminal sanctions, penalties, fines or costs.



By: \_\_\_\_\_  
Enter Landowner/Developer Authorized Signature Name

STATE OF MICHIGAN     )  
  )ss  
COUNTY OF BERRIEN    )

On this Week Day day of Date, 20Year before me, a Notary Public in and for said County, appeared Enter Landowner/Developer Authorized Signature Name, to me personally known to be the person described in and who executed the foregoing instrument and acknowledged the same to be his free act and deed.

\_\_\_\_\_  
Name, Notary Public  
Enter County Name County, Michigan  
My Commission Expires: 00/00/0000  
Acting in the County of Enter County Name



**Roger H. Zilke**  
**Berrien County Drain Commissioner**  
 701 Main Street  
 St. Joseph, MI 49085

**Ph: 269.983.7111**  
**Fax: 269.982.8658**  
**E-mail: [rzilke@berriencounty.org](mailto:rzilke@berriencounty.org)**

**INSPECTION DAILY REPORT**

<b>PROJECT NAME:</b>		<b>WORK ORDER NO:</b>	
<b>CONTRACTOR:</b>		<b>REPORT NO:</b>	
<b>SUPERINTENDENT:</b>		<b>DATE:</b>	
<b>WEATHER:</b> (CLEAR, CLOUDY, RAIN, SNOW)		<b>TEMPERATURE:</b>	<b>INSPECTOR:</b>
<b>WORK FORCE ON SITE - NUMBER:</b>	<b>TRADE</b>	<b>NUMBER:</b>	<b>TRADE</b>
<b>EQUIPMENT IN USE (Number And Type):</b>			
<b>WORK DONE (General description of location n and type of work) (list exact location, amount and type on back):</b>			
<b>REMARKS:</b>			
<b>VISITORS TO WORK SITE (Name, Affiliation):</b>			
<b>Hours on the Project:</b>			

**NOTE:** Complete in ink each day. Use reverse side if necessary. Be complete and turn in to Berrien County Drain Commissioner's Office.

**BY:** \_\_\_\_\_ **Date:** \_\_\_\_\_





**Roger H. Zilke**  
Berrien County Drain Commissioner  
701 Main Street  
St. Joseph, MI 49085

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**DETENTION AND RESTRICTION, FINAL INSPECTION REPORT FORM**

<b>Name of Site Development:</b>	
<b>Date of Inspection:</b>	
<b>Inspector's Name and Affiliation:</b>	
<b>Location:</b>	
<b>Restrictor / Outlet (Type, Size, Condition, Functionality):</b>	
<b>Detention (Correct Size, Location, Condition):</b>	
<b>Do Final Design/As-built Drawings Conform to Present Site Conditions?</b>	
<b>Soil Erosion and Sedimentation Conditions:</b>	
<b>Additional Observations/Required Action Items:</b>	

## **ENGINEER'S CERTIFICATE OF OUTLET**

### **I. ENGINEER'S CERTIFICATE OF OUTLET**

- A. Section 433 of the Drain Code requires that, prior to execution of any agreement to add additional drainage to an established County or Intercounty Drain, a registered professional engineer satisfactory to the Drain Commissioner or Drainage Board must certify:
  - 1. That the lands to be added naturally drain into the area served by the existing drain; or
  - 2. That the existing drain is the only reasonably available outlet for the drainage from the lands to be added; and
  - 3. That there is existing capacity in the existing drain to serve the lands to be added without detriment to or diminution of the drainage service provided or to be provided, in the foreseeable future, to the area in the existing drainage district.
  
- B. An Engineer's Certificate of Outlet shall be provided, in a form exactly as found on Page 2 of this Appendix, for any of the following conditions:
  - 1. As Exhibit A attached to a permit for discharge to a County or Intercounty Drain as provided under PART 3, Section III of these Rules.
  - 2. For any receiving body of water under the jurisdiction of the Berrien County Drain Commissioner, for a drain improved pursuant to a petition filed under Section 425 of the Drain Code.
  - 3. As Exhibit A attached to an agreement pursuant to Section 433 of the Drain Code for any established County or Intercounty Drain receiving additional drainage flow or volume.
  
- C. The Engineer's Certificate of Outlet must be signed by and stamped with the registered professional engineer's seal. The Certificate submitted to the Drain Commissioner shall be the original.

**ENGINEER'S CERTIFICATE OF OUTLET**

**ENGINEERING COMPANY LETTERHEAD**

**(EXHIBIT A)**

**Engineer's Certificate of Outlet**

Date: [INSERT DATE]  
Development: [NAME OF DEVELOPMENT] Drain: [NAME OF DRAIN]  
Discharge: [PROPOSED MAXIMUM DISCHARGE RATE IN CFS]  
Township / City: [NAME OF MUNICIPALITY] Section: [SECTION NUMBER]  
Berrien County, Michigan

**I HEREBY CERTIFY** (that the lands to be added naturally drain into the area served by the existing drain) (that the existing drain is the only reasonably available outlet for the drainage from the lands to be added).

**I FURTHER CERTIFY** that there is existing capacity in the [INSERT NAME OF OUTLET DRAIN] Drain to accept the discharge rate indicated above (and to serve the lands to be added) without detriment to or diminution of the drainage service provided, or to be provided in the foreseeable future, to the area in the existing drainage district.

Signed: \_\_\_\_\_ [ENGINEER'S SEAL]  
L. P. Engineer

Notations in this sample certification indicated as [PHRASE] shall be replaced by the applicable information.

Notations indicated as (Phrase) shall be omitted if not applicable to the development.

