

**OCEANA COUNTY DRAIN COMMISSIONER  
SUBDIVISION DRAINAGE RULES  
AND  
STORM WATER DESIGN CRITERIA**

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## LETTER OF INTENT

OCEANA COUNTY DRAIN COMMISSIONER  
PURSUANT TO SECTION 105  
OF ACT 288 OF PUBLIC ACTS  
OF MICHIGAN OF 1967

The Land Division Act, formerly know as the Subdivision Control Act (Act 288 of the Public Acts of Michigan of 1967, as amended by Act 591 of the Public Acts of 1996), requires the County Drain Commissioner to publish rules governing the internal drainage of proposed subdivision and outlets for drainage. The rules are intended to assist land developers by providing uniform procedures to be followed in the processing of preliminary and final plats, construction drawings, and establishments of county drains and their branches within and without of these subdivisions.

A resolution acknowledging and recognizing the Oceana County Drain Commissioner Subdivision Drainage Rules and Storm Water Design Criteria promulgated and published by the Oceana County Drain Commissioner, and to authorize the fee schedule set forth therein pursuant to the authority granted in the Land Division Act (then the Subdivision Control Act) was adapted by the Oceana County Board of Commissioners on October 1, 2004.

IT IS HEREBY ORDERED that the Oceana County Drain Commissioner Subdivision Drainage Rules and Storm Water Design Criteria promulgated pursuant to Section 105 of Act 288 of the Public Acts of Michigan of 1967, as amended by Act 591 of the Public Acts of 1996, are hereby adopted and shall be followed in the processing of all subdivision plats, and all other land developments (such as condominiums, planned unit developments [PUDs], manufactured housing communities, and other residential, commercial, industrial, or institutional developments) which impact established county or intercounty drains, or for which the Oceana County Drain Commissioner provides support to other state, county, or local reviewing agencies.

IT IS HEREBY FURTHER ORDERED that the effective dates of the following rules shall be the 1st day of October 2004.

Calvin Ackley  
Oceana County Drain Commissioner

# SUBDIVISIONS DRAINAGE RULES

## PROCEDURES FOR SUBMISSION AND REVIEW OF PLATS AND CONSTRUCTION DRAWINGS

### I. PURPOSE

All plats to be recorded with the Register of Deeds must be in conformity with the Michigan Land Division Act (Act 288 of the Public Acts of 1967, as amended by Act 591 of the Public Acts of 1996). The following rules are issued to guide land developers in subdividing land and to provide for a uniform method of preparing plats submitted to the office of the Drain Commissioner for processing in accordance with the Act.

### II. AUTHORITY

The Drain Commissioner of Oceana County, through the Michigan Drain Code (Act 40, PA 1956, as amended, MSA 11.1001 et seq.; MCLA 280.1 et seq.), has acquired jurisdiction over established county drains and under the terms of the Land Division Act acquired jurisdiction of drainage systems within subdivided lands and drains external to the proposed subdivision after January 1, 1968. In accordance with the provisions of the Land Division Act, the Drain Commissioner has the authority to ensure that established drains and natural water courses, both inside and outside of the plat, be improved or protected to the standards established by the Drain Commissioner.

### III. DEFINITIONS

**Drain Commissioner:** The Drain Commissioner of the County of Oceana, State of Michigan.

**Engineer:** The engineer appointed by the Drain Commissioner to review the drainage of a plat or any other land development.

**Proprietor:** Any person, landowner, firm, association, partnership, corporation, or combination of any of them, who submits a site plan for drainage review (may also be referred to as a developer).

**Health Department:** The state, city, county, or district health department having jurisdiction.

## **IV. PRELIMINARY PLAT REQUIREMENTS**

### **A. SUBMISSION OF PRELIMINARY PLAT**

#### **1. GENERAL INFORMATION**

In order that subdivisions be prepared in conformity with the Land Division Act, the proprietor shall have prepared a preliminary site plan showing the layout of the area intended to be platted. This plan shall be prepared under the direction of a licensed professional engineer or a licensed professional land surveyor, and shall be drawn to a scale not smaller than 1 inch = 200 feet. Outside dimensions of each sheet shall be 24 by 36 inches. North direction shall be shown. A design checklist for preliminary plats and developments is included in Appendix 2.1.

#### **2. LOCATION**

The preliminary plat shall give the location of the proposed subdivision with reference to the section, town, and range in which the parcel is situated, and the name of the township, city, or village. The plan shall show the proposed street and alley layout, lot and plat dimensions, all pertinent factors such as adjoining roads and subdivision, railroads, high tension tower lines or underground transmission lines, cemeteries, parks, sanitary sewers, floodplain areas, wetlands, natural water courses, established drains, easements, or any other features, the existence, location, or description of which might be of value in determining overall drainage requirements for the subdivision.

#### **3. TOPOGRAPHICAL INFORMATION**

Existing topographical information referenced to U.S.G.S. vertical datum shall be included on the preliminary plat, and show contours at not greater than 2-foot intervals extended onto adjoining properties to clearly define existing drainage patterns.

#### **4. EASEMENTS FOR PUBLIC UTILITIES**

Easements for public utilities shall be shown on the preliminary plat. Coordination of all required easements is the responsibility of the proprietor or his agent.



## **5. STAGED DEVELOPMENT**

The proprietor shall submit three copies of the site plan showing the entire proposed subdivision. Proposed storm water trunk lines shall be plotted for clarification, and anticipated phasing of development shall be clearly indicated. Approval shall be sought for each phase of development. Subsequent phases shall include the revised final layout of previously approved or constructed phases.

## **6. SUBMITTAL REQUIREMENTS**

Three prints of the preliminary plat prepared in accordance with the standards in this section shall be submitted together with a letter of transmittal requesting that the plan be reviewed and the appropriate review fee. Each copy of the preliminary site plan shall be accompanied by a copy of the site report furnished to the health department, if applicable. The names of the proprietor and engineering or surveying firm, with mailing addresses and telephone numbers for each, shall be included with the transmittal. No review shall commence until the contents of the preliminary plat are determined complete as specified in these rules.

## **7. APPROVAL**

The Drain Commissioner, within 30 days of receipt of the preliminary plat, shall, in writing, approve or reject it. If the proposed plat is not approved as originally submitted, the Drain Commissioner or the engineer shall notify the proprietor or the proprietor's engineer or surveyor in writing setting forth reasons for withholding approval and request that the necessary change(s) be made in the preliminary plat before proceeding with the submission of construction drawings.

## **8. CHANGES**

If the proprietor finds it advantageous to make changes in the preliminary plat, they shall be incorporated in the plan and a new preliminary plat resubmitted for approval even though the original plan may have already been approved by the Drain Commissioner.

## **9. APPROVAL OF OTHER GOVERNING BODIES**

Approval of the proposed subdivision by the local governing body is also required under the Land Division Act. Further, the approval of federal and state agencies may also be required. Should the approval of the local unit of government, federal, or state agencies require changes to the proposed plat layout or the proposed drainage facilities, such changes shall be incorporated in a new layout and a new preliminary plat be resubmitted for review by the Drain Commissioner. The resubmission is required even though the original layout may have already been approved by the Drain Commissioner.

## **10. EXPIRATION DATE OF PRELIMINARY APPROVALS**

If the proprietor does not present his final plat to the Drain Commissioner for approval within a period of two years after receiving approval of the tentative layout, it will be necessary that he resubmit the layout for review. The preliminary layout is no longer valid and a new submittal is required, including all fees.

## **B. STORM WATER MANAGEMENT PLAN**

Additional information is required by the Drain Commissioner to properly assess whether the subdivision meets the minimum requirements set forth in these rules and is adequate for internal and external drainage.

### **1. EXISTING DRAINAGE**

The proprietor's engineer shall submit with the preliminary plat, a topographical map of the entire contributing drainage area, and indicate any drainage originating outside of the subdivision limits which has previously flowed onto or across the subdivision, as well as any natural water courses and county drains that traverse or abut the subdivision. The boundary of the subdivision located within the overall drainage area boundary shall be clearly defined.

## **2. GRADING AND DRAINAGE PLAN**

### **a. FOR SITE DEVELOPMENTS**

A site grading plan shall be submitted with preliminary plat and show existing and proposed contours, major soil types, and proposed erosion control measures.

A drainage plan and supporting hydrologic and hydraulic calculations shall be submitted with the preliminary plat. The drainage plan shall include the general drainage scheme proposed for the subdivision. Proposed drainage shall conform to established county drain districts, or if there are no established drainage districts, then the proposed drainage system shall conform to the natural drainage basin. The general drainage scheme shall indicate how storm drainage will be provided, including the description and location of the outlet. The route to the outlet should be mapped. The drainage plan shall indicate any proposed onsite and/or offsite facilities required to convey the drainage to an adequate outlet. The plan sheet shall clearly show the areas which will be contributing storm water runoff to each inlet in the storm sewer system.

### **b. FOR INDIVIDUAL LOTS WITHIN A SITE DEVELOPMENT**

Approval of final lot grading and drainage for individual building sites, is the responsibility of the local municipality. The Drain Commissioner's office is not responsible for inspection of, or enforcing corrections to, final lot grading and storm water management measures constructed on individual basis at the lot level. It is the Drain Commissioner's responsibility to ensure that the overall drainage plan is consistent with sound storm water management and drainage practices.

## **3. STORM WATER FACILITIES**

### **a. GENERAL**

In general, all new land developments and additions to previous developments within Oceana County will be required to provide adequate controls for the management of storm water quantity and quality.

b. **ACCEPTANCE BY DRAIN COMMISSIONER**

An effort should be made to limit the number of storm water facilities within a development. A large number of small storm water facilities serving a development may be cause for the Drain Commissioner's refusal to accept the drainage system for operation and maintenance.

**4. PARTIAL DEVELOPMENT**

In the event the proposed subdivision is a partial development of a larger area, each subdivision shall be self sufficient from the standpoint of drainage.

**5. COMMUNITY STORM WATER MASTER PLAN**

The proposed drainage facilities shall conform to the community storm water master plan, if available. However, the more stringent requirements shall apply.

**V. CONSTRUCTION DRAWINGS**

**A. GENERAL INFORMATION**

After the preliminary plat of the proposed subdivision has been approved by the Drain Commissioner, the proprietor's engineer may proceed with the preparation of drawings for the construction of the subdivision. These construction drawings shall show plan, profile, cross-sections, location of drainage facilities and structures, special details, and such other grading and drainage information as may be required. Construction drawings, which are prepared by the proprietor's engineer, shall clearly show how the surface drainage will leave the streets in the proposed subdivision. Block grading plans shall be included to ensure that individual lot drainage will conform to the overall subdivision drainage plan. Minimum opening elevations in proposed structures must also be indicated on the drawings, where applicable. Where drainage easements are required, the existing ground elevations shall be shown together with final swale, ditch, or storm sewer profiles proposed to be constructed. Where storm sewers are to be constructed, the plans and profiles shall show the location and size of each storm sewer and drainage structure in the drainage system, together with elevations and proposed grades. Foundation drain leads shall be shown in relation to other utility services. The drawings shall be supplemented with hydrologic and hydraulic calculations for each inlet, the cumulative flow calculations for the system, and design data for structures and basins.

## **B. PERMITS FOR COUNTY DRAINS**

When the work required for the proposed plat involves occupying the drain right-of-way or crossing an existing county drain, a permit application shall be submitted to the Drain Commissioner, along with the required permit fee. An application and permit to cross or parallel a county drain is included in Appendix 3.1. Approval shall be received in advance to discharge and connect to a county drain. A permit fee will be charged.

## **C. SUBMITTAL REQUIREMENTS**

Storm water calculations and three sets of construction drawings shall be submitted to the Drain Commissioner for review. Drawing sheets shall have an outside dimension of 24 by 36 inches. Horizontal drawing scale shall be no greater than 1 inch = 100 feet. A Design Checklist for Preliminary Plats and Developments is included in Appendix 2.1.

## **D. APPROVAL**

After the drawings have been reviewed by the Drain Commissioner or the engineer, approval or rejection shall be provided within 30 days to the proprietor or the proprietor's engineer in writing. The proprietor shall submit three sets of approved construction drawings to the Drain Commissioner. Each set shall be dated, signed, and sealed by a licensed engineer and labeled for construction. When the drawings have been approved by the Drain Commissioner, the proprietor may proceed to make final arrangements for placing the work under construction.

## **E. CHANGES**

If the information given to the Drain Commissioner does not represent the conditions as they exist on the ground, and should any revisions be required as a result of this lack of complete information, such revisions shall be made by the proprietor notwithstanding that the plans have been approved. Revised drawings shall be submitted to the Drain Commissioner for approval.

## **VI. CONSTRUCTION**

### **A. INSURANCE**

#### **1. COVERAGE**

The proprietor shall maintain adequate insurance coverage for his own employees, his contractors and subcontractors, and their employees during construction. Satisfactory evidence of public liability and property damage insurance coverage as set forth by the State of Michigan may be requested by the Drain Commissioner.

#### **2. INDEMNITY**

The proprietor shall hold the Drain Commissioner and his agents harmless for acts of omission, negligence, or error by the contractor(s) and subcontractor(s), the proprietor's engineer, or the proprietor. Costs incurred by the Drain Commissioner to defend against criminal or trespass actions resulting from activities of any of the parties named above, as well as judgments awarded by any court of law shall be paid by the proprietor.

### **B. INSPECTIONS**

#### **1. PURPOSE**

##### **a. BY PROPRIETOR**

The proprietor shall employ a competent inspector during construction of storm drains and appurtenances to ensure conformity to the approved construction drawings. Written verification in the form of daily logs may be required should the Drain Commissioner feel that the product fails to meet approved industry standards.

b. **BY DRAIN COMMISSIONER**

The Drain Commissioner may employ an inspector on behalf of the drainage district should it appear that the installation fails to meet minimum requirements. Spot inspections by the engineer are to verify the proper construction of the drainage system. Inspection by the Drain Commissioner or his engineer shall not relieve the proprietor's engineer or the municipal engineer of their obligations.

c. **BY OTHERS**

Other agencies may periodically inspect progress for informational purposes. The presence of such inspectors does not release the proprietor or his engineer from obligations defined elsewhere in these rules.

**2. DOCUMENTATION**

The Drain Commissioner may require documentation relative to the contract covering the work to be performed and including the name of the contractor, the items of work involved, the total cost of drainage system and appurtenances, and the proposed construction schedule. A copy of permits and approvals by other agencies (road commission, MDOT, MDEQ, SESC agency, local municipality, etc.) may also be requested.

**3. PRECONSTRUCTION MEETING**

The Drain Commissioner may, at his discretion, request that a preconstruction meeting of all involved parties be held.

**4. COSTS**

Payment of inspection deposits shall be made to the Drain Commissioner prior to commencing work. The proprietor will be held responsible for the actual inspection costs incurred by the Drain Commissioner.

## **C. PROPRIETOR RESPONSIBILITY**

### **1. GENERAL**

The proprietor shall take whatever precautions he deems necessary in his direct relations with this contractor in order to ensure that the work performed by the contractor meets the approval of the engineer. The proprietor shall be held totally responsible for the fulfillment of his obligations to the Drain Commissioner.

### **2. CLEANING**

The proprietor shall be responsible for cleaning all sewers, manholes, catch basins, or other structures affected by the development both onsite and offsite before final release.

### **3. RESTORATION**

All unpaved areas shall have established ground cover before final release. Sodding, seeding, and mulching shall be done in accordance with current MDOT Standards for Construction.

## **VII. DRAINAGE EASEMENTS**

An easement or release of right-of-way, not land ownership, is the approved method of providing access to, and protection of, public storm drainage facilities. Transfer of land ownership to Oceana County, the Drain Commissioner, or an established Drainage District in the County is not allowed unless permitted in writing by the Drain Commissioner or other applicable authorities.

### **A. LOCATION**

#### **1. WITHIN THE PLAT**

All natural watercourses, drainage ditches, or swales, enclosed storm drain detention or retention facilities, or established drains within the plat shall have granted easements.



a. COUNTY DRAINS

Private (exclusive) Easements for County Drains shall be granted to the appropriate drainage district and must be shown on the final plat. Example: Private Easement for Drainage to the Weatherby Drainage District. Separate, recordable easements must be provided in a form acceptable to the Drain Commissioner. An acceptable drainage easement form is included in Appendix 3.2.

b. SURFACE DRAINAGE

Private Easements for Surface Drainage are for the benefit of upland lots within the subdivision or upland sites that currently drain across the proposed plat. Any improper construction, development, or grading that occurs within these easements will interfere with the drainage rights of those upland lots. Private Easements for Surface Drainage are for the continuous passage of surface water and each lot owner will be responsible for maintaining the surface drainage system across his property. No construction is permitted within a private easement for drainage. This includes swimming pools, sheds, garages, patios, decks, or any other permanent structure or landscaping feature that may interfere with surface drainage. A separate, recordable easement form is not required.

c. YARD DRAINAGE

Private Easements for Yard Drains are for the benefit of individual lots within the subdivision. Any improper construction that occurs with these easements will interfere with the future maintenance of the enclosed yard drain system. Provisions applying to surface drains shall apply to yard drains.

## **2. OUTSIDE THE PLAT**

### **a. EASEMENTS**

Easements will be required downstream of a plat when the receiving watercourse is not an established drain and lacks sufficient capacity or grade to be of ongoing service to the plat without regular maintenance. An acceptable release of right-of-way form for drainage is included in Appendix 3.3. Easements will not be required through public rights-of-way (i.e., county roads). Recordable release of rights-of-way shall be submitted to the Drain Commissioner prior to construction. The Drain Commissioner may require downstream drain construction and/or maintenance prior to plat approval.

### **b. AGREEMENTS**

When concentrated storm water is proposed to be discharged over, onto, or across private property (other than that owned by the developer), an agreement between the owners must be executed relieving the drainage district, or municipality if there is no drainage district, of any and all responsibility for damage that might occur. An acceptable "flooding" easement form is included in Appendix 3.4. Such an agreement shall be submitted to the Drain Commissioner prior to construction.

### **c. CERTIFICATION**

*Certification of No Net Increase of Storm Water* is required when storm water is proposed to be discharged over, onto, or across private property, and flooding easements are not obtained. A standard form is included in Appendix 3.7.

## **B. WIDTH**

The following minimum right-of-way widths are required for established county drains and natural water courses that will be utilized and/or lay within the confines of the proposed subdivision:

## **1. OPEN DRAINS**

Open drains and water courses shall have a minimum right-of-way equal to the extreme top width of channel, plus 30 feet. The easement shall be centered on the centerline of open channel or water course.

## **2. ENCLOSED DRAINS**

Enclosed drains shall have a minimum right-of-way of 30 feet centered on the centerline of the enclosure. The Drain Commissioner may reduce this requirement to 20 feet if it has been demonstrated that adequate space is available for maintenance.

## **3. SURFACE YARD DRAINS**

Surface drainage swales and enclosed yard drains located between or within lots shall have a minimum right-of-way of 10 feet centered on the pipe.

## **4. STORM WATER FACILITIES**

A minimum of 15 feet of open space outside the high water level and around the perimeter of a public storm water facility must be granted as a drainage easement to access and maintain the facility. Ingress and egress easements shall also be provided. For facilities located adjacent to county drains, a minimum of 15 feet open, flat space between the facility and the county drain must be granted as a drainage easement for access and maintenance of both. An acceptable detention basin easement form is included in Appendix 3.5.

