MISSOURI
DEPARTMENT OF
NATURAL RESOURCES

# Title 10—DEPARTMENT OF NATURAL RESOURCES
# Division 20—Clean Water Commission
# Chapter 8—Minimum Design Standards

# WORKING DOCUMENT

## Strawman

**The Department presents these draft materials for stakeholder review and discussion only.**
**Subject to the Red Tape Reduction review.**

The Missouri Department of Natural Resources has identified 10 CSR 20-8, Minimum Design Standards, as a potential rulemaking amendment. This workgroup has been convened for the purpose of informal and voluntary public participation and discussions regarding the development of this rule prior to initiating formal rulemaking.

Under Governor Greitens' leadership, all state agencies are working to reduce regulations and other government processes that unnecessarily burden individuals and businesses while doing little to protect or improve public health, safety, and our natural resources. The Missouri Department of Natural Resources is committed to limiting regulation to what is necessary to protect Missouri's environment, implementing statutory mandates, and maintaining state control of programs. Any further proposed changes to rules discussed on this page are being developed with these goals in mind. We welcome your comments to help ensure that our regulations provide required protections but do not add unnecessary costs.

# Title 10—DEPARTMENT OF NATURAL RESOURCES
# Division 20—Clean Water Commission
# Chapter 8—*[Design Guides]* Minimum Design Standards

## 10 CSR 20-8.130 Sewage Pumping Stations

*[PURPOSE: The following criteria have been prepared as a guide for the design of sewage pumping stations. This rule is to be used with rules 10 CSR 20-8.110–10 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 regards adequacy of design, submission of plans, approval of plans and approval of completed sewage works. Deviation from these minimum requirements will be allowed where sufficient documentation is presented to justify the deviation. These criteria are taken largely from Great Lakes-Upper Mississippi River Board of State Sanitary Engineers Recommended Standards for Sewage Works 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.]*

***PURPOSE: The following minimum criteria have been prepared as a standard for the design of wastewater systems. This rule is to be used with rules 10 CSR 20-8.110 through 10 CSR 20-8.500 for the planning and design of a treatment facility. It is not reasonable or practical to include all aspects of design in these standards. The design engineer may use other appropriate reference materials for these design aspects not addressed in this rule, which include but are not limited to: copies of all ASTM International and American Water Works Association (AWWA) standards pertaining to wastewater systems and appurtenances, design manuals such as Water Environment Federation's Manuals of Practice, Department prepared guides and other wastewater system design manuals containing principles of accepted engineering practice. This rule specifies minimum standards for the design and construction of wastewater systems, in addition to engineering experience and judgement in accordance with standards of practice.***

*[(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 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.]*

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

*[(3) General.*

*(A) Flooding. Sewage pumping station structures and electrical and mechanical equipment shall be protected from physical damage by the one hundred (100)-year flood. Sewage pumping stations should remain fully operational and accessible during the twenty-five (25)-year flood.*

*(B) Accessibility. The pumping station shall be readily accessible by maintenance vehicles during all weather conditions. The facility should be located off the traffic way of streets and alleys.*

*(C) Grit. Where it is necessary to pump sewage prior to grit removal, the design of the wet well and pump station piping shall receive special consideration to avoid operational problems from the accumulation of grit.]*

**(1) Applicability. Wastewater systems shall be designed based on criteria contained in this rule, published standards, applicable federal and state requirements, standard textbooks, current technical literature and applicable safety standards. To the extent of any conflict between the above criteria, the requirement in this rule shall prevail.**

**(A) This rule shall not apply to animal waste management systems. Regulations for these facilities are found in 10 CSR 20-8.300.**

**(B) This rule shall not apply to agrichemical facilities. Regulations for these facilities are found in 10 CSR 20-8.500.**

**(2) General.**

**(A) Flood Protection. Refer to 10 CSR 20-8.140(2)(B) for flood protection.**

**(B) Access Road. Refer to 10 CSR 20-8.140(2)(D) for access roads to pump station sites.**

**(C) Safety. Refer to 10 CSR 20-8.140(7).**

**(D) Potable Water Sources. The distance between wastewater pumping stations and all potable water sources should be one hundred feet (100') and shall be at least fifty feet (50') in accordance with 10 CSR 23-3.010(2)(A)5.**

**(E) Housed Wet Wells. Design housed wet well ventilation in accordance with 10 CSR 20-8.140(7)(J).**

(*[4]***3**) Design.