## **ENGINEER'S CERTIFICATE OF CONSTRUCTION**

### **I. ENGINEER'S CERTIFICATE OF CONSTRUCTION**

- A. The registered professional engineer responsible for the supervision of construction inspection shall provide an Engineer's Certificate of Construction.
- B. For any site discharging to a County or Intercounty Drain, or any body of water regulated under Phase II of the Clean Water Act amendments, the engineer shall certify, in a form as provided on Page 2 of this Appendix, that:
  - 1. Construction of storm water management facilities is complete.
  - 2. He/she has supervised inspection of the construction.
  - 3. All facilities were installed in accordance with the final construction plan approved by the Drain Commissioner.
  - 4. Inspection and construction material tests have been filed with the Berrien County Drain Commissioner.
- C. The Engineer's Certificate of Construction must be signed by and stamped with the registered professional engineer's seal. The Certificate submitted to the Drain Commissioner shall be the original.

**ENGINEER'S CERTIFICATE OF CONSTRUCTION**

**ENGINEERING COMPANY LETTERHEAD**

**Engineer's Certificate of Construction**

Date: [INSERT DATE]  
Development: [NAME OF DEVELOPMENT] Drain: [NAME OF DRAIN]  
Township / City: [NAME OF MUNICIPALITY] Section: [SECTION NUMBER]  
Berrien County, Michigan

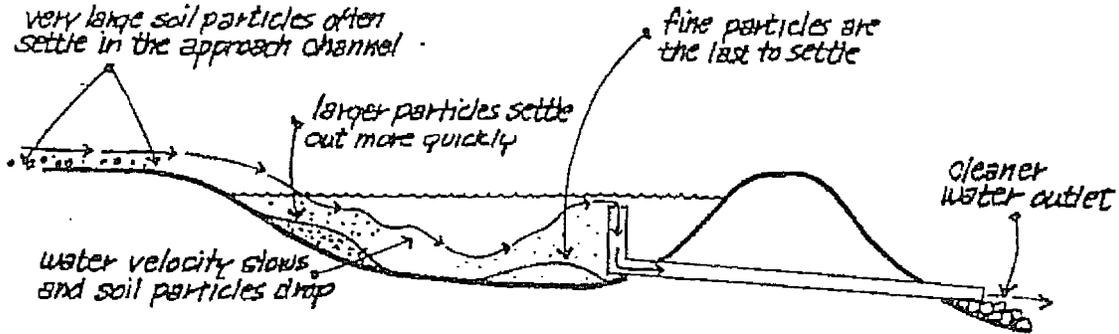
**I HEREBY CERTIFY** that construction of all storm water management facilities for the above-referenced development is complete and that:

1. I have supervised inspection of the construction.
2. All facilities have been installed in accordance with final construction plans approved by the Berrien County Drain Commissioner.
3. Inspection reports and construction material testing reports have been filed with the Berrien County Drain Commissioner.

Signed: \_\_\_\_\_ [ENGINEER'S SEAL]  
L. P. Engineer

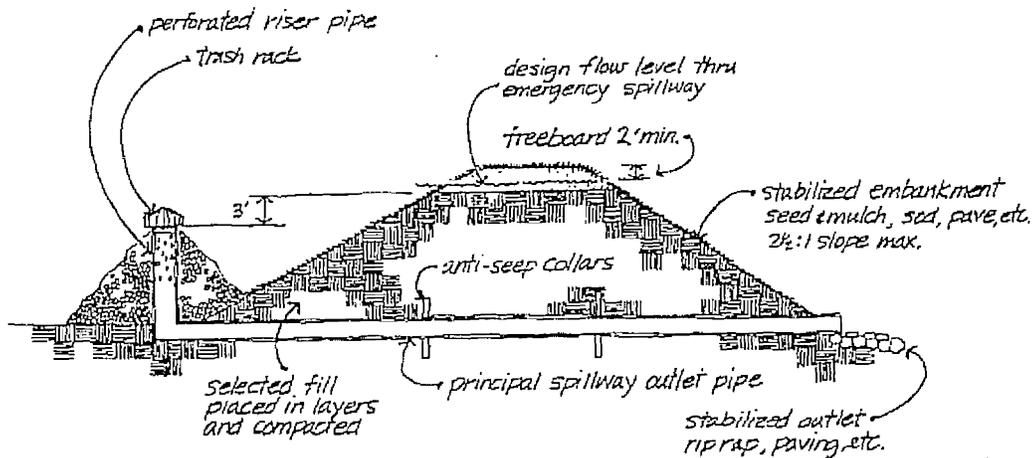
Exhibit 2

Side View of a Sediment Basin



**HOW A SEDIMENT BASIN WORKS**

NOT TO SCALE



**SECTION THRU EMBANKMENT & BASIN CONTROLS**

NOT TO SCALE

Source: Sediment Basin (brochure). Michigan Department of Natural Resources, Land and Water Management Division.

