

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

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# LETTER OF INTENT

NEWAYGO 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 Newaygo County Drain Commissioner Subdivision Drainage Rules and Storm Water Design Criteria promulgated and published by the Newaygo County Drain Commissioner, and to authorize the fee schedule set forth therein pursuant to the authority granted in the Land Division Act was adapted by the Newaygo County Board of Commissioners on \_\_\_\_\_.]

IT IS HEREBY ORDERED that the Newaygo 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 Newaygo 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 \_\_\_\_\_ day of \_\_\_\_\_.

Cynthia J. Sullivan  
Newaygo County Drain Commissioner

# SUBDIVISION DRAINAGE RULES

# **PART 1: 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 Newaygo 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 Newaygo, 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.

## **B. GRADING AND DRAINAGE 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. GRADING PLAN**

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

### **2. 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.

### **3. DRAINAGE PLAN**

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.

### **4. STORM WATER MANAGEMENT**

#### **a. GENERAL**

In general, all new land developments and additions to previous developments within Newaygo 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.

### **5. 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.

### **6. 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.

### **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 the Soil Erosion and Sedimentation Control Permit may also be requested.

**3. PRECONSTRUCTION MEETING**

The Drain Commissioner may 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 Newaygo 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 Wheeler 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 Newaygo 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.

## **D. MAINTENANCE PLANS**

- 1.** Maintenance plans shall be submitted with construction drawings for all multi-lot/multi-unit 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. Examples include:
  - (1) Conveyance Controls
    - Debris removal from catch basins and channels
    - Cleaning of pipes, catch basins, and channels
  - (2) Storm Water Facilities
    - Debris removal
    - Maintenance of outflow control structure
    - Sediment removal
    - Replacement of infiltration media
    - Maintenance of vegetated buffers
    - Maintenance of wetland vegetation
- 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 Newaygo 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 Newaygo County Drain Commissioner's office pertaining to subdivision development are hereby repealed, effective on the date of publication of these rules.

## **XIV. HISTORY**

Previous rules had been published by the Newaygo County Drain Commissioner's office on April 8, 1993.

## **PART 2: 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 Newaygo 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

## PART 3: STORM WATER MANAGEMENT

### 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.

**Pocket Wetlands:** A storm water wetland design adapted for small drainage areas without a reliable source of baseflow. The surface area of pocket wetlands is usually less than one-tenth of an acre. The pocket wetland is usually intended to provide some pollutant removal for very small development sites.

**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. OVERVIEW

In the broadest sense, storm water management has come to be addressed through the planning and implementation of six major elements or “tools”:

- Public Involvement/Education
- Water Resource Based Zoning
- Elimination of Illicit Discharges
- Construction Site Erosion/Sediment Controls
- Post-Construction Storm Water Runoff BMPs
- Source Control/Good Housekeeping

This six-pronged approach is recommended by the Center for Water Resource Protection in Ellicott City, Maryland, and is required under Phase II of the National Pollutant Discharge Elimination System (NPDES) Storm Water Permit program, and for Michigan Department of Environmental Quality (MDEQ) approvable watershed management plans.

Because these rules deal with urban storm water runoff from subdivisions and other site developments, the focus of this manual is exclusively on Post-construction Storm Water Runoff BMPs.

### **III. 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 Newaygo County.

#### **IV. GENERAL REQUIREMENTS FOR STORM WATER DISCHARGE**

- A.** 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.
  
- B.** A description of the offsite outlet and evidence of its adequacy is required. See Part 1, Section VIII, B, 2c.
  
- C.** If the proposed storm water management system cannot meet the requirements of the first paragraph, it is the responsibility of the proprietor to secure necessary easements from downstream property owners. See Part 1, Section VII, A, 2.
  
- D.** Storm water discharges shall outlet within the same drainage basin or district where flows originate, and generally may not be diverted to another drainage basin/district. See Part 1, Section IV, B, 3.

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

### **A. OUTLINE**

Guidelines for designing the storm water management system for a site development are outlined here.

First, uniform treatment criteria for urban storm water practices are defined based on four factors:

- Water Quality
- Stream Protection
- Flood Control
- Provisions for Accidental Spills (Storm Water Hot Spots)

Second, urban storm water practices are categorized by the major elements of a site development storm water management system:

- Lot Level Controls
- Conveyance Controls
- Storm Water Facilities (end-of-pipe)
- Protection of Natural Hydrologic Buffers

Direction for the appropriate selection of urban storm water practices is summarized in Appendix 5.1:

Treatment Suitability. Can the BMP meet all uniform treatment criteria, or is a combination of BMPs required?

A Required Treatment Volume Worksheet for storm water facilities is included in Appendix 5.2.

Finally, specific performance/design criteria for each urban storm water practice are given in Part 4: Design Standards.

