Mason County

Stormwater Runoff, Soil Erosion and

Sedimentation Control Guidelines

Prepared for:

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Article 1
General Requirements

1.01 General Requirements

A. The Stormwater Runoff, Soil Erosion, and Sedimentation Control Plan for commercial sites, industrial sites, and multiple family residential developments shall be prepared and sealed by a professional engineer licensed in the State of Michigan.

B. Best management practices shall be installed and maintained in accordance with the approved maintenance agreement.

C. Stormwater management and soil erosion control systems shall be designed to protect the public health, safety, and welfare and be visually attractive. No discharges of stormwater to a wetland, water body, or watercourse shall be allowed unless sediment is removed prior to discharge and stormwater discharges are limited to non-erosive velocities.

D. For large or phased developments, the applicant shall provide a general layout for the entire site. The layout shall indicate the different phases and stages of construction for the proposed development. The applicant shall provide ample area for all stormwater runoff, soil erosion and sedimentation control facilities, both temporary and permanent. An application for each subsequent phase of development shall follow the same procedures outlined in the Ordinance and these guidelines until the development is completed. Acceptance of preliminary layouts and early phases does not ensure approval of future permit applications.

E. As a minimum, all stormwater systems within public right-of-ways shall be designed in accordance with the Road Design Manual (Michigan Department of Transportation, 1995), the Roadside Design Guide (American Association of State Highway and Transportation Officials, 1989) and/or requirements of the Mason County Road Commission, in addition to the requirements of the Ordinance or these guidelines.

F. At a minimum, all construction practices shall be in accordance with the Michigan Department of Transportation standard specification, or as may be modified or approved by the Drain Commissioner, the Ordinance, or these guidelines.

G. Where applicable, temporary and permanent stormwater runoff, soil erosion and sedimentation control measures shall be designed in accordance with Mason County Standards and Specifications for Soil erosion and Sedimentation Control (Mason-Lake Soil Conservation District, 1997), the Michigan Soil Erosion and Sedimentation Control Guidebook (Michigan Department of Natural Resources, 1975) and the Guidebook of Best Management Practices for Michigan Watersheds (Michigan Department of Natural Resources, 1993).

H. Cluster development that minimizes the amount and the period of land disturbance shall be preferred over other types of development.

I. A natural vegetative buffer shall be maintained between earth change activities and all existing ponds, lakes, watercourses and wetlands. Buffer zones shall be a minimum of 25 feet from the ordinary high water mark or wetland perimeter. The distance may be reduced, if it is determined by the Drain Commissioner that it is not feasible or practicable to maintain this distance.

Article 2
Stormwater Management Facilities

2.01 Conveyance Facilities

A. Possible conveyance facilities include swales, channels and closed conduit sewers. In general, conveyance facilities such as swales that promote infiltration of stormwater are preferred over closed conduit storm sewers. Infiltration devices shall not be used where the stormwater could have a negative impact on drinking water aquifers and where infiltration will compromise the structural integrity of the measure.

2.02 Retention and Detention Facilities

A. The stormwater management alternatives discussed below are listed in order of preference. The applicant shall be responsible for determining the most appropriate measures based on existing and proposed site conditions.

1. Retention facilities that include, but are not limited to, infiltration basins and infiltration trenches. Retention facilities shall be located and designed in a manner that prevents contamination of useable drinking water aquifers.

2. Stormwater facilities that use both retention and detention where the first 0.5 inch of stormwater runoff is infiltrated and the remaining stormwater runoff is released at a peak rate equal to, or less than, the maximum allowable rate.

3. Detention facilities that maintain a permanent pool of water and release water at a peak rate equal to, or less than, the maximum allowable release rate.

4. Detention facilities that are normally dry and release water at a peak rate equal to, or less than, the maximum allowable release rate. It should be recognized that water quality for this type of facility, and the one above, can be enhanced using a sand filter or other filtering medium.

B. The Drain Commissioner may require the applicant to provide hydrogeological evaluations necessary to document that there will be no impact on any private or public drinking water well, or useable aquifer, due to stormwater infiltration from the proposed stormwater management facilities.

C. It is recommended that a two-stage design for retention and/or detention basins be used on sites where impervious surfaces exceed 5 acres in size, as well as sites identified by the Drain Commissioner as requiring special protection for water quality purposes. In such cases, the upper (first-stage) detention area shall be designed to provide pretreatment of the stormwater before being discharged to the retention and/or detention facility. Pretreatment alternatives include a shallow pool or forebay, wetland or other biofiltration area or sand filter. The lower (second-stage) area shall be designed as an infiltration or detention basin, or combination of both, to optimize pollutant treatment capabilities.

2.03 Design Guidelines

A. General Design Criteria

1. Retention and/or detention facilities shall be designed to store, at a minimum, a 25-year storm event. Detention and/or retention facilities shall provide an emergency overflow spillway designed to safely pass the 100-year storm event. Where there is no legal authority to discharge stormwater off-site and the proprietor cannot provide for an emergency overflow system, the retention facility shall be designed to store back-to-back 100-year storm events. See Section C of this Article for design procedures.

2. For a proposed site, the maximum allowable release rate shall be 0.1 cubic feet per second (cfs) per acre of tributary area. Off-site drainage may either be stored and released in the on-site stormwater management facilities, or it may be diverted directly to the outlet of the site. If the

applicant elects to store and release off-site stormwater, then the release rate is based upon the total area tributary to the facility.

3. Retention facilities shall not be used unless the soil has a minimum infiltration rate of 0.5 inches per hour and a clay content of less than 30 percent.