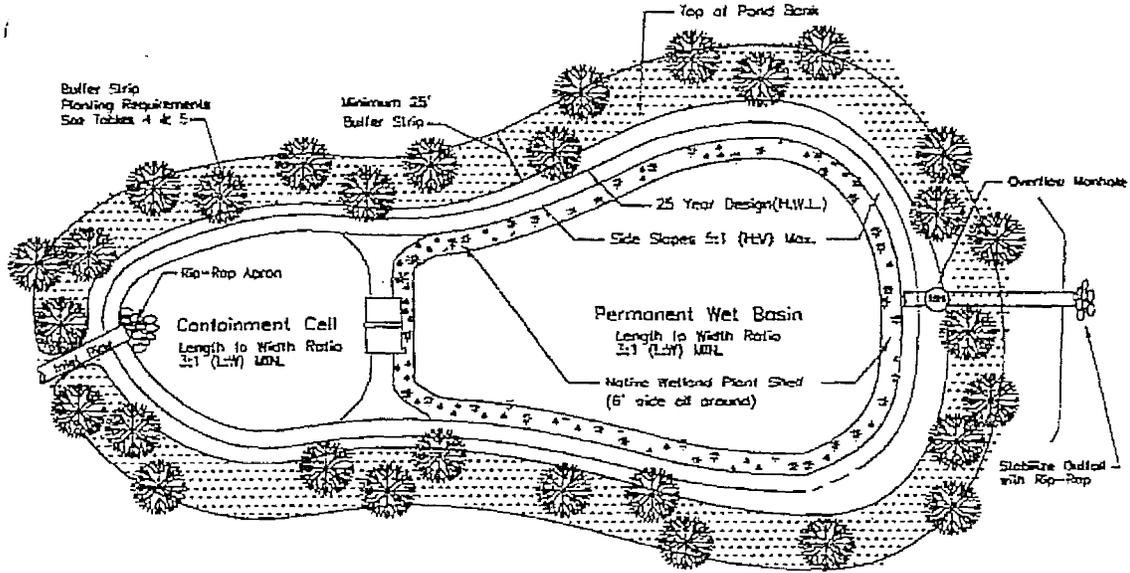
ROGER H. ZILKE  
BERRIEN COUNTY DRAIN COMMISSIONER

**GUIDELINES FOR STORM WATER MANAGEMENT**  
**HOW A SEDIMENT BASIN WORKS &**  
**SECTION THRU EMBANKMENT & BASIN CONTROLS**

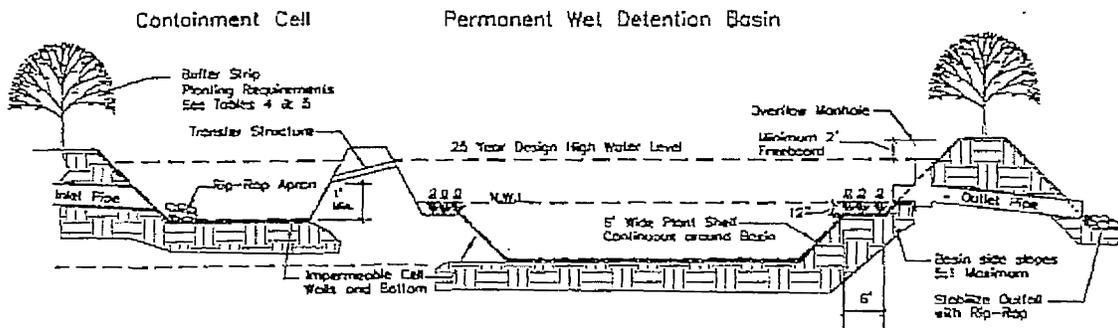
DATE FEBRUARY, 2013  
SCALE NONE

SHEET 1 OF 1

SAMPLE DETAIL



**HIGH RISK – DETENTION @ PLAN VIEW**  
**(EXTENDED WET BASIN)**  
 NOT TO SCALE



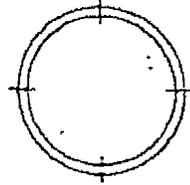
**HIGH RISK – DETENTION @ SIDE VIEW**  
**(EXTENDED WET BASIN)**  
 NOT TO SCALE

ROGER H. ZILKE  
 BERRIEN COUNTY DRAIN COMMISSIONER

**GUIDELINES FOR STORM WATER MANAGEMENT**  
**HOW A SEDIMENT BASIN WORKS &**  
**SECTION THRU EMBANKMENT & BASIN CONTROLS**

