LEGEND: **DRAFT 08/04/16**
Text to be *[deleted]* is in italics and bracketed.
Black bold text is added from 10 States Standards Chapter 60 2014.
Blue bold text is added from 10 CSR 20-8.020(12).
Orange bold text is added for clarification.
Underline text is added or altered from the previous stakeholder meeting on July 12, 2016.

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

10 CSR 20-8.150 *[Screening, Grit Removal and Flow Equalization]* Preliminary Treatment.

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 screening, grit removal and flow equalization facilities. This rule is to be used with rules 10 CSR 20-8.110[–] through 10 CSR 20-8.2[2]10 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. 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 wastewater screening, grit removal, flow equalization and appurtenances, design manuals such as Water Environment Federation's Manuals of Practice, and other wastewater treatment facility 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 2014 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.]

(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.

(B) Comminutor. A comminutor is an instrument that cuts and shreds stringy materials and coarse solids into smaller sizes (approximately 0.25 to 0.75 inches).
(C) Diurnal Flow Equalization. Diurnal flow equalization provides flow equalization for the dry weather diurnal flow received by a wastewater treatment facility in a twenty-four (24)-hour period.
(D) Fats, Oils, and Grease (FOG). Animal and plant derived substances that may solidify or become viscous between the temperatures of thirty-two and one hundred fifty degrees Fahrenheit (32°F - 150°F), and that separates from wastewater by gravity.
(E) Flow Equalization. Flow equalization is a process of controlling flow rate variations to improve the performance of downstream processes and to reduce the size and cost of downstream treatment facilities.
(F) Grease Interceptor. A grease interceptor is a tank that intercepts and collects FOG from a commercial or institutional kitchen waste stream.
(G) Grit. Grit includes sand, gravel, cinder, or other heavy solid materials that have a higher specific gravity than the organic biodegradable solids in the wastewater. Grit also includes eggshells, bone chips, seeds, coffee grounds, and large organic particles, such as food waste.
(H) Pump and Haul. Pump and haul systems temporarily hold domestic or industrial wastewater; the wastewater is then pumped down and hauled to an appropriate wastewater treatment facility for ultimate disposal.
(I) Screening Device. A screening device physically removes inorganic objects from wastewater such as rags, paper, plastics, and other such debris to prevent damage and clogging of downstream equipment, piping, and appurtenances.
(J) Screenings. Screenings include rags, toilet paper, disposable wipes, trash, and other large, nuisance inorganic materials in the wastewater.
(K) Septage. Septage is a general term for the contents removed from septic tanks, portable vault toilets, privy vaults, holding tanks, semi-public facilities (i.e. mobile home parks, camp grounds, small commercial businesses, etc.) receiving wastewater from domestic sources. Septage usually is quite high in organics, grease, scum, grit, solids, and other extraneous debris.
(L) Wet Weather Flow Equalization. Wet weather flow equalization provides flow equalization during wet weather events which have a hydraulic peaking factor above the capacity of the wastewater treatment facility.

Comment [ETC1]: Will be moved to 8.140.

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

(2) Applicability. This rule shall apply to all wastewater treatment facilities.
(A) This rule shall not apply to animal feeding operations, animal manure management systems, or other agricultural waste management systems. Design guide and criteria for these facilities are found in 10 CSR 20-8.300 and 10 CSR 20-8.500.

LEGEND: **DRAFT 08/04/16**
Text to be *[deleted]* is in italics and bracketed.
Black bold text is added from 10 States Standards Chapter 60 2014.
Blue bold text is added from 10 CSR 20-8.020(12).
Orange bold text is added for clarification.
Underline text is added or altered from the previous stakeholder meeting on July 12, 2016.

(3) General.

(A) A wastewater treatment facility must be designed with the ability to add provisions for removing fats, oils, and grease (FOG) from the wastewater.

(B) If fats, oils, or grease have caused operational failures in an existing treatment unit that is being modified or replaced, then FOG removal must be provided to prevent future failures.

(C) All wastewater treatment facilities must have a screening device, comminutor, or septic tank for the purpose of removing debris and nuisance materials from the influent wastewater.

*[(3)]***(4)** Screening Devices.

(A) General.

1. Design.

A. Flow distribution. Entrance channels should be designed to provide equal and uniform distribution of flow to the screening devices.