## **5. EXCEPTIONS**

The above widths shall govern, generally. However, if the engineer determines that additional right-of-way is required for proper construction, or because of special circumstances, such facts shall be made known to the proprietor upon review by the engineer. Exceptions to the above requirements may be made only at the discretion of the Drain Commissioner.

## **C. UTILITIES**

If any utilities are to be located within the drainage easement of the proposed subdivision, the proprietor's engineer shall present plans detailing such utilities to the Drain Commissioner for his approval as to location. Utility plans shall be presented at the same time as drainage plans so that all details of construction and location may be checked and properly oriented with each other. An application and permit to cross or parallel a county drain is included in Appendix 3.1.

## **D. EXISTING EASEMENTS**

The liber and page reference of all recorded easements shall be shown on the final plat. Drainage easements obtained prior to 1956 were not required by statute to be recorded. Therefore, it may be necessary to check the permanent record of the Drain Commissioner's office. Drainage District Easements, Private Easements for Drainage Purposes, Drainage Easements, Drainage Easements to the Drain Commissioner or the Drain Commission, or other variations of these recorded subdivisions are considered exclusive easements that may be utilized by the Drain Commissioner for the purposes of accessing, maintaining, and constructing open or enclosed drains.

## **VIII. DEDICATION AGREEMENTS**

Two methods for establishing and dedicating drainage facilities are provided for by the Michigan Drain Code (Act 40, PA 1956, as amended). Rules developed by the Oceana County Drain Commissioner for each method are similar.

### **A. SECTION 425 APPLICATION AND PETITION**

#### **1. USE**

Section 425 of the Michigan Drain Code addresses the addition of branch drains to serve lands entirely within an existing drainage district, and the enclosure or enlargement of an existing drain. Under this paragraph, the proprietor must petition the Drain Commissioner or Intercounty Drainage Board for permission to construct or improve the additional drainage for public use.

## **2. SUBMITTALS**

### **a. APPLICATION/PETITION**

The proprietor is required to submit an Application to Lay Out a Drainage District and a Petition to Locate, Establish, and Construct a Drain. An acceptable application/petition is included in Appendix 3.6.

### **b. LEGAL DESCRIPTIONS**

The proprietor's engineer or surveyor shall provide centerline descriptions of the drains or branches, and a complete legal description of the drainage area affected. The description shall list each parcel and the acreage located within the drainage subdistrict. In addition, the engineer shall complete an apportionment data sheet for the subdistrict.

### **c. CERTIFICATION**

The proprietor's engineer shall include a sealed and dated statement attesting to the adequacy of existing receiving drains. A standard form for *Certification of Adequate Outlet* is included in Appendix 3.7.

## **3. COSTS**

The proprietor shall reimburse the Drain Commissioner for publishing and legal expenses. In addition, the proprietor shall deposit into the maintenance account for the drain, a non-refundable maintenance fee in the amount required by Section 433 of the Michigan Drain Code.

## **B. SECTION 433 AGREEMENT**

### **1. USE**

Section 433 of the Michigan Drain Code addresses enlargement of existing drainage districts, and creation of new districts where none previously existed. A formal agreement is required between the proprietor and the Drain Commissioner or drainage board on behalf of the affected drainage district. Owners of lands not owned by the proprietor who will be included in the drainage district must also sign the agreement.

### **2. SUBMITTALS**

#### **a. AGREEMENT**

The proprietor and all parties having legal interest in a plat, as well as adjoining landowners whose properties will be included in the enlarged or new drainage district, shall enter into a formal agreement dedicating drainage facilities therein for public use. The agreement form will be completed in coordination with the Drain Commissioner and stipulate conditions of transfer and responsibilities of parties. An acceptable Section 433 Agreement form is included in Appendix 3.8.

#### **b. LEGAL DESCRIPTIONS**

The proprietor's engineer shall provide centerline descriptions for each drain or branch to be dedicated, and a metes and bounds description of the contributing drainage area (drainage district) benefiting from such. A 24- by 36-inch Drainage District map showing the drainage district boundary line, lot and parcel lines with numbering, and all other pertinent information shall be required. A breakdown of individual areas in acres shall be provided by municipality for each parcel, and for railroad, state and county road, and municipal street rights-of-way. In addition, the engineer shall complete an apportionment data sheet for the new district. The Drain Commissioner may also require that adjoining drainage district boundaries changed by the dedication be described in their entirety for amending documents pertaining to those drains.

c. **CERTIFICATION**

The proprietor's engineer shall include a sealed and dated statement attesting that lands to be added to a drainage district naturally drain into the area served by the existing drain or that the existing drain is the only reasonably available outlet, and attesting to the adequacy of existing receiving drains. A standard form for *Certification of Adequate Outlet* is included in Appendix 3.7.

**3. COSTS**

The proprietor shall reimburse the Drain Commissioner for publishing and legal expenses.

**4. MAINTENANCE FEE**

The Michigan Drain Code requires that any person dedicating a drain for public use shall provide funding for initial maintenance operations. Contribution is calculated by taking the lesser amount of \$2,500 or 5% of the cost of constructing the drain and its appurtenances. These funds are deposited in the account set up for the subject drain, and are not refundable.

**C. OPERATION AND MAINTENANCE AGREEMENTS**

**1. PUBLIC SYSTEMS**

If a municipality (township, city, or village) or a governmental agency with taxing powers (road commission) is willing to accept, maintain, and operate the proposed drainage system and/or storm water facility on a permanent basis, then the preliminary plat submitted to the Drain Commissioner for approval must be accompanied by a Letter of Commitment from said entity. Such Letter of Commitment shall be proof of entity's willingness to accept, maintain, and operate the proposed drainage system and/or storm water facility on a permanent basis. This letter is not required if the local units of government have adopted a storm water management ordinance which defines maintenance responsibility. If a municipality or governmental agency with taxing powers refuses to accept, maintain, and operate a proposed drainage system and/or storm water facility on a permanent basis, then the Drain Commissioner must be petitioned to

establish a county drainage district according to procedure provided in Sections 425 and/or 433 of the Michigan Drain Code.

## **2. PRIVATE SYSTEMS**

A legally binding maintenance agreement shall be executed before final plat or project approval is granted. The agreement shall be included in the property deed restrictions or condominium master deed documents so that it is binding on all subsequent property owners. A sample agreement is included in Appendix 3.12.

## **D. MAINTENANCE PLANS**

- 1.** Maintenance plans shall be submitted with construction drawings for all private developments and be included in the subdivision agreement (or for other developments, legally binding documents such as the property deed or condominium master deed). A sample maintenance plan and budget is included in Appendix 3.11. The plan shall include the following information:
  - a. An annual maintenance budget, itemized by task. The financing mechanism shall also be described.
  - b. A copy of the final approved storm water management system for the development that delineates the conveyance system, storm water facilities, easements, and buffer areas.
  - c. A listing of tasks defined for each component of the storm water management system.
  - d. The party responsible for performing each maintenance activity.
  - e. A detailed description of the procedures for record keeping of maintenance operations and expenditures.



- f. A schedule for implementation, and a time frame for corrective measures to be taken. Language shall be included which states that if the private entity fails to act within the time frame specified, the responsible governmental entity may perform the needed maintenance and assess the costs against the property owners within the subdivision (or other development).
  - (1) Routine maintenance inspections conducted at least twice a year in the spring and in the fall, including inspection of all structural elements conducted annually. Corrective action shall be completed within 30 days of regularly scheduled inspection or notification that action is required.
  - (2) Emergency inspection on an as-needed basis. Corrective action shall be completed within 36 hours of notification unless threat to public health, safety, and welfare requires immediate action.

## **IX. FINAL PLAT REQUIREMENTS**

### **A. APPROVAL**

The Land Division Act requires that a true plat be delivered to the Drain Commissioner for review. Such final plats must be prepared in accordance with the requirement of the Land Division Act. If the Drain Commissioner approves the plat, he will transcribe thereon its certificate of approval and deliver the plat within ten days after date of approval. If the Drain Commissioner rejects the plat, written notice of such rejection and reason therefore are given to the proprietor and the clerk of the related local municipality within ten days. A submittal checklist is included in Appendix 2.2 for plats and other developments.

A modified version is provided in Appendix 2.3 for private developments.

## **B. REQUIREMENTS**

Prior to approval of the final plat, the Drain Commissioner shall require that the following provisions are met:

### **1. WORK COMPLETED PRIOR TO FINAL APPROVAL**

Certification from the proprietor's engineer that the county drains and watercourses shown on the plat have been improved in accordance with the approved construction drawings.

OR

### **2. WORK COMPLETED AFTER FINAL PLAT APPROVAL**

A proprietor who desires to expedite the formal platting procedure shall enter into an agreement with the Drain Commissioner and post surety for faithful performance of the agreement. Failure to fulfill terms of an agreement executed under this provision will result in appointment of a Board of Determination to rule on necessity for the drain(s). Expenses incurred subsequent to said appointment will be assessed against lands within the plat still owned by the proprietor.

#### **a. SURETY**

The surety shall consist of a cash deposit, a certified check, or an irrevocable letter of credit in the amount of 130% of the uncompleted portion of the project. An acceptable irrevocable commercial letter of credit is included in Appendix 3.9.

#### **b. CONSTRUCTION CONTRACT AS BASIS FOR REQUIRED SURETY**

Valid existing contracts for construction of the drains, watercourses, and detention/retention basins executed between the proprietor and his contractor shall be the basis for establishing the portion of the contract to be covered by surety.

c. **ENGINEER'S ESTIMATE AS A BASIS FOR REQUIRED SURETY**

In the event the owner has not contracted for the construction of the drains, watercourses, and storm water facilities (e.g., contractor is the owner) then the proprietor's engineer shall estimate the cost of said construction. The estimate of cost, as reviewed by the engineer and approved by the Drain Commissioner, shall be the basis for the amount of surety.

d. **REBATE**

A rebate shall be made to the proprietor, as the work progresses, of the amounts of any cash deposits equal to the ratio of the work completed to the entire project as determined by the Drain Commissioner.

**C. RESTRICTIVE COVENANTS**

**1. GENERAL**

A copy of restrictive covenants related to drainage shall be provided to the Drain Commissioner.

**2. BLOCK GRADING PLAN**

A block grading plan shall be incorporated in the restrictive covenants of the plat to ensure proper drainage. The block grading plan shows the direction of flow for the surface drainage for all lots. It is the lot owner's responsibility to ensure that the final grading of the lot is in accordance with the block grading plan. During the final lot grading and landscaping, the owner shall take care to ensure that the installation of fences, plantings, trees, and shrubs do not interfere with nor concentrate the flow of surface drainage.

**3. MINIMUM OPENING ELEVATIONS**

Minimum building opening elevations shall be established to eliminate the potential of structural damage due to flooding and backyard surface drainage. Minimum opening elevations shall be incorporated in the restrictive covenants of the plat, including bench mark references.

## **D. PLAT SUBMITTAL AND REPAIR BOND**

Upon completion of the requirements specified in this section, the proprietor may submit their final plat to the Drain Commissioner for approval. At this time, the proprietor shall be required to post a repair bond in the amount of \$5,000 or 10% of the construction cost, whichever is less, with the Drain Commissioner to guarantee repairs of any defects which may show up as a result of poor workmanship of defective materials within one year after completion of the improvement. Should no defects occur within this period of one year and should no adjustments be required, this bond will be returned to the proprietor in its entirety. An acceptable repair bond form is included in Appendix 3.10.

## **E. CONSTRUCTION RECORD DRAWINGS**

After the final plat approval, but prior to the final release of surety money, the proprietor's engineer shall submit a complete set of construction record drawings showing all of the approved field changes. Two paper copies and one reproducible set shall be submitted on mylar or on magnetic disc as an AutoCAD drawing file. The construction record drawings will be kept on file with the Drain Commissioner for permanent public record.

## **X. PLAT REVIEW FEES**

The fees for reviewing a plat to determine that the provisions of the Land Division Act and the provisions of the Oceana County Drain Commissioner's rules have been complied with are set forth on the fee schedule included in Appendix 4.

## **XI. CONFLICT WITH LOCAL ORDINANCES**

If any part of these rules is found to contradict requirements set forth in local ordinances, the most stringent requirements shall govern.

## **XII. SEVERABILITY CLAUSE**

If any part of these rules is found to be invalid, such invalidity shall not affect the remaining portions of the rules which can be given effect without the invalid portion, and to this end the rules are declared to be severable.

### **XIII. REPEAL**

Rules previously published by the Oceana County Drain Commissioner's office pertaining to subdivision development are hereby repealed, effective on the date of publication of these rules.

### **XIV. HISTORY**

Subdivision Drainage Rules, December 1, 1990

Guidelines for Storm Water Management, August 2002

## **RULES AND PROCEDURES FOR OTHER SITES**

Development governed under these provisions shall include all site development construction projects. Examples include:

- condominium or site condominium
- planned unit or cluster development
- mobile home park
- multi-unit residential apartment
- public or private school and attendant facilities
- church and attendant facilities
- commercial or retail site
- office or professional building site
- industrial site
- public service facility

Published Subdivision Drainage Rules and Storm Water Design Criteria of the Oceana County Drain Commissioner and the fee schedule referenced herein shall apply to all developments as provided by the Michigan Drain Code, or as requested/required by a local municipality or regulatory agency with jurisdiction over the proposed development. Drain Commissioner review of these developments shall focus on the allowable storm water discharge from the site, and protection of adjoining or downstream properties and utilities.

# STORM WATER DESIGN CRITERIA

## I. DEFINITIONS

The following definitions include storm water management terms and storm water facility design criteria terms:

**Bankfull Flood:** A condition where flow completely fills the stream channel to the top of the bank. In undisturbed watersheds, this occurs on average every 1.5 to 2 years and controls the shape and form of natural channels.

**Best Management Practice (BMP):** A structural or non-structural practice or combination of practices that prevent or reduce storm water runoff and/or associated pollutants.

**Buffer Strip:** A zone of variable width located along a natural feature (stream, wetland, etc.) where plantings capable of filtering storm water are established or preserved.

**Design High Water Level:** The high water level in a storm water conveyance channel or facility calculated using the specified design criteria, which will not result in overbank flow in the channel, or outflow from the facility via the emergency overflow spillway.

**Design Maximum Water Level:** The water level in a storm water facility calculated for the design discharge of the emergency overflow spillway.

**Detention:** The temporary storage of storm runoff, to control peak discharge rates and provide gravity settling of pollutants.

**Detention Basin:** A constructed basin that temporarily stores water before discharging into a surface water body. Basins can be classified into four groups:

- **Dry Detention Basin:** A basin that remains dry except for short periods following large rainstorms or snow melt events. This type of basin is not effective at removing pollutants.

- **Extended Dry Detention Basin:** A dry detention basin that has been designed to increase the length of time that storm water will be detained, typically between 24 and 40 hours. This type of basin is not effective at removing nutrients such as phosphorous and nitrogen, unless a shallow marsh is incorporated into the lower stage of the design.
- **Wet Detention Basin:** A basin that contains a permanent pool of water that will effectively remove nutrients in addition to other pollutants.
- **Extended Wet Detention Basin:** A wet detention basin that has been designed to increase the length of time that storm water will be detained, typically between 24 and 40 hours.

**Directly Connected Impervious Area (DCIA):** Those impervious surfaces that are directly connected to the storm water conveyance system and storm water facility.

**Drawdown:** The gradual reduction in water level in a pond BMP due to the combined effect of infiltration and evaporation.

**Dual-Cell Basin:** A detention or infiltration basin preceded by a spill containment cell.

**Extended Detention:** A storm water design feature that provides for the holding and gradual release of storm water over a longer period of time than that provided by conventional detention basins, typically 24 to 40 hours. Extended detention allows pollutants to settle out before storm water is discharged from the basin.

**First Flush:** The delivery of a highly concentrated pollutant loading during the early stages of a storm, due to the washing effect of runoff on pollutants that have accumulated on the land.

**Freeboard:** The difference in elevation from the top of an embankment to the highest water elevation expected for the largest design storm to be stored or conveyed. The distance is required as a safety margin in a pond, basin, or channel.

**Hot Spot:** An area where land use or activities generate highly contaminated runoff, with a concentration of pollutants in excess of those typically found in storm water.

**Headwater Stream:** The smallest streams in a drainage network defined as first- and second-order streams. Headwater streams represent a majority of the drainage network and are exceptionally vulnerable to watershed development.

**Hydraulic Length:** The shortest length between the inlet to a treatment cell and the outlet, measured along the normal water surface. Minimum hydraulic length is based on the necessary travel time of water through a basin to allow for a specific size of soil particle to settle out.

**Impervious Cover:** Those surfaces of the landscape that cannot infiltrate rainfall consisting of building rooftops, pavement, sidewalks, driveways, etc.

**Infiltration Basin:** A facility without a positive outlet in which storm water runoff is collected and allowed to infiltrate into the ground.

**In-line Detention:** Detention provided within the flow-carrying network.

**Off-line Detention:** Detention of storm water that has been diverted outside of the natural watercourse or storm sewer system.

**Pretreatment:** Technique to capture or trap coarse sediments within runoff, before they enter a BMP to preserve storage volumes or prevent clogging. Examples include swales, forebays, and micropools.

**Retention Pond:** A wet infiltration basin designed to capture runoff that does not discharge directly to a surface water body. The water is “discharged” by infiltration or evaporation.

**Sediment Forebay:** A small, separate storage area near the inlet to a storm water facility, used to trap and settle incoming sediments before they can be delivered to the basin.

**Short Circuiting:** The passage of runoff through a BMP in less than the theoretical or design detention time.

**Spill Containment Cell:** The first cell of dual-cell detention and infiltration basins (or storm water wetlands) designed to provide controlled removal of oils and grease, coarse to fine sediments, and the pollutants associated with them to protect groundwater and surface water quality, and provide for a containment area in the case of an accidental spill.



**Storm Water Facility:** A BMP usually located at the downstream end of the site conveyance system (end-of-pipe) that is designed to provide the uniform treatment volumes required for the site, (detention basins, storm water wetland, and infiltrations basins).

**Storm Water Wetland:** A detention area consisting of deep water, low marsh, and high marsh zones that creates conditions suitable for the growth of marsh plants. Storm water wetlands are designed to maximize pollutant removal through wetland uptake, retention, and settling. These constructed systems are not located within delineated natural wetlands.

**Treatment:** The additional measures taken for the specific purpose of collecting storm water runoff rates and volumes and enhancing water quality by the removal of pollutants beyond those required for the adequate collection and removal of storm water runoff and maintenance of the collection system.

**Urban Storm Water Practice:** Any technique for the collection, storage, treatment, infiltration, or prevention of storm water runoff from urban site developments.

## II. PURPOSE

The general intent of storm water management for site developments is to achieve pre-development conditions with respect to the quantity of storm water runoff, including both rate and volume, and with respect to water quality to protect natural resources and man-made improvements both downstream of and internal to the site. To this end, the following requirements and guidelines shall be applied to all site developments in Oceana County.