*[(A) Type. Sewage pumping stations should be of the wet/dry well type. Other types as set forth under sections (5) and (6) of this rule may be approved where circumstances justify their use.]*

(*[B]***A**) Structures.

1. Separation. Dry wells, including their superstructure, shall be completely separated from the wet well with gas tight common walls.

*[2. Equipment removal. Provision shall be made to facilitate removing pumps, motors and other mechanical and electrical equipment]*

*[3]***2**. Access. Suitable and safe means of access **for persons wearing self-contained breathing apparatus** shall be provided to dry wells and to wet wells**.** *[containing either bar screens or mechanical equipment requiring inspection or maintenance. For built-in-place pump stations, a stairway with rest landings shall be provided at vertical intervals not to exceed twelve feet (12') (3.7m). For factory-built pump stations over fifteen feet (15') (4.6m) deep, a rigidly fixed landing shall be provided at vertical intervals not to exceed ten feet (10') (3.0m). Where a landing is used, a suitable and rigidly fixed barrier shall be provided to prevent an individual from falling past the intermediate landing to a lower level. Where approved by the agency, a manlift or elevator may be used in lieu of landings in a factory-built station, provided emergency access is included in the design. Reference should be made to local, state and federal safety codes and, if they are more stringent, they shall govern (also see 10 CSR 20-8.140(8)(F))].*

*[4. Construction materials. Due consideration shall be given to the selection of materials because of the presence of hydrogen sulfide and other corrosive gases, greases, oils and other constituents frequently present in sewage.]*

(*[*C*]***B***)* Pumps *[and Pneumatic Ejectors]*.

1. Multiple units. *[At least two (2) pumps or pneumatic ejectors shall be provided. A minimum of three (3) pumps should be provided for stations handling flows greater than one (1) mgd (3800m$^3$/d). If only two (2) units are provided, they should have the same capacity. Each shall be capable of handling flows in excess of the expected maximum flow. Where three (3) or more units are provided, they should be designed to fit actual flow conditions and must be of a capacity that with any one (1) unit out-of-service the remaining units will have capacity to handle maximum sewage flows.]* **Multiple pumps shall be provided except for design average flows of less than fifteen hundred (1,500) gallons per day.**

*[2. Protection against clogging. Pumps handling combined sewage shall be preceded by readily accessible bar racks to protect the pumps from clogging or damage. Bar racks should have clear openings not exceeding two and one-half inches (2 1/2") (6.4 cm). Where a bar rack is provided, a mechanical hoist shall also be provided. Where the size of the installation warrants, mechanically cleaned and/or duplicate bar racks shall be provided. Pumps handling separate sanitary sewage from thirty inches (30") (76 cm) or larger diameter sewers shall be protected by bar racks meeting these requirements. Appropriate protection from clogging shall also be considered for small pumping stations.*

*3. Pump openings. Except where grinder pumps are used, pumps shall be capable of passing spheres of at least three inches (3") (7.6 cm) in diameter and pump suction and discharge piping shall be at least four inches (4") (10.2 cm) in diameter.*

*4. Priming. The pump shall be so placed that under normal operating conditions it will operate under a positive suction head, except as specified in section (5) of this rule.]*

*[5]***2**. Electrical equipment. **The following shall be met:**

**A.** *[Electrical systems and components (for example, motors, lights, cables, conduits, switchboxes, control circuits, etc.) in enclosed or partially enclosed spaces where hazardous concentrations of flammable gases or vapors may be present, including raw sewage wet wells, shall be suitable for hazardous locations(National Electrical Code , Class I, Group D, Division 1, location).]***Refer to 10 CSR 20-8.140(6)(B); ***[In addition,]***