B. Flow measurement. Flow measurement devices should be selected for reliability and accuracy. The effect of changes in backwater elevation due to intermittent cleaning of screening devices should be considered in locations of flow measurement equipment. See 10 CSR 20-8.140(8)(I) regarding flow measurement devices.

C. Freeze protection. Mechanically cleaned screening devices and screening storage areas shall be protected from freezing.

D. Corrosion resistance. Screening devices and related structures must be designed to resist the effects of a corrosive environment, including long-term exposure to hydrogen sulfide.

2. Screenings removal and disposal.

A. A convenient and adequate means for removing screenings shall be provided. Any screening device with the working surface of the screen located in pits more than four feet (4') deep shall be provided with mechanical hoisting or lifting equipment capable of lifting the screenings to ground level without facility personnel entry.

B. Facilities shall be provided for handling, storage, and disposal of screenings in a sanitary manner with provisions to minimize vector attraction. Separate grinding of screenings and return to the wastewater flow is unacceptable.

C. Manually cleaned screening devices shall include an accessible platform from which facility personnel may rake screenings easily and safely. Suitable drainage facilities shall be provided for both the platform and the screenings storage area.

D. Impervious, non-slip, working surfaces with adequate drainage shall be provided for screening handling areas.

E. Screening transporting facilities shall be provided with protection against loss of material.

F. Screenings must be disposed of at a frequency that prevents creation of a nuisance. Odor control facilities may also be warranted.

3. Servicing.

A. When used, hosing equipment shall be in accordance with 10 CSR 20-8.140(8)(D) for wastewater treatment facility water supplies.

B. Provisions shall be made for isolating or removing screening devices from their location for servicing. See 10 CSR 20-8.140(6)(B) unit isolation for more information.

4. Access. Screening devices located in pits more than four feet (4') deep should consider providing stairway access. Access ladders are acceptable for pits less than four feet (4') deep, in lieu of stairways.

5. Ventilation.

A. Screening devices, installed in a building where other equipment or offices are located, shall be isolated from the rest of the building by an air-tight partition, be provided with separate outside entrances, and be provided with separate and independent fresh air supply.

B. Fresh air shall be forced into enclosed screening device areas or open pits more than four feet (4') deep.

C. Dampers should not be used on exhaust or fresh air ducts. Fine screens or other obstructions on exhaust or fresh air ducts should be avoided to prevent clogging.

D. Where continuous ventilation is required, at least twelve (12) complete air changes per hour shall be provided. Where continuous ventilation would cause excessive heat loss, intermittent ventilation of at least thirty (30) complete air changes per hour shall be provided when facility personnel enter the area. The air change requirements shall be based on one hundred (100) percent fresh air.

E. Switches for operation of ventilation equipment shall be marked and conveniently located. All intermittently operated ventilation equipment shall be interconnected with the respective pit lighting system.

F. The fan wheel shall be fabricated from non-sparking material.

G. Explosion proof gas detectors shall be provided in accordance with 10 CSR 20-8.140(9).

6. Safety.

A. Railings and gratings.

(I) Manually cleaned screen channels shall be protected by guard railings and deck gratings, with adequate provisions for removal or opening to facilitate raking.

(II) Mechanically cleaned screen channels shall be protected by guard railings and deck gratings. Consideration should also be given to temporary access arrangements to facilitate maintenance and repair.

(III) Also refer to 10 CSR 20-8.140(8)(G).

B. Mechanical devices.

(I) Mechanical screening equipment shall have adequate removal enclosures to protect facility personnel against accidental contact with moving parts and to prevent dripping in multi-level installations.

(II) A positive means of locking out each mechanical device shall be provided.

(III) An emergency stop button with an automatic reverse function shall be located in close proximity to the mechanical device.

C. Lighting. Suitable lighting shall be provided in all work and access areas. Refer to subparagraph (4)(A)7.B. of this rule.

7. Electrical equipment and control systems.

A. Timing devices. All mechanical units that are operated by timing devices shall be provided with auxiliary controls that will set the cleaning mechanism in operation at a preset high water elevation. If the cleaning mechanism fails to lower the high water, a warning should be signaled.