The maximum rate or volume of storm water discharged from a site shall not impair or exceed the capacity of the downstream storm sewer, open channel, watercourse, wetland, or overland flow path. It is the proprietor's obligation to meet this standard. Should a storm water system, as built, fail to comply, it is the proprietor's responsibility to design and construct at his expense, any additional and/or alternative storm water management facilities. Such additional facilities shall be subject to the Drain Commissioner's review and approval.

### **III. DESIGNING A STORM WATER MANAGEMENT SYSTEM**

#### **A. UNIFORM TREATMENT CRITERIA**

In an attempt to develop a uniform standard for the growing list of urban storm water practices, adequate controls and treatment volumes shall be provided to maintain groundwater recharge, meet pollutant removal goals, reduce channel erosion, prevent overbank flooding, and provide for containment of accidental spills of toxic materials. Four criteria are used:

- Water Quality Volume
- Stream Protection Volume
- Flood Control Volume
- Spill Containment Volume
- A worksheet to determine which of the volumes are required for an individual site is included in Appendix 5.1

##### **1. WATER QUALITY VOLUME**

Water quality volume is required to treat the “first flush” of storm water runoff that typically carries with it the highest concentration of pollutants. Water quality volume shall be provided for all developments, with the exception of low density residential developments with percent impervious cover of less than 30%.

##### **2. STREAM PROTECTION VOLUME**

Stream protection volume is required to control urban storm water runoff for the smaller, more frequent rainfall events (bankfull flood) that have a greater impact on the stability of headwater streams. Stream protection volume shall be provided for all discharges to natural watercourses.

##### **3. FLOOD CONTROL VOLUME**

The flood control volume has traditionally been the only detention basin storage volume required to control the larger, less frequent rainfall events that typically cause flooding.

Flood control volume shall be provided for all developments. An alternative release rate may be allowed as determined by the Drain Commissioner based on system hydrology and downstream hydraulic capacities.

#### **4. SPILL CONTAINMENT VOLUME**

Land use activities included on the Environmental Protection Agency Standard Industrial Classification (SIC) Code List are considered to be storm water hot spots. A copy of the SIC list included in Appendix 5.2. These activities involve the production, transfer, and/or storage of hazardous materials that pose a risk particularly to groundwater quality.

Spill containment volume is required for storm water hot spots to provide for capture and containment of a slug discharge of pollutants from an accidental spill, especially when infiltration basins or detention basins/storm water wetlands that have a direct groundwater interface are used.

### **B. PROTECTION OF NATURAL HYDROLOGIC BUFFERS**

This section governs natural wetlands, streams, floodplains, and vegetated buffers.

#### **a. NATURAL WETLANDS**

- (1) Wetlands shall be delineated prior to siting storm water BMPs.
- (2) Wetlands shall be protected from damaging modifications and adverse changes in runoff quality and quantity associated with land developments. All necessary wetland permits from the MDEQ (Part 303, Act 451, PA 1994) and local governments shall be in place prior to final plat approval.
- (3) Direct discharge of untreated storm water to a natural wetland is prohibited. All runoff from the development will be pre-treated to remove sediment and other pollutants prior to discharge to a natural wetland.

- (4) Energy dissipation measures shall be incorporated at the end of pipe outfalls to natural wetlands to reduce erosive velocities and spread the flow entering the wetland.

b. **STREAMS**

- (1) In-line detention is prohibited on perennial streams.

c. **FLOODPLAINS**

- (1) Where available, the community flood insurance study shall be used to determine the 100-year floodplain.
- (2) Under no conditions shall a storm water facility be located within the 100-year floodplain of a stream, creek, or lake with a drainage area of over 2 square miles.
- (3) The proprietor shall demonstrate that any activity proposed within a 100-year floodplain will not diminish the flood storage capacity.
- (4) Compensatory storage will be required at a minimum ratio of 1:1 for all lost floodplain storage, unless hydrologic analysis of the watershed indicates no harmful interference at a lower ratio.
  - i. The compensating cut must be available during a flood event.
  - ii. Water must be able to move freely from stream to storage.
  - iii. Excavation must be adjacent to the floodplain.
  - iv. Compensating storage shall NOT be provided through channel widening.

d. **VEGETATED BUFFERS**

- (1) Buffer strips shall be established adjacent to all surface waters and natural wetlands through deed restrictions or provisions of condominium master deed documents.

- (2) Buffers adjacent to Michigan designated natural rivers shall meet the requirements of the Natural Rivers Act (Act 231, PA 1970). Natural rivers in Oceana County include the White River, including the South Branch of the White River, North Branch of the White River and Sand Creek; and the Pere Marquette River including Ruby Creek.
- (3) Plantings capable of intercepting and/or filtering storm water shall be preserved or established.
- (4) The minimum width shall be 25 feet measured from the top of bank or edge of delineated wetland. Storm water BMPs may be located within a buffer.
- (5) The developer shall demonstrate that the clearing of wooded areas has been minimized in the site plan.

#### **IV. DETERMINATION OF SURFACE RUNOFF**

##### **A. METHOD**

- 1. The proprietor's engineer may be required to use the SCS TR-20 hydrologic method to generate hydrographs and perform reach and reservoir routing for large sites and/or smaller sites of sufficient complexity. However, the Rational Method of calculating storm water runoff is generally acceptable for sites less than 120 acres, and is given by the equation:

$$Q = CIA$$

Where:

Q	=	Peak Discharge (cfs)
C	=	Runoff Coefficient
I	=	Rainfall Intensity (in/hr)
A	=	Contributing Drainage Area (acres)

2. For sites with an upstream watershed equal to or greater than 2 square miles, approval of the MDEQ is required, pursuant to the Floodplain Control Section (Part 31) of Act 451, PA 1994. The MDEQ will compute flood frequency discharges for the watercourse upon request.
3. Values of runoff curve number and average percent impervious for various development types for use with SCS method are included in Appendix 5.3. Values of runoff coefficients for various development types, for use with the Rational Method, are included in Appendix 5.4.
4. The minimum time of concentration value shall be 15 minutes. Guidelines for estimating the time of concentration are included in Appendix 5.5.
5. An antecedent moisture condition of II, reflective of normal soil moisture, shall be used with the SCS method.

## **B. DESIGN RAINFALL**

1. The 24-hour rainfall amounts in Bulletin 71, located in Appendix 5.6 Climatic Zones for Michigan, shall be used with the SCS method to calculate peak runoff rates. The rainfall duration-frequency table from Bulletin 71 shall be used with the Rational Method to determine a rainfall intensity for a rainfall duration equal to the time of concentration.
2. A Type II rainfall distribution shall be used with the SCS method.

## **V. CONVEYANCE CONTROLS**

### **A. STRATEGY**

In general, grassed waterways (ditches) are used for rural drainage applications. However, their use is encouraged for more urban applications, where practical, to encourage longer storm water travel times and contact with vegetation to provide some filtering of pollutants.

Perforated storm sewer and catch basins (leaching basins) provide for groundwater recharge and reduce the volume of surface water runoff discharged to a receiving stream. However, their use is prohibited as a conveyance measure due to the difficulty in pre-treating storm water and containing spills along a linear route with numerous inlets.

The strategy for rainfalls greater than the flood control rainfall event is safe passage through floodplain preservation, and planning for secondary conveyance of the 100-year storm.

## **B. STORM SEWERS**

### **1. SIZING**

- a. The storm sewer system shall be designed to convey runoff from a 10-year frequency rainfall event.
- b. Storm sewer design velocities, capacities, and friction losses shall be based on Manning's equation:

$$Q = \frac{1.49 \ A R^{\frac{2}{3}} \ S^{\frac{1}{2}}}{n}$$

Where:

Q	=	Discharge (cfs)
A	=	Wetted Area (sft)
R	=	Hydraulic Radius (ft)
S	=	Slope (ft/ft)
N	=	Manning's Coefficient

- c. Manning's coefficients for closed conduit are included in Appendix 5.7.
- d. Acceptable slopes for circular pipe ("n" = 0.013) are included in Appendix 5.8. Minimum and maximum grade for other Manning's n values must be calculated based on allowable minimum and maximum velocities.
- e. As a general rule, surcharging the pipe will be allowed to 1 foot below the top of casting. However, minor losses must be considered in hydraulic grade line calculations.

- f. Storm sewer pipe shall have a minimum diameter of 12 inches.
- g. The minimum depth of cover shall be 24 inches from grade to the top of pipe.
- h. Restricted conveyance systems designed to create backflow into storm water storage facilities are not permitted.

## **2. END TREATMENT**

Outlet protection shall be provided as necessary to prevent erosion, based on the maximum velocities given in Section V.D - Grassed Waterways.

## **3. MANHOLES AND CATCH BASINS**

- a. Manhole spacing shall not exceed 400 feet for sewers less than 42 inches in diameter and 600 feet for larger sewers.
- b. Manholes shall be placed at all changes in pipe direction, pipe size, all inlet connection locations, and at the end of the storm sewer.
- c. Pipe inverts at junctions shall be designed to minimize junction losses (match 0.8 points of pipe diameters).
- d. Minimum inside diameter of all manholes, catch basins, and inlet structures shall be 48 inches.
- e. Inlet structures shall be placed at low points of streets and yards, and be spaced a maximum of 400 feet apart. Spacing and/or number of inlet structures required to accommodate the design flows in streets, private drives, and parking areas shall be provided based on inlet capacity. The maximum height of water allowed to pond over inlet structures in these areas shall be 0.5 feet from top of grate during a 10-year storm. The maximum height of water for inlet structures set in road ditches or grassed areas will be 1.5 foot from top of grate. This condition may be waived if, in the opinion of the Drain Commissioner, the resulting elevation of water will not cause adverse effects and is necessary for storm water treatment.
- f. No more than 150 feet of street drainage will be allowed to flow around a corner.



- g. No flow will be allowed across a street intersection.

#### **4. MATERIAL**

- a. Storm sewer pipe shall be reinforced concrete or smooth interior wall polyethylene in accordance with MDOT Standard Specifications.
- b. Pipe joints shall be designed to prevent excessive infiltration or exfiltration.
- c. Manholes and catch basins shall be in accordance with MDOT Standard Specifications.
- d. Connections to manholes shall be made with a resilient connector for pipe diameters 24 inches or less.

### **C. CULVERTS AND BRIDGES**

#### **1. SIZING**

- a. For drainage areas of 2 square miles or more, crossings must meet the requirements of the Floodplain Control Section (Part 31) of Act 451, PA 1994.
- b. Bridges shall be designed to provide a 2-foot-minimum freeboard to the underside (low chord) of the bridge for a 100-year flood. Footings shall extend at least 4 feet below the bottom of the channel.
- c. Culverts serving a drainage area of less than 2 square miles shall be designed for a minimum 10-year storm in the developed watershed with a maximum outlet velocity of 8 ft/s. A maximum of 1 foot of inlet submergence may be permitted, if this does not backup water out of the easement. The effect of the 100-year storm will be reviewed to ensure no adverse increase in water elevation off of the development property or flooding of structures within the development.
- d. Sizing of culverts and bridges shall include consideration for entrance and exit losses, and tailwater condition.
- e. Minimum diameter of a drive culvert shall be 12 inches.

- f. Minimum diameter of a road crossing culvert shall be 18 inches or equivalent pipe arch.

## **2. END TREATMENT**

Headwalls, wingwalls, and all other end treatments shall be designed to ensure the stability of the surrounding soil. MDOT, Oceana County Road Commission, or manufacturer's designs may be used.

## **3. MATERIAL**

Culverts may be reinforced concrete pipe, corrugated steel pipe, or pipe arch in accordance with MDOT Standard Specifications.

Smooth interior wall with polyethylene pipe may be used for private developments.

## **D. GRASSED WATERWAYS**

### **1. SIZING**

- a. The minimum required discharge capacity shall be for a 10-year frequency rainfall event with 0.5 foot of freeboard to top of bank.
- b. Velocities, capacities, and friction losses shall be based on Manning's formula. Typical Manning's coefficients for open channels, swales, and ditches are included in Appendix 5.7.
- c. A minimum "n" value of 0.035 shall be used as the roughness coefficient for open channels, unless special treatment is given to the bottom and sides (riprap, paving, mown sod).
- d. Minimum bottom width for grassed waterways shall be 1 foot.
- e. Minimum bottom slope shall be 0.50%.
- f. Side slopes shall be no steeper than 3:1 (H:V).

## **2. SOIL EROSION AND SEDIMENTATION CONTROL**

- a. Grassed waterway flow velocities shall be neither siltative nor erosive. The minimum velocity for vegetated channels shall be 1.5 ft/s. The maximum velocity shall be 4 ft/s. Riprap protection or equivalent erosion control measures shall be used where the velocity exceeds 4 ft/s, up to maximum allowable design velocity of 8 ft/s.
- b. Where maximum velocities are exceeded due to channel slope, rock check dams or grade control structures shall be used to reduce overall flow velocities.
- c. Erosion control blankets shall be used to protect bare channels.

## **3. LAYOUT**

- a. Outlets into the grassed waterway shall enter at an angle of 90 degrees or less with the direction of flow.
- b. A minimum clearance of 4 feet is required between vegetated swale and ditch inverts and underground utilities unless special provisions are approved. In no case will less than 2 feet of clearance be allowed.

## **E. YARD DRAINAGE**

### **1. Lot Grading**

The grading of lots will be such that surface runoff is away from homes and toward swales, ditches, or drainage structures. Provision for drainage through properly graded storm water conveyance systems will be made for all areas within the proposed subdivision (see Subdivision Drainage Rules, Section IX.C.2).

### **2. Drainage Swales**

Where finished grades indicate a substantial amount of drainage across adjoining lots, a drainage swale shall be provided on the lot line to intercept this drainage. Easements will be required to ensure that property owners do not alter or fill these drainage ways (see Subdivision Drainage Rules, Section VII.A.1.c).

3. Rear Yard Drains: Tile drains shall be a minimum of 6-inch-diameter and have a minimum cover of 2-feet. Rear lot catch basins shall be a minimum of 2-foot diameter.
4. Emergency Overflow for Rear Yard Drains: A surface water outlet shall be graded to allow the safe passage of storm water runoff during the 100-year rainfall event without flooding building walkouts or first floor elevators.

## **VI. STORM WATER FACILITIES**

### **A. STRATEGY**

1. The type or types of storm water facility selected for a given site shall meet all of the uniform volume criteria required for the site. A Required Treatment Volume Worksheet is included in Appendix 5.1.
2. Except for storm water hotspots, infiltration shall be required where feasible for soils classified as well to imperfectly drained sands, deep dry sands, well-drained loamy sands, and sandy loams (gravel-sand substratum), as indicated in the County soil survey.
3. The use of integrated measures, such as, interception of runoff, reduction of lot grading and impervious cover, preservation of existing trees, etc. to maintain pre-development site hydrology shall be demonstrated prior to discharging to the detention basin.

### **B. DETENTION BASINS**

- Dry Detention Basin
- Wet Detention Basin (Storm Water Pond)

#### **1. PHYSICAL FEASIBILITY**

- a. Minimum setback for storm water detention basins shall be 30 feet from buildings. Minimum isolation distances from drain fields and water supply wells shall be in accordance with the local health authority.

- b. A reliable supply of base flow is required for wet basins to prevent excessive drawdown of the permanent pool.

**2. TREATMENT CRITERIA**

a. WATER QUALITY VOLUME (VWQ)

- (1) The water quality volume (Vwq) shall be defined as 0.5 inch of runoff from the directly connected impervious area, as is given by the equation:

$$V_{wq} = 1815 (DCIA)$$

Where:  $V_{wq}$  = Water Quality Volume (cft)  
 1815 = 0.5 Inch of Runoff x 3,630 to Convert ac-in to cft  
 DCIA = Directly Connected Impervious Area (acres)

- (2) A minimum water quality volume of 550 cft/ac shall be used for sites with less than 30% DCIA.
- (3) Water quality volume may be provided by a permanent pool or extended detention.
- (4) When extended detention is used, the maximum release rate to detain this volume for 24 hours is given by the equation:

$$Q_{out} = \frac{V_{wq}}{24hrs(3600)s / hr}$$

Where:  $V_{wq}$  = Water Quality Volume (cft)  
 $Q_{out}$  = Maximum Release Rate (cfs)

b. **STREAM PROTECTION VOLUME (VSP)**

- (1) The stream protection volume shall be defined as the routed volume of runoff from the 1.5-year, 24-hour, SCS Type II rainfall event (2.03 inches) with post-development conditions. The minimum required stream protection volume is calculated as:

$$V_{sp} = 5,000 \text{ cft per impervious acre}$$

- (2) Stream protection volume by extended detention is not allowed for sites where  $CxA < 1$  acre. For these small developments, stream protection volume shall be achieved through the use of infiltration or underdrains.
- (3) The maximum release rate to detain this volume for at least 24 hours is 0.05 cfs per impervious acre.
- (4) Where stream protection volume is necessary, a separate outlet for water quality volume is not required.
- (5) The stream protection volume must be provided for all contributing acreage, including the developed offsite acreage, unless required by the Drain Commissioner.

c. **FLOOD CONTROL VOLUME (VFC)**

- (1) The flood control volume shall be sized to detain the 25-year rainfall event with a maximum release rate of 0.20 cfs per acre by the Rational Method (Modified Chicago Method), or by pond routing using the SCS Method. For the Rational Method, the maximum storage volume shall be multiplied by 1.25 to obtain the minimum required flood control volume. The minimum flood control volume required per acre can be read directly from the table included in Appendix 5.9.
- (2) The water quality and stream protection volume may be included in the flood control volume.

- (3) The flood control volume must be provided for all contributing acreage, including the developed offsite acreage.
- (4) Flood control and streambank protection volumes must be provided above the permanent pool elevation of wet basins. Any volume provided below the invert of the outlet is considered "dead storage" and will not be considered as detention volume.

### **3. PRE-TREATMENT CRITERIA**

#### **a. SEDIMENT FOREBAY**

- (1) Sediment forebays or equivalent upstream pre-treatment shall be provided for all storm water detention basins to provide energy dissipation and to trap and localize incoming sediments.
- (2) The forebay shall be a separate sump, which can be formed by grading, a compacted earthen berm, or other suitable structure.
- (3) The capacity of the forebay shall be equivalent to 5% of the 25-year flood control volume. Where more than one inlet pipe is required, the calculated forebay volume shall be pro-rated by flow contribution of each inlet.
- (4) The length-to-width ratio shall be a minimum of 1.5:1 and a maximum of 4:1.

#### **b. SPILL CONTAINMENT CELL**

- (1) **General**
  - i. A spill containment cell or equivalent storm water filter shall be used to trap and localize incoming sediments, and to capture slug pollutant loads from accidental spills of toxic materials (spill containment volume).

- ii. The spill containment cell shall be a wet basin with an impermeable bottom and sides to the design high water level.

(2) Sizing

- i. The spill containment cell volume shall be calculated as 30% of the water quality volume.
- ii. The minimum surface area shall be 25% of the required volume.
- iii. The length-to-width ratio shall be a minimum of 3:1, and a maximum of 4:1 to allow for adequate hydraulic length, yet minimize scour velocities.
- iv. The minimum hydraulic length shall be equal to the length specified in the length-to-width ratio.
- v. The overflow structure from the spill containment cell shall be sized for the peak inflow from a 10-year rainfall event.
- vi. The top-of-berm elevation between the spill containment cell and the basin shall be a minimum of 1 foot below the outer berm elevation.
- vii. The spill containment cell shall have a minimum 1-foot-deep sump below the inlet pipe for sediment accumulation.
- viii. The outlet structure from the spill containment cell shall be designed to draw water from the central portion of the water column within the cell to trap floatables and contain sediments. The inlet side of the structure shall be located a minimum of 1 foot below the normal water level, and a minimum of 1.5 feet from the bottom of the spill containment cell. Minimum depth of the permanent pool is 2.5 feet.



