

1.01 TECHNICAL STANDARDS AND REFERENCES

A. Erosion Control and Stormwater Management Technical Standards

All drainage facilities and practices required to comply with the Erosion Control and Stormwater Management Ordinances shall incorporate technical standards and design methods specified in this document, maintained and periodically updated by the City Engineer. Where not superceded by stricter requirements in this document, the following standards are also incorporated by reference:

1. Applicable design criteria, standards, and specifications identified in the Wisconsin Department of Natural Resources Stormwater Technical Standards.
2. Other design guidance and technical standards identified or developed by the Wisconsin Department of Natural Resources under subchapter V of chapter NR 151, Wisconsin Administrative Code.
3. WDNR is required by recent rule revisions to develop technical standards to provide guidance for measurement and evaluation of this performance standard. Measurement and evaluation of this performance standard shall be based on guidance published by the WDNR. Until such guidance is published, total suspended solids removal shall be achieved to the maximum extent practical through implementation of approved Best Management Practices (BMPs).

1.02 PRECIPITATION DEPTH, DISTRIBUTION, AND AVERAGES

A. Precipitation Depths

The following references may be used as a source for design rainfall depths:

1. United States Department of Commerce, *Rainfall Frequency Atlas of the United States*, Weather Bureau Technical Paper No. 40, May 1961.
2. Huff, Floyd A., and Angel, James R., *Rainfall Frequency Atlas of the Midwest*, Midwestern Climate Center, Bulletin 71, 1992.

B. Precipitation Distribution

1. Where Technical Paper No. 40 rainfall depths are used, they shall be used in conjunction with the SCS Type II rainfall distribution for a 24-hour storm duration. Technical Paper No. 40 rainfall depths shall not be allowed with Huff rainfall distributions.
2. Where Bulletin 71 rainfall depths are used, they shall be used in conjunction with the appropriate quartile Huff rainfall distribution for the storm duration producing the highest peak discharge.

C. Average Annual Rainfall

For applications requiring use of average annual rainfall, recorded City of Madison depths for March 12 through December 2, shall be used.

1.03 DESIGN METHODS

A. Stormwater Runoff Calculations

1. For design of volume-dependent practices (detention basins, retention basins, infiltration systems), a hydrograph-producing method hydrologic model shall be developed. The following computer programs shall be allowed:
 - a. TR-55
 - b. TR-20
 - c. HEC-1
 - d. HEC-HMS
 - e. HydroCAD
 - f. Other computer programs as allowed by the City Engineer.
2. The Rational Method may be used to calculate peak discharges for tributary areas less than 20 acres for purposes of conveyance system design.
3. Estimation of Required Storage Volume
 - a. Final detention basin sizing shall be based on hydrograph routing through the basin with the proposed outlet structure.
 - b. The Soil Conservation Service TR-55 Approximate Method may be utilized to calculate the required storage volume. This may be used for developments with watershed areas of less than 25 acres which do

not involve significant off-site drainage that must be passed through the detention basin or routing of stormwater runoff through a series of detention basins. Soil Conservation Service Type II rainfall shall be utilized to estimate storage volume and peak inflow requirements.

4. Stormwater Conveyance System Design
 - a. Storm sewers shall be designed in accordance with procedures described in Procedures 13-25-35 through 13-25-45 of the Wisconsin Department of Transportation (WisDOT) Facilities Design Manual (FDM).
 - b. Ditches shall be designed in accordance with procedures described in Procedures 13-30-5 through 13-30-10 of the WisDOT FDM.
 - c. Cross culverts shall be designed in accordance with procedures described in Procedure 13-15-10 of the WisDOT FDM.
 - d. Open drainage inlet pipes or culverts with any opening dimension in excess of eighteen (18) inches shall be equipped with debris grates having an exposed area at least seven (7) times the pipe opening area to avoid backwater accumulations from trash buildup and unsafe stream velocities and a maximum opening size of six (6) inches. Drainage piping outfalls with any opening dimension in excess of thirty-six (36) inches shall be protected from unauthorized entry by fencing, partial or total submergence of the outlet, debris grates or other methods approved by the City Engineer unless in such a location as to render routine maintenance operations impossible. Outfalls and their channels shall be protected from damages due to scour and erosion to the satisfaction of the City Engineer.
 - e. When, on the basis of the soils information, the City Engineer determines that the ground water elevation is less than nine (9) feet below the proposed street centerline elevation and the adjacent lots have access to a storm drainage piping system, the subdivider shall be required to provide approved sump pump laterals from the storm sewer piping system to the property line of each lot for connection to by the property owner.
 - f. Agricultural drain tiles which are disturbed during construction shall be restored, reconnected or connected to public storm drainage facilities.

