

33 40 00 STORMWATER UTILITIES

1. Applicability

- 1.1. The installation, construction, alteration, and repair of the storm sewer utility system beginning five feet from the building foundation on any and all University of Minnesota property in the state of Minnesota.

2. General Information

- 2.1. Ownership of the storm sewer system varies by Campus and location throughout the state of Minnesota. The UMN Civil Engineer shall be consulted regarding jurisdiction/ownership during feasibility and/or pre-design.
- 2.2. Post construction permanent stormwater treatment systems shall meet the requirements set forth in 33 46 00 - Permanent Stormwater Treatment System Standards.
- 2.3. For any project with proposed permanent stormwater treatment systems, regardless of project size, the Engineer of Record shall complete the Stormwater Treatment System Design Worksheet (Appendix M) during design.
 - 2.3.A. Refer to 33 46 00 - Permanent Stormwater Treatment Systems for submittal requirements.
- 2.4. Depressed paved areas exposed to rainfall or snowmelt shall have area drains that flow to an underground storm sewer pipe unless designed as part of a stormwater treatment facility.
- 2.5. **PROHIBITED:** Roof discharges to the ground that flow over a sidewalk or into the street.
- 2.6. **PROHIBITED:** Creating adverse conditions, such as ponding or flooding, including on neighboring properties.
- 2.7. **PROHIBITED:** Non-stormwater discharges to the storm sewer system.
 - 2.7.A. Non-stormwater discharges or flows authorized under the Minnesota Pollution Control Agency Small MS4 General Permit MNR040000 (November 16, 2020 issuance date), are listed in Item 3.2 of the Permit.

3. Permits

- 3.1. Additions, connections, and/or modifications to the storm sewer system will require a Utility Permit from the University Building Codes Department.
- 3.2. Construction projects may require a Construction Stormwater Permit from the MPCA. See 31 25 00 - Erosion and Sedimentation Controls for more information.
- 3.3. Connections to storm sewer systems not owned by the University may require permits from the owner.
- 3.4. Other permits may apply.

4. Acceptable Materials

- 4.1. Reinforced Concrete Pipe (RCP)
 - 4.1.A. Pipe and fittings shall conform to the latest requirements of ASTM C76 Class 4 with confined rubber O-ring gasketed joints (R-4) for storm sewer.
 - 4.1.B. Joints shall meet the requirements of ASTM C361 and ASTM C443.
 - 4.1.C. Shall conform to the latest MnDOT Standard Specification 3236.

- 4.2. Polyvinyl Chloride Pipe (PVC)
 - 4.2.A. Pipe and fittings shall conform to the latest requirements of ASTM D3034 and ASTM F679 for the size, standard dimension ratio (SDR), and strength requirements.
 - 4.2.B. The grade used shall be resistant to aggressive soils or corrosive substances in accordance with the latest requirements of ASTM D543.
 - 4.2.C. Unless specified otherwise, all pipe and fittings shall be a minimum thickness of SDR-26.
 - 4.2.C.1. Connections shall be push-on with elastomeric gasket joints bonded to the inner wall of the gasket recess of the bell socket.
 - 4.2.C.2. Joints shall conform to the latest requirements of ASTM D3212.
 - 4.2.C.3. Pipe-to-pipe Fernco connections are allowed ONLY with approval from the UMN Civil Engineer.
 - 4.2.D. Diameters 10” and smaller
 - 4.2.D.1. Pipes shall be PVC Schedule 40 or greater with solvent cement joints.
 - 4.2.D.2. Pipe and fittings shall conform to the latest requirements of ASTM D1785 and ASTM D2665.
 - 4.2.E. Perforated subsurface drainage
 - 4.2.E.1. Pipe and fittings shall meet the latest requirements of MnDOT Standard Specification 3245.
- 4.3. Ductile Iron Pipe
 - 4.3.A. Pipe shall conform to the latest requirements of AWWA C115 or C151.
 - 4.3.B. Thickness design shall conform to the latest requirements of AWWA C150.
 - 4.3.C. Fittings shall conform to the latest requirements of AWWA C110 or AWWA C153.
 - 4.3.D. All fittings shall be furnished with cement mortar lining conforming to the latest requirements of AWWA C104 for standard thickness lining.
 - 4.3.E. All exterior surfaces of the pipe and fittings shall have an asphaltic coating at least one mil thick, or approved equivalent.
 - 4.3.F. Rubber gasket joints for ductile iron pressure pipe and fittings shall conform to the latest requirements of AWWA C111.
- 4.4. Dual-Wall Corrugated Polyethylene Pipe (PE/HDPE)
 - 4.4.A. Pipe diameters 12” through 60”
 - 4.4.B. Pipe and couplings shall conform to AASHTO M294 Type “S” pipe.
 - 4.4.C. Conveyance pipes shall conform to Design 18 of the AASHTO Standard Specifications for Highway Bridges for storm sewer pipe sizes 12 in through 36 in.
 - 4.4.D. Joints shall be watertight with bell and spigot push-on type joints and conform to ASTM D3212.
 - 4.4.E. Gaskets shall conform to ASTM F477, elastomeric seals.
 - 4.4.F. Pipe and fittings shall be manufactured from high-density polyethylene (HDPE) virgin compounds.
- 4.5. Corrugated Polyethylene Drainage Tubing (PE/HDPE)
 - 4.5.A. Pipe diameters 3” through 10”
 - 4.5.B. Pipe and couplings shall conform to AASHTO M252.