(3) Material

The spill containment cell shall be lined with impermeable materials extending up to the design high water elevation. A minimum 18-inch-thick clay later, or an impermeable liner protected with a minimum 12 inches of soil cover are acceptable alternatives. Maximum allowable permeability shall be 1 by 10<sup>-7</sup> cm/sec as determined by the geotechnical consultant for clay placement, or manufacturer's certificate for liner products.

#### 4. CONTROLS

a. INLET DESIGN

- (1) Inlet pipes shall not be fully submerged at normal pool elevations.
- (2) A sediment forebay shall be provided at each inlet, unless the inlet supplies less than 10% of the total design flow into the detention basin.
- (3) Where a spill containment cell is required, all inlet pipes must enter this cell for pre-treatment.

b. OUTLET DESIGN

- (1) The outlet may be designed using the orifice equation, rearranged to solve for area.

$$A = \frac{Q}{c \sqrt{2gH}}$$

- Where:
- A = Required Area (sft)
  - Q = Required Outflow (cfs)
  - c = Orifice Coefficient (Approximately 0.6)
  - 2g = Two Times the Gravitation Constant (g = 32.2 ft/s)
  - H = Height of Design High Water Level Above Center of Orifice Outlet

- (2) Other types of outlet devices shall have full design calculations provided for review.
- (3) The outlet shall be designed to prevent clogging.
- (4) Pipes or orifice plates shall have a minimum diameter of 4 inches.
- (5) Riser pipes with holes or slits less than 4 inches in diameter shall have a stone and gravel filter placed around the outside of the pipe.
- (6) Hoods and trash racks shall be placed on riser pipes. Grate openings shall be a maximum of 3 inches on center.
- (7) Orifices used to maintain a permanent pool shall be designed to withdraw water a minimum of 1 foot below the surface of the pond.
- (8) Riser pipes shall have a minimum diameter of 24 inches. Riser pipes greater than 4 feet in height shall be 48 inches in diameter.
- (9) Riser pipes shall be constructed of reinforced concrete or corrugated metal and be set in a concrete base. Plastic is not acceptable as a riser material.
- (10) Outlet control structures shall be placed near or within the embankment to facilitate maintenance access.
- (11) A drain for completely dewatering the detention facility shall be installed for maintenance purposes.

c. EMERGENCY OVERFLOW

- (1) All detention facilities must have a provision for overflow at the high water level. A spillway shall be designed for the 10-year inflow from the fully developed watershed with a maximum flow depth of 1 foot. The spillway shall be sized using the weir equation.

$$Q = 2.6LH^{\frac{3}{2}}$$

Where: Q = Discharge (cfs)  
 2.6 = Coefficient of Discharge  
 L = Length of Spillway Crest (ft)  
 H = Total Head Measured Above Spillway Crest (ft)

(2) The top of berm elevation shall be a minimum of 1 foot above the design maximum water level.

d. **EROSION CONTROL**

(1) Upland construction areas shall be completely stabilized prior to final detention basin construction. The detention basin may be constructed first as a temporary erosion control measure during construction.

(2) Overflow spillways shall be protected with riprap or a permanent erosion control blanket to prevent erosion of the structure.

(3) Inlets and outlets require energy dissipation and transition from outlet to open channel based on the maximum velocities given in Section V.D -Grassed Waterways.

**5. GEOMETRY**

a. The distance between inlets and outlets shall be maximized. If possible, inlets and outlets should be offset at opposite longitudinal ends of the facility. The length of the flow path across the basin can be maximized by:

(1) Increasing the length-to-width ratio of the entire design. A minimum length-to-width ratio of 3:1 shall be used unless structural measures are used to extend the flow path.

(2) Increasing the dry weather flow path within the system to attain maximum sinuosity.

- b. The bottom of dry detention basins shall be graded to provide positive flow to the pipe outlet. A minimum flow line bottom slope of 1% should be provided. Cross slopes should be 2% minimum. If continuous flow is anticipated, a low-flow channel shall be provided, with necessary crossings, and sloped to eliminate standing water.
- c. Permanent pools for wet basins shall be a minimum of 3 feet deep in the center of the basin.
- d. Storm water ponds shall be wedge-shaped, narrower at the inlet, and wider at the outlet. Irregular shorelines are preferred.

## **6. PUBLIC SAFETY**

- a. Detention basins that have an impoundment area of 5 acres or more, and a hydraulic head of 6 feet or more, must meet the requirements of the Dam Safety Section (Part 315) of Act 451, PA 1994.
- b. Side slopes for dry basins shall not be steeper than 4:1 (H:V) to eliminate the need for safety ledges, facilitate mowing, and ensure stable side slopes.
- c. Side slopes for wet basins shall not be steeper than 3:1 (H:V) and terminate at a safety ledge.
- d. A minimum 5-foot-wide safety ledge with a maximum slope of 6% shall be provided around the perimeter of wet basins and shall be located 1 foot below the normal water level.
- e. Where steeper side slopes are unavoidable, safety railing, fencing, or other access barriers shall be used.

## **7. LANDSCAPING**

- a. A minimum of 15 feet around the top edge of the entire detention basin shall be reserved as a buffer strip.

- b. When required by the Drain Commissioner, a landscape plan shall be prepared with emphasis on low maintenance and water tolerant native plant and tree species.

## **8. MAINTENANCE**

- a. A minimum 12-foot-wide maintenance access route from a public or private right-of-way to the basin shall be provided. The access way shall have a slope of no greater than 5:1 (H:V), and shall be stabilized to withstand the passage of heavy equipment. Direct access to the forebay, control structures, and the outlet shall be provided.
- b. Detention basin maintenance plans will require that sediment be removed when it reaches a depth equal to 50% of the depth of the forebay or 12 inches, whichever is less.

## **C. INFILTRATION BASINS**

Dry Infiltration Basin

Retention Pond

### **1. PHYSICAL FEASIBILITY**

- a. Minimum setback for storm water infiltration basins shall be 30 feet downgradient from buildings. Minimum isolation distances from drain fields and water supply wells shall be in accordance with the local health authority.
- b. Infiltration basins will be permitted only with adequate soil data to ensure the Drain Commissioner that the infiltration basin will have a minimum infiltration capacity of 1.04 inches per hour. The geotechnical investigation shall follow the procedure outlined in Appendix 5.10.
- c. Permeability testing is not required for soils classified by the geotechnical consultant as GW, GP, SW, or SP unless silt or clay seams, layers, or partings are included in the soil description. When permeability testing is not performed, the minimum design infiltration rate of 0.52 in/hr shall be used.

- d. The bottom of dry infiltration basins shall be a minimum of 4 feet above the highest known water table elevation.

## 2. TREATMENT CRITERIA

### a. FLOOD CONTROL VOLUME (VFC)

- (1) Infiltration basins shall be sized to store the volume of runoff produced from a 25-year, 24-hour rainfall event, with an infiltration rate of 0.52 inches per hour, and a 72-hour drain time. The flood control volume shall be calculated by the equation:

$$V_{fc} = CAP_a (3630)$$

Where:  $V_{fc}$  = Total Required Volume of the Infiltration Basin (cft)  
C = Runoff Coefficient  
A = Area (Acres)  
 $P_a$  = Adjusted 25-year Rainfall Amount = 3.55 inches  
3630 = Factor to Convert ac-in to cft

- (2) A minimum flood control volume of 3,630 cft per acre shall be provided.
- (3) Where a basin overflow would cause downstream flooding due the absence of an acceptable conveyance route, the flood control volume shall be multiplied by a factor of safety of 1.5.
- (4) Retention basins with a permanent water level shall be sized based on the horizontal projection of the side slopes above the permanent water elevation to calculate the required infiltration area by the equation:

$$V_{fc} = \frac{(A_t - A_w) D}{2}$$

Where:  $V_{fc}$  = Total Required Volume of the Retention Basin Above the Permanent Water Level (cft) as Calculated in Equation 2.a.(1).

$A_t$  = Area at Top of Design Depth (sft).

$A_w$  = Area of Permanent Water Surface (sft).

$D$  = Storage Depth (ft) as Calculated in Equation 2.b.(1)

**b. MAXIMUM DRAIN TIME**

- (1) Dry infiltration basins shall be designed to drain completely within 72 hours. A design infiltration rate of 0.5 times the infiltration rate determined by geotechnical investigation, or a minimum infiltration rate of 0.52 in/hr, shall be used to calculate the maximum storage depth by the equation:

$$D \leq \frac{72(I)}{12}$$

Where:  $D$  = Storage Depth (feet)

72 = Maximum Allowable Drain Time (hours)

$I$  = Design Infiltration Rate (in/hr)

12 = Factor to Convert Inches to Feet

**3. PRE-TREATMENT CRITERIA**

- a. Detention basin design criteria for pre-treatment shall apply to the design of infiltration basins, with the following exceptions.

- b. For infiltration basins, the capacity of the sediment forebay shall be equivalent to 30% of the water quality volume. The water quality volume is given by the equation:

$$V_{wq} = 1815(DCIA)$$

Where:  $V_{wq}$  = Water Quality Volume (cft)  
1815 = 0.5 Inch of Runoff x 3630 to Convert ac-in to cft  
DCIA = Directly Connected Impervious Area (acres)

#### **4. CONTROLS**

- a. Detention basin design criteria for inlets and emergency overflow apply to the design of infiltration basins.

b. **EROSION CONTROL**

- (1) Upland construction areas shall be completely stabilized prior to final infiltration basin construction.
- (2) Infiltration basins shall NOT be used as sediment basins during construction.
- (3) Overflow spillways shall be protected with riprap or a permanent erosion control blanket to prevent erosion of the structure.
- (4) Inlets and outlets require energy dissipation and transition from outlet to open channel based on the maximum velocities given in Part 4.II.C - Grassed Waterways.

#### **5. GEOMETRY**

- a. The floor of dry infiltration basins shall be flat to encourage uniform ponding and infiltration.
- b. The floor of the dry basin shall be scarified to a depth of 4 to 6 inches after final grading has been established.



## **6. PUBLIC SAFETY**

- a. Side slopes for dry basins shall not be steeper than 4:1 (H:V) to eliminate the need for safety ledges, facilitate mowing, and ensure stable side slopes.
- b. Side slopes for retention ponds shall not be steeper than 3:1 (H:V) and terminate at a safety ledge.
- c. A minimum 5-foot-wide safety ledge with a maximum slope of 6% shall be provided around the perimeter of retention ponds and shall be located 1 foot below the normal water level.
- d. Where steeper side slopes are unavoidable, safety railing, fencing, or other access barriers shall be used.

## **7. LANDSCAPING**

- a. A minimum of 15 feet around the top edge of the entire infiltration basin shall be reserved as a buffer strip.
- b. When required by the Drain Commissioner, a landscape plan shall be prepared with emphasis on low maintenance and water tolerant native plant and tree species.

## **8. MAINTENANCE**

- a. A minimum 12-foot-wide maintenance access route from a public or private right-of-way to the basin shall be provided. The access way shall have a slope of no greater than 5:1 (H:V), and shall be stabilized to withstand the passage of heavy equipment. Direct access to the forebay, control structures, and the overflow shall be provided.
- b. Infiltration basin maintenance plans will require that sediment be removed when it reaches a depth equal to 50% of the depth of the forebay or 12 inches, whichever is less.

## ABBREVIATIONS

### 1. Acronyms

BMP - Best Management Practice  
MDEQ - Michigan Department of Environmental Quality  
MDOT - Michigan Department of Transportation  
MSA - Michigan Statutes Annotated  
PA - Public Act  
SCS - Soil Conservation Service

### 2. Units

ac-in - acre inch  
cfs - cubic feet per second  
cft - cubic feet  
cm/sec - centimeter per second  
ft/s - feet per second  
(H:V) - horizontal to vertical  
in/hr - inches per hour  
sft - square feet

**DESIGN CHECKLIST FOR PRELIMINARY PLATS AND DEVELOPMENTS**

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

Date: \_\_\_\_\_  
 Reviewed By: \_\_\_\_\_

Developer/Owner: \_\_\_\_\_

Developer's Engineer: \_\_\_\_\_

Contact Person: \_\_\_\_\_ Telephone: \_\_\_\_\_  
 Fax: \_\_\_\_\_

Reviewing Agency: \_\_\_\_\_

Contact Person: \_\_\_\_\_ Telephone: \_\_\_\_\_  
 Fax: \_\_\_\_\_

	<u>Provided/ Satisfactory</u>	<u>Comments</u>
<b>General</b>		
1. Development name/subdivision number.	_____	_____
2. Description of location (including section and fractional portion thereof, Town and Range, township, city or village and county, Michigan).	_____	_____
3. Location map.	_____	_____
4. Name, address, and telephone number of proprietor.	_____	_____
5. Name, address, and telephone number of engineer or surveyor.	_____	_____
6. North arrow and scale.	_____	_____

**Provided/  
Satisfactory**      **Comments**

**Legend**

- |     |   |       |  |
|-----|---|-------|--|
| 7.  | Development boundary.   | _____ |  |
| 8.  | Identification of all adjoining parcels (for subdivisions show lot number, subdivision name, liber, and page numbers; for metes and bounds parcels show permanent parcel number). | _____ |  |
| 9.  | Overall property description metes and bounds (with ties to government corner).   | _____ |  |
| 10. | Lot dimensions (scaled or computed).  | _____ |  |
| 11. | Lot numbers.  | _____ |  |
| 12. | Building setback lines.   | _____ |  |

**Topographical**

- |     |   |       |  |
|-----|---|-------|--|
| 13. | Existing buildings (label those under construction with address).   | _____ |  |
| 14. | Existing roads (with name, ROW width, and type of surface).   | _____ |  |
| 15. | Proposed roads (with name, ROW width, and type of surface).   | _____ |  |
| 16. | Existing contours (no greater than a 2' interval inside the plat; no greater than a 10' interval outside the plat). | _____ |  |
| 17. | Proposed contours.  | _____ |  |
| 18. | Typical lot grading plan (detail, statement, or drainage arrows).   | _____ |  |
| 19. | Available soils data, soil boring logs, and locations (include ground elevation and water table information).       | _____ |  |

**Provided/  
Satisfactory**      **Comments**

**Drainage**

- 20. Offsite watershed areas (with boundaries and acreage to be shown on location map). \_\_\_\_\_
- 21. All existing drainage courses and structures (with proper labeling as to type, size, and invert elevations). \_\_\_\_\_
- 22. County drains (permission required to connect). \_\_\_\_\_
- 23. Proposed drainage systems (clearly identify all open and enclosed portions). \_\_\_\_\_
- 24. Floodplain contour (existing and proposed). \_\_\_\_\_
- 25. Wetlands (existing and proposed). \_\_\_\_\_
- 26. Buffers provided. \_\_\_\_\_
- 27. Proposed storm water facilities (detention/infiltration). \_\_\_\_\_

**Storm Water Management System Design**

- 28. Calculation of runoff. \_\_\_\_\_
- 29. Effective layout. \_\_\_\_\_
- 30. Inlet capacity/spacing. \_\_\_\_\_
- 31. Adequate size/slopes. \_\_\_\_\_
- 32. Pipe material. \_\_\_\_\_
- 33. Submergence. \_\_\_\_\_
- 34. High water level in relation to low top-of-casting elevation. \_\_\_\_\_
- 35. Storm water facilities appropriately selected (worksheet). \_\_\_\_\_
- 36. Minimum basement floor elevations/openings in structures. \_\_\_\_\_
- 37. Ensure proper siting. \_\_\_\_\_
- 38. Required volume/release rate. \_\_\_\_\_
- 39. Pretreatment. \_\_\_\_\_

	<u>Provided/ Satisfactory</u>	<u>Comments</u>
40. Adequate volume provided.	_____	_____
41. Hydraulic calculations for transfer or outlet pipe.	_____	_____
42. Overflow spillway.	_____	_____
43. Geometry.	_____	_____
44. Side slopes.	_____	_____
45. Soil erosion controls.	_____	_____

**Easements**

46. Utility easements (with dimensions and type of utility).	_____	_____
47. Existing and proposed drainage easements.	_____	_____
48. Offsite drain easements or rights-of-way.	_____	_____

**Maintenance**

49. Identification of agency proposed to assume ownership of the storm water management system.	_____	_____
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**Fee**

50. Development fee.	_____	_____
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**COMMENTS:**

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## SUBMITTAL CHECKLIST

(Final plats, developments with public roads or downstream drainage course to be dedicated and improved as a county drain, and private developments that wish to be established as a county drainage district).

DEVELOPMENT NAME: \_\_\_\_\_ DEVELOPER: \_\_\_\_\_

LOCATION: \_\_\_\_\_ ENGINEER: \_\_\_\_\_

**Initial Reviews**

**Date(s) Completed**

- |   |       |
|---|-------|
| 1. Preliminary plat (including site plan, grading & drainage plan, and engineering calculations) and review fees: |       |
| Submitted   | _____ |
| Approved  | _____ |
| 2. Construction drawings:   |       |
| Submitted   | _____ |
| Approved  | _____ |

**Prior to Construction**

- |   |       |
|---|-------|
| 3. Evidence of contractor's insurance coverage.   |       |
| _____   | _____ |
| 4. Construction contract information.   |       |
| _____   | _____ |
| 5. Soil erosion and sedimentation control permit (Part 91 Act 451, P.A. 1994); NPDES storm water Notice of Coverage for over 5 acres disturbed. |       |
| _____   | _____ |
| 6. Inspection deposit paid.   |       |
| _____   | _____ |
| 7. Recordable rights-of-way for downstream properties, or "flooding" easement agreement submitted.  |       |
| _____   | _____ |
| 8. Certification of adequacy of existing receiving drains/ no net increase in storm water.  |       |
| _____   | _____ |

- Or -

Approval has been given for any improvements required to existing county drains. \_\_\_\_\_

**Prior to Final Plat Approval**

**Date(s) Completed**

9. Certification that county drains and storm water system have been improved in accordance with approved construction drawings (same as item No. 17).

\_\_\_\_\_

- Or -

The proprietor has entered into an agreement with the Drain Commissioner and has posted surety for faithful performance of the agreement.

\_\_\_\_\_

10. Recordable release of rights-of-way within the plat provided in the name of the drainage district.

\_\_\_\_\_

11. 425 Application and legal descriptions submitted.

\_\_\_\_\_

- Or -

A drainage district has been established (adjusted). 433 Agreement and legal descriptions submitted.

\_\_\_\_\_

- Or -

A letter of commitment from the local municipality, governmental agency, or association has been executed.

\_\_\_\_\_

12. Maintenance fee submitted (per Sections 425 and 433).

\_\_\_\_\_

13. Maintenance plan submitted (for private developments).

\_\_\_\_\_

14. Copies of restrictive covenants (if any).

\_\_\_\_\_

15. Guarantee for repairs (repair bond) of any defects in the work for a period of one year.

\_\_\_\_\_

**Upon Completion of Construction**

16. Construction record drawings.

\_\_\_\_\_

17. Certification that county drains and storm water system have been improved in accordance with approved construction drawings (same as item No. 9).