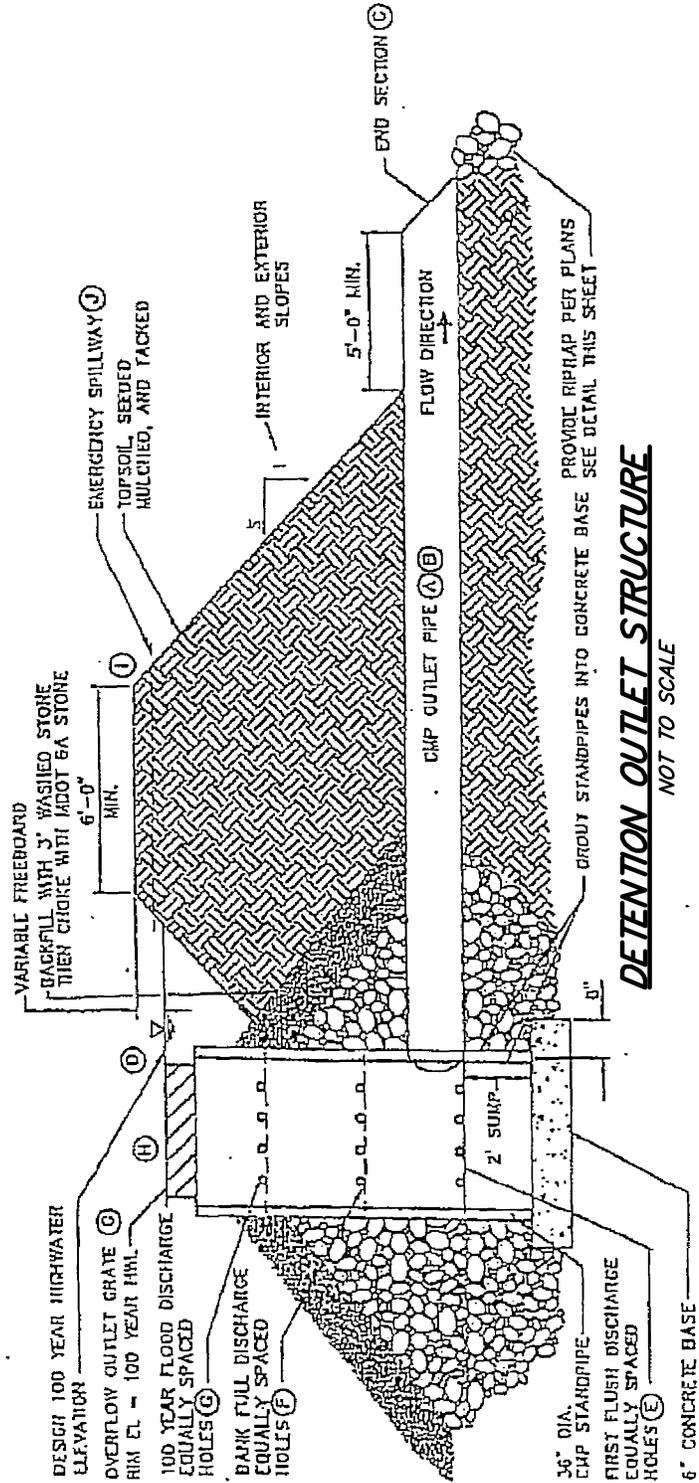
DETENTION OUTLET SCHEDULE

OUTLET PIPE LENGTH (A)	OUTLET PIPE SLOPE (B)	END SECTION INVERT (C)	100-YEAR HWL (D)	FIRST FLUSH DISCHARGE INV/ORIFICE SIZE (E)	BANK FULL DISCHARGE INV/ORIFICE SIZE (F)	100-YEAR FLOOD DISCHARGE INV/ORIFICE SIZE (G)	TOP OF STAND PIPE ELEVATION (H)	POND CREST ELEVATION (I)	EMERGENCY SPILLWAY ELEVATION (J)
------------------------	-----------------------	------------------------	------------------	--	--	---	---------------------------------	--------------------------	----------------------------------



PERFORATED PVC PIPE ATTACHED TO EXTERIOR OF CAP STANDPIPE WITH GALVANIZED 1/2" THREADED ROD, BOLTS AND LOCK WASHERS VERTICALLY SPACED EVERY 6" OF STANDPIPE

NOTE: E, F AND G HOLES TO BE DRILLED IN CAP STANDPIPE AT ELEV. LISTED IN TABLE.



**DETENTION OUTLET STRUCTURE**

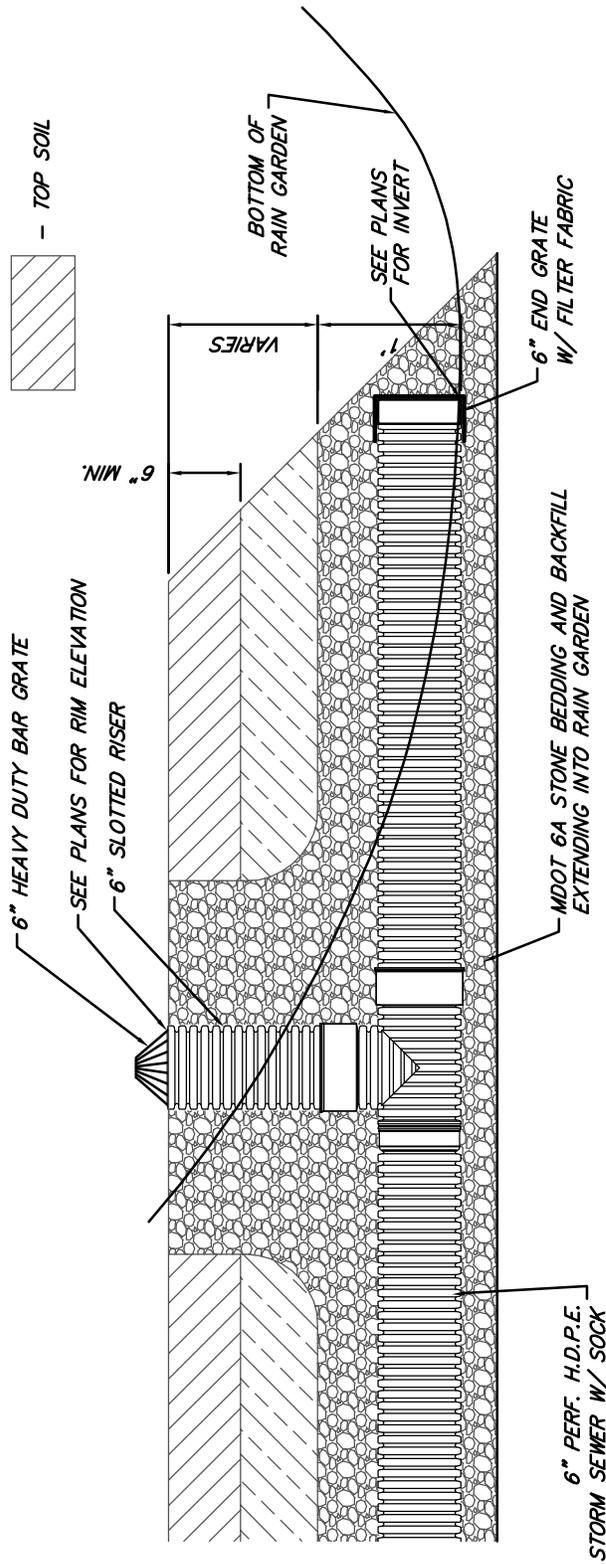
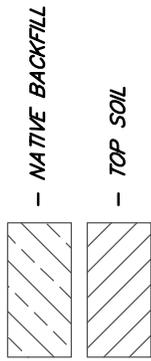
NOT TO SCALE