**B. Utilize corrosive resistant** equipment located in the wet well *[shall be suitable for use under corrosive conditions. Each flexible cable shall be provided with]***;**
**C**. **Provide a** watertight seal and separate strain relief*[.]* **for all flexible cable;**
**D. Install** *[A]***a** fused disconnect switch located above ground *[shall be provided]* **for the main power feed** for all pumping stations.
**E**. When *[the]* **such** equipment is exposed to weather, *[it shall meet]* **comply with** the requirements of weather proof equipment *[(NEMA 3R)]***, at a minimum enclosure NEMA 4, and NEMA 4X where necessary; NEMA Standard 250-2014, published December 15, 2014. This standard is incorporated by reference in this rule, as published by National Electrical Manufacturers Association, 1300 North 17th Street, Arlington, VA 22209;**
**F. Install lightning and surge protection systems;**
**G. Install a one hundred ten volt (110 V) power receptacle inside the control panel located outdoors to facilitate maintenance; and**
**H. Provide Ground Fault Circuit Interruption (GFCI) protection for all outdoor receptacles.**

*[6. Intake. Each pump should have an additional individual intake. Wet well design should be such as to avoid turbulence near the intake. Intake piping should be as straight and short as possible.*

*7. Dry well de-watering. A separate sump pump equipped with dual check valves shall be provided in the dry wells to remove leakage or drainage with the discharge located as high as possible. A connection to the pump suction is also recommended as an auxiliary feature. Water ejectors connected to a potable water supply will not be approved. All floor and walkway surfaces should have an adequate slope to a point of drainage. Pump seal water shall be piped to the sump.*

*8. Pumping rates. The pumps and controls of main pumping stations and especially pumping stations pumping to the treatment works or operated as part of the treatment works should be selected to operate at varying delivery rates to permit discharging sewage at approximately its rate of delivery to the pump station. Design pumping rates should be established in accordance with 10 CSR 20-8.120(5) or 10 CSR 20-8.140(5)(C)1. as appropriate.]*

(*[*D*]***C***) Controls. **Water level controls must be accessible without entering the wet well.**

*[1. Type. Control systems shall be of the air bubbler type, the encapsulated float type or the flow measuring type. Float tube control systems on existing stations being upgraded may be approved. The electrical equipment shall be suitable for hazardous locations (National Electrical Code, Class I, Group D, Division 1 location).*

*2. Location. The control system shall be located away from the turbulence of incoming flow and pump suction.*

*3. Alternation. In small stations, provisions should be made to automatically alternate the pumps in use.]*

(*[*E*]***D***) Valves. **Valves shall not be located in the wet well unless integral to a pump or its housing**.

*[1. Suitable shutoff valves shall be placed on the suction line of each pump except on submersible and vacuum primed pumps.*

*2. Suitable shutoff and check valves shall be placed on the discharge line of each pump. The check valve shall be located between the shutoff valve and the pump. Check valves*

*shall be suitable for the material being handled. Check valves shall not be placed on the vertical portion of discharge piping. Valves shall be capable of withstanding normal pressure and water hammer. Where limited pump backspin will not damage the pump and low discharge head conditions exist, short individual force mains for each pump may be considered in lieu of discharge valves.*

*3. Valves shall not be located in the wet well.]*

(*[*F*]***E**) Wet Wells. **Covered wet wells shall have provisions for air displacement to the atmosphere, such as an inverted and screened "j" tube or other means.**

*[1. Divided wells. Consideration should be given to dividing the wet well into multiple sections, properly interconnected, to facilitate repairs and cleaning.*

*2. Size. The wet well size and control setting shall be appropriate to avoid heat buildup in the pump motor due to frequent starting and to avoid septic conditions due to excessive detention time.*

*3. Floor slope. The wet well floor shall have a minimum slope of one to one (1:1) to the hopper bottom. The horizontal area of the hopper bottom shall not be greater than necessary for proper installation and function of the inlet.]*

*[(G) Ventilation. Adequate ventilation shall be provided for all pump stations. Where the pump pit is below the ground surface, mechanical ventilation is required, so arranged as to independently ventilate the dry well and the wet well if screens or mechanical equipment requiring maintenance or inspection are located in the wet well. There shall be no interconnection between the wet well and dry well ventilation systems. In pits over fifteen feet (15') (4.6m) deep, multiple inlets and outlets are desirable. Dampers should not be used on exhaust or fresh air ducts and fine screens or other obstructions in air ducts should be avoided to prevent clogging. Switches for operation of ventilation equipment should be marked and located conveniently. All intermittently operated ventilating equipment shall be interconnected with the respective pit lighting system. Consideration should be given also to automatic controls where intermittent operation is used. The fan wheel should be fabricated from nonsparking material. Consideration should be given to installation of automatic heating and/or dehumidification equipment.*