\_\_\_\_\_

18. Release of surety (posted per item No. 9).

\_\_\_\_\_

**One Year After Final Completion of Construction**

19. Return repair bond.

\_\_\_\_\_



## SUBMITTIAL CHECKLIST (Private Developments)

DEVELOPMENT NAME: \_\_\_\_\_ DEVELOPER: \_\_\_\_\_

LOCATION: \_\_\_\_\_ ENGINEER: \_\_\_\_\_

### Initial Reviews

### Date(s) Completed

- |   |  |
|---|--|
| <p>1. Preliminary drawings (including site plan, grading and drainage plan, and engineering calculations) and review fees:</p> <p style="padding-left: 40px;">Submitted _____</p> <p style="padding-left: 40px;">Approved _____</p> |  |
| <p>2. Construction drawings:</p> <p style="padding-left: 40px;">Submitted _____</p> <p style="padding-left: 40px;">Approved _____</p>   |  |

### Prior to Construction

- |  |  |
|--|--|
| <p>3. Soil erosion and sedimentation control permit (Part 91 Act 451, P.A. 1994); NPDES storm water Notice of Coverage for over 5 acres disturbed.</p> <p>_____</p>  |  |
| <p>4. Inspection deposit paid (if Drain Commissioner will inspect).</p> <p>_____</p>   |  |
| <p>5. Recordable rights-of-way for downstream properties or "flooding" easement agreement submitted.</p> <p>_____</p>  |  |
| <p>6. Certification of adequacy of existing receiving drains/ no net increase in storm water.</p> <p>- Or -</p> <p>Approval has been given for any improvements required to existing county drains.</p> <p>_____</p> |  |
| <p>7. The proprietor has entered into an agreement with the Drain Commissioner for county drains to be improved and has posted surety for faithful performance of the agreement.</p> <p>_____</p>                    |  |
| <p>8. Maintenance plan submitted.</p> <p>_____</p>   |  |
| <p>9. Copies of restrictive covenants/deeds (if any).</p> <p>_____</p>   |  |
| <p>10. Guarantee for repairs (repair bond) of any defects in the work on a county drain for a period of one year.</p> <p>_____</p>   |  |

**Upon Completion of Construction**

**Date(s) Completed**

11. Construction record drawings.

\_\_\_\_\_

12. Certification that county drains and storm water system have been improved in accordance with approved construction drawings.

\_\_\_\_\_

13. Release of surety (posted per item No. 7).

\_\_\_\_\_

**One Year After Final Completion of Construction**

14. Return repair bond.

\_\_\_\_\_

**APPLICATION TO CROSS, PARALLEL OR CONNECT TO A COUNTY DRAIN**

OCEANA COUNTY DRAIN COMMISSIONER'S OFFICE  
100 State Street, Hart, MI 49420

NAME OF DRAIN: \_\_\_\_\_  
APPLICANT: \_\_\_\_\_  
Company: \_\_\_\_\_  
Address: \_\_\_\_\_  
\_\_\_\_\_  
Phone: ( ) \_\_\_\_\_  
Representative: \_\_\_\_\_  
Owner ( ) Agent ( )

Applicant agrees to abide by current rules and specifications of the Oceana County Drain Commissioner's Office (the Owner), and to hold the Owner and the named Drainage District harmless in the event of injury to persons, lands, and properties sustained during the permitted activity. Applicant agrees to promptly reimburse the Owner for costs incurred to defend against any action brought against the Owner or District by an aggrieved party resulting from the permitted activity.

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

ACTIVITY (describe):  
\_\_\_\_\_  
\_\_\_\_\_

LOCATION:  
City/Village \_\_\_\_\_ Township \_\_\_\_\_ Section: \_\_\_\_\_  
(Describe location to nearest section line and quarter post)

ATTACHMENTS (check):  
\_\_\_\_\_ Construction Plans \_\_\_\_\_ Other (name): \_\_\_\_\_

(Office Use Only)

Reviewed by \_\_\_\_\_  
Approved by \_\_\_\_\_ Date: \_\_\_\_\_

Bond: Y ( ) N ( ) Owner's Protective Policy: Y ( ) N ( )  
Amount: \$ \_\_\_\_\_ Date \_\_\_\_\_  
Surety: \_\_\_\_\_ Surety: \_\_\_\_\_  
Expiration Date: \_\_\_\_\_

Final Inspection and Approval

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

**SAMPLE**

**PERMIT TO CROSS, PARALLEL OR CONNECT TO A COUNTY DRAIN**

The Drain Drainage District, by and through the Oceana County Drain Commissioner (hereinafter "Drain Commissioner"), does hereby grant permission to \_\_\_\_\_ of \_\_\_\_\_ and use a portion of the established right-of-way/easement for the \_\_\_\_\_ Drain in \_\_\_\_\_ Township(s), Oceana County, Michigan. This permit is issued for the sole and only purpose of allowing Permittee the following use:

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In consideration of granting this permit, Permittee does hereby agree to comply with all terms and conditions as set forth in this permit, together with the rules and regulations as established by the Oceana County Drain Commissioner, said rules and regulations are as follows:

1. All utilities and/or facilities must be a minimum of four (4) feet below the established drain bottom (may be lower than existing drain bottom) when crossing or paralleling a county drain or right-of-way.
2. Permanent soil erosion control measures shall be installed where a storm water drainage system connects to an open drain.
3. Connections to existing enclosed county drains shall be made at a storm structure (i.e., catch basin or manhole).
4. Any structures removed such as headwalls, wingwalls, concrete slabs, riprap, erosion protection, tiling and culverts - metal or concrete, must be replaced with new material and reconstructed to original condition or better.
5. All ditch banks, when disturbed, must be reshaped to original slope, compacted, topsoiled, and seeded, fertilized, and mulched or hydroseeded.
6. A minimum of seventy-two (72) hours notice is required to the inspection department prior to any construction that will involve a county drain.
7. Equipment and materials may not be stored in any way so as to cause blockage of a county drain.
8. Permittee is responsible for maintaining all storm drainage during the time of construction, whether by use of pumping equipment or construction of a bypass system.
9. Permit fee will be One Hundred Dollars (\$100.00), payable by check to the Oceana County Treasurer. Prior to issuance of a permit, proof of Contractor's Liability Insurance must be filed with the Office of the Drain Commissioner, with the named insured, in compliance with the Oceana County Drain Commissioner's standards, (including indemnity insurance, in the amount of \$1,000,000).
10. This permit does not relieve applicant from meeting any application requirement of law or other public bodies or agencies. Additionally, the issuance of this permit does not relieve the utility of any future expense for relocation of said utility to accommodate for future drain improvements.
11. Permittee shall be responsible for and pay all costs for engineering and inspection services incurred by the Oceana County Drain Commissioner in the review of the Permit Application and inspection of work performed hereunder. Payment is to be made within thirty (30) days of invoice.
12. Other: \_\_\_\_\_ further agrees, either to pay any increased cost to the Drainage District due to this utility occupying said drain, said cost to be determined as a separate bid item during construction or reconstruction, or if determined by the Oceana County Drain

Commissioner, the Utility Company occupying said drain right-of-way, shall relocate or lower if the location of the utility shall increase the cost of performing drain improvements or drain maintenance.

All expenses pertaining to said relocations shall be paid for by the owner of the utility company. Relocation shall be completed within ninety (90) days from receipt of written request by the Drain Commissioner.

Additional time may be granted by the Drain Commissioner if determined necessary.

When crossing or paralleling a county drain permittee does hereby acknowledge and agree that, in the event the area of the right-of-way for which this permit is granted is necessary for future maintenance and operation of the \_\_\_\_\_ Drain, Permittee at its own expense, shall remove all conflicting facilities, structures, pipelines, cables, and other appurtenances to said use in and during the time of the maintenance of said Drain. Upon request of the Drain district, said utility will be relocated within ninety (90) days from said request.

Further, Permittee shall hold harmless and indemnify the Oceana County Drain Commissioner, the Drain Drainage District, and their employees, agents or contractors from any injury to person or property sustained as a result of the placement of the uses specified herein.

Further, this permit is subject to additional terms and conditions as follows: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

ACKNOWLEDGMENT AND AGREEMENT

The terms and conditions of this permit and attachments hereto are acknowledged by \_\_\_\_\_ (Permittee) of \_\_\_\_\_.

Dated: \_\_\_\_\_

WHEREFORE this permit is granted this \_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_.

\_\_\_\_\_  
Oceana County Drain Commissioner

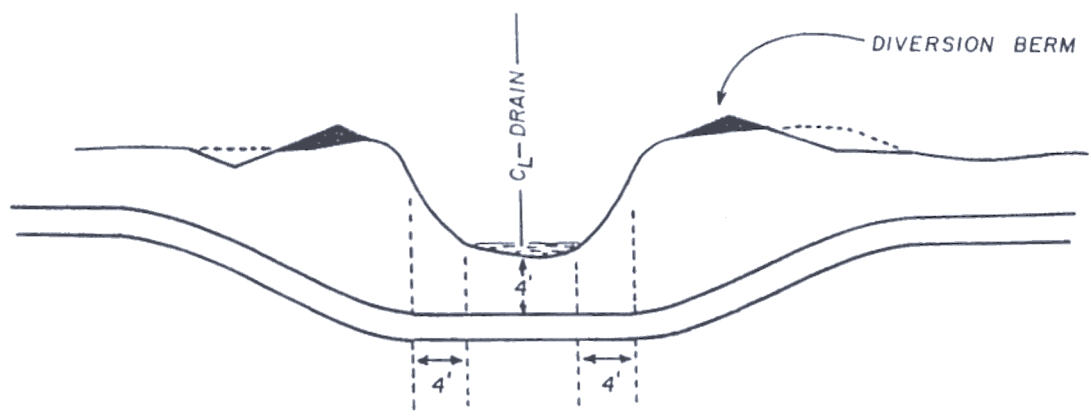
Occupation Permit: Part Two

NAME OF DRAIN: \_\_\_\_\_

Section No

Type of Installation: \_\_\_\_\_

T\_\_\_\_, R\_\_\_\_



DISTANCE FROM TOP-OF-BANK: \_\_\_\_\_

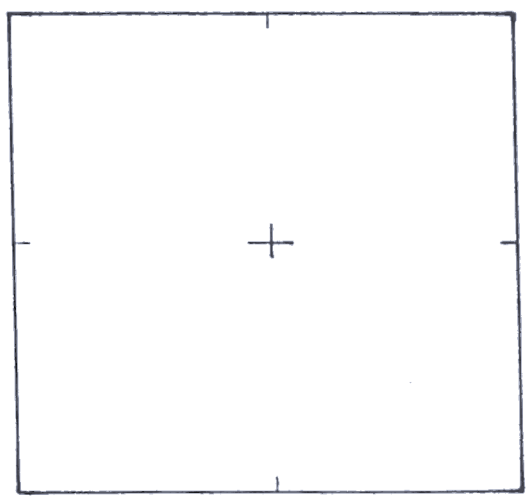
LOCATE CROSSING IN PROXIMITY TO SECTION LINES ON SKETCH AT LOWER RIGHT. NAME ROADS OR STREETS WHERE APPLICABLE. FOR INSTALLATIONS LYING PARALLEL WITH A CHANNEL OR TILE DRAIN, SHOW LOCATION ON THE ABOVE SKETCH AND THE AVERAGE DISTANCE FROM TOP-OF-BANK.

FOR ALL TILE DRAINS: LOCATE DRAIN THROUGH SECTION ON SKETCH AT RIGHT AND REFERENCE CROSSING TO THE NEAREST ROAD OR STREET, OR THE NEAREST SECTION CORNER.

NORTH



1' = 2000'



Plan Preparer: \_\_\_\_\_

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

# SAMPLE

## REPAIR BOND

KNOWN ALL MEN BY THESE PRESENTS, that we, the undersigned, \_\_\_\_\_, as Principal, and \_\_\_\_\_, as Surety, are held and firmly bound onto the Oceana County Drain Commissioner, Owner, in the sum of \_\_\_\_\_ dollars (\$\_\_\_\_\_) to be paid to the Owner for which payment will and truly to be made we jointly and severally bind ourselves, our heirs, our executors, administrators, and assigns, firmly by these presents.

Sealed with our seals and dated this \_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_.

WHEREAS, the above named principal has entered into a certain written contract with the Oceana County Drain Commissioner dated \_\_\_\_\_, 20\_\_\_\_, wherein the principal agreed as follows:

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NOW THEREFORE, THE CONDITION OF THIS OBLIGATION IS SUCH that by and under said Contract, the above named principal has agreed with the Owner, for a period of one (1) year from the date of payment of the final estimate, to keep in good order and repair any defect in all work done under said Contract, either by the principal or his subcontractors, or his suppliers, that may develop during said period due to improper materials, defective equipment, workmanship or arrangements; any other work affected in making good such imperfections, shall also be made good, all without expense to the Owner, excepting only such part or parts of said work as may have been disturbed without the consent or approval of the principal after final acceptance of the work, and that whenever directed to do so by the Owner, by notice served in writing, either personally or by mail, on the Principal, legal representative, successor, or on the Surety, he/she will at once make such repairs as directed by the Owner; and in the case of failure to do so within one (1) week from the date of service of such notice, then the Owner shall have the right to purchase such materials and employ such labor and equipment as may be necessary for the purpose and undertake to do and make such repairs, and charge the expense thereof to and receive same from said Principal or Surety. If any repair is necessary to be made at once to protect life and property, then and in that case, the Owner may take immediate steps to repair or barricade such defects without notice to the Contractor. In such accounting, the Owner shall not be held to obtain the lowest figure for doing of the work or any part thereof, but all sums actually paid therefore shall be charged to the Principal or Surety. In this connection, the judgment of the Owner is final and conclusive. If the said Principal, for a period of one (1) year from the date of the final estimate payment, shall keep such work so constructed under the contract in good order and repair, excepting only such part or parts of such work as may have been disturbed without the consent or approval of said Principal after the final acceptance of the same, and shall, whenever notice is given as herein specified, at once proceed to make repair as in said notice directed or shall reimburse the Owner for any expense incurred by making such repairs should the Principal or Surety fail to do as hereinbefore specified, and shall fully indemnify, defend, and save harmless the said Owner from all suits and actions for damages of every name and description brought or claimed against it for or on account of any party or parties, by or from any of the acts or omissions or through the negligence of said Principal, servants, or employees, in the prosecution of the work included in the said Contract, and from any and all claims arising under the Workmen's Compensation Act, so-called, of the State of Michigan, then the above obligation shall be void, otherwise to remain in full force and effect.

IN WITNESS WHEREOF, the parties hereto have caused this instrument to be executed by their respective authorized officers this \_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_.

Signed, Sealed, and Delivered  
in the presence of:

_____	_____ (L.S.)
_____	_____ (L.S.)
_____	_____ (L.S.)



**SAMPLE  
MAINTENANCE PLAN AND BUDGET**

“XYZ” Company  
Storm Water Management System Maintenance Plan  
for  
“XYZ” Development

1. Responsibility for Maintenance
  - a. During construction, it is the developer’s responsibility to perform the maintenance.
  - b. Following construction, it will be the responsibility of “XYZ” Company to perform the maintenance.
  - c. If “XYZ” Company fails to act within the time frame specified, the [City/Township of \_\_\_\_\_] will perform the needed maintenance and assess the costs against the property owners within the [subdivision] [condominium association] [other type of development].
  
2. Time Frame for Corrective Action
  - a. Routine Maintenance: Corrective action shall be completed within 30 days of regularly scheduled inspection or notification that action is required.
  - b. Emergency Maintenance: Corrective action shall be completed within 36 hours of notification unless threat to public health, safety, and welfare requires even more immediate action.
  
3. Source of Financing
  - a. “XYZ” Company will pay for all maintenance activities on a continuing basis. The funding source will be [describe].
  
4. Maintenance Tasks and Schedule
  - a. See attached drawings of storm water management system.
  - b. See attached Table No. 1.
  
5. Annual Maintenance Budget
  - a. The annual maintenance budget for “XYZ” development is itemized as follows:

1.	\$
2.	\$
3.	\$
4.	\$
5.	\$
6.	\$
TOTAL	\$
  
6. Written documentation of maintenance inspections, maintenance activities, and expenditures will be kept on file at \_\_\_\_\_.

**TABLE No. 1  
 “XYZ” DEVELOPMENT  
 STORM WATER MANAGEMENT SYSTEM  
 MAINTENANCE TASKS AND SCHEDULE**

Tasks	Storm Sewer and Culverts	Ditches and Swales	Detention Basins	Infiltration Basins	Proprietary Pre-treatment Systems	Inspection Schedule	Maintenance Schedule
Clean catch basin sumps						Bi-annually	
Remove debris from pipes, open channels and outlet structures						Bi-annually	
Remove sediment accumulation						Bi-annually	
Remove floatables and debris						Bi-annually	
Repair erosion						Bi-annually	
Replace riprap						Bi-annually	
Repair/replace structural components						Annually by licensed professional engineer	
Maintain vegetative buffers						Bi-annually	
Mowing						[Set based on use]	
Trim brush/trees						Bi-annually	
Refresh/replace infiltration/filter media						Bi-annually	
Maintenance of wetland vegetation						Bi-annually	
Pump and haul from spill containment						Bi-annually	
[            ]							

## AGREEMENT

1. Storm water runoff control facilities and measures will be constructed, continued, and perpetually maintained upon the Property in accordance with the Plan, and as hereinafter set forth, at the sole cost and expense of the Owner and all future owners of the Property until such obligation is released, discharged or modified by the Drain Commissioner.
2. The obligation of owners of the Property to maintain and continue the storm water runoff control facilities and measures in accordance with the Plan and as otherwise herein set forth shall be deemed to be a covenant running with the land and specifically enforceable against current and future owners of the Property.
3. The Owner shall notify the Drain Commissioner of the completion of construction and installation of storm water runoff facilities and measures in accordance with the Plan. The Drain Commissioner may, from time to time thereafter, perform or cause to be performed an inspection of such facilities, at the Owner's expense, and shall notify in writing the Owner of any deficiencies in construction or maintenance under the Plan. The Owner of the Property shall within thirty (30) days of notice, remedy and correct any such deficiencies. Should Owner fail to remedy the deficiency as noticed by the Drain Commissioner within the time prescribed, the Drain Commissioner is authorized to perform the necessary maintenance, utilizing contractors selected by the Drain Commissioner. Owner shall be responsible for all costs incurred by the Drain Commissioner in performing the maintenance, including but not limited to inspection, construction, material removal and disposal, equipment, engineering, legal or related consultant, administrative, and insurance expenses.

Upon completion of the maintenance, the Drain Commissioner shall present Owner with a written itemized bill of costs. Owner shall pay the bill of costs within thirty (30) days or same shall become a lien upon the lands subject to all rights and remedies for collection. Any expenses incurred by the Drain Commissioner in collection of the stated bill of costs, including actual cost and attorney fees, shall be paid by Owner.