ROGER H. ZILKE  
BERRIEN COUNTY DRAIN COMMISSIONER

**GUIDELINES FOR STORM WATER MANAGEMENT  
DETENTION OUTLET STRUCTURE**

DATE FEBRUARY, 2013  
SCALE NONE

SHEET 1 OF 1



**H.D.P.E. RAIN GARDEN INLET  
MINIMUM COVER APPLICATIONS**  
NOT TO SCALE

- QUANTITIES PER DETAIL**
- 6" AGRI-DRAIN SLOTTED RISER
  - 6"X6" AGRI-DRAIN TEE SECTION
  - 6" EXTERNAL GUARD W/FILTER FABRIC
  - 6" HEAVY DUTY BAR GRATE (1/4" ROD W/BLACK POWDER COAT)

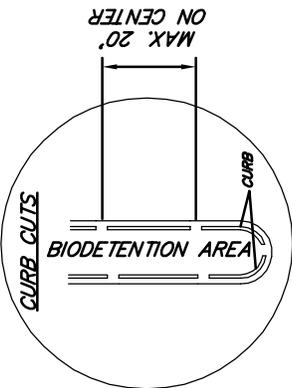
ROGER H. ZILKE  
BERRIEN COUNTY DRAIN COMMISSIONER

**GUIDELINES FOR STORM WATER MANAGEMENT**  
**H.D.P.E. RAIN GARDEN INLET**  
**MINIMUM COVER APPLICATIONS**

DATE FEBRUARY, 2013  
SCALE NONE

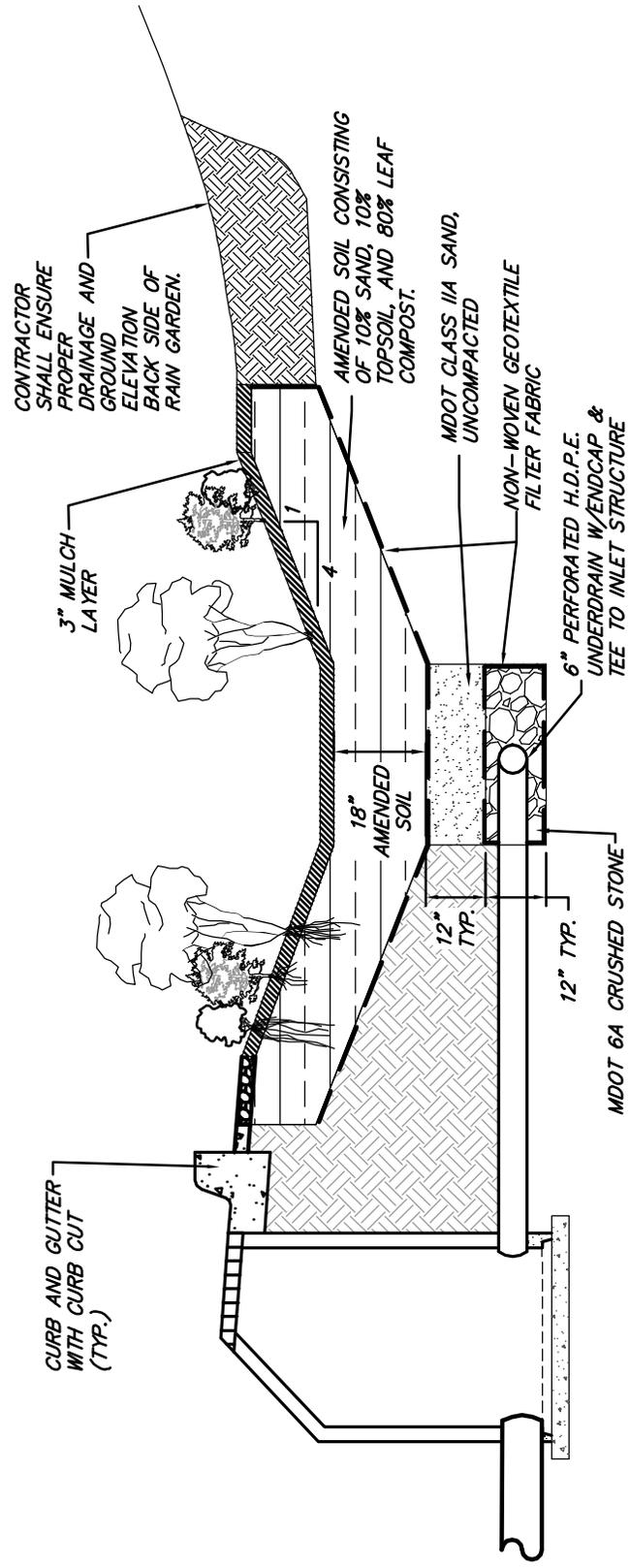
SHEET 1 OF 1

SAMPLE DETAIL



SEE VEGETATION SCHEDULE & PLAN FOR PLANTING AND/OR SEEDING.

CURB CUT LOCATION AS INDICATED ON PLANS.