B. Electrical equipment, fixtures, and controls. Electrical equipment, fixtures, and controls in screening area where hazardous gases may accumulate shall meet the requirements of the National Electrical Code for Class I, Division 1, Group D locations.

C. Manual override. Automatic controls shall be supplemented by a manual override.

*[(A)]***(B)** *[Bar Racks and Screens.]* **Coarse Screens.**

1. *[When]* **Where** required. Protection for pumps and other equipment shall be provided by *[either]* **trash racks,** coarse bar racks**,** or *[bar]* **coarse** screens **at a minimum**.

[Protection for comminutors should be provided by coarse bar racks.]

[2. Location.

A. Indoors. Screening devices, installed in a building where other equipment or offices are located, should be accessible only through a separate outside entrance.

B. Outdoors. Screening devices installed outside shall be protected from freezing.

C. Access. Screening areas shall be provided with stairway access, adequate lighting and ventilation and a convenient and adequate means for removing the screenings.]

*[3.]***2.** Design *[and installation]*.

A. Bar spacing.

(I) Manually cleaned. Clear openings between bars should be *[no less than]* **from** one *[inch (1") (2.54 cm)]* **to three inches (1" – 3")** for manually cleaned screens.

(II) Mechanically cleaned. Clear openings for mechanically cleaned screens may be *[as]* small**er** *[as five-eighths of an inch (5/8") (1.50 cm)]* **than one inch (1")**. Maximum clear openings should be one and three-fourths inches (1 3/4") *[(4.45 cm)]*.

B. Slope. Manually cleaned screens*[, except those for emergency use,]* should be placed on a slope of thirty to forty-five degrees (3*[5]***0**°–45°) *[on]* **from** the horizontal.

C. Velocities. At *[normal operating]* **design average** flow conditions, approach velocities should be no less than 1.25 feet per second *[(38.1 cm/sec)]*, to prevent settling; and no greater than **three (**3.0**) feet per second** *[fps (91.4 cm/sec)]* **at peak hourly flows** to prevent forcing material through the openings.

D. Channels. Dual channels shall be provided and equipped with the necessary gates to isolate flow from any screening unit. Provisions shall *[also]* be made to facilitate de*[-]*watering each *[unit]* **channel**. The channel preceding and following the screen shall be shaped to eliminate stranding and settling of solids.

E. Auxiliary screens.

(I) Where a single mechanically cleaned screen is used, an auxiliary manually cleaned screen shall be provided. The design should consider provisions for future installation of a second mechanically cleaned screen to meet the requirements of part (4)(B)2.E.(II) of this rule.

(II) Where two (2) or more mechanically cleaned screens are used, the design shall provide for taking any unit out-of-service without sacrificing the capability to handle the design peak instantaneous flow.

*[E.]***F.** Invert. The screen channel invert should be three to six inches (3"–6") *[(7.6–15.2 cm)]* below the invert of the incoming sewer. **To prevent jetting action, the length and construction of the channel shall be adequate to reestablish the hydraulic flow pattern following the drop in elevation.**

[F. Flow distribution. Entrance channels should be designed to provide equal and uniform distribution of flow to the screens.

G. Flow measurement. Flow measurement devices should be selected for reliability and accuracy. The effect of changes in backwater elevations, due to intermittent cleaning of screens, should be considered in locations of flow measurement equipment.]

[4. Safety.

*A. Railings and gratings. Manually cleaned screen channels shall be protected by guard railings and deck gratings**,** with adequate provisions for removal or opening to facilitate raking. Mechanically cleaned screen channels shall be protected by guard railings and deck gratings. Consideration should also be given to temporary access arrangements to facilitate maintenance and repair.*

B. Mechanical devices. Mechanical screening equipment shall have adequate removal enclosures to protect personnel against accidental contact with moving parts and to prevent dripping in multi-level installations. A positive means of locking out each mechanical device shall be provided.

5. Control systems.

A. Timing devices. All mechanical units which are operated by timing devices shall be provided with auxiliary controls which will set the cleaning mechanism in operation at a pre-set high water elevation.