4. This Agreement grants to the Drain Commissioner and the Drain Commissioner's agents, employees or contractors, the right of entry upon the Property to perform the inspection, maintenance or all other such activities in accomplishing the terms of this Agreement.
5. This Agreement and its attachments as affecting the Property shall be recorded in the office of the Register of Deeds or the County of Oceana, State of Michigan. This Agreement is binding on the parties, their assigns and successors in interest and is intended and deemed to run with the land.

I

**IN THE PRESENCE OF:**

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Print Name

\_\_\_\_\_  
Title

\_\_\_\_\_  
Signature

Michelle L. Martin

\_\_\_\_\_  
Print Name

Oceana County Drain Commissioner

\_\_\_\_\_  
Title

**WITNESSES:**

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Print Name

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Print Name

**STATE OF:** \_\_\_\_\_  
**COUNTY OF:** \_\_\_\_\_

On this day before me personally  
appeared \_\_\_\_\_,  
and \_\_\_\_\_ title of  
\_\_\_\_\_.

**STATE OF:** \_\_\_\_\_  
**COUNTY OF:** \_\_\_\_\_

On this day before me personally  
appeared \_\_\_\_\_,  
and \_\_\_\_\_ title of  
\_\_\_\_\_.

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Print Name

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Print Name

I Hereby state I am a Notary in the County  
of \_\_\_\_\_, and my commission  
expires on \_\_\_\_\_.

I Hereby state I am a Notary in the County  
of \_\_\_\_\_, and my commission  
expires on \_\_\_\_\_.

**DRAFTED BY:**

NAME: \_\_\_\_\_

ADDRESS: \_\_\_\_\_

# SAMPLE

## AGREEMENT FOR MAINTENANCE OF STORM WATER MANAGEMENT FACILITIES AND MEASURES

THIS AGREEMENT is made and entered into effective the \_\_\_\_ day of \_\_\_\_\_, \_\_\_\_\_, by and between the Oceana County Drain Commissioner's Office, at 100 State Street, Hart, Michigan 49420, hereinafter referred to as "the Drain commissioner" and

\_\_\_\_\_, of \_\_\_\_\_, its assigns and successors in interest, hereinafter referred to as "the Owner", and is entered into with respect to the land described on Exhibit A attached hereto, hereinafter called "the Property".

### Background

- A. The Owner is owner of the Property
- B. The Owner has submitted to the Drain Commissioner a proposed storm water management plan including a document entitled "Storm Water Management Maintenance Plan for \_\_\_\_\_ Development" hereinafter called "the Plan", a copy of which is attached hereto as Exhibit B.
- C. The Drain Commissioner has found the Plan to be satisfactory and will approve subject improvements and land use in consideration of, and in reliance upon, the Owner undertaking the covenants, commitments, and obligations hereinafter set forth.

## **AGREEMENT**

1. Storm water runoff control facilities and measures will be constructed, continued, and perpetually maintained upon the Property in accordance with the Plan, and as hereinafter set forth, at the sole cost and expense of the Owner and all future owners of the Property until such obligation is released, discharged or modified by the Drain Commissioner.
2. The obligation of owners of the Property to maintain and continue the storm water runoff control facilities and measures in accordance with the Plan and as otherwise herein set forth shall be deemed to be a covenant running with the land and specifically enforceable against current and future owners of the Property.
3. The Owner shall notify the Drain Commissioner of the completion of construction and installation of storm water runoff facilities and measures in accordance with the Plan.
4. The Owner of the Property shall within thirty (30) days of notice, remedy and correct any identified deficiencies. Owner shall be responsible for all costs incurred in performing the maintenance, including but not limited to inspection, construction, material removal and disposal, equipment, engineering, legal or related consultant, administrative, and insurance expenses.
5. This Agreement and its attachments as affecting the Property shall be recorded in the office of the Register of Deeds or the County of Oceana, State of Michigan. This Agreement is binding on the parties, their assigns and successors in interest and is intended and deemed to run with the land.

**IN THE PRESENCE OF:**

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Print Name

\_\_\_\_\_  
Title

\_\_\_\_\_  
Signature

Michelle L. Martin

\_\_\_\_\_  
Print Name

Oceana County Drain Commissioner

\_\_\_\_\_  
Title

**WITNESSES:**

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Print Name

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Print Name

**STATE OF:** \_\_\_\_\_  
**COUNTY OF:** \_\_\_\_\_

On this day before me personally  
appeared \_\_\_\_\_,  
and \_\_\_\_\_ title of \_\_\_\_\_.

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Print Name

I Hereby state I am a Notary in the County  
of \_\_\_\_\_, and my commission  
expires on \_\_\_\_\_.

**DRAFTED BY:**

NAME: \_\_\_\_\_

ADDRESS: \_\_\_\_\_

**STATE OF:** \_\_\_\_\_  
**COUNTY OF:** \_\_\_\_\_

On this day before me personally  
appeared \_\_\_\_\_,  
and \_\_\_\_\_ title of \_\_\_\_\_.

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Print Name

I Hereby state I am a Notary in the County  
of \_\_\_\_\_, and my commission  
expires on \_\_\_\_\_.

# SAMPLE

(Release of Right-of-Way Within a Plat)

## **DRAINAGE EASEMENT**

IN CONSIDERATION OF LESS THAN ONE HUNDRED DOLLARS (\$100.00), NAME of CORPORATION, a corporation formed under the laws of the State of MICHIGAN, whose address is STREET, CITY, ZIP (hereafter referred to as the "Grantor"), conveys and releases to NAME of PLAT Drainage District, whose address is 100 State Street, Hart, MI 49420 (hereafter referred to as the "District"), an irrevocable easement and right-of-way in which to construct, maintain, repair, replace, and/or remove drains, over, across, under and through the following parcel of land situated in the CITY or TWP , Oceana County, Michigan, and legally described as follows:

### LEGAL DESCRIPTION OF PARENT PARCEL

(hereafter referred to as the Parent Parcel), the easement and right-of-way to be located as follows;

### LEGAL DESCRIPTION of EASEMENT and RIGHT-OF-WAY

The conditions of this easement are such that:

1. The District's rights and obligations are limited to the maintenance, repair, and replacement of the drainage facilities, in accordance with the provisions of the Drain Code. The cost of which may be assessed to the benefitting properties as shown in Exhibit \_\_\_ MAP of the DRAINAGE DISTRICT.
2. The Grantor shall retain all other property rights and obligations, including turf maintenance. No buildings, construction, or decorative landscaping of any kind or nature shall be placed within the easement and right-of-way described above. Fences placed within the easement and right-of-way shall not impede drainage or appreciably increase the District's obligations. If the District shall in the exercise of its rights disturb the easement and right-of-way, then the District shall only be obliged to restore the ground to its original grade, place four (4) inches of top soil, seed, fertilizer and mulch.
3. Should the District in the reasonable discharge of its obligations be required to enter upon the Parent Parcel it shall have the right to do so. If the District shall in the exercise of its foregoing powers disturb the Parent Parcel described above, then the District shall restore it to its original condition.
4. Prior to each exercise of rights granted herein, the District shall make reasonable efforts to serve notice on the Grantor of its intent to enter upon the easement and right-of-way. In cases of emergency, no prior notice need be given.
5. By this conveyance the Grantor releases the District from any and all claims for damage arising from or incidental to the exercise of any of the foregoing powers.



This Grant of Easement is intended to run with the land and shall be binding upon and shall inure to the benefit of the parties hereto, their respective heirs, personal representatives, successors and assigns, and may not be amended or modified without prior written approval of the District. Any amendment or modification to this Grant of Easement shall be by an instrument in recordable form executed by both the Grantor and the District and recorded at the office of the Oceana County Register of Deeds.

Dated this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_.

WITNESSES:

GRANTORS:

NAME of CORPORATION

\_\_\_\_\_  
\_\_\_\_\_

by  
by

\_\_\_\_\_  
\_\_\_\_\_

STATE OF MICHIGAN        )  
  )ss.  
COUNTY OF                    )

The foregoing instrument was acknowledged before me this \_\_\_ day of \_\_\_\_\_, 20\_\_ by PERSON'S NAME, president and PERSON'S NAME, Secretary/Treasurer of the NAME of CORPORATION described herein, and who executed the above instrument, on behalf of said Corporation.

\_\_\_\_\_  
Notary Public \_\_\_\_\_ County, MI  
My commission expires \_\_\_\_\_

Prepared by: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

SAMPLE

(County Drain Release of Right-of-Way)

RELEASE OF RIGHT-OF-WAY

Proper Parcel No. [ \_\_\_\_\_ ]

For and in consideration of prospective benefits to be derived by reason of the locating, establishing, constructing, maintaining, and improving of a certain Drain under the supervision of the [Drain Commissioner] of the County of [ \_\_\_\_\_ ] and State of Michigan, as hereinafter described,

\*\*Note to Preparer: Grantee's marital status and rights of survivorship must come from the recorded deed.\*\*

[ \_\_\_\_\_ ] and [ \_\_\_\_\_ ], (husband and wife), as tenants by the entirety, of [ \_\_\_\_\_ ], Michigan [ \_\_\_\_\_ ], (do/does) hereby convey and release to the [ \_\_\_\_\_ ], the Right-of-Way for a certain Drain, hereinafter more particularly designated and described, over and across the following land owned by (him, her, them), and situated in the (City of/Village of/Township of) [ \_\_\_\_\_ ], County and State aforesaid, which lands owned are described as follows: \

The Right-of-Way or Easement is described as:

PERMANENT EASEMENT: \_\_\_\_\_ SEE EXHIBIT A.

TEMPORARY EASEMENT: \_\_\_\_\_ SEE EXHIBIT A.

Said temporary easement is intended for construction activities.

Said temporary easement to terminate at the end of the one-year guarantee period after final completion of the petitioned project.

[Additional consideration of \_\_\_\_\_ Dollars (\$ \_\_\_\_\_) is paid herewith.]

[NAME DRAIN], [COUNTY], MICHIGAN    \*\* Note to typist: The drain name, county, and state should appear at the top of each page following the cover page.\*\*

The Right-of-Way hereby conveyed and released is for the sole and only purpose of constructing, maintaining, and improving over and across said premises a certain Drain, petition for which in writing was made on \_\_\_\_\_, 20\_\_\_\_, by\_\_\_\_\_, and the necessity for which has been determined by the [Board of Determination hearing date of \_\_\_\_\_Hearing of Necessity on \_\_\_\_\_, 20\_\_\_\_], the route and course of said Drain is described as follows, to wit:

[MAIN:]

[Insert Description here];

or

[SEE EXHIBIT B];

or

[the route and course description is recorded in the Final Order of Determination on file at the office of the \_\_\_\_\_ County Drain Commissioner].

[BRANCH:]

[EXTENSION:]

This conveyance is based upon the above-described line of route and shall be deemed to include the extreme width of said Drain as shown in the survey thereof, to which survey reference is hereby made for a more particular description and includes a release of all claims to damages in any way arising from or incident to the operating and maintaining of said Drain across said premises; and also sufficient ground on either side of the center line of said Drain, for the construction thereof; and shall be deemed a sufficient conveyance to vest in the Drainage District an easement in said land for the uses and purposes of drainage together with such rights of entry upon, passage over, deposit of excavated earth and storage of material and equipment on such land, as may be necessary or useful for the construction, maintenance, cleaning out, and repair of such Drain.

WITNESS, our hands and seals, dated \_\_\_\_\_, 20\_\_\_\_.

Sign \_\_\_\_\_  
[\_\_\_\_\_]

Sign \_\_\_\_\_  
[\_\_\_\_\_]

[NAME DRAIN], [COUNTY], MICHIGAN

\*\* Note to typist: The drain name, county, and state should appear at the top of each page following the cover page.\*\*

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

On \_\_\_\_\_, 20\_\_\_, before me, a Notary Public in and for said County, personally appeared \_\_\_\_\_, [husband and wife], to me known to be the persons/person described in and who executed the foregoing instrument, and (he/she/they) acknowledged that (he/she/they) executed the same as (his/her/their) free act and deed.

\_\_\_\_\_  
\_\_\_\_\_. Notary Public  
\_\_\_\_\_. County, Michigan  
My Commission expires: \_\_\_\_\_

**When recorded return to:**  
[\_\_\_\_\_] Drain Commissioner]  
[\_\_\_\_\_] Address]  
[\_\_\_\_\_]

## SAMPLE

### FLOODING EASEMENT

THIS AGREEMENT, made and entered into this \_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_, for and in consideration of \$\_\_\_\_\_ and prospective benefits to be derived by reason of the construction, operating, improving, and maintaining of a certain Drain under the supervision of the Oceana County Drain Commissioner as hereinafter described, \_\_\_\_\_, (the "Landowners") do hereby convey and release to \_\_\_\_\_, Oceana County Drain Commissioner on behalf of the Oceana County Drainage District, (the "Drainage District") a public body corporate, of 100 State Street, Hart, MI 49420, an Easement for the \_\_\_\_\_ Drain situated in the County and State aforesaid. Landowners do hereby convey and release to Drainage District a Drainage Easement with an elevation of approximately \_\_\_\_\_ feet above mean sea level, USGS datum, for drainage purposes and flood control.

WHEREAS, Landowners are the owners of lands in the aforesaid County described as:

WHEREAS, the Drainage District wishes to obtain an easement from Landowners in the event that there is an increase in the velocity or quantity of water flowing onto Landowners' property as a result of the construction, maintenance, improvement, or operation of the Drain.

NOW THEREFORE, the parties agree as follows:

1. Landowners hereby grant, convey, and release unto Drainage District as Easement over and upon their lands for the purpose of allowing for increases in velocity or quantity of water flow onto Landowners' property.
2. Said Easement is described separately as follows:
3. Landowners, their heirs, executors, administrators, successors, and assigns reserve their rights and privileges to the area encompassed by the Easement as may be used and enjoyed to include the planting and harvesting of agricultural crops so long as the use(s) do not interfere with or abridge the rights granted to and easement hereby acquired by the Drainage District;
4. Landowners, their heirs, executors, administrators, successors, and assigns hold Drainage District harmless to all claims to damages in any way arising from or incident to the drainage and any increased flow onto said premises by reason of the drain and maintenance or improvement thereof. During the time of maintenance and improvement of said drain, or at any time in the future, such release for damages releases the Drainage District, its successors and assigns from any damages whatsoever arising out of the flooding of said lands within the easement right-of-way to any depth at any time in the future by reason of the construction of such drainage improvements and the flooding caused by such construction or their use during the time of construction or at any time in the future;
5. This Easement may be terminated in whole or in part by written agreement of all of the parties;
6. This conveyance shall be deemed sufficient to vest in Drainage District and Easement in said lands for the uses and purposes of any increased flow onto Landowners' property.

In witness whereof, the parties hereto have executed this Agreement the day and year first above written.

WITNESSES:

LANDOWNERS:

sign \_\_\_\_\_  
type/print:

sign \_\_\_\_\_  
type/print:

sign \_\_\_\_\_  
type/print:

sign \_\_\_\_\_  
type/print:

WITNESSES:

DRAIN DRAINAGE DISTRICT

sign \_\_\_\_\_  
type/print:

\_\_\_\_\_  
Oceana County Drain Commissioner

sign \_\_\_\_\_  
type/print:

STATE OF MICHIGAN        )  
                                      ) ss.  
COUNTY OF                    )

The foregoing instrument was acknowledged before me this \_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_, by \_\_\_\_\_.

\_\_\_\_\_  
\_\_\_\_\_, Notary  
County, Michigan  
My commission expires:

STATE OF MICHIGAN        )  
                                      ) ss.  
COUNTY OF                    )

The foregoing instrument was acknowledged before me this \_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_, by \_\_\_\_\_.

\_\_\_\_\_  
\_\_\_\_\_, Notary  
County, Michigan  
My commission expires:

STATE OF MICHIGAN        )  
  ) ss.  
COUNTY OF                    )

The foregoing instrument was acknowledged before me this \_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_,  
by \_\_\_\_\_, Oceana County Drain Commissioner, on behalf of the Drain Drainage District.

\_\_\_\_\_  
\_\_\_\_\_, Notary  
County, Michigan  
My commission expires:

When Recorded Return To:  
Oceana County Drain Commissioner  
100 State Street  
Hart, MI 49420

Drafted By:

SAMPLE

DETENTION BASIN EASEMENT

NAME OF PLAT

THIS INDENTURE, entered into this \_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_ by DEVELOPER, a Michigan Corporation, (hereafter referred to as the "Grantor"), and the NAME OF PLAT Drainage District, a public body corporate, 100 State Street, Hart, MI 49420 (hereafter referred to as the "District").

WITNESSETH:

WHEREAS, the Grantor is developing certain property located in the CITY or TWP, County of Oceana, to be known as NAME OF PLAT, and

WHEREAS, the Grantor, in order to develop said property in the manner it desires, finds it necessary to construct a storm water detention basin for the benefit of the property and to give the District certain easement rights therein.

NOW THEREFORE, in consideration of the respective convents contained herein, the parties agree as follows:

- 1. In consideration of less than one hundred dollars (\$100.00), the receipt of which is hereby acknowledged, the Grantor does hereby grant, warrant and convey to the District, an easement for storm water detention over, across and within the following described land in the CITY or TWP, County of Oceana, State of Michigan, described as follows:

LEGAL DESCRIPTION of STORM WATER DETENTION EASEMENT

- 2. The Grantor agrees for itself, its heirs, administrators, successors, and assigns, that it shall be the property owner's responsibility to maintain the easement area grounds including the removal of debris in such a manner that the proper functioning of the detention basin is not interfered with, and that the property owner will not make any changes in size, shape, capacity, rate of flow, rate of outflow, or changes in any other characteristics of the detention pond without the prior written approval of the District, which approval can only be given by the way of amendment to this instrument, properly recorded.
- 3. The drainage District shall be responsible for the maintenance and control of the hydraulic functioning of the detention basin pursuant to MPA 40, DRAIN CODE OF 1956, as amended, or successor statute. Cost for maintenance by the NAME OF PLAT DISTRICT may be charged against the property owners within the plat pursuant to MPA 40, DRAIN CODE OF 1956, as amended, or its successor statute. The property owner on whose parcel the easement rests is responsible for the turf maintenance.
- 4. The Grantor, it's heirs, administrators, successors, and assigns, shall save and hold the District, it's officers, employees, and agents harmless and indemnify the District against any claim or suit which seeks damages for an injury, death, or damage resulting from the construction, operation, and existence of the detention pond.
- 5. The District agrees to maintain the detention basin outlet in accordance with the provisions under MPA 40, Drain Code of 1956, as amended. It is further understood that a provision of these statutes allow the District to specially assess the property owners in the plat if it so chooses.





**SAMPLE**

APPLICATION FOR LAYING OUT AND DESIGNATING  
A COUNTY DRAINAGE DISTRICT UNDER  
SECTION 425 OF DRAIN CODE OF 1956  
STATE OF MICHIGAN C.L. 70 280.433 (5) & (7)  
AND PETITION TO LOCATE, ESTABLISH, AND CONSTRUCT A DRAIN

---

TO THE COUNTY DRAIN COMMISSIONER,  
COUNTY OF OCEANA, STATE OF MICHIGAN:

Your petitioner respectfully shows that [he/she] is the only freeholder and owner in the [City or Township] of \_\_\_\_\_, in the County of Oceana, State of Michigan, of the lands included in this application and that the proposed drain shall be entirely located within the [City or Township] of \_\_\_\_\_, that all lands to be drained by said proposed drain are located in said [City or Township] of \_\_\_\_\_.

