

Missouri Clean Water Commission  
Department of Natural Resources  
Lewis and Clark State Office Building  
LaCharrette/Nightingale Conference Rooms  
1101 Riverside Drive  
Jefferson City, Missouri 65102

November 2, 2011

### **10 CSR 20-8.120 Design of Gravity Sewers**

**Issue:** The Department is presenting the Order of Rulemaking for 10 CSR 20-8.120, Design of Gravity Sewers regulation, for adoption by the Commission. It is anticipated this Order of Rulemaking amendment will be published in the Code of State Regulations January 30, 2012, upon adoption by the Commission.

**Background:** This Order of Rulemaking amendment will allow 10 CSR 20-8.120 to be updated to national industry standards.

On August 1, 2011, the Proposed Amendment to 10 CSR 20-8.120, Design of Gravity Sewers, was placed on public notice. The public comment period was from August 1, 2011, date of publication in the *Missouri Register*, through September 14, 2011.

No testimonies were received at the public hearing, held on September 7, 2011. However, the Department did receive two comment letters, one from an engineering consultant and the second from a sewer district. These comments resulted in some changes to the proposed rule. Department staff also provided a comment, which resulted in a minor correction that clarified and improved the existing rule language.

**Recommended Action:** Adoption of the Order of Rulemaking amending 10 CSR 20-8.120, Design of Gravity Sewers.

**Suggested Motion Language:** "I move the Commission adopt the Order of Rulemaking for 10 CSR 20-8.120 and the Department file the Order with the Joint Committee on Administrative Rules and the Secretary of State."

**List of Attachments:**

- Order of Rulemaking with Response to Comment
- Proposed rulemaking for 10 CSR 20-8.120, as published in the *Missouri Register* on August 1, 2011
- Rulemaking Schedule



**Title 10 – DEPARTMENT OF NATURAL RESOURCES**  
**DIVISION 20 – Clean Water Commission**  
**Chapter 8 – Design Guides**

**ORDER OF RULEMAKING**

By the authority vested in the Clean Water Commission under section 644.026, RSMo 2000, the Clean Water Commission amends a rule as follows:

10 CSR 20–8.120 is amended.

A notice of proposed rulemaking containing the text of the proposed amendment was published in the *Missouri Register* on August 1, 2011 (36 MoReg 1815—1820). Those sections with changes are reprinted here. This proposed amendment becomes effective thirty (30) days after publication in the *Code of State Regulations*.

**SUMMARY OF COMMENTS:** A public hearing on this proposed amendment was held September 7, 2011, and the public comment period ended September 14, 2011. At the public hearing, the Water Protection Program staff explained the proposed amendment. The department received thirteen (13) written comments from two (2) sources, a private consultant and a regulated sewer district. Department staff also submitted one (1) comment.

**COMMENT #1:** Cary Sayre, P.E., with Allstate Consultants, LLC, questioned the construction testing practice and safety involved in following the ASTM C1244 test prior to backfilling of the concrete manhole. Mr. Sayre's preference would be to vacuum test concrete manholes after backfilling.

**RESPONSE AND EXPLANATION OF CHANGE:** ASTM International develops technically competent standards, which are used throughout the United States and internationally. ASTM C1244 is a "Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test Prior to Backfill." This standard was originally approved and published by ASTM in 1993. This test method ensures the integrity and watertightness of the concrete manhole sections utilizing mortar, mastic, or gasketed joints installed by the contractor. The intention of the test is to demonstrate the condition of the concrete manhole installed by the contractor, prior to backfill. The National Precast Concrete Association (NPCA) is a non-profit organization which provides education and support to the precast concrete industry. The NPCA warns against vacuum testing concrete manholes after backfill. The main disadvantages to performing this test after backfill are the following:

1. There are no industry standards for vacuum testing after backfill;
2. It is difficult to locate and repair leak(s) after backfill; and
3. The manhole can fail if additional pressures (e.g., ground water and soil pressures) are not taken into account.

Staff deliberated and decided to change the language to require either ASTM C1244 or the manufacturer's recommendation if vacuum testing of concrete manholes is specified.



COMMENT #2: Nicholas Bauer, P.E., with the Metropolitan St. Louis Sewer District (MSD), suggested adding language to subsection (1)(A) to allow consideration of a cost benefit analysis during a deviation review.

RESPONSE: Department staff believes the current language allows the consideration of any justification for a deviation, including cost benefit analysis. No changes have been made to the rule as a result of this comment.