- 4.5.C. Pipe and fittings shall meet MnDOT Standard Specification 3278.
- 4.5.D. For application of perforated subsurface drainage pipe only.
- 4.6. Reinforced Concrete Box Culverts
 - 4.6.A. Conform to MnDOT Standard Specification 2412 and MnDOT Standard Plans Manual, Box Culverts.
 - 4.6.B. Concrete ties shall be used at all joints.
 - 4.6.B.1. Ties shall meet MnDOT Standard Specification 3145.
 - 4.6.C. Box Culverts used for storage
 - 4.6.C.1. See UMN standard plate STM-0020 Box Culvert Watertight Joint.
- 4.7. Cast-in-Place Concrete (CIP)
 - 4.7.A. Conform to MnDOT Standard Specification 2411.
- 4.8. Pipe Lining Material
 - 4.8.A. Polyethylene liner
 - 4.8.A.1. Conform to MnDOT Standard Specification 2507 and MnDOT Standard Specification 3249.
 - 4.8.B. Cured in-place liner (CIPP)
 - 4.8.B.1. Conform to City Engineers Association of Minnesota Standard Specification section 2631.

5. Storm Sewer Main Distribution Piping

- 5.1. Storm sewer pipe shall be designed with adequate slope to produce a minimum flow of 3 ft/s (self-cleaning velocity) when flowing at full capacity.
- 5.2. Pipe diameter shall be (minimum) sized based on a 10-year design return frequency storm event.
- 5.3. Pipe diameter shall be (minimum) 12" when carrying surface drainage.
- 5.4. Pipe material shall be RCP.
 - 5.4.A. UMD: may allow HDPE when approved by the UMN Civil Engineer.
- 5.5. Storm sewer discharges shall be designed to not exceed the capacity of the existing downstream pipe.
 - 5.5.A. If a permanent stormwater system is required to provide rate control to not exceed the downstream pipe capacity, the Engineer of Record shall complete the Stormwater Treatment Design Worksheet (Appendix M) during design.
- 5.6. Storm water inlets shall be sized and located to avoid standing water in driving lanes and pedestrian sidewalks during the design storm.
- 5.7. Access structures shall be provided at all changes in vertical and horizontal alignment.
- 5.8. Pipe shall be laid straight and uniform between structures.
- 5.9. A structure shall be provided in the storm sewer main where it connects to a building service. No branch fittings, such as tees, wyes, etc. are allowed.
- 5.10. Storm sewer mains to be installed with a minimum cover of 3 ft.
 - 5.10.A. Storm sewer mains installed with less than 3 ft of cover shall be approved during design by the UMN Civil Engineer and shall have insulation installed above the pipe.
 - 5.10.B. See 33 05 04 for insulation installation requirements.
- 5.11. Storm sewer mains crossing water distribution piping
 - 5.11.A. See 33 10 00 section 14 - Water and Sewer Crossings.