*1. Wet wells. Ventilation may be either continuous or intermittent. Ventilation, if continuous, shall provide at least twelve (12) complete air changes per hour, if intermittent, at least thirty (30) complete air changes per hour. Air shall be forced into the wet well rather than exhausted from the wet well.*

*2. Dry wells. Ventilation may be either continuous or intermittent. Ventilation, if continuous, shall provide at least six (6) complete air changes per hour, if intermittent, at least thirty (30) complete air changes per hour.]*

*[(H) Flow Measurement. Suitable devices for measuring sewage flow should be considered at all pumping stations.]*

**(F) Ventilation. Interconnection between the wet well and dry well ventilation systems is not acceptable. See requirements in 10 CSR 20-8.140(7)(J).**

(*[I]***G**) Water Supply. There shall be no physical connection between any potable water supply and a *[sewage]* **wastewater** pumping station which**,** under any conditions**,** might cause contamination of the potable water supply. If a potable water supply is brought to the station, *[it should comply with]* **conform to the** conditions stipulated under 10 CSR 20-8.140(*[8]***6**)(*[B]***D**).

(*[5]***4**) Suction Lift Pumps. Suction lift pumps shall *[be of the self priming or vacuum priming type and shall]* meet the applicable requirements under section (*[4]***3**) of this rule. *[Suction lift pump stations using dynamic suction lifts exceeding the limits outlined in the following subsections may be approved by the agency upon submission of factory certification of pump performance and detail calculations indicating satisfactory performance under the proposed operating conditions. Detail calculations must include static suction lift as measured from "lead pump off" elevation to center line of pump suction, friction and other hydraulic losses of the suction piping, vapor pressure of the liquid, altitude correction, required net positive suction head and a safety factor of at least six feet (6') (1.8m). The pump equipment compartment shall be above grade or offset and shall be effectively isolated from the wet well to prevent the humid and corrosive sewer atmosphere from entering the equipment compartment. Wet well access shall not be through the equipment compartment. Valving shall not be located in the wet well.]*

(A) Self-Priming Pumps. *[Self-priming pumps shall be capable of rapid priming and repriming at the "lead pump on" elevation. This self-priming and repriming shall be accomplished automatically under design operating conditions. Suction piping should not exceed the size of the pump suction and shall not exceed twenty-five feet (25') (7.6m) in total length. Priming lift at the ''lead pump on'' elevation shall include a safety factor of at least four feet (4') (1.2m) from the maximum allowable priming lift for the specific equipment at design operating conditions.]* The combined total of dynamic suction lift at the "pump off" elevation and required net positive suction head at design operating conditions shall not exceed twenty-two feet (22') (6.7m).

(B) Vacuum Priming Pumps. Vacuum priming pump stations shall be equipped with dual vacuum pumps capable of automatically and completely removing air from the suction lift pump. *[The vacuum pumps shall be adequately protected from damage due to sewage. The combined total of dynamic suction lift at the "pump off" elevation and required net positive suction head at design operating conditions shall not exceed twenty-two feet (22") (6.7m).]*

**(C) Equipment, Wet Well Access, and Valve Location.**

**1. Wet well access. Wet well access shall not be through the equipment compartment and be at least twenty-four inches (24") in diameter.**

**2. Valve location. Valves shall not be located in the wet well.**

(*[6]***5**) Submersible Pump Stations. Submersible pump stations shall meet the applicable requirements under section (*[4]***3**) of this rule, except as modified in this section.

*[(A) Construction. Submersible pumps and motors shall be designed specifically for raw sewage use, including totally submerged operation during a portion of each pumping cycle. An effective method to detect shaft seal failure or potential seal failure shall be provided and the motor shall be of squirrel-cage type design without brushes or other arc-producing mechanisms.]*

(*[B]***A**) Pump Removal. Submersible pumps shall be readily removable and replaceable without **personnel entering or** de*[-]*watering the wet well or disconnecting any piping in the wet well.