COMMENT #3: Nicholas Bauer, P.E., with MSD, requested the deletion of paragraph (5)(H)6. as MSD does not believe video inspection of new and rehabilitated sewers is necessary.

RESPONSE: The current language recommends video inspecting new and rehabilitated sewers after installation. This recommendation is for consideration by the design engineer; it is not a mandatory requirement. Recommendations demonstrate the preference of the department and are not requirements for construction approval. Video inspection of a new or rehabilitated sewer is especially applicable for sewers with service connections. The testing of sewers is performed prior to any service connections. Therefore, a video inspection could show if proper service connections were made. No changes have been made to the rule as a result of this comment.

COMMENT #4: Nicholas Bauer, P.E., with MSD, suggested adding ASTM C 1103 for reinforced concrete pipe greater than twenty-seven inches (27") to paragraph (5)(I)5.

RESPONSE AND EXPLANATION OF CHANGE: Department staff agrees with the suggestion by MSD and changed the language of this paragraph.

COMMENT #5: Nicholas Bauer, P.E., with MSD, requested the department retain the existing language in subsection (6)(C) with regards to the minimum manhole diameter. The existing language requires a minimum diameter of forty-two inches (42"), and the proposed language requires a minimum diameter of forty-eight inches (48"). MSD asserts this change in rule will add an extra cost of ten dollars per foot (\$10/ft) in depth.

RESPONSE AND EXPLANATION OF CHANGE: The department reverted to the existing language. The department wants to avoid any cost for this rulemaking.

COMMENT #6: Nicholas Bauer, P.E., with MSD, requested the department retain the existing language in subsection (6)(C) with regards to the minimum access diameter of a manhole. The existing language requires a minimum access diameter of twenty-two inches (22"), and the proposed language requires a minimum access diameter of twenty-four inches (24"). MSD declares their standard size of twenty-one and three-eighths inches (21 3/8") is a sufficient access diameter to accommodate operation and maintenance needs. MSD asserts this change in rule will add an extra cost of fifteen dollars (\$15) per manhole cover, plus the burden of stocking two (2) different size manhole covers for repairs.

RESPONSE AND EXPLANATION OF CHANGE: The department reverted to the existing language. The department wants to avoid any cost for this rulemaking.

COMMENT #7: Nicholas Bauer, P.E., with MSD, provided new language to replace the proposed language in paragraph (6)(D)1. MSD believed the department proposed language to be confusing and may cause poor manhole design.

RESPONSE AND EXPLANATION OF CHANGE: Department staff accepts the MSD proposed language and removed the language describing the channel walls.

COMMENT #8: Nicholas Bauer, P.E., with MSD, did not support the requirement to vacuum test manholes twice as described in proposed paragraph (6)(G)1.

RESPONSE AND EXPLANATION OF CHANGE: Department staff believes this concern has been addressed by Comment #1. The change to the language only requires one (1) vacuum test by following ASTM C1244 or the manufacturer's recommendation. This change corresponds with the 2009 MSD Standard Construction Specifications, page 58, which states, "A vacuum test shall be in accordance with ASTM C-1244..."

COMMENT #9: Nicholas Bauer, P.E., with MSD, questioned the value of providing engineering plans showing if any existing waterworks units are within a two-hundred-foot (200') range of the proposed sewer.

RESPONSE: The range of two-hundred-foot (200') allows the department to determine if set back distances are met. 10 CSR 23-3.010(2)(A)5. requires a set back distance from a well of fifty feet (50') to any sewer. 10 CSR 23-3.010(2)(C) requires a set back distance from an irrigation well of two-hundred-foot (200') to any sewer. In order for the department to review and determine whether these set back distances are met, existing waterworks units need to be shown on engineering plans. No changes have been made to the rule as a result of this comment.

COMMENT #10: Nicholas Bauer, P.E., with MSD, questioned the validity of subparagraph (10)(C)1.B. if the deviation requirements of subparagraph (10)(C)1.A. are met.

RESPONSE: Department staff believes the proposed language plainly presents the horizontal and vertical separations in subparagraph (10)(C)1.A. If these separation distances cannot be met, the preferred deviation is to allow the water main and sewer be constructed in separate trenches or on an undisturbed earth shelf with the water main eighteen inches (18") above the top of the sewer, as described in subparagraph (10)(C)1.A. If the defined separation distances are impossible to obtain and the preferred deviation is not achievable, then a second common deviation is described in subparagraph (10)(C)1.B. No changes have been made to the rule as a result of this comment.