5.12. **PROHIBITED:** Deflections in horizontal or vertical pipe alignment between structures.

5.13. **PROHIBITED:** Blind connections to the storm sewer system.

6. Storm Sewer Service Laterals

6.1. Storm sewer service laterals shall be installed from the building to the sewer main.

6.2. Storm sewer service laterals shall be a gravity flow system.

6.3. Storm sewer service laterals shall be a minimum diameter of 6" with a minimum slope of 1% (0.01 ft/ft).

6.4. Storm sewer lateral pipe material may be PVC or DIP.

6.5. Pipe shall be laid straight and uniform between the building and the main, perpendicular to the building.

6.6. An access structure shall be provided at all changes in horizontal alignment, vertical alignment or change in pipe material.

6.7. Storm sewer service laterals to be installed with a minimum cover of 3 ft.

6.7.A. Pipes installed with less than 3 ft of cover shall be approved during design by the UMN Civil Engineer, and shall have insulation installed above the pipe.

6.7.B. See 33 05 00 for insulation installation requirements.

6.8. **PROHIBITED:** Deflections in horizontal or vertical pipe alignment between structures.

6.9. **PROHIBITED:** Blind connections to storm sewer.

7. Subsurface Drainage

7.1. General Information

7.1.A. For building foundation drainage, see Division 22.

7.2. Pipe and Fittings

7.2.A. Material

7.2.A.1. Polyvinyl Chloride (PVC)

7.2.A.2. Corrugated Polyethylene Drainage Tubing

7.2.A.2.a. **PROHIBITED:** UMD: Installation under paved surfaces.

7.2.A.3. Fittings shall be the same material as the pipe.

7.2.B. All perforated pipe drains shall have uniform slots.

7.2.B.1. **PROHIBITED:** Field drilled holes

7.2.C. Junctions and turns to be wyes or bends, suitable for cleaning and inspection.

7.2.D. Connections to storm structures shall be fully grouted and watertight.

7.2.E. Upgrade ends of pipe shall be closed with caps.

7.2.F. Cleanout shall be installed at upgrade ends of pipes in stormwater filtration systems.

7.2.F.1. Cleanout shall be PVC

7.3. Filter Material

7.3.A. Fabric

7.3.A.1. MnDOT Geotextile, Type 1 shall meet the latest requirements of MnDOT Standard Specification 3733.

7.3.A.2. Place the fabric seam at the top of the pipe, opposite the perforations.

7.3.A.3. Fabric seams at fittings/connections shall be mechanically fastened or overlap adjoining geotextile at least 6".

7.3.B. Medium Filter Aggregate

7.3.B.1. Meet the latest requirements of MnDOT Standard Specification 3149.2J.1.

7.3.C. Fine Filter Aggregate

7.3.C.1. Meet the latest requirements of MnDOT Standard Specification 3149.2J.2.

7.3.D. PROHIBITED: Drain tile sock

7.4. Drain Discharge

7.4.A. Connection to structures

7.4.A.1. Drain tile pipe connections shall be fully grouted inside and outside of the structure.

7.4.B. Open discharge

7.4.B.1. Screen drain openings with a rodent shield.

7.4.B.2. All open pipe ends shall be free-flowing.

7.4.C. UMD: Construct precast concrete headwall or approved equal at drain tile pipe ends located in grassy areas.**8. Structures and Appurtenances**

8.1. Precast concrete riser sections and appurtenant units used in the construction of structures shall conform with the requirements of the UMN standard plates, MnDOT 2506 and the following supplementary provisions:

8.1.A. The precast sections and appurtenant units shall conform to all requirements as shown on the UMN standard plates.