*[(C) Electrical.*

*1. Power supply and control. Electrical supply and control circuits shall be designed to allow disconnection at a junction box located or accessible from outside the wet well.*

*Terminals and connectors shall be protected from corrosion by location outside of the wet well or by watertight seals.*

*2. Controls. The motor control center shall be located outside the wet well and be protected by a conduit seal to prevent the atmosphere in the wet well from gaining access to the control center. The seal shall be located so that the motor may be removed and electrically disconnected without disturbing the seal.*

*3. Power cord. Pump motor power cords shall be designed for flexibility and serviceability under conditions of extra hard usage and shall meet the requirements of the Mine Safety and Health Administration for trailing cables. Ground fault interruption protection shall be used to de-energize the circuit in the event of any failure in the electrical integrity of the cable. Power cord terminal fittings shall be corrosion resistant and be constructed in a manner to prevent the entry of moisture into the cable, shall be provided with strain relief appurtenances and shall be designed to facilitate field connecting.]*

(*[D]***B**) **Valve Chamber and** Valves. Valves required under subsection *[(4)(E)]* **(3)(D)** of this rule shall be located in a separate valve *[pit]* **chamber**. *[Accumulated water shall be drained to the wet well or to the soil. If the valve pit is drained to the wet well, an effective method shall be provided to prevent sewage from entering the pit during surcharged wet well conditions.]*

**1. Access. A minimum access hatch dimensions of twenty-four inches by thirty-six inches (24" x 36") shall be provided. Provide access in accordance with paragraph (3)(A)2. of this rule.**

**2. Portable pump connection. A portable pump connection on the discharge line with rapid connection capabilities shall be provided in the valve chamber.**

(*[7]***6**) Alarm Systems. Alarm systems **with a backup power source** shall be provided for pumping stations. *[The alarm shall be activated in cases of power failure, pump failure, use of the lag pump, unauthorized entry or any cause of pump station malfunction. Pumping station alarms shall be telemetered, including identification of the alarm condition, to a municipal facility that is manned twenty-four (24) hours a day. If such a facility is not available and twenty-four (24)-hour holding capacity is not provided, the alarm shall be telemetered to city offices during normal working hours and to the home of the person(s) responsible in charge of the lift station during off-duty hours. Audiovisual alarm systems with a self-contained power supply may be acceptable in some cases in lieu of the telemetering system outlined in this section, depending upon location, station holding capacity and inspection frequency.]*

*[(8) Emergency Operation. Pumping stations and collection systems shall be designed to prevent or minimize bypassing of raw sewage. For use during possible periods of extensive power outages, mandatory power reductions or uncontrolled storm events, consideration should be given to providing a controlled, high-level wet well overflow to supplement alarm systems and emergency power generation in order to prevent backup of sewage into basements, or other discharges which may cause severe adverse impacts on public interests, including public health and property damage. Where a controlled diversion is utilized, consideration shall also be given to the installation of storage-detention tanks or basins, which will be made to drain to the station wet well. Where overflows affect public water supplies, shellfish production or waters used for*

*culinary or food processing purposes, a storage-detention basin or tank, shall be provided having two (2)-hour detention capacity at the anticipated overflow rate.*

*(A) Overflow Prevention Methods. A satisfactory method shall be provided to prevent or minimize overflows. The following methods should be evaluated on an individual basis. The choice should be based on least cost and least operational problems of the methods providing an acceptable degree of reliability. The methods are—*

*1. Storage capacity including trunk sewers for retention of wet weather flows. Storage basins must be designed to drain back into the wet well or collection system after the flow recedes;*

*2. An in-place or portable pump, driven by an internal combustion engine meeting the requirements of subsection (8)(B) of this rule, capable of pumping from the wet well to the discharge side of the station; and*

*3. Two (2) independent public utility sources or engine-driven generating equipment meeting the requirements of subsection (8)(B) of this rule.*

*(B) Equipment Requirements.*

*1. General. The following general requirements shall apply to all internal combustion engines used to drive auxiliary pumps, service pumps through special drives or electrical generating equipment.*

*A. Engine protection. The engine must be protected from operating conditions that would result in damage to equipment. Unless continuous manual supervision is planned, protective equipment shall be capable of shutting down the engine and activating an alarm on-site and as provided in section (7) of this rule. Protective equipment shall monitor for conditions of low oil pressure and overheating, except oil pressure monitoring will not be required for engines with splash lubrication.*

*B. Size. The engine shall have adequate rated power to start and continuously operate all connected loads.*