1.04 DESIGN CRITERIA

A. Drainage System Requirements

The subdivider shall install all the storm drainage facilities indicated on the plans required in Subsection (a) of Sec. 13-9-58 of the Subdivision Regulations.

1. All streets shall be provided with an adequate storm drainage system. The street storm system shall serve as the primary drainage system and shall be designed to carry street, adjacent land and building storm water drainage. No storm water shall be permitted to be run into the sanitary sewer system within the proposed subdivision.
2. The design of the off-street drainage system shall include the watershed affecting the subdivision and shall be extended to a watercourse or ditch adequate to receive the storm drainage. When the drainage system is outside the street right-of-way, the subdivider shall make provisions for dedicating an easement of the City to provide for the future maintenance of said system.
3. The subdivider shall adequately protect all ditches to the satisfaction of the City Engineer. Ditches and open channels shall be seeded, sodded or paved depending upon grades and soil types. Ditches or channels will be protected per City of Onalaska Erosion Control Specifications.
4. Where a land division is traversed by a watercourse, drainage way, channel or stream:
 - a. There shall be provided a storm water easement or drainage right-of-way conforming substantially to the lines of such watercourse and such further width or construction, or both, as will be adequate for the purpose and as may be necessary to comply with this Section; or
 - b. The watercourse, drainage way, channel or stream may be relocated in such a manner that the maintenance of adequate drainage will be assured and the same provided with a storm water easement or drainage right-of-way conforming to the lines of the relocated watercourse, and such further width or construction, or both, as will be adequate for the purpose and may be necessary to comply with this Section; or
 - c. Wherever possible, drainage shall be maintained in an easement by an open channel with landscaped banks and adequate width for maximum potential volume flow. In all cases, such easements shall be of a minimum width established at the high water mark or, in the absence of such specification, not less than thirty (30) feet.

5. Whenever a parcel is to be subdivided or consolidated and embraces any part of a drainage way identified on a City Comprehensive Storm Water Management Plan, master plan and/or official map or any portion thereof, such part of said existing or proposed public drainage way shall be platted and dedicated by the subdivider as an easement or right-of-way in the location and at the size indicated along with all other streets and public ways in the land division. Whenever any parcel is to be subdivided or consolidated and is part of a drainage district established under the authority of Chapter 88, Wis. Stats., the subdivider shall petition the Circuit Court to transfer the jurisdiction of that portion of the drainage district being subdivided or consolidated to the City in accordance with Chapter 88.83, Wis. Stats.
6. The subdivider shall dedicate sufficient land area for the storage of storm water to meet the needs to be created by the proposed land development and in accordance with the standards for on-site detention and as determined by the City Engineer. Whenever a proposed storm water management facility (e.g., detention or retention basin) shown on the Comprehensive Storm Water Management Plan, Master Plan and/or Official Map is located, in whole or in part, within the proposed land division, ground areas for providing the required storage capacity in such proposed public facility shall be dedicated to the public to the requirements of the master plan and/or official map. Storage areas necessary to serve areas outside the land division shall be held in reserve for a period of five (5) years from the date of the final plat approval for future acquisition by the City or other appropriate agency having the authority to purchase said property. The subdivider and City shall enter into an agreement with the City to provide for the purchase of the lands held in reserve prior to the conclusion of the five (5) year reserve period.
7. The subdivider shall install all minor drainage system components necessary to reduce inconvenience and damages from frequent storms. Minor drainage components shall include all inlets, piping, gutters, channels, ditching, pumping and other facilities designed to accommodate the post-development runoff resulting from a five (5) year storm [ten (10) years for commercial-industrial properties]. Temporary accumulations of storm runoff from ponding or flowing water, in or near minor system components, shall be permitted providing such accumulations do not encroach on any traffic lane of any collector or arterial street, nor on the center twenty-four (24) feet of any local street, except on cul-de-sac or permanently dead-end streets serving less than ten (10) dwelling units, where such accumulations may not overtop the curb. In drainage ways and drainage way easements, accumulations of water shall not inundate beyond the limits of the drainage way or drainage way easement. Cross street drainage channels (valley gutters) shall not be permitted except on cul-de-sac or permanent dead-end streets serving less than ten (10) dwelling units and where the minimum grade in the valley gutter