8.1.B. Base shall be solid precast concrete with a poured floor sloped toward the invert of the outlet pipe, conforming to MnDOT standard plate 4011.

8.1.B.1. Base may be poured in place with the floor sloped toward the invert of the outlet pipe, upon approval by the UMN Civil Engineer.

8.1.C. Pipe connections to the structure shall be fully grouted inside and outside the structure, unless fully watertight connections are required.

8.1.C.1. Fully watertight connections shall be gasketed joints.

8.1.D. Joints of manhole riser sections shall be tongue and groove with rubber "O" ring or profile gaskets.

8.1.E. A minimum of two 2" adjusting rings shall be installed. A maximum of five, 2" adjusting rings shall be installed.

8.1.E.1. Concrete: Adjusting rings shall be installed with a full bed of mortar between each ring.

8.1.E.2. HDPE: Follow manufacturers instructions for installation.

8.1.E.3. Modifications to existing structures shall adhere to minimum and maximum adjusting ring requirements.

8.1.F. Structures with a build height greater than 4 ft shall install steps spaced 16" on center over the downstream outlet.

8.1.F.1. Steps shall be Neenah R-1980E or similar.

8.2. Structures

8.2.A. Access Structures and Catch Basins

8.2.A.1. Barrels shall be a minimum of 48" diameter with an access of 27" diameter.

8.2.A.2. Top section may be as follows:

8.2.A.2.a. MnDOT standard plate 4005 Type B for eccentric cones

1. PROHIBITED: MnDOT standard plate 4005 Type A for concentric cone

8.2.A.2.b. MnDOT standard plate 4020 for top slabs

8.2.A.2.c. MnDOT standard plate 4022 for 3'x2' catch basins

8.2.A.3. See UMN standard plate STM-0002.

8.2.B. **Curblin**e Catch Basins

Building Standards

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- 8.2.B.1. UMTC: Build height of five feet and shorter
 - 8.2.B.1.a. Barrel shall be one 2 ft x 3ft rectangular section with a maximum height of 4 ft.
 - 8.2.B.1.b. See UMN standard plate STM-0003.
- 8.2.B.2. Gutter line shall be, at a minimum, the same width as the catch basin casting.
- 8.2.B.3. Should be located between parking stalls, if located in a parking area.
- 8.2.B.4. UMD: Open grates set in concrete shall have a gutter stamp. See UMN standard plate STM-4001.
- 8.2.C. Area Drain Catch Basins
 - 8.2.C.1. Build height of 42" and shorter
 - 8.2.C.1.a. Barrel may be 27" diameter if there is only an outlet.
 - 8.2.C.1.b. See UMN standard plate STM-0004.
- 8.2.D. Structures with Sumps
 - 8.2.D.1. Sump depth shall be a minimum of 3 ft below the outlet invert.
 - 8.2.D.1.a. Sump depth to be designed by the Engineer of Record.
 - 8.2.D.1.b. Sump depth shall be based on the outlet pipe diameter.
 - 8.2.D.1.c. Sump invert shall not exceed 20 ft below final grade.
 - 8.2.D.2. Outlet invert to have a skimmer and/or flow dissipation device.
 - 8.2.D.2.a. Skimmer device
 1. Shall have a port that allows access to the outlet pipe.
 2. Shall have an anti-siphon device.
 - 8.2.D.3. Should not be located inside of parking stalls.
 - 8.2.D.4. See UMN standard plate STM-0005.
- 8.2.E. Cleanouts/Inspection Risers
 - 8.2.E.1. Shall be sized to allow maintenance and visual inspection.
 - 8.2.E.2. Covers shall be suitable for the location and shall consider long-term durability and aesthetics.
 - 8.2.E.3. Cleanout structure shall connect to the pipe with a wye fitting oriented in the direction of flow.
 - 8.2.E.4. Inspection riser shall connect to the pipe with a tee fitting oriented vertically.
 - 8.2.E.5. Should not be located inside of parking stalls.
- 8.2.F. Trench Drains
 - 8.2.F.1. Use of trench drains should be limited. It is not preferred to use trench drains as a last line of defense for runoff entering a facility. Grading and elevation adjustments that prevent runoff from entering the facility should be pursued first.
 - 8.2.F.2. Located in pedestrian areas
 - 8.2.F.2.a. Grate shall be ADA compliant.
 - 8.2.F.2.b. Grate shall be ductile iron.
 - 8.2.F.3. Located in vehicular drives
 - 8.2.F.3.a. Grate and structure to meet highway loads.
 - 8.2.F.3.b. Grate width shall be 10", minimum.
 - 8.2.F.3.c. Grate shall be heavy duty bolted.
 - 8.2.F.3.d. Grate shall be Neenah R-4990 type or equal.
 - 8.2.F.4. UMD: Open grates set in concrete shall have a gutter stamp. See UMN standard plate STM-4001.
- 8.2.G. Aprons/Flared End Sections (FES)