Your petitioner further respectfully shows that the person signing this petition constitutes the only freeholder and owner of land included in the application in the [City or Township] of \_\_\_\_\_ which said proposed drain and the lands to be drained thereby are located and that as the owner of the land he/she is the only one liable to an assessment for the construction of the proposed drain.

Your petitioner further makes application and hereby respectfully asks you to lay out and designate a drainage district in the [City or Township] of \_\_\_\_\_, County of Oceana, State of Michigan, under the provisions of Act 40 Public Acts of Michigan, 1956, as amended. The location and route of said proposed drain is to be set forth on the attached riders.

Your petitioner agrees to pay the cost incurred by the Drain Commissioner in establishing this drainage district.

Signed by:

\_\_\_\_\_

Type/print:

STATE OF MICHIGAN            )  
  ) ss.  
COUNTY OF                    )

The foregoing instrument was acknowledged before me this \_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_,  
by \_\_\_\_\_.

\_\_\_\_\_, Notary  
County, Michigan

My commission expires:

# SAMPLE

## CERTIFICATION OF ADEQUATE OUTLET (Required for 425 and 433 Agreements)

[Development Name]  
[Location]  
Oceana County, Michigan

"I, \_\_\_\_\_, a Licensed Professional Engineer in the State of \_\_\_\_\_,  
do hereby certify that:

1. The lands to be developed naturally drain into the area served by the existing drain, or that the existing drain is the only reasonably available outlet for the drainage from the lands to be developed.
2. There is adequate capacity in the existing drain to service lands to be developed without detriment or diminution of drainage service provided or to be provided in the foreseeable future to the area in the existing district.

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Type/Print

\_\_\_\_\_  
Date

\_\_\_\_\_  
Engineer's Seal

# SAMPLE

## CERTIFICATION OF NO NET INCREASE OF STORM WATER

[Development Name]  
[Location]  
Oceana County, Michigan

"I, \_\_\_\_\_, a Licensed Professional Engineer in the State of \_\_\_\_\_,  
do hereby certify that:

1. The lands to be developed naturally drain into the area located offsite on private property.
2. The development will not discharge storm water at a greater rate than pre-development conditions for the design discharge(s).
3. The development will not discharge concentrated storm water directly to offsite property where it was not historically concentrated.
4. The development will not discharge a greater volume of storm water onto offsite property where no surface water outlet is available.

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Type/Print

\_\_\_\_\_  
Date

\_\_\_\_\_  
Engineer's Seal

# SAMPLE

AGREEMENT FOR THE ESTABLISHMENT OF A COUNTY DRAIN  
AND COUNTY DRAINAGE DISTRICT  
PURSUANT TO SECTION 433 OF ACT NO. 40 OF  
THE PUBLIC ACTS OF 1956, AS AMENDED

THIS AGREEMENT, made and entered into this \_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_, by and between \_\_\_\_\_, OCEANA COUNTY DRAIN COMMISSIONER, hereinafter referred to as "Drain Commissioner" on behalf of the proposed \_\_\_\_\_ Drain Drainage District; and \_\_\_\_\_, as owner(s) of land described in Exhibit A attached hereto, hereinafter referred to as "Landowner".

WITNESSETH:

WHEREAS, Section 433 of Act No. 40 of the Public Acts of 1956, as amended, authorizes the Drain Commissioner to enter into an Agreement with the Landowner and developer, if any, to establish a drain which was constructed by the Landowner or developer to service an area of its own land as a County Drain; and,

WHEREAS, Landowner, pursuant to Section 433 of Act No. 40 of 1956, as amended, wishes to provide drainage service to its own lands and has requested same to be established and dedicated as a County Drain under the jurisdiction of the Oceana County Drain Commissioner; and,

WHEREAS, Landowner has been advised and understands and agrees to assume the total cost of the construction of the drain to include engineering, inspection, easement acquisition, legal, and administrative expenses and costs attendant to this Agreement; and,

WHEREAS, Landowner further understands that the Drain constructed, or to be constructed, pursuant to this Agreement, when finally accepted by the Drain Commissioner, will be known as the \_\_\_\_\_ Drain, and that the land to be known and constitutes as the \_\_\_\_\_ Drain Drainage District and will be subject to assessments, for costs of future operation, inspection, maintenance, and improvement; and,

WHEREAS, Landowner has agreed to assume and pay all costs as set forth herein; and

WHEREAS, Landowner has obtained, at its own expense, a certificate from a registered professional engineer satisfactory to the Drain Commissioner to the effect that the Drain has sufficient capacity to provide adequate drainage service without detriment to or diminution of the drainage service which the outlet currently provides. A copy of said certificate being attached hereto as Exhibit B.

NOW, THEREFORE, in consideration of the premises and covenants of each, the parties agree as follows:

1. The Landowner agrees to pay the costs of construction of said Drain and drainage facilities, including the acquisition of the necessary rights-of-way or easements, engineering, surveying, inspection, legal, and administration costs. In addition, the Landowner has deposited with the Drain Commissioner an amount of money equivalent to five (5%) percent of the costs of construction of the Drain, not to exceed Two Thousand Five Hundred and No/100 (\$2,500.00) Dollars, which monies are to be deposited in a special drain fund to be used for future maintenance of the Drain, hereinafter referred to as " \_\_\_\_\_ Drain Maintenance Fund".

2. Landowner shall secure all necessary permits or authorizations as may be required by local, state, or federal law and provide copies to the Drain Commissioner. The Drain Commissioner shall be provided copies of all correspondence and reports involving any governmental agency with respect to the Drain.
3. The \_\_\_\_\_ Drain Maintenance Fund is agreed and understood as being for the sole benefit of the \_\_\_\_\_ Drain and use thereof may be made by the \_\_\_\_\_ Drain Drainage District at large, or part thereof, and that such payment shall not relieve the subject property from any future assessments levied pursuant to the Drain Code of 1956, as amended.
4. Landowner agrees to indemnify and hold harmless the Drain Commissioner for any and all claims, damages, lawsuits, costs, and expenses arising out of or incurred as a result of the Drain Commissioner assuming responsibility for the drain under federal, state, and/or local environmental laws and standards and specification and the administrative and judicial interpretation thereof.
5. Modification, amendments, or waivers of any provision of the agreement may be made only by the written mutual consent of the parties.

This Agreement shall become effective upon its execution by the Landowner and the Drain Commissioner and shall be binding upon the successors and assigns of each party.

IN WITNESS WHEREOF, the parties hereto have caused this Agreement to be executed this \_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_.

WITNESSES:

\_\_\_\_\_  
sign  
type/print:

\_\_\_\_\_  
sign  
type/print:

\_\_\_\_\_  
sign  
type/print:

\_\_\_\_\_  
sign  
type/print:

LANDOWNERS:

\_\_\_\_\_  
sign  
type/print:

\_\_\_\_\_  
sign  
type/print:

DEVELOPER:

\_\_\_\_\_  
sign  
type/print:

STATE OF MICHIGAN            )  
  ) ss.  
COUNTY OF                    )

The foregoing instrument was acknowledged before me this \_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_,  
by \_\_\_\_\_ and \_\_\_\_\_.

\_\_\_\_\_  
\_\_\_\_\_, Notary  
County, Michigan

My commission expires:

WITNESSES:

DRAIN DRAINAGE DISTRICT

sign \_\_\_\_\_  
type/print:

\_\_\_\_\_

sign \_\_\_\_\_  
type/print:

\_\_\_\_\_

Oceana County Drain Commissioner

STATE OF MICHIGAN        )  
  ) ss.  
COUNTY OF                    )

The foregoing instrument was acknowledged before me this \_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_,  
by \_\_\_\_\_, on behalf of the Drain Drainage District.

\_\_\_\_\_  
\_\_\_\_\_, Notary  
County, Michigan

My commission expires:

Prepared By: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

SAMPLE

IRREVOCABLE COMMERCIAL LETTER OF CREDIT

For Construction Surety  
Act 591, Public Act 1996 (Formerly Act 288, Public Act 1967)

(Name and address of institution)  
(Effective date of Agreement)

To: \_\_\_\_\_  
Oceana County Drain Commissioner  
100 State Street  
Hart, MI 49420

RE: (name or address of proposed development)

Dear Sir/Madam:

We, the undersigned, represented by our Officer(s), hereby acknowledge and establish our Irrevocable Letter of Credit # \_\_\_\_\_, and authorize you to draw on us at sight for the account of (name of principle party) up to an aggregate total of \$\_\_\_\_\_.

This Letter of Credit is given for the purpose of assuring the Drain Commissioner's Office that (describe project).

All drafts presented for payment must be marked "Drawn under Letter of Credit # \_\_\_\_\_ for (name principle party), dated \_\_\_\_\_".

This authorization expires at the close of business on \_\_\_\_\_.

We hereby agree with the drawers, endorsers, and bonafide holders of drafts drawn under and in compliance with the terms stated herein, that such drafts will be duly honored upon due presentation to the drawees negotiated on or before the expiration date of this letter, or upon presentation at this office together with this document on or before the stated date of expiration.

(Officer's signature)

(seal if required)

\_\_\_\_\_



## SCHEDULE OF FEES

As of October 1, 2004, fees for storm water reviews are as follows:

Preliminary Submittal:

Preliminary plat and land divisions submittal fee:	\$10.00 per lot or, \$200.00 minimum fee
Other development submittal fee:	\$200.00
Drain Commissioner's inspection fee:	200.00
Deposit for engineering review and inspection:	\$1,000.00

The above fees shall be payable at the time of preliminary plat or site plan submittal and made to the Oceana County Drain Commissioner. If work commences prior to submittal and approval, the fees shall be doubled.

Engineering Review:

Total charges incurred by the Drain Commissioner's office for engineering services deemed necessary to perform reviews and inspections shall be charged in addition to the above submittal fees. Engineering services will be based on current hourly billing rates for actual time and reimbursable expenses.

Charges are to be paid by the proprietor within 15 days of invoice by the Drain Commissioner. Failure to make timely payment constitutes a violation, and approval will be rescinded, or permit will be revoked and deposit forfeited. Deposit will be returned to proprietor of good standing upon receipt of construction record drawings (as-builts).

Permit:

Permit Fee (permit to occupy easement or to cross a county drain with utilities, roads, drives, etc., or to connect to a county drain):	\$100.00
---	----------

If work commences without a permit or if a violation occurs, which results in the permit being revoked, a new permit must be obtained and a new fee paid:	\$100.00
---	----------

Recording:

Any recording fees incurred due to registering a document are the responsibility of the proprietor.

**REQUIRED TREATMENT VOLUME WORKSHEET  
FOR  
STORM WATER FACILITIES**

Water Quality Volume Required?	Yes _____	No _____
--------------------------------	-----------	----------

(If the following is checked yes, water quality volume is NOT required.)

- Percent impervious of a low density residential development less than or equal to 30%, and does not discharge to an inland lake. Yes \_\_\_\_\_ No \_\_\_\_\_

Stream Protection Volume Required?	Yes _____	No _____
------------------------------------	-----------	----------

(If the following is checked yes, stream protection volume is required.)

- Discharge to a natural water course. Yes \_\_\_\_\_ No \_\_\_\_\_

Flood Control Volume Required?	Standard _____	Alternate _____
--------------------------------	----------------	-----------------

(If any of the following are checked yes, alternate flood control volume may be allowed.)

- Development located in a “no-detention” zone identified in a watershed management plan. Yes \_\_\_\_\_ No \_\_\_\_\_
- Direct discharge to a lake. Yes \_\_\_\_\_ No \_\_\_\_\_
- Direct discharge to a river. Yes \_\_\_\_\_ No \_\_\_\_\_
- Direct discharge to a storm sewer designed to accommodate peak flows higher than the maximum allowable release rate. Yes \_\_\_\_\_ No \_\_\_\_\_

Spill Containment Volume Required?	Yes _____	No _____
------------------------------------	-----------	----------

(If both of the following are checked yes, spill containment volume is required.)

- Land use activity a designated storm water hot spot. Yes \_\_\_\_\_ No \_\_\_\_\_
- Infiltration is proposed. Yes \_\_\_\_\_ No \_\_\_\_\_

## **GEOTECHNICAL REQUIREMENTS FOR STORM WATER FACILITIES**

### **Qualifications**

Soil testing by a qualified geotechnical consultant is required when it is necessary to determine the site soil infiltration characteristics and groundwater table. The geotechnical consultant shall be either a registered professional engineer, soil scientist, or geologist licensed in the State of Michigan.

### **Initial Feasibility Investigation**

An initial feasibility investigation may be conducted to screen unsuitable sites. Initial investigation involves making use of any of the following resources:

1. Oceana County Soil Survey prepared by the NRCS.
2. Existing soil borings or geotechnical report on the site prepared by a qualified geotechnical consultant.
3. Onsite septic percolation testing within 200 feet of the proposed infiltration basin location and on the same contour.

### **Soil Boring Requirements**

One soil boring is required per 5,000 square feet of storm water facility bottom area.

Soil borings shall be located within the perimeter of the proposed storm water facility.

Each boring shall extend a minimum of 5 feet below the proposed bottom elevation of the storm water facility.

Groundwater elevations must be recorded during drilling, and again upon completion of drilling.

Standard penetration testing shall be performed at 2-foot intervals, and changes in soil type noted. Each soil type shall be classified using the Unified Soil Classification System.

Soil boring logs shall be referenced to a top-of-ground elevation, and include the above information .

### **Field Permeability Testing**

A minimum of one test per storm water facility shall be performed, where required, by the following method:

Infiltration Rate of Soils in Field Using Double-Ring Infiltrimeters (ASTM D-3385)

## CLASSIFICATION OF STORM WATER HOT SPOTS

The following land uses and activities are deemed storm water hot spots:

- vehicle salvage yards and recycling facilities
- vehicle service and maintenance facilities
- vehicle and equipment cleaning facilities
- fleet storage areas (bus, truck, etc.)
- industrial sites (included on SIC code list)
- marinas (service and maintenance)
- public works storage areas
- facilities that generate or store hazardous waste materials
- commercial container nursery
- other land uses and activities as designated by an appropriate review authority

Storm water pollution prevention plan implementation may be required for these land uses or activities under the EPA NPDES storm water program.

## STANDARD INDUSTRIAL CLASSIFICATION (SIC) CODE LIST

Most industries are listed in the federal storm water regulations by their Standard Industrial Classification (SIC) code. Others are listed by narrative industrial description rather than SIC code. The following 11 major categories of industries (i through xi) are covered under the federal storm water regulations at 40 CFR 122.26(b)(14):

- i. Facilities subject to storm water effluent limitations guidelines, new source performances standards, or toxic pollutant effluent standards under 40 CFR subchapter N (except facilities with toxic pollutant effluent standards which are exempted under 40 CFR 122.26(b)(14)(xi).
- ii. All industries under the following SIC Major Group (two digit), Industry Group (three digit), or Industry Number (four digit):
  - 24 LUMBER AND WOOD PRODUCTS, EXCEPT FURNITURE  
Except: 2434 - wood kitchen cabinets\*
  - 26 PAPER AND ALLIED PRODUCTS (pulp, paper and paperboard mills)  
Except: 265 - paperboard containers and boxes\*  
267 - converted paper and paperboard products (other) \*
  - 28 CHEMICALS AND ALLIED PRODUCTS  
Except: 283 - drugs\*
  - 29 PETROLEUM REFINING AND RELATED INDUSTRIES
  - 311 LEATHER TANNING AND FINISHING
  - 32 STONE, CLAY, GLASS, AND CONCRETE PRODUCTS  
Except: 323 - glass products made of purchased glass\*
  - 33 PRIMARY METAL INDUSTRIES
  - 3441 FABRICATED STRUCTURAL METAL
  - 373 SHIP AND BOAT BUILDING AND REPAIR
- iii.
  - 10 METAL MINING
  - 12 COAL MINING
  - 13 OIL AND GAS EXTRACTION
  - 14 MINING AND QUARRYING OF NONMETALLIC MINERALS, EXCEPT FUELS
- iv. Hazardous waste treatment, storage, or disposal facilities, including those that are operating under interim status or permit under subtitle C or RCRA.
- v. Landfills, land application sites, and open dumps that receive or have received any industrial wastes (waste that is received from any of the facilities described under this subsection) including those that are subject to regulation under subtitle D of RCRA.
- vi. Facilities involved in the recycling of materials, including metal scrap yards, battery reclaimers, salvage yards and automobile junkyards, including but limited to those classified as Standard Industrial Classification 5015 (motor vehicle parts, used) and 5093 (scrap and waste materials).

\*included under category xi.

- vii. Steam electric power generating facilities, including coal handling sites.
- vii. Transportation facilities which have vehicle maintenance shops (including vehicle rehabilitation, mechanical repairs, painting, fueling and lubrication), equipment cleaning operations, or airport deicing operations, and which belong to the following list of SIC code groups or industry numbers:

- 40 RAILROAD TRANSPORTATION
- 41 LOCAL AND SUBURBAN TRANSIT AND INTERURBAN HIGHWAY PASSENGER TRANSPORTATION (e.g. bus lines, school buses, trolleys, trams, taxis, limousines, and airport local transportation services)
- 42 MOTOR FREIGHT TRANSPORTATION AND WAREHOUSING  
  - Except: 4221 - farm product warehousing and storage\*
  - 4222 - refrigerated warehousing and storage\*
  - 4225 - general warehousing and storage\*
- 43 U.S. POSTAL SERVICE
- 44 WATER TRANSPORTATION (e.g. marinas, Great Lakes freight and passenger ship docking)
- 45 TRANSPORTATION BY AIR
- 5171 PETROLEUM BULK STORAGE AND TERMINALS, WHOLESALE

ix. Treatment works treating domestic sewage or any other sewage sludge or wastewater treatment device or system, used in the storage treatment, recycling, and reclamation of municipal or domestic sewage, including lands dedicated to the disposal of sewage sludge that are located within the confines of the facility, with a design flow of 1.0 mgd or more, or required to have an approved pretreatment program under 40 CFR part 403. Not included are farmlands, domestic gardens, or lands used for sludge management where sludge is beneficially reused and which are not physically located in the confines of the facility, or areas that are in compliance with section 405 of the CWA.

x. Construction activity\*\* including clearing, grading and excavation activities except: operations that result in the disturbance of less than five acres of total land area which are not part of a larger common plan of development or sale.

xi. Applications for industries in category xi. are required only if there are storm water discharges from areas where material handling equipment or activities, raw materials, intermediate products, final products, waste materials, by-products, or industrial machinery are exposed to stormwater. The following industries are listed by SIC Major Group, Industry Group, or Industry Number:

- 20 FOOD AND KINDRED PRODUCTS
- 21 TOBACCO PRODUCTS
- 22 TEXTILE MILL PRODUCTS
- 23 APPAREL AND OTHER FINISHED PRODUCTS MADE FROM FABRICS AND SIMILAR MATERIALS

\*included under category xi.

\*\*construction covered under Michigan's permit-by-rule for construction activities

\*\*\*included under category ii.