*B. Electrical fixtures and controls. Electrical fixtures**,** and controls in screening areas where hazardous gases may accumulate shall be suitable for hazardous locations (National Electrical Code, Class I, Group D, Division 1 location).*

C. Manual override. Automatic controls shall be supplemented by a manual override.

6. Disposal of screenings. Facilities must be provided for removal, handling, storage and disposal of screenings in a sanitary manner. Separate grinding of screenings and return to the sewage flow is unacceptable. Manually cleaned screening facilities should include

an accessible platform from which the operator may rake screenings easily and safely. Suitable drainage facilities shall be provided for both the platform and storage areas.
7. Auxiliary screens. Where a single mechanically cleaned screen is used, an auxiliary manually cleaned screen shall be provided. Where two (2) or more mechanically cleaned screens are used, the design shall provide for taking any unit out-of-service without sacrificing the capability to handle the peak design flow.]

*[(B)]***(C)** Fine Screens.

1. General.

A. Fine screens, as discussed in this subsection, have clear openings of one sixteenth to one quarter inch (1/16" – 1/4"). The amount of material removed by fine screens is dependent on the waste stream being treated and screen opening size.

B. Fine screens should not be considered equivalent to primary settling. However, *[F]***f**ine screens may be used in lieu of primary *[sedimentation providing that]* **settling where** subsequent treatment units are designed on the basis of anticipated screen performance. *[Fine screens should not be considered equivalent to primary sedimentation.]* **Selection of screen capacity should consider flow restriction due to retained solids, adhesive materials, frequency of cleaning, and extent of cleaning.** Where fine screens are used, additional provisions for the removal of *[floatable oils and greases]* **FOG** shall be considered.

C. Hosing equipment shall be provided to facilitate cleaning. Refer to 10 CSR 20-8.140(8)(D) for wastewater treatment facility water supplies.

2. Design. *[Tests should be conducted to determine BOD_5 and suspended solids removal efficiencies at the design peak hydraulic and peak organic loadings.]*

A. A minimum of two (2) fine screens shall be provided*[;]* **with** each unit being capable of independent operation. Capacity shall be provided to treat **design** peak *[design]* **instantaneous** flow*[s]* with *[one (1)]* **the largest** unit out-of-service.

B. Fine screens *[shall]* **should** be preceded by a *[mechanically cleaned bar screen or other protective]* **coarse screening** device. *[Comminuting devices shall not be used ahead of fine screens.]*

C. During operation, a moving or rotating fine screen must use a cleaning device, such as water jets or wiper blades.

D. A fine screen must automatically convey the screenings to a storage area or processing unit with provisions to minimize vector attraction.

E. A fine screen must meet the manufacturer's recommendations with respect to velocity and head loss through the fine screen.

[3. Electrical fixtures, and controls. Electrical fixtures, and controls in screening areas where hazardous gases may accumulate shall be suitable for hazardous locations (National Electrical Code, Class I, Group D, Division 1 location).
4. Servicing. Hosing equipment shall be provided to facilitate cleaning. Provisions shall be made for isolating or removing units from their location for servicing.]

3. Organic removal credit. Any BOD_5 and suspended solids reduction percentage claimed for a fine screen must be developed through a pilot study conducted on

actual full-scale operation of the proposed fine screen at the design maximum day flow and design maximum day organic loadings. Pilot testing for an extended time is preferred to cover seasonal operational variations.

A. The BOD_5 reduction percentage claimed must not exceed thirty-five percent (35%).

B. The facility plan must justify any reduction in the size of the treatment unit that is based on organic removal by a fine screen.

C. A wastewater treatment facility claiming an organic reduction credit must include a sufficient number of fine screen units so that any organic reduction claimed will be met with the largest fine screen out-of-service.

D. No organic removal credit shall be allowed with a single fine screen design.

(D) Microscreens. Wastewater treatment facilities proposing microscreens for preliminary treatment shall be evaluated on a case-by-case basis. Refer to 10 CSR 20-8.210(5).

1. Microscreens have openings of less than one millimeter (1 mm).

2. Microscreens shall be located downstream of grit removal equipment and be protected by a coarse screening device at a minimum.

*[(4)]***(5)** Comminutors.

(A) General. Provisions for *[location]* **access, ventilation, and safety** shall be in accordance with *[screening devices,]* paragraph**s** (*[3]***4**)(A)*[2]***4**. **through (4)(A)6.** of this rule.