COMMENT #11: Nicholas Bauer, P.E., with MSD, requested striking out the requirement of subparagraph (10)(C)1.B. to construct both the water main and sewer of slip-on or mechanical joint pipe or continuously encased and pressure tested. MSD believes only the sewer should be constructed to assure watertightness when installing near an existing water main.

RESPONSE AND EXPLANATION OF CHANGE: Department staff agreed with MSD that only the sewer pipe should be constructed to assure watertightness. The language was changed to remove the requirement for the water pipe to be constructed to assure watertightness.

COMMENT #12: Nicholas Bauer, P.E., with MSD, indicated that subparagraph (10)(C)2.B. refers to a horizontal and vertical separation, when only a vertical separation is referenced.

RESPONSE AND EXPLANATION OF CHANGE: Department staff appreciates MSD supplying this comment to improve and clarify the rule language. Department staff removed the horizontal separation reference.

COMMENT #13: Nicholas Bauer, P.E., with MSD, requested the addition of concrete encasement for consideration to meet the requirements of part (10)(C)2.B.(II).

RESPONSE AND EXPLANATION OF CHANGE: Department staff considers concrete encasement an appropriate and approvable method to ensure a watertight pipe. The language has been changed to include this material request.

COMMENT #14: Department staff discovered an inconsistency in subparagraph (10)(C)1.B. A comma is missing from the metric value in parentheses.

RESPONSE AND EXPLANATION OF CHANGE: Department staff added a comma to the metric value in parentheses.

## **10 CSR 20-8.120 Design of Gravity Sewers**

### **(5) Details of Design and Construction.**

#### **(I) Joints and Infiltration.**

1. Joints. The installation of joints and the materials used shall be included in the specifications. Sewer joints shall be designed to minimize infiltration and to prevent the entrance of roots throughout the life of the system.
2. Service connections. Service connections to the sewer main shall be watertight and not protrude into the sewer. If a saddle-type connection is used, it shall be a device designed to join with the types of pipe which are to be connected. All materials used to make service connections shall be compatible with each other and with the pipe materials to be joined and shall be corrosion proof.
3. Leakage tests. Leakage tests shall be specified. This may include appropriate water or low pressure air testing. The testing methods selected should take into consideration the range in groundwater elevations during the test and anticipated during the design life of the sewer.
4. Water (hydrostatic) test. The leakage exfiltration or infiltration shall not exceed one hundred (100) gallons per inch of pipe diameter per mile per day ( $0.38 \text{ m}^3/\text{cm}$  of pipe diameter/km/day) for any section between manholes of the system. An exfiltration or infiltration test shall be performed with a minimum positive head of two feet (2') (0.6 m).
5. Air test. The air test shall, as a minimum, conform to the test procedure described in ASTM C828 for clay pipe, ASTM C924 for concrete pipe twenty-four inches (24") or less in diameter, ASTM C1103 for concrete pipe diameters twenty-seven inches (27") or greater in diameter, and ASTM F1417 for plastic, composite, and ductile iron pipe. All other materials shall have test procedures approved by the department.

#### **(6) Manholes.**

(C) Diameter. The minimum diameter of manholes shall be forty-two inches (42") (107 cm) on eight-inch (8") (20 cm) diameter gravity sewer lines and forty-eight inches (48") (122 cm) on all sewer lines larger than eight inches (8") (20 cm) in diameter. Larger diameter manholes are necessary for large diameter sewers in order to maintain structural integrity. A minimum access diameter of twenty-two inches (22") (56 cm) shall be provided.

#### **(D) Flow Channel.**

1. The flow channel straight through a manhole should be made to conform as closely as possible in shape and slope to that of the connecting sewers, without obstructing maintenance, inspection, or flow in the sewers.

2. When curved flow channels are specified in manholes, including branch inlets, minimum slopes indicated in paragraph (5)(D)1. of this rule should be increased to maintain acceptable velocities.

(G) Inspection and Testing. The specifications shall include a requirement for inspection and testing for watertightness or damage prior to placing into service.

1. Vacuum testing, if specified for concrete sewer manholes, shall conform to the test procedures in ASTM C1244 or the manufacturer's recommendation.

2. Exfiltration testing, if specified for concrete sewer manholes, shall conform to the test procedures in ASTM C969.

(10) Protection of Water Supplies.

(C) Relation to Water Main.