and street gutter between the valley gutter and the next downstream drainage inlet is not less than one percent (1%).

8. The subdivider shall install all major drainage system components necessary to reduce inconvenience and damages from infrequent storms. Major system components shall include large channels and drainage ways, streets, easements and other paths and shall be capable of accommodating post-development runoff in excess of that accommodated by minor system components resulting from a one hundred (100) year storm. On local and collector streets and drainage ways and drainage easements, accumulations of water shall not inundate any buildings at the ground line, unless such buildings are flood-proofed. On arterial streets and in commercial zoning districts, accumulations of water shall not inundate any buildings at the ground line, unless such buildings are flood-proofed and the depth of water at the street crown shall not exceed six (6) inches to permit operation of emergency vehicles.

B. Wet Detention Basins

Design in accordance with the Wet Detention Basin Conservation Practice Standard (WDNR), Section V.A.1, 2, 4-11 (Appendix A).

In addition, subdivisions may employ on-site detention to control erosion and sedimentation, reduce the post-development peak runoff rate or temporarily store storm water runoff due to inadequate downstream drainage facilities. The detention (storage) facilities shall be subject to regulation in accordance with the following standards:

1. Where on-site detention is temporarily employed for erosion and sedimentation control, the detention facilities shall safely contain the predevelopment runoff from a twenty-five (25) year storm event of twenty-four (24) hour duration within the limits of the facility.
2. Where on-site detention is permanently employed to reduce the post-development peak runoff, the detention facility at a minimum shall safely contain the difference between the pre-developed and the post-developed runoff from a two (2), five (5), ten (10), twenty-five (25) and one hundred (100) year storm event of twenty-four (24) hour duration within the limits of the facility.
3. Detention facility post-development peak discharge rates shall not exceed the pre-development peak discharge rates for the same storm events and durations.

4. All temporary detention facilities shall safely contain or pass the runoff from the one hundred (100) year storm event of twenty-four (24) hour duration.
5. All permanent detention facilities shall safely contain the runoff from the one hundred (100) year storm event of twenty-four (24) hour duration on public properties without inundating the travel lanes of any arterial street, the center ten (10) feet of any collector street or the top of the curb on any local street.
6. The storage of storm water runoff shall not encroach on any public park (except parks designed with detention facilities) or any private lands outside the land division unless an easement providing for such storage has been approved and recorded for said lands.
7. All detention facilities shall be designed with the safety of the general public and any considerations for ease of maintenance as top proprieties.
8. The Common Council, upon recommendation by the City Engineer, may require the installation of fencing or other such security measures in detention facilities with excessively long draw down times or permanent water features, or other features requiring additional security for safety reasons.

C. Dry Detention Basins

Section 1.04, A., 1-8 also apply to Dry Detention Basins.

1. Minimum grades for the bottom of the basin shall be 2 percent unless underdrain is installed. If underdrains are installed, the minimum grade shall be 0.5 percent.
2. Basin side slopes shall not be steeper than 4:1 or flatter than 10:1.
3. Dry detention basins shall be designed to drain completely within 24 hours after the storm event.
4. Forebays shall be used to the maximum extent practical to prevent concentrated flow from entering the basin and allow sediment to settle prior to entering the basin.
 - a. Forebay area should be 10 to 25 percent of the basin's surface area.
 - b. Length-to-width ratio shall be at least 2:1.
 - c. The forebay shall be located opposite of the basin's outlet to increase detention time.