*C. Fuel type. Reliability and ease of starting, especially during cold weather conditions should be considered in the selection of the type of fuel.*

*D. Engine ventilation. The engine shall be located above grade with adequate ventilation of fuel vapors and exhaust gases.*

*E. Routine start-up. All emergency equipment shall be provided with instructions indicating the need for regular starting and running of the units at full loads.*

*F. Protection of equipment. Emergency equipment shall be protected from damage at the restoration of regular electrical power.*

*2. Engine-driven pumping equipment. Where permanently installed or portable engine-driven pumps are used, the following requirements in addition to general requirements shall apply:*

*A. Pumping capacity. Engine-driven pump(s) shall meet the design pumping requirements unless storage capacity is available for flows in excess of pump capacity. Pumps shall be designed for anticipated operating conditions, including suction lift if applicable;*

*B. Operation. The engine and pump shall be equipped to provide automatic start-up and operation of pumping equipment. Provisions shall also be made for manual start-up. Where manual start-up and operation is justified, storage capacity and alarm system must meet the requirements of subparagraph (8)(B)2.C. of this rule; and*

*C. Portable pumping systems. Where part or all of the engine-driven pumping equipment is portable, sufficient storage capacity to allow time for detection of pump station failure and transportation and hookup of the portable equipment shall be provided. A riser from the force main with quick-connect coupling and appropriate valving shall be provided to hookup portable pumps.*

*3. Engine-driven generating equipment. Where permanently installed or portable engine-driven generating equipment is used, the following requirements in addition to general requirements shall apply:*

*A. Generating capacity. Generating unit size shall be adequate to provide power for pump motor starting current and for lighting, ventilation and other auxiliary equipment necessary for safety and proper operation of the lift station. The operation of only one (1) pump during periods of auxiliary power supply must be justified. Justification may be made on the basis of maximum anticipated flows relative to single pump capacity, anticipated length of power outage and storage capacity. Special sequencing controls shall be provided to start pump motors unless the generating equipment has capacity to start all pumps simultaneously with auxiliary equipment operating;*

*B. Operation. Provisions shall be made for automatic and manual start-up and load transfer. The generator must be protected from operating conditions that would result in damage to equipment. Provisions should be considered to allow the engine to start and stabilize at operating speed before assuming the load. Where manual start-up and transfer is justified, storage capacity and alarm system must meet the requirements of subparagraph (8)(B)3.C. of this rule; and*

*C. Portable generating equipment. Where portable generating equipment or manual transfer is provided, sufficient storage capacity to allow time for detection of pump station failure and transportation and connection of generating equipment shall be provided. The use of special electrical connections and double throw switches are recommended for connecting portable generating equipment.]*

**(7) Emergency Operation.**

**(A) Emergency High Level Overflows.**

**1. All structures capable of bypassing shall be controlled by a lockable, manually operated valve. Where such overflows are considered, contact the Department for the necessary treatment or storage requirements.**

**2. In addition to the required emergency means of operation, where overflows may affect public water supplies, a high level wet well overflow and a storage/detention basin or tank, the following minimum retention time shall be provided:**

**A. For facilities with a design average flow one hundred thousand (100,000) gallons per day or greater, a storage capacity for two (2)-hour retention of the peak hourly flow; or**

**B. For facilities with a design average flow of less than one hundred thousand (100,000) gallons per day, a storage capacity for four (4)-hour retention of the peak hourly flow.**

**(B) Independent Utility Substations. Where independent substations are used for emergency power, each separate substation and its associated distribution lines shall be capable of starting and operating the pump station at its rated capacity.**

*[(9) Grinder Pumps in Pressure Sewer Systems. A pressure sewer system is defined as two (2) or more grinder pump units at different locations discharging into a common force main. Grinder pump units and pressure systems are not to be used in lieu of conventional gravity collection systems; however, grinder pumps may be used where it is not feasible to provide conventional gravity sewer service, such as where the topography makes it difficult for the users to be served by a conventional system, groundwater conditions make construction and maintenance of a conventional system difficult or excessive rock excavation makes a conventional system impractical. The operating authority shall be responsible for the entire system which shall include the force mains, grinder pump units and appurtenances.*