1. Horizontal and vertical separation.

A. Sewer mains shall be laid at least ten feet (10') (3.0 m) horizontally from any existing or proposed water main. The distances shall be measured edge-to-edge. In cases where it is not practical to maintain a ten-foot (10') (3.0 m) separation, the department may allow deviation on a case-by-case basis, if supported by data from the design engineer. Such a deviation may allow installation of the sewer closer to a water main, provided that the water main is in a separate trench or on an undisturbed earth shelf located on one (1) side of the sewer and at an elevation so the bottom of the water main is at least eighteen inches (18") (46 cm) above the top of the sewer.

B. If it is impossible to obtain proper horizontal and vertical separation as described above for sewers, the sewer must be constructed of slip-on or mechanical joint pipe or continuously encased and be pressure tested to one hundred fifty pounds per square inch (150 psi) (1,034 kPa) to assure watertightness.

C. Manholes should be located at least ten feet (10') (3.0 m) horizontally from any existing or proposed water main.

2. Crossings.

A. Sewers crossing water mains shall be laid to provide a minimum vertical distance of eighteen inches (18") (46 cm) between the outside of the water main and the outside of the sewer. This shall be the case where the water main is either above or below the sewer. The crossing shall be arranged so that the sewer joints will be equidistant and as far as possible from the water main joints. Where a water main crosses under a sewer, adequate structural support shall be provided for the sewer to maintain line and grade.

B. When it is impossible to obtain proper vertical separation as stipulated above, one (1) of the following methods must be specified:

(I) The sewer shall be designed and constructed equal to water pipe and shall be pressure tested to assure watertightness prior to backfilling; or

(II) Either the water main or sewer line may be continuously encased or enclosed in a watertight carrier pipe which extends ten feet (10') (3.0 m) on both sides of the crossing, measured perpendicular to the water main. The carrier pipe shall be of materials approved by the department for use in water main construction.

**PRIVATE COST:** This proposed amendment will not cost private entities more than five hundred dollars (\$500) in the aggregate.

**NOTICE OF PUBLIC HEARING AND NOTICE TO SUBMIT COMMENTS:** A public hearing on this proposed amendment will begin at 9:00 a.m., September 29, 2011. The public hearing will be held at the Holiday Inn Southeast, Grand Ballroom A, B, and C, 9103 East 39th Street, Kansas City, Missouri. Opportunity to be heard at the hearing shall be afforded any interested person. Interested persons, whether or not heard, may submit a written or email statement of their views until 5:00 p.m., October 6, 2011. Written comments shall be sent to Chief, Air Quality Planning Section, Missouri Department of Natural Resources' Air Pollution Control Program, PO Box 176, Jefferson City, MO 65102-0176. Email comments shall be sent to [apcprulespn@dnr.mo.gov](mailto:apcprulespn@dnr.mo.gov).

**Title 10—DEPARTMENT OF NATURAL RESOURCES  
Division 20—Clean Water Commission  
Chapter 8—Design Guides**

**PROPOSED AMENDMENT**

**10 CSR 20-8.120 Design of Gravity Sewers.** The Missouri Department of Natural Resources (department) is amending the rule title, the purpose statement, and sections (1), (3), (4), and (6)–(10); deleting sections (2) and (5); adding a new section (2); and renumbering as necessary.

**PURPOSE:** This amendment will update the rule to current industry practices.

**PURPOSE:** The following criteria have been prepared as a guide for the design of sewers. This rule is to be used with rules 10 CSR 20-8.110[–] through 10 CSR 20-8.220 for the planning and design of the complete treatment facility. This rule reflects the minimum requirements of the Missouri Clean Water Commission [as] in regard[s] to adequacy of design, submission of plans, approval of plans, and approval of completed [sewage works.] wastewater treatment facilities and collection systems. It is not reasonable or practical to include all aspects of design in these standards. The design engineer should obtain appropriate reference materials which include but are not limited to: copies of all ASTM International standards pertaining to sewers and appurtenances, design manuals such as Water Environment Federation's Manuals of Practice, and other sewer design manuals containing principles of accepted engineering practice. Deviation from these minimum requirements will be allowed where sufficient documentation is presented to justify the deviation. These criteria are taken largely from the 2004 edition of the Great Lakes-Upper Mississippi River Board of State [Sanitary Engineers] and Provincial Public Health and Environmental Managers' Recommended Standards for [Sewage Works] Wastewater Facilities and are based on the best information presently available. These criteria were originally filed as 10 CSR 20-8.030. It is anticipated that they will be subject to review and revision periodically as additional information and methods appear. [Addenda or supplements to this publication will be furnished to consulting engineers and city engineers. If others desire to receive addenda or supplements, please advise the Clean Water Commission so that names can be added to the mailing list.]