[(B) When Required. Comminutors shall be used in plants that do not have primary sedimentation or fine screens and should be provided in cases where mechanically cleaned bar screens will not be used.]

(B) When Used. Comminutors may be used in lieu of screening devices to protect equipment where stringy substance accumulation on downstream equipment will not be a substantial problem.

(C) Design Considerations.

1. Location.

A. Comminutors should be located downstream of *[any]* grit removal equipment **and be protected by a coarse screening device**.

B. Comminutors not preceded by grit removal equipment shall be protected by a six inch (6") deep gravel trap.

2. Size. Comminutor capacity shall be adequate to handle **design** peak **hourly** flow*[s]*.

3. Installation.

A. A**n auxiliary coarse, manually cleaned** screened *[bypass]* channel shall be provided **at a minimum**. The use of the *[bypass]* **auxiliary screened** channel should be automatic *[at depths of flow exceeding the design capacity for the comminutor]* **for all comminutor failures and at depths of flow exceeding the design capacity for the comminutor**. *[Each comminutor that is not preceded by grit removal equipment should be protected by a six inch (6.0") (15.2 cm) deep gravel trap.]*

B. Gates shall be provided in accordance with subparagraph**s** (*[3]***4**)(A)*[3]***2**.D. **through (4)(A)2.E.** of this rule.

Comment [ETC2]: Comment: If a facility claimed this credit, would a landfill accept the screenings as residual waste or as municipal sludge?

I will ask Solid Waste what the requirements would be.

4. Servicing. Provisions shall be made to facilitate servicing units in place and **to** remov*[ing]***e** units from their location for servicing.

5. Electrical controls and motors. Electrical equipment in comminutor chambers where hazardous gases may accumulate shall *[be suitable for hazardous locations ()* **meet the requirements of the** National Electrical Code*[,]* **for** Class I, *[Group D,]* Division 1**, Group D** location*[)]***s**. Motors *[in areas not governed by this requirement may need protection]* **shall be protected** against accidental submergence.

*[(5)]***(6)** Grit Removal Facilities.

(A) When Required.

1. Wastewater treatment facilities using, membrane bioreactors for secondary treatment, anaerobic digestion, and *[Grit removal facilities should be provided for all sewage treatment plants; and are required for plants]* **facilities** receiving *[sewage]* **wastewater** from **either** combined sewers or from sewer systems receiving substantial amounts of grit **must have grit removal facilities**.

2. Grit removal facilities should be provided for all mechanical wastewater treatment facilities. If a *[plant]* **wastewater treatment facility** serving a separate sewer system is designed without grit **removal** facilities, the design shall include provisions for future installation. Consideration shall be given to possible damaging effects on pumps, comminutors**,** and other *[preceding]* equipment**,** and the need for additional storage capacity in treatment units where grit is likely to accumulate.

(B) Location.

1. General. Grit removal facilities should be located ahead of pumps and comminuting devices. Coarse *[bar racks]* **screening devices** should be placed ahead of grit removal facilities.

2. Housed facilities.

A. Ventilation. **Refer to paragraph (4)(A)5. of this rule.** *[Uncontaminated]* **Fresh** air shall be introduced continuously at a rate of **at least** twelve (12) air changes per hour**;** *[or]* **if** intermittently**,** *[at a rate of]* **shall provide at least** thirty (30) air changes per hour. Odor control facilities may also be warranted.

B. Access. Adequate stairway access to above or below grade facilities shall be provided. **Refer to paragraph (4)(A)4. of this rule.**

C. Electrical. *[All electrical work]* **Electrical equipment** in enclosed grit removal areas where hazardous gases may accumulate shall *[be suitable for hazardous locations ()* **meet the requirements of the** National Electrical Code*[,]* **for** Class I, *[Group D,]* Division 1**, Group D** location*[)]***s**. **Explosion proof gas detectors shall be provided in accordance with 10 CSR 20-8.140(9).**

3. Outside facilities. Grit removal facilities located outside shall be protected from freezing.

(C) Size. Grit removal facilities with fixed capacity shall be provided to treat the design peak hourly flow.

*[(C)]***(D)** *[Type and]* Number of Units.

1. *[Plants]* **Wastewater treatment facilities** treating wastes from combined sewers

should have at least two (2) mechanically cleaned grit removal units**,** with provisions for *[bypassing]* **unit isolation**.

