

GUIDELINES FOR STORM WATER MANAGEMENT IONIA COUNTY, MICHIGAN

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

Prepared For:

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STORM WATER MANAGEMENT
IONIA COUNTY



I. INTRODUCTION

The purpose of these Guidelines is to establish requirements and general compliance guidelines for storm water management practices in Ionia 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 the 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 Ionia 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 chance of being equaled or exceeded in any given year.
3. *Conduit*: Any channel, pipe, sewer or culvert used for the conveyance or movement of water, whether open or closed.
4. *Construction Site Storm Water Runoff*: Storm water runoff from a development site following an earth change.
5. *Design Engineer*: Registered and licensed professional engineer retained by Owner/Developer responsible for the design of a drainage plan.
6. *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.
7. *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.
8. *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.
9. *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.
10. *Developer*: Any person proposing or implementing the development of land.
11. *Development Site*: Any land that is being or has been developed, or that a developer proposes for development.
12. *Discharge*: The release or outflow of water from any source.
13. *Drain*: Any drain as defined in and established under the Drain Code of 1956, as amended, being MCL 280.1 *et seq.*

14. *Drain Commissioner:* The Ionia County Drain Commissioner or his designee.
15. *Drainage District/Watershed:* All drainage areas contributing surface water runoff upstream of a discharge location of the proposed development.
16. *Erosion:* The process by which the ground surface is worn away by action of wind, water, gravity or a combination thereof.
17. *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.
18. *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.
19. *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.
20. *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.
21. *Impervious Surface:* Surface that does not allow storm water runoff to slowly percolate into the ground.
22. *MDEQ:* Michigan Department of Environmental Quality.
23. *Overland flow-way:* Surface area that conveys a concentrated flow of storm water runoff.
24. *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.
25. *Peak Discharge:* The maximum rate of flow of storm water runoff at a given location.
26. *Person:* An individual, firm, partnership, association, public or private corporation, public agency, instrumentality, or any other legal entity.
27. *Plan:* Written narratives, specifications, drawings, sketches, written standards, operating procedures, or any combination thereof containing information pursuant to these Guidelines.
28. *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 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.
29. *Retention:* A system which is designed to capture storm water and contain it until it infiltrates the soil or evaporates.
30. *Storm Drain:* A system of open or enclosed conduits and appurtenant structures intended to convey or manage storm water runoff, ground water and drainage.

31. *Storm Water Permit*: A permit issued pursuant to these Guidelines.
32. *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.
33. *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.
34. *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.
35. *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.
36. *Twenty-five Year Design Storm*: A precipitation event with a duration equal to the time of concentration, having a four-percent chance of occurring in any one year.
37. *Water Body*: A river, lake, stream, creek or other watercourse or wetlands.
38. *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.
39. *Watershed*: A region draining into a water body.

B. Permit Application and Review Procedure

1. Conceptual Review Prior to Permit Application

- a. Prior to the permit application, 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.

- b. 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.
- c. The Owner/Developer and the Design Engineer must coordinate with the Drain Commissioner or his designee, the Ionia 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.
- d. 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. Permit Application Submittal

Permit 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 permit shall be made prior to the start of any work on the proposed development requiring a permit 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, application for permit 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 permit application.

4. Application Submittal Requirements

- a. The Owner/Developer or Design Engineer shall submit four sets of plans, four sets of calculations, and any other supporting information for the site to the Drain Commissioner or his designee with the application. 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 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 USGS datum). The information shall be superimposed on the pertinent Ionia 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 upstream and 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;
 - 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; and
 - xiii. Any other information necessary for the Drain Commissioner or his designee to verify that the drainage plan complies with these Guidelines. All design information must be compatible for conversion to the Ionia County Geographic Information System.
- 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. 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.

5. Permit Application 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 21 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 permit application has met all of the requirements of these Guidelines, the Drain Commissioner will issue a permit specifying the work approved. The Drain Commissioner shall notify the Owner/Developer of the approval or approval with conditions by first class mail or delivery in person along with a set of plans stamped approved.
- b. Disapproval. If the proposed drainage system is disapproved, four sets of plans and calculations may be resubmitted with the appropriate revisions.

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.
- 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 permit will be necessary.

7. Permit Expiration

Permits shall expire automatically upon the project completion date provided on the permit. Permits shall also terminate automatically if construction has not commenced within one year of the date of issuance. The Drain Commissioner may extend a permit 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. Permit Revocation

Any permit issued by the Drain Commissioner under these Guidelines may be revoked or suspended if there is a violation of the conditions of the permit 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 permit in writing by certified 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:

- Ionia County Road Commission which has or shares jurisdiction over drainage along county roads and county rights-of-way within Ionia 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 road side drain, a permit must be obtained from the Road Commission. An application is included in Appendix B.
- Michigan Department of Transportation (MDOT) which has or shares jurisdiction over drainage along state highways and state rights-of-way within Ionia County. Sites located along MDOT rights-of-way and discharging to MDOT drainage systems must obtain a permit from MDOT.
- Soil Erosion and Sedimentation Control. The Drain Commissioner is the County Enforcing Agent for Ionia County, and a permit must be obtained when applicable.
- Michigan Department of Environmental Quality (MDEQ) which 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. 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 sewer 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 sewer, 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 Appendix A.