5. The basin shall be designed with an emergency spillway designed to convey the 100-year peak discharge entering the basin.
6. The basin shall have a ponding depth of less than 10 feet, with at least 1 foot of freeboard above the 100-year flood elevation or emergency spillway elevation, whichever is higher.
7. The basin shape should be designed with a length-to-width ratio of 3:1 in either a long narrow shape or a teardrop shape, to the maximum extent practical.
8. The basin shall be seeded with vegetation that is tolerant of inundation.
9. The basin outlet structure shall discharge to a stable outlet.

D. Storm Sewers

1. Unless otherwise approved by the City Engineer, all storm sewer in the public right-of-way (R/W) shall be constructed of reinforced concrete pipe of appropriate class for the expected loading. Storm sewer materials outside of the R/W shall be subject to approval of the City Engineer.
2. The minimum allowable pipe diameter shall be 12 inches.
3. Sewer grades shall be designed so that, in general, a minimum of 3-foot cover is maintained over the top of the pipe. Pipe cover less than the minimum may be used upon site-specific approval by the City Engineer. Uniform slopes shall be maintained between inlets, manholes, and inlet to manhole. Minimum and maximum allowable slopes shall be those capable of producing velocities between 2 and 12 feet per second, respectively, when the sewer is flowing full. Velocities lower than the minimum or higher than the maximum may be used upon site-specific approval by the City Engineer.
4. The maximum distance for overland flow of stormwater runoff to an underground storm sewer system shall be 600 feet unless a longer distance is approved by the City Engineer.

E. Ditches

1. Ditch side slopes shall be no steeper than 4:1.
2. The minimum ditch grade is 1 percent. Ditch grades of less than 1 percent may be allowed but may require ditch underdrains.

3. Ditches and open channels shall be protected with erosion mat as necessary to prevent erosion. The erosion mat shall be of an approved type and application specified in the “Erosion Control Product Acceptability List,” most current revision, by the WisDOT.
4. Where ditches are utilized in either the minor or major drainage system, they shall be designed so as to minimize maintenance requirements and maximize safety. Drainage easements (in lieu of dedications) shall be utilized to accommodate ditches provided adequate access by the City for maintenance of drainage capacity. Side slopes shall not exceed four-to-one (4:1) slope. Ditches with grades of 0.75% or less, or where subject to high ground water, continuous flows, or other conditions as determined by the City Engineer that would hamper maintenance operations due to consistently wet conditions shall have an under drain system or an approved design by the City Engineer.
5. In areas where invert paving is not required, the ditch bottom shall be grass. If the ditch has a bare soil bottom or the natural grasses in the ditch are disturbed due to development operations, the ditch bottom shall be sodded and securely staked to one (1) foot above the high-water elevation. Other disturbed areas shall be seeded and prepared in accordance with the City’s Erosion Control requirements. Velocities for grass-lined channels shall not exceed that which cannot be accommodated by best management practices.

F. Culverts

1. Culverts and similar structures shall have a capacity that meets or exceeds the capacity of the surface drainageway and shall be a minimum of 18 inches in diameter for culverts under roadways and 12 inches for culverts under private entrances. The flowline of a culvert shall match the flowline of the surface drainage way. Submitted plans shall indicate the sizes for all culverts including the opening size of culverts for private entrances.
2. No plastic culvert piping is allowed.
3. A minimum of 2 feet of cover shall be maintained over culverts under roadways and 18 inches for culverts under private entrances. If these cover standards cannot be met, backfill around and over the culverts shall be slurry backfill or ready-mix concrete according to the City’s specifications.
4. Culvert backfill shall be compacted granular fill material. Culverts shall be properly bedded.

5. Culverts shall not create backwater that adversely impacts upstream properties. Design of new culverts shall consider impacts of future upstream development.
6. End sections shall be provided for all culverts. Grates shall be required on end sections for all culverts greater than 18 inches in diameter.