- 8.2.G.1. Material shall match pipe type or manufacturers recommendations.
 - 8.2.G.1.a. RCP
 - 1. Shall meet MnDOT standard plate 3100G or equal.
 - 2. Tie the three end sections (including apron) of a free end (no manhole). See MnDOT standard plate 3145G.
 - 3. See MnDOT standard plate 3133D for riprap installation.
 - 8.2.G.2. Pipe diameters 12” or larger with open discharges shall have FES.
 - 8.2.G.3. Inlets shall have a trash guard.
 - 8.2.G.3.a. Not required for driveway culverts.
 - 8.2.G.4. **PROHIBITED:** HDPE not allowed for FES.
- 8.2.H. Structures located in pavers, Class V, or gravel
 - 8.2.H.1. Install a concrete collar that extends a minimum of 12” around all sides of casting. See UMN standard plate GEN-0002.
 - 8.2.H.1.a. Concrete shall be designed for traffic loading, 8” minimum thickness.
 - 8.2.H.1.b. When located in a paver surface, size concrete collars such that there are no pavers less than ½ of a paver wide.
 - 8.2.H.2. Open grate castings located in Class V or gravel shall have a sump.
 - 8.2.H.2.a. See section 8.2.D above for sump structure requirements.
- 8.2.I. Structures located in pedestrian areas
 - 8.2.I.1. To the maximum extent practicable, locate structures outside of pedestrian walkways and plazas.
- 8.3. Castings
 - 8.3.A. All castings to be flush with grade, unless specified below:
 - 8.3.A.1. Casting may be installed up to ¼” below grade in areas that have pedestrian traffic.
 - 8.3.A.2. Solid castings may be installed up to ½” below grade in areas that have vehicle traffic.
 - 8.3.A.3. Inlet castings to be installed one ½” below grade in the curb line.
 - 8.3.A.4. Castings in mulched areas to be installed 1” above grade.
 - 8.3.B. Solid Castings
 - 8.3.B.1. Neenah R-1733-0805 or approved equal with a University of Minnesota block ‘M’ and the words “STORM SEWER” stamped onto the lid. See UMN standard plate STM-1001.
 - 8.3.C. Open Grates
 - 8.3.C.1. Castings that can be mowed over by a lawnmower should be used in grassy areas unless there is a specific need for a beehive cover. Beehive covers are appropriate in areas not accessible by a lawnmower.
 - 8.3.C.2. Area Drains located in pedestrian areas
 - 8.3.C.2.a. Castings shall be ADA compliant.
 - 8.3.C.2.b. Neenah R-2370 Type Q grate
 - 8.3.C.3. Area Drains located outside of pedestrian areas
 - 8.3.C.3.a. Neenah R-2573 Type C grate, R-2577 Type C grate, or similar. Grate shall fit into the Neenah R-1733 frame.
 - 8.3.C.4. Beehive Grates
 - 8.3.C.4.a. Neenah R-2561, R-2561-A, or similar. Grate shall fit into the Neenah R-1733 frame.