**TYPICAL ROADSIDE RAIN GARDEN CROSS SECTION**  
(NOT TO SCALE)

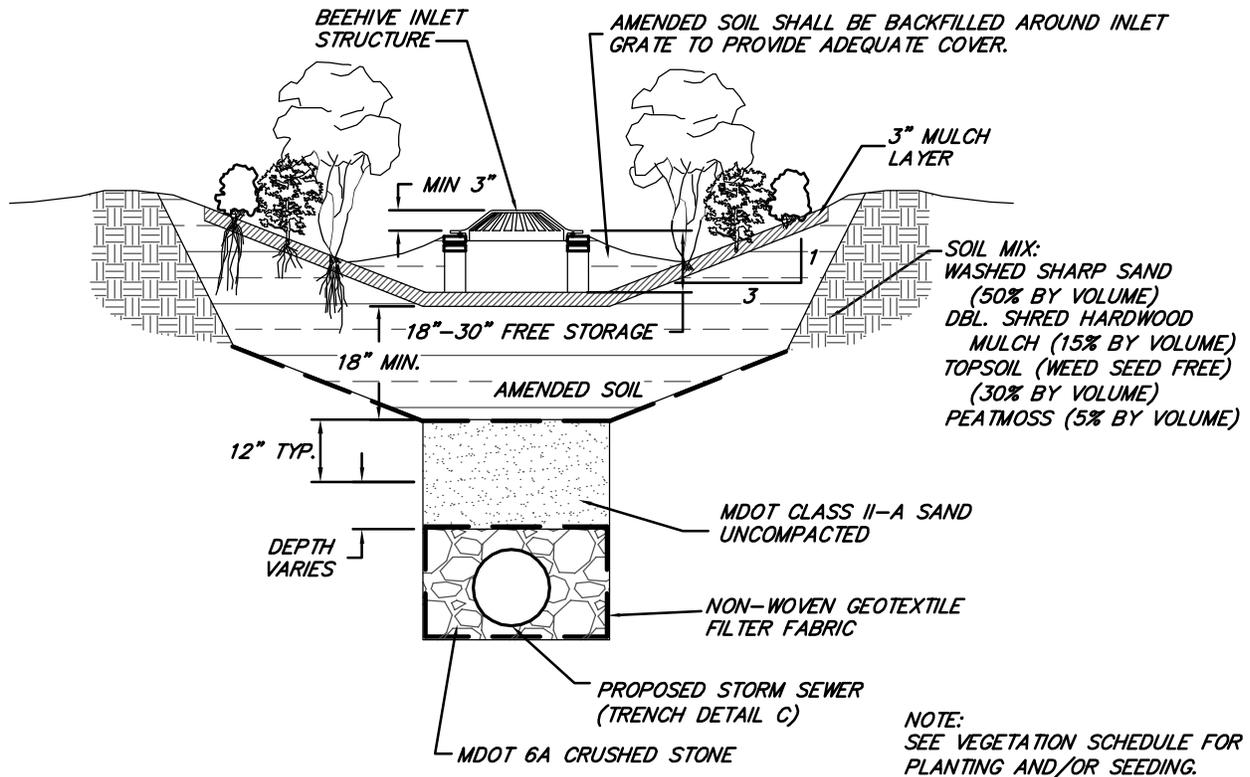
ROGER H. ZILKE  
BERRIEN COUNTY DRAIN COMMISSIONER