*[Editor's Note: The secretary of state has determined that the publication of this rule in its entirety would be unduly cumbersome or expensive. The entire text of the material referenced has been filed with the secretary of state. This material may be found at the Office of the Secretary of State or at the headquarters of the agency and is available to any interested person at a cost established by state law.]*

(1) Definitions. Definitions as set forth in the Clean Water Law and 10 CSR 20-2.010 shall apply to those terms when used in this rule, unless the context clearly requires otherwise. Where the terms "shall" and "must" are used, they are to mean a mandatory requirement insofar as approval by the [agency] Missouri Department of Natural Resources (department) is concerned, unless justification is presented for deviation from the requirements. Other terms, such as "should," "recommend," "preferred," and the like, indicate [discretionary requirements on the part of the agency and deviations are subject to individual consideration.] the preference of the department for consideration by the design engineer.

(A) Deviations. Deviations from these rules may be approved by the department when engineering justification satisfactory to the department is provided. Justification must substantially demonstrate in writing and through calculations that a variation(s) from the design rules will result in either at least equivalent or improved effectiveness. Deviations are subject to case-by-case review with individual project consideration.

[(2) Exceptions. This rule shall not apply to facilities designed for twenty-two thousand five hundred (22,500) gallons per day (85.4 m<sup>3</sup>) or less (see 10 CSR 20-8.020 for the requirements for those facilities).]

(2) Applicability. This rule shall apply to all facilities with a design flow of one hundred thousand (100,000) gallons (378.5 m<sup>3</sup>) per day or greater. This rule shall also apply to all facilities with a design flow of twenty-two thousand five hundred (22,500) gallons (85.2 m<sup>3</sup>) per day or greater until such time as 10 CSR 20-8.020 is amended.

(3) Approval of Sewers. [In general, the agency] The department will approve plans for new systems, extensions to new areas, or replacement sanitary sewers only when designed upon the separate [plan] basis, in which rainwater from roofs, streets, and other areas and groundwater from foundation drains are excluded.

(4) Design Capacity and Design Flow.

(A) [In general, s]Sewer capacities [should] shall be designed for the estimated ultimate tributary population, except in considering parts of the systems that can be readily increased in capacity. Similarly, consideration [should] must be given to the maximum anticipated capacity of institutions, industrial parks, etc. [Where future relief sewers are programmed, economic analysis of alternatives should accompany initial permit applications. In determining the required capacities of sanitary sewers, the following factors should be considered: maximum hourly domestic sewage flow;] An economic analysis of alternatives must be included in the engineering report or facility plan where future relief sewers are planned.

1. The following factors must be considered in determining the required capacities of sanitary sewers:

- A. Design peak hourly flow;
- B. [a]Additional maximum [sewage] wastewater or waste flow from industrial plants;
- C. [inflow and groundwater] Inflow and infiltration (I/I);
- D. [t]Topography of area;
- E. [l]Location of [sewage] wastewater treatment [plant] facilities;
- F. [d]Depth of excavation; and
- G. [p]Pumping requirements.

2. The basis of design for all sewer projects shall [accompany the plan documents] be included in the engineering report or facility plan. More detailed computations may be required by the [agency] department for critical projects.

(B) Sewer flows shall be based on the design peak hourly flow in accordance with 10 CSR 20-8.110(4)(C)4. and must be designed to prevent or eliminate sanitary sewer overflows (SSOs).



Clean Water Commission  
Rulemaking Schedule

Approved by: John Madras  
Prepared by: Pat Smith

Item	5/4/2011	5/25/2011	5/4/2011	8/1/2011	9/7/2011	9/14/2011	11/2/2011	11/4/2011	12/6/2011	1/17/2012	1/30/2012	2/29/2012	7/1/2013
Inter Agency Review													
CWC Meeting - Finding of Necessity													
RTR Public Notice (Date) N/A													
RTR Close of Comment (Date) N/A													
CWC Meeting Proposed Rule / Public/Private Fiscal Costs to be Filed w/ Joint Committee on Administrative Rules & Secretary of State & the SBRFB as Required													
Publication in MO Register													
CWC Meeting - Public Hearing to Rescind Proposed Rulemaking & to Accept Public Comment													
End of Public Comment													
CWC Meeting - Response to Comment & Adoption of Order of Rulemaking													
File Order w/ Joint Committee on Administrative Rules, JCAR Necessary													
Order Published in Missouri Register													
Order With Secretary of State, SOS													
Order Published in the Code of State Regulations, CSR													
Rule Effective													
Statement of Actual Cost FY													