*(A) Pump Openings. The grinder unit must be capable of reducing any material which enters the grinder unit to a size that the materials will pass through the pump unit and force main without plugging or clogging. No screens or other devices requiring regular maintenance may be used to keep trashy or stringy material out of the grinder pump or force main. This requirement shall be in lieu of the requirements in paragraph (4)(C)3. of this rule.*

*(B) Storage Capacity. The minimum storage capacity of the grinder pump unit shall be fifty (50) gallons (189 l). The unit shall be capable of accommodating normal peak flows for periods of eight to twelve (8–12) hours.*

*(C) Alarm System. For grinder pump units serving a single home, an audiovisual alarm capable of alerting the resident and operating personnel in the area may be used in lieu of the alarm system specified in section (7) of this rule.*

*(D) Valves. A gate valve must be provided on the service line near the common force main.*

*(E) Force Main Velocity. The velocity shall meet the requirements of subsection (11)(A) of this rule based on the most probable number of pump units expected to operate simultaneously or on some other acceptable method of computing the peak pumpage rate.*

*(F) Cleaning. Consideration should be given to providing a suitable method of cleaning the force main whenever the velocity in the force main may be less than two feet (2') per second (0.61m/s) before ultimate development is reached.*

*(G) Electrical. Units must be serviceable and replaceable under wet conditions without electrical hazard to repair personnel. Electrical equipment shall be suitable for hazardous locations (National Electrical Code, Class I, Group D, Division 1 location).*

*(H) Standby Units. One (1) standby unit for each fifty (50) units or fraction thereof must be provided for each model installed.*

*(I) Service Interruptions. Provisions shall be made to avoid interruption of service due to mechanical or power failure by providing standby power, storage capacity or interconnection with another disposal system.]*

*[(10) Instructions and Equipment. Sewage pumping stations and their operators should be supplied with a complete set of operational instructions, including emergency procedures, maintenance schedules, special tools and spare parts as may be necessary.]*

*[(11) Force Mains.*

*(A) Velocity. At design average flow a velocity of at least two feet (2') per second (0.61m/s) shall be maintained.*

*(B) Air Relief Valve. An air relief valve shall be placed at high points in the force main to prevent air locking. When accumulation of air or decomposition gases are likely, an automatic air relief valve suitable for use on sewage force mains shall be used.*
*(C) Termination. Force mains should enter the gravity sewer system at a point not more than two feet (2') (30 cm) above the flow line of the receiving manhole.*
*(D) Design Pressure. The force main and fittings including reaction blocking shall be designed to withstand normal pressure and pressure surges (water hammer).*
*(E) Special Construction. Force main construction near streams or used for aerial crossings shall meet applicable requirements of 10 CSR 20-8.120(9) and (10).*
*(F) Design Friction Losses. Friction losses through force mains shall be based on the Hazen and Williams formula or other acceptable method. When the Hazen and Williams formula is used, the following values for "C" shall be used for design; unlined iron or steel—one hundred (100) and all other—one hundred twenty (120). When initially installed, force mains will have a significantly higher "C" factor. The higher "C" factor should be considered only in calculating maximum power requirements.*
*(G) Separation from Water Mains. There shall be at least a ten-foot (10') (3.0 m) horizontal separation between water mains and sanitary sewer force mains. Force mains crossing water mains shall be laid to provide a minimum vertical distance of eighteen inches (18") (46 cm) between the outside of the force main and the outside of the water main. This shall be the case where the water main is either above or below the force main. At crossings, one (1) full length of water pipe shall be located so both joints will be as far from the force main as possible. Special structural support for the water main and force main may be required.*
*(H) Identification of Force Mains. Where force mains are constructed of material which might cause the force main to be confused with potable water mains, the force main should be appropriately identified.]*

**(8) Force Mains.**

**(A) Velocity. At design pumping rates, a cleansing velocity of at least two feet (2') per second shall be maintained.**

**(B) Installation. Refer to 10 CSR 20-8.120(3)(B).**

**(C) Protection of Water Supplies. Comply with 10 CSR 20-8.120(5) for separation between water mains and sanitary sewer force mains.**

*AUTHORITY: section 644.026, RSMo Supp. 1988.* Original rule filed Aug. 10, 1978, effective March 11, 1979.*
**Original authority 1972, amended 1973, 1987, 1993.*