**GUIDELINES FOR STORM WATER MANAGEMENT**  
**TYPICAL ROADSIDE RAIN GARDEN CROSS SECTION**

DATE FEBRUARY, 2013  
SCALE NONE

SHEET 1 OF 1





**R.C.P. STORM SEWER TRENCH DETAIL**  
**TYPICAL RAIN GARDEN CROSS SECTION**

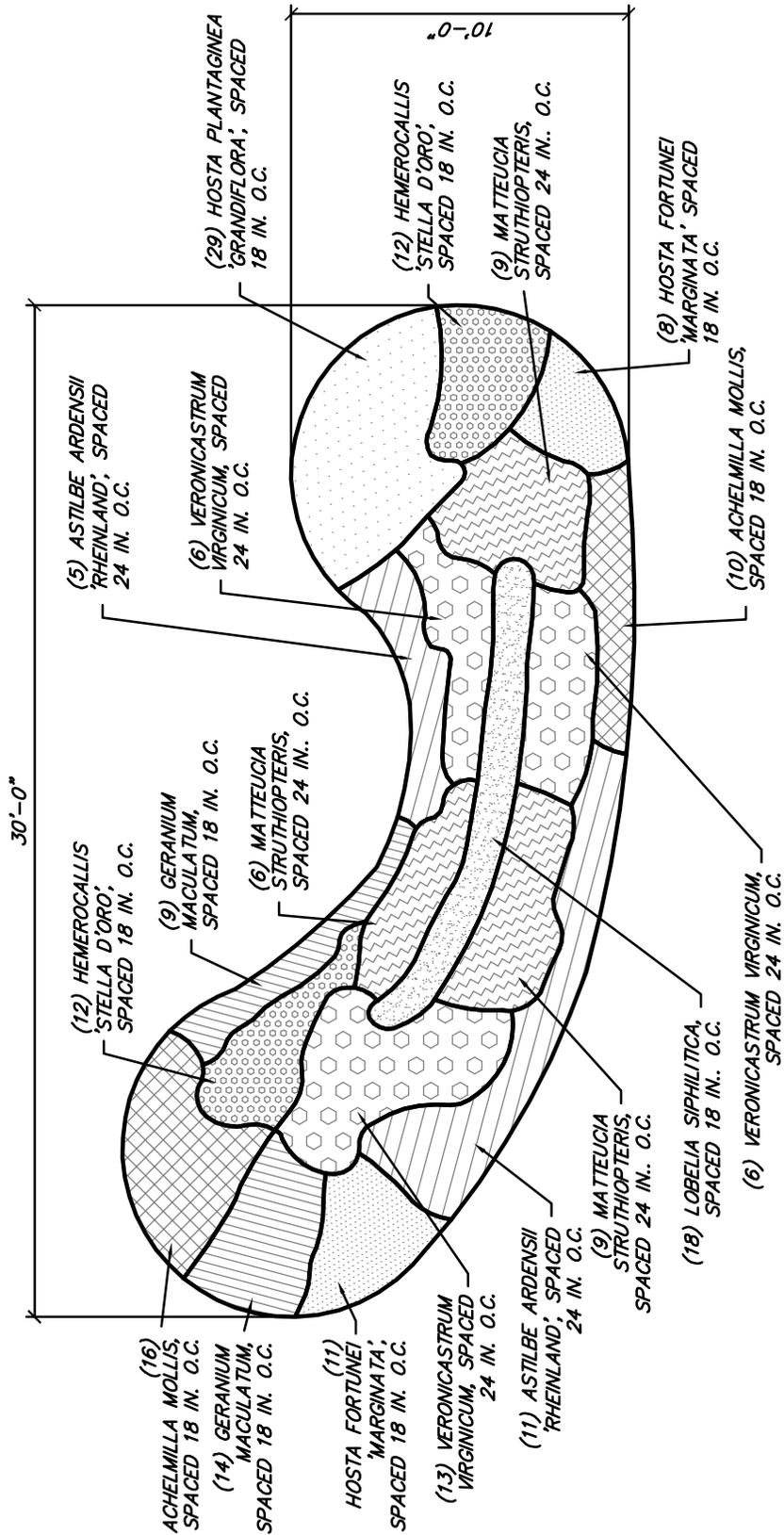
NOT TO SCALE

ROGER H. ZILKE  
 BERRIEN COUNTY DRAIN COMMISSIONER

**GUIDELINES FOR STORM WATER MANAGEMENT**  
**R.C.P. STORM SEWER TRENCH DETAIL**  
**TYPICAL RAIN GARDEN CROSS SECTION**

DATE **FEBRUARY, 2013**  
 SCALE **NONE**

SHEET **1** OF **1**



**TYPICAL RAIN GARDEN PLANTING DETAIL  
FOR SHADY LOCATIONS**

NOT TO SCALE

ROGER H. ZILKE  
BERRIEN COUNTY DRAIN COMMISSIONER

**GUIDELINES FOR STORM WATER MANAGEMENT  
TYPICAL RAIN GARDEN PLANTING DETAIL  
FOR SHADY LOCATIONS**

DATE FEBRUARY, 2013  
SCALE NONE

SHEET 1 OF 2

**MASTER PLANT LIST**

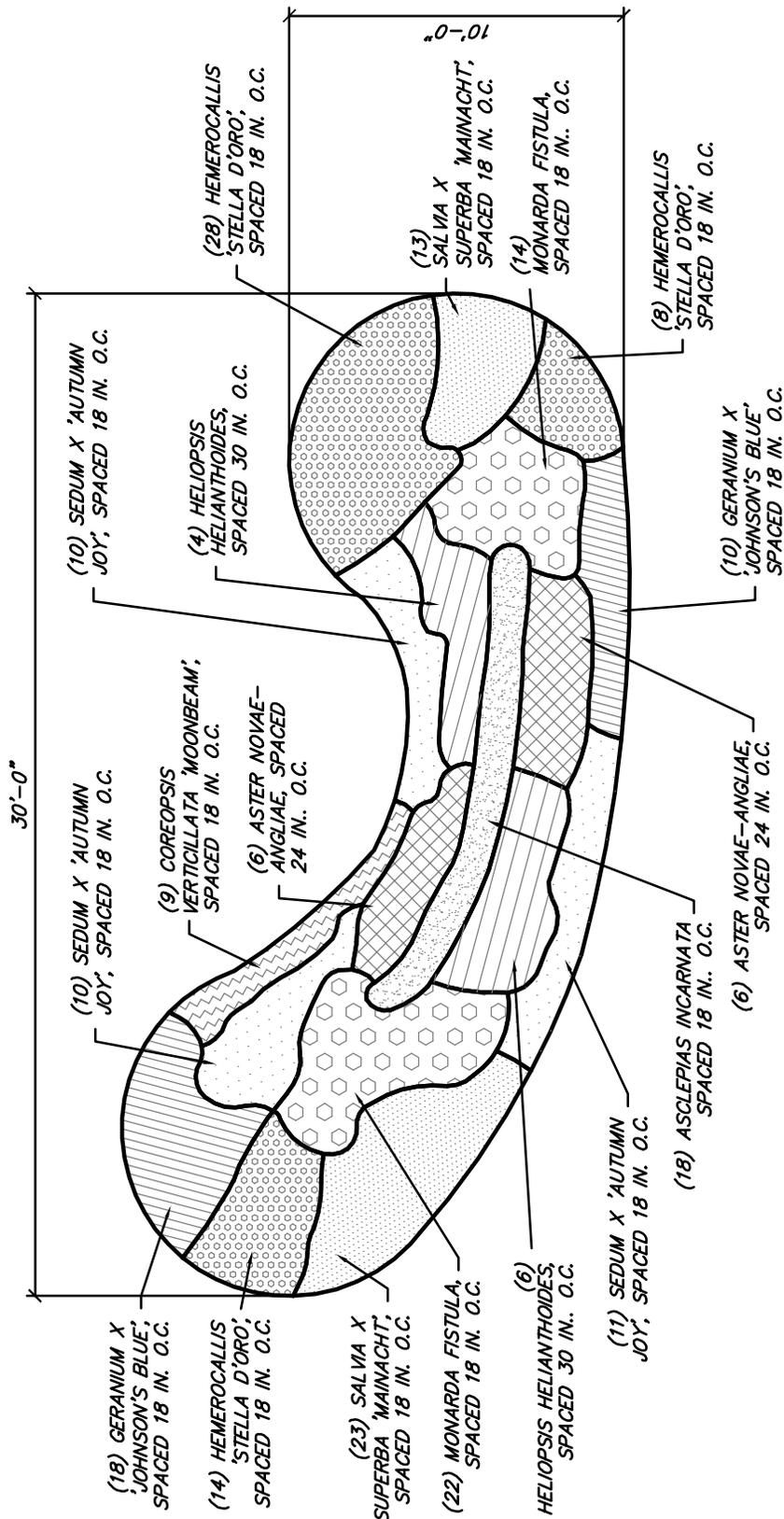
Total of Each Detail	Typical Detail Qty. (per each detail)	Description / Botanical Name	Common Name	Size	Notes
<b>28 TYPICAL RAIN GARDEN (SHADY)</b>					
SITE PREPARATION					
1750 SY	70 SY	Site preparation (includes excavation, topsoil & mulch)			
GROUNDCOVER / PERENNIALS					
650	26	Achelmilla mollis	Lady's Mantle	No. 1	Spacing, 18in. o.c.
400	16	Astilbe arendsii 'Rheinland'	Pink Astilbe	No. 1	Spacing, 24in. o.c.
575	23	Geranium maculatum	Wild Geranium	No. 1	Spacing, 18in. o.c.
600	24	Hemerocallis 'Stella D'Oro'	'Stella D'Oro' Daylily	No. 1	Spacing, 18in. o.c.
475	19	Hosta fortunei 'Marginata'	Golden-Edged Hosta	No. 1	Spacing, 18in. o.c.
725	29	Hosta plantaginea 'grandiflora'	August Lily Hosta	No. 1	Spacing, 18in. o.c.
450	18	Lobelia siphilitica	Great Blue Lobelia	No. 1	Spacing, 18in. o.c.
600	24	Mateuccia pennsylvanica	Ostrich Fern	No. 1	Spacing, 24in. o.c.
625	25	Veronicastrum virginicum	Culver's Root	No. 1	Spacing, 24in. o.c.