## **B. 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

### **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%.

BMPs listed in Appendix 5.1 which meet the uniform criteria for water quality volume, are considered to meet a minimum acceptable standard. Redundant treatment and higher removal efficiencies for target pollutants may be achieved by using certain BMPS (e.g., storm water wetlands), or with a combination of BMPs.

### **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, excluding: Direct discharge to a fourth-order (or higher) river. Watercourses in Newaygo County that do not require stream protection volume are:

- Muskegon River
- Little Muskegon River
- South Branch of the White River
- Little South Branch of the Pere Marquette River (downstream of McDuffee Creek)

- Big South Branch of the Pere Marquette River (downstream of Cedar Creek and Freeman Creek).

### **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.

The standard flood control volume shall be provided unless the development is located in a “no detention” zone identified in a watershed management plan; or located at the downstream end of an MDEQ watershed unit for a headwater stream as shown in Figure 1; or for direct discharge into a lake or larger-order stream that traverses the watershed unit as shown in Figure 1. Storm water detention in these areas may actually increase the peak discharge from the watershed due to the coincidence of hydrograph peaks from the upper watershed with detained flows from the lower watershed. An alternate flood control volume shall be provided in these areas. In all cases, the proprietor must also verify that the immediate downstream conveyance system has adequate capacity for the 10-year post-development design flow.

### **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 5.3. 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.

## **C. STORM WATER SYSTEM COMPONENTS**

Urban storm water practices are categorized by four primary components of a site development's storm water management system. Individual urban storm water practices and their ability to meet the uniform treatment criteria are summarized in Appendix 5.1.

### **1. STORM WATER LOT LEVEL CONTROLS**

#### **a. MEASURES**

Storm water lot level controls involve measures to manage storm water before it reaches the subdivision/development conveyance system. Typical measures include:

- Limiting the number of roof drains to provide rooftop detention of storm water
- Catch basin restrictors to provide parking lot or rear yard detention of storm water
- Oversizing storm sewers and installing restrictors to provide in-line pipe storage
- Infiltration trenches or leaching basins
- In-line oil and grit separators
- Water quality swales
- Reduced lot grading to allow greater ponding of storm water and natural infiltration
- Disconnect roof drains from the conveyance system
- Impervious cover reduction
- Rain gardens/urban forestation

These types of measures are also applicable for very small commercial sites where space is not available to meet the uniform treatment volume requirements. The MDEQ (formerly Michigan Department of Natural Resources) *Guidebook of BMPs for Michigan Watersheds* should be referred to for design criteria, concept sketches, and maintenance requirements for specific practices.

b. APPLICATION

Approval of final lot grading and drainage 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 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. The subdivision storm water management plan will provide for the following:

- (1) 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 Part 1, Section IX.C.2.).
- (2) 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 Part 1, Section VII.A.1.c).

## **2. STORM WATER CONVEYANCE CONTROLS**

### **a. MEASURES**

Storm water conveyance controls consist of the following:

- Storm Sewer and Catch Basins
- Perforated Storm Sewer and Leaching Basins
- Culverts and Bridges
- Grassed Waterways

Specific design criteria are given in Part 4 of this manual.

### **b. APPLICATION**

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.

### **3. STORM WATER FACILITIES (END-OF-PIPE)**

#### **a. MEASURES**

Storm water facilities are those practices implemented at the downstream end of the conveyance system (end-of-pipe) on a site development level. They consist of the following urban BMP groups:

- Detention Basins (dry, wet)
- Storm Water Wetlands
- Infiltration Basins (dry, retention ponds)

Specific design criteria are given in Part 4 of this manual. Concept sketches, design variations, and additional types of BMPs are included in the MDEQ Guidebook of BMPs for Michigan Watersheds.

#### **b. APPLICATION**

- (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 as specified in Part 3, Section V, B. A Required Treatment Volume Worksheet is included in Appendix 5.2. The table in Appendix 5.1 can then be used to select appropriate BMPs.
- (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.

### **4. 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

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 Newaygo County include the White River and the Pere Marquette River.
- (3) Plantings capable of 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.

## **PART 4: DESIGN STANDARDS**

### **I. 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 5.4. Values of runoff coefficients for various development types, for use with the Rational Method, are included in Appendix 5.5.
4. The minimum time of concentration value shall be 15 minutes. Guidelines for estimating the time of concentration are included in Appendix 5.6.
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 5.7 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.

## II. CONVEYANCE CONTROLS

### A. 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 5.8.
- d. Acceptable slopes for circular pipe ("n" = 0.013) are included in Appendix 5.9. 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 Part 4.II.C - 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 with no ponding occurring during a 10-year storm.
- 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.

### **B. 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 25-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, Newaygo 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.

# **C. 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 5.8.
- 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.