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 (Appendix A) will be completed by the Drain Commissioner or his designee. Subsequent inspections may be required if deficiencies exist.

2. *Residential and Condominium Projects* - Full time inspection of storm sewer 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 Appendix A. 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 (Appendix A) 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 sewer, 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 Appendix A.

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 (Appendix A) will be completed by the Drain Commissioner or his designee. Subsequent inspections may be required if deficiencies exist.

D. Fee Schedule

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

REVIEW FEES:

<i>Permit Application Reviews:</i>	<u>Fee</u>
Developments and Redevelopments	\$800 review fee
(The estimated fee will be provided by the Drain Commissioner after reviewing the conceptual site plan).	(\$1000 deposit)

Re-Review Fees: The permit 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.

INSPECTION FEES:

	<u>Fee</u>
<i>Site Plans:</i> General site inspection of the Restrictor and the Detention Storage	\$200 per inspection
<i>Re-Inspector/Additional Inspection Fees:</i>	Hourly, based upon the time required
<i>Residential Subdivisions and Condominiums:</i> Full-time inspection of the installation of the storm sewer and construction of the storm water detention areas.	Hourly, specific to the job and the contractor

III. STORM DRAINAGE SYSTEMS WITHIN IONIA COUNTY

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. Qa=CIA

- c. The percentage of capacity available in the downstream receiving storm sewer and/or water course. <i.e. capacity of outlet storm sewer 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 = Qa 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 Ionia 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.

A sediment forebay retention area is required in addition to the storm water detention requirements equal to 0.5 inches of runoff from the entire contributing area, see the calculation spreadsheet.

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.

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

a = area of orifice (sq. ft.)

Δh = 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 100% of the 100 year 24 hour storm event. The rainfall amount for the 100-year storm is 5.5 inches. Retention calculations must be done using the Ionia County Storm Water Management Guidelines Spreadsheet.

A soil investigation must be completed at a maximum spacing of a 30-foot grid within the location of the proposed storm water basin/system and 30 feet outside of the site location. Soil boring must be a minimum of 10' below the proposed basin/system. 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 (ie 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.

Adequate retention of sediment must be designed within the system to meet NPDES Phase II requirements. A retention basin must include as part of the retention volume an area equal to 0.5 inches of runoff from the site as a sediment forebay. An underground system must include vortex separation units or equivalent cleansing system to assure that the retention system does not become plugged with sediment and/or other fine materials.

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 Ionia County will be determined according to the permit procedure outlined in these Guidelines.
- b. A permit 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. This activity will be regulated under the building permit.
- 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 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 permit application. The calculations shall follow the procedures outlined in these Guidelines.
- g. Roof drains may be connected to a sewer system if the flow through the outlet to the drainage system is properly restricted. Unrestricted runoff from roof drains will not be accepted, there are no exemptions.
- 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 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 future land use, not necessarily existing conditions.
- k. Soil erosion and sedimentation control measures 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 (Qd).
- b. All storm sewer materials must comply with the authority having jurisdiction over the storm sewer system.
- c. Provide two (2) feet minimum cover with minimum five (5) feet cover in MDOT rights-of-way and four (4) feet minimum cover in Ionia County Road Commission rights-of-way under the roadway.
- d. Provide eighteen (18) inch vertical separation between all other utilities including, sanitary sewers and water mains.
- e. Provide ten (10) feet horizontal separation from other utilities.
- f. Manholes/catch basins shall be placed at a maximum distance of three hundred fifty (350) feet from any other manholes/catch basins for access/maintenance purposes.
- g. Provide a sump discharge outlet for each individual lot in all developments. This outlet shall be a catch basin (minimum two (2) feet diameter).
- h. Place a catch basin (minimum two (2) feet diameter) between each pair of driveways, if curb and gutter, driveway culverts, and/or valley shaped ditches are not proposed.
- i. Minimum pipe grades must be such to produce minimum scouring velocity of 2.5 ft/sec when pipe is flowing full without surcharging.
- j. Concrete pipe (C-76-III) should have fabric wrapped joints.
- k. For private storm sewer 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.
- l. Minimum pipe diameter for catch basin leads is ten (10) inches.
- m. Minimum pipe size for storm sewer main is twelve (12) inches.

- n. Pipe should be sized for a 10-year design storm without surcharging when possible.
- o. When two pipes or more of different sizes come into a structure, the 8/10th flow lines shall match when possible.
- p. Catch basins should have a minimum sump depth of twenty-four (24) inches.

3. Detention Requirements

- a. Proposed storm sewer 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.
- 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 Design Engineer shall submit an Operation and Maintenance (O&M) Plan and/or provide maintenance agreement, as necessary, for any detention facility prior to its approval 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.
- 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 sewer 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 requiring rear lot drainage shall be adjacent to a rear lot catch basin.
- 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, 0.28%.
 - 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, 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. Variations from Requirements

The Drain Commissioner may issue a permit 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.
2. Special circumstances or conditions exist which will affect the property under consideration such that strict compliance with the provisions of the permit would deprive the Owner/Developer of the reasonable use of their land.
3. A variance is necessary for the preservation and enjoyment of a substantial property right of the Owner/Developer.
4. Granting of the variance will not be detrimental to the public health, safety or welfare, or injurious to other property in the territory in which said property is located.