ROGER H. ZILKE  
BERRIEN COUNTY DRAIN COMMISSIONER

**GUIDELINES FOR STORM WATER MANAGEMENT**  
**TYPICAL RAIN GARDEN PLANTING DETAIL MASTER PLANT LIST**  
**FOR SHADY LOCATIONS**

DATE *FEBRUARY, 2013*  
SCALE *NONE*

SHEET *2* OF *2*



**TYPICAL RAIN GARDEN PLANTING DETAIL  
FOR SUNNY LOCATIONS**

NOT TO SCALE

ROGER H. ZILKE  
BERRIEN COUNTY DRAIN COMMISSIONER

**GUIDELINES FOR STORM WATER MANAGEMENT  
TYPICAL RAIN GARDEN PLANTING DETAIL  
FOR SUNNY LOCATIONS**

DATE FEBRUARY, 2013  
SCALE NONE

SHEET 1 OF 2

**MASTER PLANT LIST**

Total of Each Detail	Typical Detail Qty. (per each detail)	Description / Botanical Name	Common Name	Size	Notes
<b>27 DETAIL F: TYPICAL RAIN GARDEN (SUNNY)</b>					
SITE PREPARATION					
1540 SY	70 SY	Site preparation (includes excavation, topsoil & mulch)			
GROUNDCOVER / PERENNIALS					
396	18	Asclepias incarnata	Marsh Milkweed	No. 1	Spacing, 18in. o.c.
264	12	Aster novae-angliae	New England Aster	No. 1	Spacing, 24in. o.c.
198	9	Coreopsis verticillata 'Moonbeam'	Moonbeam Coreopsis	No. 1	Spacing, 18in. o.c.
616	28	Geranium x 'Johnson's Blue'	Johnson's Blue Geranium	No. 1	Spacing, 18in. o.c.
220	10	Heliopsis helianthoides	Oxeye Sunflower	No. 1	Spacing, 30in. o.c.
1100	50	Hemerocallis 'Stella D'Oro'	'Stella D'Oro' Daylily	No. 1	Spacing, 18in. o.c.
792	36	Monarda fistula	Bee Balm; Bergamot	No. 1	Spacing, 18in. o.c.
792	36	Salvia x superba 'Mainacht'	May Night Salvia	No. 1	Spacing, 18in. o.c.
682	31	Sedum x 'Autumn Joy'	Autumn Joy Sedum	No. 1	Spacing, 18in. o.c.

ROGER H. ZILKE  
BERRIEN COUNTY DRAIN COMMISSIONER

**GUIDELINES FOR STORM WATER MANAGEMENT**  
**TYPICAL RAIN GARDEN PLANTING DETAIL MASTER PLANT LIST**  
**FOR SUNNY LOCATIONS**

DATE	<i>FEBRUARY, 2013</i>	SHEET	<i>2</i>	OF	<i>2</i>
SCALE	<i>NONE</i>				