### III. STORM WATER FACILITIES

The three groups of urban BMPs identified as storm water facilities, or “end-of-pipe” storage and treatment measures are as follows:

- Detention Basins (dry, wet)
- Storm Water Wetlands
- Infiltration Basins (dry, retention ponds)

Performance criteria are given for each to ensure an effective and durable BMP. Performance criteria are based on eight factors:

- Physical Feasibility
- Treatment Criteria
- Pre-treatment Criteria
- Controls
- Geometry
- Public Safety
- Landscaping
- Maintenance

## A. 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 (2.06 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 is not required for sites where  $CxA < 1$  acre.
- (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 standard flood control volume shall be sized to detain the 25-year rainfall event with a maximum release rate of 0.13 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 standard flood control volume required per acre can be read directly from the table included in Appendix 5.10.
- (2) The alternate flood control volume shall be sized to detain the 25-year rainfall event with a maximum release rate equal to the 10-year undeveloped peak discharge from the contributing drainage area. A spreadsheet for use with the Rational Method is included in Appendix 5.10. The maximum storage volume shall be multiplied by 1.25 to obtain the minimum required alternate flood control volume. The maximum storage volume shall be multiplied by 1.7 if stream protection volume is also required. Pond routing by the SCS Method may also be used to determine the alternate flood control volume.
- (3) The water quality and stream protection volume may be included in the flood control volume.
- (4) The flood control volume must be provided for all contributing acreage, including the developed offsite acreage unless waived by the Drain Commissioner.

d. DRY BASINS

Dry detention basins must be combined with other BMPs to meet water quality volume criteria. An extended detention basin design with a shallow marsh incorporated into the lower stage is also acceptable.

e. WET BASINS

Flood control and streambank protection volumes must be provided above the permanent pool elevation. 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 Part 4.II.C - 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.
- f. Warning signs prohibiting swimming and skating shall be posted for wet basins.

## **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.

## **B. STORM WATER WETLANDS**

All of the detention basin design criteria also apply to the design of storm water wetlands. Additional criteria exclusive to storm water wetlands is presented in this section.

### **1. PHYSICAL FEASIBILITY**

#### **a. WATER BALANCE**

To avoid excessive drawdowns, a reliable supply of baseflow and/or groundwater is required.

- (1) Confirm a minimum baseflow rate of 0.002 cfs per acre, and a dry weather groundwater table elevation. For pocket wetlands, only the groundwater need be confirmed.
- (2) A water balance must be performed to demonstrate that a storm water wetland can withstand a 30-day drought at summer evaporation rates without completely drawing down. A short cut assessment method for calculating water balance is included in Appendix 5.11.

#### **b. GEOTECHNICAL**

Soil borings shall be taken to confirm the depth to the groundwater table, and the soil classification as an indicator of permeability. The geotechnical investigation shall follow the procedure outlined in Appendix 5.12.

### **2. TREATMENT CRITERIA**

- a. The surface area of the entire storm water wetland shall be at least 1% of the total drainage area to the facility.
- b. At least 20% of the total water quality volume shall have a minimum depth of 4 feet (deep pool). The forebay and micro pool may meet this requirement. A minimum of 10% of the surface area shall be deep pool for a pocket wetland.

- c. A minimum of 30% of the total surface area shall have depth of 6 inches or less (high marsh), and at least 25% of the total surface area shall have a depth between 6 and 18 inches (low marsh).
- d. Water level fluctuations associated with water quality or stream protection volumes shall not exceed 3 feet.

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

No additional criteria.

### **4. CONTROLS**

No additional criteria.

### **5. GEOMETRY**

- a. An overall length-to-width ratio of 1.5:1 is recommended.
- b. Irregular flow paths shall be used to maximize flow length from inflow to outflow points. These paths may be achieved by constructing internal berms (high marsh wedges, rock filters).
- c. The bed of the storm water wetland shall be graded to create the maximum possible micro topography (irregular shoreline, islands, mud flats, deeper channels, benches, etc.) to enhance wetland diversity.
- d. A micro pool shall be located at the outlet of the storm water wetland to protect the low flow pipe from clogging and prevent sediment resuspension. The micro pool shall be 3 to 6 feet deep, and have a minimum surface area equivalent to that of the forebay.

### **6. PUBLIC SAFETY**

No additional criteria.

## **7. LANDSCAPING**

- a. A landscape plan shall be prepared by a qualified wetland consultant and indicate methods used to establish and maintain wetland coverage. Minimum elements of the plan include:

- Delineation of pondscape zones
- Selection of corresponding plan species
- Planting configuration
- Sequence for preparing wetland bed
- Schedule for planting

- b. A wetland buffer should extend 25 feet outward from the maximum water surface elevation. The minimum buffer for a pocket wetland shall be 15 feet.

## **8. MAINTENANCE**

If a minimum coverage of 50% is not achieved in the planted wetland zone after the second growing season, a reinforcement planting will be required.

## **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 5.12.
- 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 = 3.17 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 to 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.
- e. Warning signs prohibiting swimming and skating shall be posted for retention ponds.

## **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.