4. Drainage wells, commonly known as dry wells, shall be discouraged as a stormwater control method. If the use of stormwater retention or detention is not feasible, the installation of drainage wells may be considered at the discretion of the Drain Commissioner.

5. For all retention facilities, pretreatment measures shall be provided that remove all sediment before stormwater is discharged into the retention facility. Permanent sediment removal facilities may include, but are not limited to, catch basins with sumps, premanufactured sediment removal products, sediment basins, silt traps, sand filters and vegetative filter strips.

6. Developments that have the potential to produce pollutants that exceed water quality standards shall provide pretreatment facilities to meet water quality standards before discharging into stormwater management facilities. All stormwater management systems handling water that exceeds water quality standards shall make provisions to prevent discharge of these pollutants to surface or groundwater.

7. Stormwater basins with pools of water shall have one or more to the following safety features: safety ledges which are at least 10 feet wide; aquatic vegetation that discourages wading; slopes below normal pool levels that do not exceed 6 horizontal to 1 vertical, and/or fencing to prevent unauthorized access to the basin.

8. Stormwater collection and conveyance facilities shall be designed in such a manner so as to maintain stormwater at non-erosive velocities.

B. Stormwater Collection System

1. The conveyance system shall contain two components: A primary and a secondary stormwater conveyance system. The primary stormwater conveyance system shall be designed to safely convey, at a minimum, a 10-year storm to the detention and/or retention facilities. The primary system may consist of pipes, swales, and ditches, as appropriate. Other conveyance systems will be considered at the discretion of the Drain Commissioner. The secondary conveyance system shall be able to safely convey a 100-year storm event to the detention and/or retention facilities. The secondary conveyance system may consist of, but not be limited to, swales, streets, gutters, parking lots and lawn areas. The secondary conveyance system shall limit the maximum depth of flow in parking lots and streets to 10 inches.

2. The following formulas shall be used for determination of rainfall intensity:

10 year: $i = \frac{148}{t + 24}$

25 year $i = \frac{162}{t + 20}$

100 year $i = \frac{200}{t + 22}$

Where t is the time of concentration as determined by standard engineering practices.

C. Design Procedures

1. The following tables shall be used for selection of a runoff coefficient:

Table 1.
Average Runoff Coefficients
for Urban Areas:
5 and 10-year Design Frequency

Description of Area	Runoff Coefficients
Business	
Downtown areas	0.70 to 095
Neighborhood areas	0.50 to 0.70
Residential	
Single family areas	0.30 to 0.50
Multiple units, detached	0.40 to 0.60
Multiple units, attached	0.60 to 0.75
Residential (suburban)	0.25 to 0.40
Apartment dwelling areas	.050 to 0.70
Industrial	
Light areas	0.50 to 0.80
Heavy areas	0.60 to 0.90
Parks, cemeteries	0.10 to 0.25
Playgrounds	0.10 to 0.25
Railroad yard areas	0.20 to 0.40
Improved areas	0.10 to 0.30

Character of Surface	Runoff Coefficients
Streets	
Asphaltic	0.70 to 0.95
Concrete	0.80 to 0.95
Brick	0.70 to 0.85
Drives and walks	0.70 to 0.85
Roofs	0.75 to 0.95
Lawns, sandy soil	
Flat (2 percent)	0.05 to 0.10
Average (2 to 7 percent)	0.10 to 0.15
Steep (7 percent)	0.15 to 0.20
Lawns, heavy soil	
Flat (2 percent)	0.13 to 0.17
Average (2 to 7 percent)	0.18 to 0.22
Steep (7 percent)	0.25 to 0.35

Source: Design and Construction of Sanitary and Storm Sewers. ASCE Manual of Engineering Practice, No. 37, 1960.

Table 2.
Average Runoff Coefficients
for Rural Areas

Topography and Vegetation	Soil Texture: Open Sandy Loam	Clay and Silt Loam	Tight Clay
Woodland			
Flat	0.10	0.30	0.40
Rolling	0.25	0.35	0.50
Hilly	0.30	0.50	0.60
Pasture			
Flat	0.10	0.30	0.40
Rolling	0.16	0.36	0.55
Hilly	0.22	0.42	0.60
Cultivated Land			
Flat	0.30	0.50	0.60
Rolling	0.40	0.60	0.70
Hilly	0.52	0.72	0.80

Note: Flat (0-5% slope); Rolling (5-10% slope); Steep (10-30%)

Source: Schwab, R.J. et al. (1971). Elementary Soil and Water Engineering 2nd. ed. New York: John Wiley.

2. Detention Basins

Determine the amount of acreage (*A*) contributing runoff to the detention basin and the weighted runoff coefficient (*C*).

Determine the maximum allowable outflow (Q_3), in cubic feet per second (cfs) based on a maximum release rate of 0.1 cfs per acre of contributing area.

$$Q_3 = 0.1 \text{ cfs/acre} \times A \qquad (A \text{ in acres, } Q_3 \text{ in cfs})$$

Calculate the maximum storage time (*T*) using the following equation:

$$T = -20 + \text{square root of } (48{,}600 \times C) \qquad (T \text{ in minutes})$$

Calculate the minimum storage volume (*V*) in cubic feet using the following equation:

$$V = \left(\frac{9720 \times T}{T + 20} - \frac{4 \times T}{C}\right) C \times A \qquad (T \text{ in minutes, } A \text{ in acres, } V \text{ in cubic feet})$$

Determine the type of outlet devices (i.e., orifice, weir, pipe, etc.) and size accordingly.