- 8.3.C.5. Curb and Gutter
 - 8.3.C.5.a. UMTC: Neenah R-3067 Type R grate or similar.
 - 8.3.C.5.b. UMD: Neenah R-3250-EVSP or approved equal.
- 8.3.C.6. **UMD: Open grates set in concrete shall have a gutter stamp. See UMN standard plate STM-4001.**
- 8.3.C.7. Outstate Campus
 - 8.3.C.7.a. Catch basins, area drains and beehives to follow the local municipal practices.
- 8.4. Structures to be owned and operated by another governing entity (e.g. City of Minneapolis, City of Duluth) are to follow the entity's standards as applicable.

9. Underground Detention/Retention Systems

- 9.1. Cisterns
 - 9.1.A. See 33 47 00, Section 5.3 for acceptable materials.
- 9.2. Design Loading
 - 9.2.A. See 33 47 00, Section 7
- 9.3. Anchoring
 - 9.3.A. See 33 47 00, Section 8
- 9.4. Access
 - 9.4.A. See 33 47 00, Section 9
- 9.5. Inlets
 - 9.5.A. See 33 47 00, Section 11

10. Abandoning/Removing Storm Sewer

- 10.1. Removals
 - 10.1.A. Storm sewer structures and pipes that are taken out of service shall be removed within excavation limits.
 - 10.1.A.1. UMD: Storm sewer structures and pipes that are taken out of service shall be removed within the construction site limits, unless otherwise approved by the UMN Civil Engineer.
 - 10.1.B. Open pipe ends shall be bulkheaded.
- 10.2. Abandoning Pipe
 - 10.2.A. Remaining storm sewer pipes that are not removed shall be properly abandoned.
 - 10.2.B. Pipes 6" diameter and smaller can be left in place as-is and bulkheaded.
 - 10.2.C. Pipes larger than 6" diameter shall be filled and both pipe ends bulkheaded.
 - 10.2.D. Fill material may be flowable fill, sand, or other approved material.
- 10.3. Abandoning Structures
 - 10.3.A. Storm structures may be abandoned in place in limited situations if allowed by the UMN Civil Engineer based on project excavation limits, invert elevations, and/or preservation of existing features.
 - 10.3.B. Abandoned structures shall follow UMN standard plate GEN-0001.
- 10.4. Documentation of Abandoned Features
 - 10.4.A. All abandoned pipe ends and structures shall be located and included in as-builts.

10.4.A.1. UMTC: GPS locations required.

10.4.A.2. UMD/Outstate: Tie-ins dimensioned on as-built prints if GPS locating is not available.

11. Acceptance Testing of Stormwater Utilities

11.1. Testing

11.1.A. All storm sewer lines, including laterals, shall be substantially watertight and may be tested for excessive leakage upon completion if requested by the University Building Code Official, UMN Civil Engineer, or Engineer of Record.

11.1.B. The testing method shall be determined by the Contractor if not specified by the Engineer of Record.

11.1.C. All testing shall be performed by the Contractor, and the Contractor shall furnish all necessary equipment and materials as required.

11.2. Closed Circuit Television (CCTV)

11.2.A. CCTV testing is required for the following conditions:

11.2.A.1. Trenchless installation of storm sewer pipe

11.2.A.2. Lining of storm sewer pipe

11.2.B. Storm sewer line televising may be required by the University Building Code Official, UMN Civil Engineer, or Engineer of Record, at the cost of the Contractor, if visual inspection and/or leakage testing indicate the storm sewer has not been constructed in accordance with specifications.

11.2.C. The CCTV inspection must be conducted with a crawler propelled camera equipped with on-board lighting that is able to record digital videos of the pipe condition.

11.2.D. The inspection shall maintain high-quality video resolution; maintain a clean lense; maintain appropriate lighting and true color of the video image; control inspection speed; document visible damage; note condition-related factors that impact video quality; and note environmental-related factors that impact video quality.

11.3. Submittals

11.3.A. Submit copies of all sewer testing results to the Engineer of Record, the University Building Code Official, and the UMN Civil Engineer.

END OF SECTION