- 2434 WOOD KITCHEN CABINETS
- 25 FURNITURE AND FIXTURES
- 265 PAPERBOARD CONTAINERS AND BOXES
- 267 CONVERTED PAPER AND PAPERBOARD PRODUCTS
- 27 PRINTING, PUBLISHING, AND ALLIED INDUSTRIES
- 283 DRUGS
- 285 PAINTS, VARNISHES, LACQUERS, ENAMELS, AND ALLIED PRODUCTS
- 30 RUBBER AND MISCELLANEOUS PLASTICS PRODUCTS
- 31 LEATHER AND LEATHER PRODUCTS  
Except: 311 - leather tanning and finishing\*\*\*
- 323 GLASS PRODUCTS. MADE OF PURCHASED GLASS
- 34 FABRICATED METAL PRODUCTS. EXCEPT MACHINERY AND TRANSPORTATION  
EQUIPMENT  
Except: 3441 - fabricated structural metal\*\*\*
- 35 INDUSTRIAL AND COMMERCIAL MACHINERY AND COMPUTER EQUIPMENT
- 36 ELECTRICAL AND OTHER ELECTRICAL EQUIPMENT AND COMPONENTS  
EXCEPT COMPUTER EQUIPMENT
- 37 TRANSPORTATION EQUIPMENT  
Except: 373 - ship and boat building and repairing\*\*\*
- 38 MEASURING, ANALYZING, AND CONTROLLING INSTRUMENTS;  
PHOTOGRAPHIC, MEDICAL AND OPTICAL GOODS; WATCHES AND CLOCKS
- 39 MISCELLANEOUS MANUFACTURING INDUSTRIES
- 4221 FARM PRODUCT WAREHOUSING AND STORAGE
- 4222 REFRIGERATED WAREHOUSING AND STORAGE
- 4225 GENERAL WAREHOUSING AND STORAGE

\*included under category xi.

\*\*construction covered under Michigan's permit-by-rule for construction activities

\*\*\*included under category ii.

**Runoff Curve Numbers for Selected Agriculture, Suburban, and Urban Land Use  
(Antecedent Moisture Condition 2 and  $I_a = 0.2S$ )**

Land Use Description	Hydrologic Soil Group			
	A	B	C	D
Cultivated land <sup>1</sup> : Without conservation treatment	72	81	88	91
With conservation treatment	62	71	78	81
Pasture or range land: Poor condition	68	79	86	89
Good condition	39	61	74	80
Meadow: Good condition	30	58	71	78
Wood or forest land: Thin stand, poor cover, no mulch	45	66	77	83
Good cover <sup>2</sup>	25	55	70	77
Open spaces, lawns, parks, golf courses, cemeteries, etc.				
Good condition Grass cover on 75% or more of the area	39	61	74	80
Fair condition Grass cover on 50% to 75% of the area	49	69	79	84
Commercial and business areas (85% impervious)	89	92	94	95
Industrial Districts (72% impervious)	81	88	91	93
Residential: <sup>3</sup> (house + drive + lawn)				
<u>Average lot size</u> <u>Average % Impervious</u>				
1/8 acre or less    65	77	85	90	92
1/4 acre    38	61	75	83	87
1/3 acre    30	57	72	81	86
1/2 acre    25	54	70	80	85
1 acre    20	51	68	79	84
Paved parking lots, roofs, driveways, etc. <sup>5</sup>	98	98	98	98
Streets and roads:				
Paved with curbs and storm sewers <sup>5</sup>	98	98	98	98
Gravel	76	85	89	91
Dirt	72	82	87	89

<sup>1</sup> For a more detailed description of agricultural land use curve numbers, refer to National Engineering Handbook, Section 4, Hydrology, Chapter 9, August 1972.

<sup>2</sup> Good cover is protected from grazing and litter and brush cover soil.

<sup>3</sup> Curve numbers are computed assuming the runoff from the house and driveway.

<sup>4</sup> The remaining pervious areas (lawn) are considered to be in good pasture condition for these curve numbers.

<sup>5</sup> In some warmer climates of the country, a curve number of 95 may be used.

Source: Soil Conservation Service, 1986.



### Rational Method Runoff Coefficients

Type of Development	Runoff Coefficients
Business Downtown Neighborhood	0.70 to 0.95 0.50 to 0.70
Residential Single family Multi-units (detached) Multi-units (attached)	0.30 to 0.50 0.40 to 0.60 0.60 to 0.75
Residential (suburban)	0.25 to 0.40
Apartment	0.50 to 0.70
Industrial Light Heavy	0.50 to 0.80 0.60 to 0.90
Park, Cemeteries	0.10 to 0.25
Playgrounds	0.20 to 0.35
Railroad Yard	0.20 to 0.35
Unimproved	0.10 to 0.30
<b>Character of Surface</b>	
Pavement Asphalt and Concrete Brick	0.70 to 0.95 0.70 to 0.85
Roofs	0.75 to 0.95
Lawns, Sandy Soil Flat                   2% Average               2% to 7% Steep                   7%	0.05 to 0.10 0.10 to 0.15 0.15 to 0.20
Lawns, Heavy Soil Flat                   2% Average               2% to 7% Steep                   7%	0.13 to 0.17 0.18 to 0.22 0.25 to 0.35

Source: Design and Construction of Sanitary and Storm Sewers, American Society of Civil Engineers and the Water Pollution Control Federation, 1969.

## DETERMINATION OF TIME OF CONCENTRATION

The variables needed to compute time of concentration for a proposed development are its length, slope, and surface retardants. These variables can be computed from field survey notes.

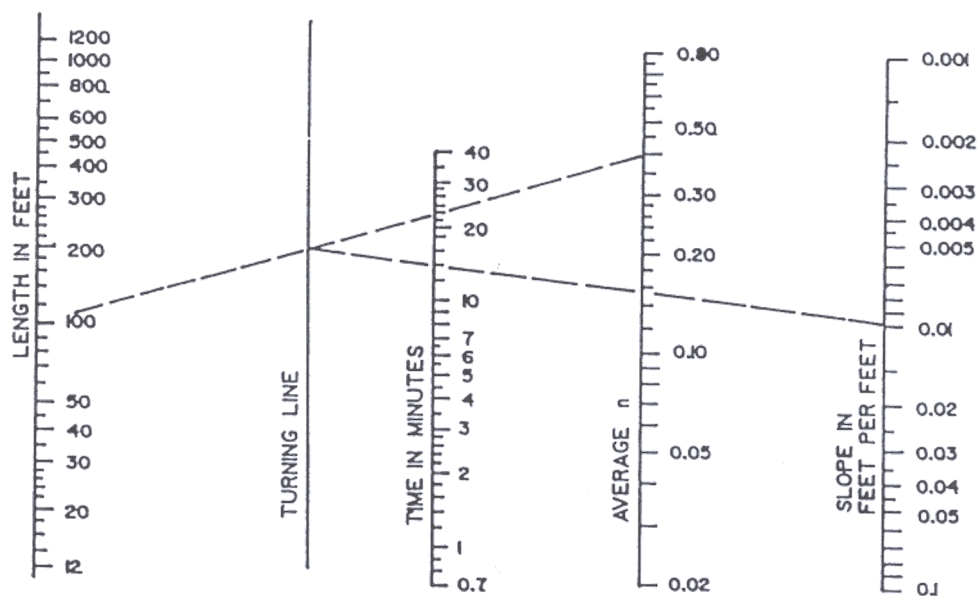
The length  $L$  is the distance from the extremity of the development area in a direction parallel to the slope until a defined channel is reached. The units are in feet. Overland flow will become channel flow within 1,200 feet in almost all cases. Time of concentration is the sum of overland flow and channel flow.

The slope  $S$  is the difference in elevation between the extremity of the drainage area and the point in question divided by the horizontal distance. The units are in feet/foot.

The surface retardants coefficient,  $n$ , is the average surface retardants value of the overland flow.

The following is a table used for determining n

<u>TYPE OF SURFACE</u>	<u>n VALUE</u>
Smooth impervious Surface	0.02
Smooth bare packed soil	0.10
Poor grass, cultivated row crops or moderately rough bare surface	0.20
Pasture or average grass	0.40
Deciduous Timberland	0.60
Conifer Timberland, Deciduous Timberland with deep forest litter or dense grass	0.80



Example:  $N=0.40$ ,  $L=100'$ ,  $S=0.01$  feet/foot and  $t_c=13.6$  minutes

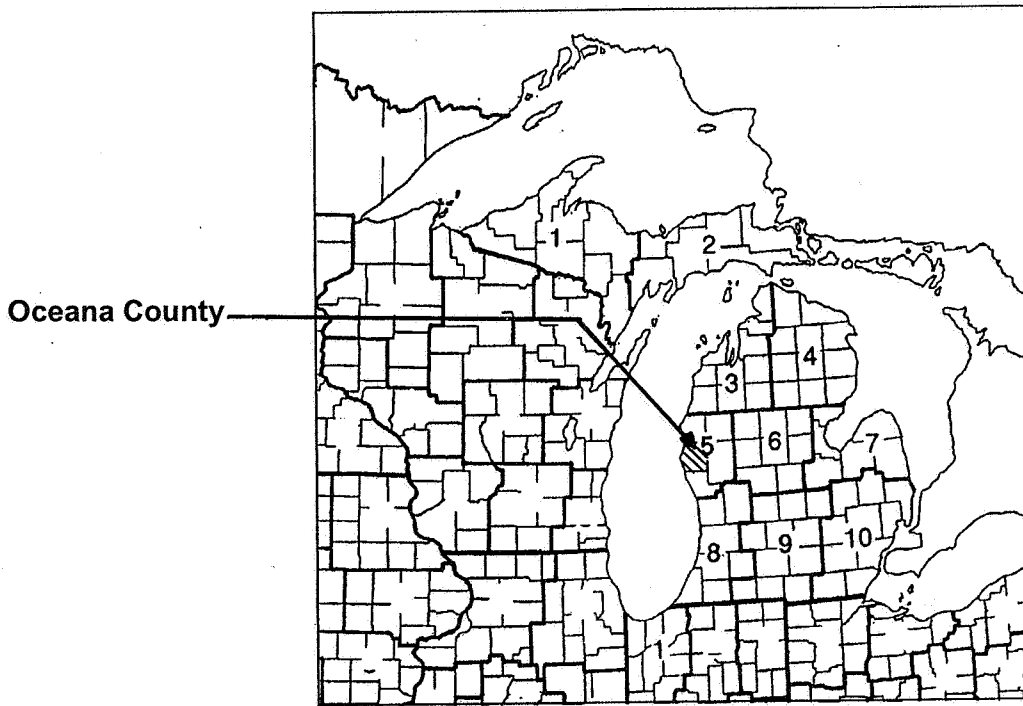
Chart is printed from the following equation.

$$t_c = \left( \frac{2Ln}{3\sqrt{S}} \right) \times X \quad X = \frac{1}{2.14}$$

Taken from ENGINEER'S NOTEBOOK

"Time of concentration for overland flow" W.S. Kerby, J.M. Asce, Hydrologist, Servis, Van Doren & Hazard, Engineers, Topeka, Kansas.

## Climatic Zones for Michigan



**Rainfall amounts corresponding to Oceana County, Climatic Zone 5, from the  
Rainfall Frequency Atlas of the Midwest, Huff and Angel (1992)**

*Rainfall inches for given recurrence interval*

<i>Section</i>	<i>Duration</i>	<i>2-month</i>	<i>3-month</i>	<i>4-month</i>	<i>6-month</i>	<i>9-month</i>	<i>1-year</i>	<i>2-year</i>	<i>5-year</i>	<i>10-year</i>	<i>25-year</i>	<i>50-year</i>	<i>100-year</i>
05	10-day	1.64	1.97	2.27	2.67	3.07	3.34	4.14	5.28	6.21	7.59	8.75	10.02
05	5-day	1.38	1.65	1.86	2.16	2.48	2.70	3.36	4.30	5.07	6.25	7.26	8.36
05	72-hr	1.18	1.38	1.56	1.81	2.08	2.26	2.88	3.74	4.46	5.45	6.31	7.26
05	48-hr	1.04	1.22	1.36	1.58	1.81	1.97	2.53	3.34	4.01	4.97	5.81	6.73
05	24-hr	0.97	1.13	1.24	1.43	1.63	1.77	2.28	3.00	3.60	4.48	5.24	6.07
05	18-hr	0.91	1.06	1.16	1.34	1.53	1.66	2.14	2.82	3.38	4.21	4.93	5.71
05	12-hr	0.85	0.99	1.08	1.25	1.42	1.54	1.98	2.61	3.13	3.90	4.56	5.28
05	6-hr	0.73	0.85	0.93	1.08	1.22	1.33	1.71	2.25	2.70	3.36	3.93	4.55
05	3-hr	0.62	0.72	0.79	0.92	1.04	1.13	1.46	1.92	2.30	2.87	3.35	3.88
05	2-hr	0.57	0.66	0.72	0.83	0.95	1.03	1.32	1.74	2.09	2.60	3.04	3.52
05	1-hr	0.46	0.53	0.58	0.67	0.76	0.83	1.07	1.41	1.69	2.11	2.46	2.85
05	30-min	0.36	0.42	0.45	0.53	0.60	0.65	0.84	1.11	1.33	1.66	1.94	2.25
05	15-min	0.26	0.31	0.34	0.39	0.44	0.48	0.62	0.81	0.97	1.21	1.41	1.64
05	10-min	0.20	0.24	0.26	0.30	0.34	0.37	0.48	0.63	0.76	0.94	1.10	1.27
05	5-min	0.12	0.13	0.15	0.17	0.19	0.21	0.27	0.36	0.43	0.54	0.63	0.73

### Manning's Roughness Coefficients ("n")

Conduit	Manning's Coefficients
<b>Closed Conduits</b>	
Asbestos-Cement Pipe	0.011 to 0.015
Brick	0.013 to 0.017
Cast Iron Pipe Cement-lined and seal-coated	0.011 to 0.015
Concrete (Monolithic) Smooth forms	0.012 to 0.014
Rough forms	0.015 to 0.017
Concrete Pipe	0.011 to 0.015
Corrugated-Metal Pipe (1/2 - STUL 34470 2 1/2-inch corrgrtn.) Plain	0.022 to 0.026
Paved invert	0.018 to 0.022
Spun asphalt-lined	0.011 to 0.015
Plastic Pipe (Smooth)	0.011 to 0.015
Vitrified Clay Pipes	0.011 to 0.015
Liner channels	0.013 to 0.017
<b>Open Channels</b>	
Lined Channels Asphalt	0.013 to 0.017
Brick	0.012 to 0.018
Concrete	0.011 to 0.020
Rubble or riprap	0.020 to 0.035
Vegetal	0.030 to 0.040
Excavated or Dredged Earth, straight and uniform	0.020 to 0.030
Earth, winding, fairly uniform	0.025 to 0.040
Rock	0.030 to 0.045
Unmaintained	0.050 to 0.140
Natural Channels (minor streams, top width at flood state < 100 feet) Fairly regular section	0.030 to 0.070
Irregular section with pools	0.040 to 0.100

Source: Design and Construction of Sanitary and Storm Sewers, American Society of Civil Engineers and the Water Pollution Control Federation, 1969.

### Minimum and Maximum Slopes for Storm Sewers

(Manning's "n" = 0.013)

Pipe Size	Minimum % of Grade (V = 2.5 ft/sec)	Maximum % of Grade (V = 10 ft/sec)
12"	0.32	4.88
15"	0.24	3.62
18"	0.20	2.84
21"	0.16	2.30
24"	0.14	1.94
27"	0.12	1.66
30"	0.10	1.44
36"	0.08	1.12
42"	0.06	0.92
48"	0.06	0.76
54"	0.04	0.60
60"	0.04	0.54
66"	0.04	0.48

DETENTION BASIN SIZING  
(RATIONAL METHOD)

PROJECT: [REDACTED] Fishbeck, Thompson, Carr & Huber, Inc.  
 JOB NO.: [REDACTED] 1515 Arboretum Drive, SE  
 Grand Rapids, MI 49546  
 DATE: [REDACTED] 616-575-3824  
 BY: [REDACTED]

LOCATION: Oceana County      CONTRIB. AREA (acres) = [REDACTED] 0  
 RUNOFF "C" VALUE = [REDACTED] 0  
 RAINFALL FREQUENCY = 25  
 ALLOWABLE  
 RELEASE RATE (cfs) = [REDACTED] 0  
 0.20 cfs/acre

TIME (hrs)	(1) RAINFALL INTENSITY (in/hr)	(2) RAINFALL RUNOFF (cft)	(3) DISCHARGE VOLUME (cft)	(4) STORAGE VOLUME (cft)	(5) STORAGE VOLUME (ac-ft)	(6) TIME TO EMPTY (hrs)
0.17	5.64	0	0	0	0.00	#DIV/0!
0.25	4.84	0	0	0	0.00	#DIV/0!
0.33	4.354	0	0	0	0.00	#DIV/0!
0.5	3.32	0	0	0	0.00	#DIV/0!
0.67	2.909	0	0	0	0.00	#DIV/0!
0.75	2.715	0	0	0	0.00	#DIV/0!
0.83	2.52	0	0	0	0.00	#DIV/0!
1	2.11	0	0	0	0.00	#DIV/0!
2	1.3	0	0	0	0.00	#DIV/0!
3	0.956	0	0	0	0.00	#DIV/0!
4	0.824	0	0	0	0.00	#DIV/0!
5	0.692	0	0	0	0.00	#DIV/0!
6	0.56	0	0	0	0.00	#DIV/0!
7	0.521	0	0	0	0.00	#DIV/0!
8	0.482	0	0	0	0.00	#DIV/0!
9	0.443	0	0	0	0.00	#DIV/0!
10	0.403	0	0	0	0.00	#DIV/0!
12	0.325	0	0	0	0.00	#DIV/0!
18	0.234	0	0	0	0.00	#DIV/0!
24	0.187	0	0	0	0.00	#DIV/0!
36	0.146	0	0	0	0.00	#DIV/0!
48	0.104	0	0	0	0.00	#DIV/0!

- NOTES:
- (1) Input rainfall intensity, I, in in/hr for the specified design rainfall at each duration (time, t).  $I = P/t$  where P is the rainfall in inches.
  - (2) Rainfall runoff volume is calculated by multiplying the Rational Formula,  $Q = CIA$ , by the time, t:  $V = (It)CA$
  - (3) Discharge volume is calculated by multiplying the discharge rate by the time:  $V_o = Q_o t$
  - (4) Storage volume is calculated by subtracting the discharge volume from the runoff volume.
  - (5) Storage volume is converted to acre-feet by dividing by 43,560 sft/acre
  - (6) Time to empty is calculated by dividing the storage volume by the discharge rate.

### Minimum Required Flood Control Volume

(For Standard Release Rate of 0.20 cfs/ac)

Rational Formula Runoff "C"	Minimum Required Storage Volume (cft/ac)
0.10	355
0.15	725
0.20	1,175
0.25	1,635
0.30	2,100
0.35	2,575
0.40	3,050
0.45	3,525
0.50	4,100
0.55	4,690
0.60	5,375
0.65	6,125
0.70	6,870
0.75	7,620
0.80	8,365
0.85	9,115
0.90	9,860
0.95	10,610
1.00	11,355

Rainfall Source: Bulletin 71, Table 5, Section 5



## REFERENCES

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