2. A single manually cleaned or mechanically cleaned grit chamber with *[bypass]* **provisions for unit isolation** is acceptable for *[small sewage]* **wastewater** treatment *[plants]* **facilities with a design average flow of less than one (1) million gallons per day** serving separate sanitary sewer systems.

3. *[Minimum facilities for larger plants]* **Wastewater treatment facilities with a design average flow of one (1) million gallons per day or greater** serving separate sanitary sewers should *[be]* **have** at least one (1) mechanically cleaned unit with *[a bypass]* **provisions for unit isolation**.

(E) Grit Chamber Types. Facilities other than channel-type *[are acceptable if]* **shall be** provided with adequate and flexible controls for *[agitation]* **velocity** and/or air supply devices and with grit collection and removal equipment.

1. Channel-type grit chambers.

A. Velocity must range from 0.8 to 1.3 feet per second at design average flow.

B. The channel must minimize turbulence and provide uniform velocity across the channel.

C. The channel size must accommodate the grit removal equipment capacity and grit storage.

2. Aerated grit chambers.

A. Aerated grit chambers should have air rates adjustable in the range of three to eight (3 – 8) cubic feet per minute per foot of tank length.

B. Detention time in the tank should be in the range of three to five (3 – 5) minutes at design peak hourly flows.

C. The grit hopper must be located under an air diffuser.

3. Mechanical grit chambers.

A. The velocity must be no greater than one (1) foot per second at design average flow.

B. Each channel must include a grit hopper at the side of a tank contiguous to a grit removal mechanism.

C. An inlet must include baffles to prevent short-circuiting.

D. Grit removal must be provided by one (1) of the following mechanisms:

(I) Reciprocating rake;

(II) Screw conveyor; or

(III) Air lift pump.

4. Cyclonic grit chambers.

A. A cyclonic grit chamber must prevent inlet-to-outlet short circuiting.

B. A cyclonic grit chamber must include an adjustable apex with a quick disconnect assembly to remove any oversized object.

C. Detention time must be at least one (1) minute at the design average flow.

D. The flow velocity range must be one to two (1-2) feet per second at design average flow.

E. A screening device must be installed upstream of a cyclonic grit chamber.

5. Vortex grit chamber.

A. An inlet channel must include a straight length in order to deliver smooth flow into the vortex grit chamber. The length of the inlet channel must be at least seven (7) times the width or fifteen feet (15'), whichever is greater.

B. Detention time must be at least thirty (30) seconds at the design average flow.

C. The inlet velocity must be at least two (2) feet per second at peak flow.

D. Provide a propeller with a variable speed drive to operate the unit based upon the wastewater treatment facility flow.

E. An outlet channel must maintain a constant elevation.

F. Provide air or water scour to loosen compacted grit and facilitate the grit lifting and removal from the chamber.

*[(D)]***(F)** Design Factors.

1. General. The design effectiveness of a grit removal system shall be commensurate with the requirements of the subsequent process units.

[2. Inlet. Inlet turbulence shall be minimized.]

*[3.]***2.** *[Velocity and d]***D**etention. *[Channel-type chambers shall be designed to control velocities during normal variations in flow as close as possible to one foot (1') per second (30 cm/sec).]* The detention period shall be based on the size of particle to be removed.

3. Aerated grit removal. All **aerated** grit removal facilities should be provided with adequate *[automatic]* control devices to regulate *[detention time, agitation or]* air supply **and agitation**.

4. Pumped grit removal. All pumped grit removal shall be by pumps specifically designed to handle grit.

*[4.]***5.** Grit washing. The need for grit washing should be determined by the method of **grit handling and** final *[grit]* disposal.

6. Grit piping. Cleanouts should be installed on grit piping to facilitate maintenance. Quick removable fittings should be installed at all changes in alignment on grit piping.

*[5.]***7.** *[Drains]***Dewatering**. Provisions shall be made for isolating and de*[-]*watering each unit. **The design shall provide for complete draining and cleaning by means of a sloped bottom equipped with a drain sump.**

*[6.]***8.** Water. An adequate supply of water under pressure shall be provided for cleanup. **Refer to 10 CSR 20-8.140(8)(D) for wastewater treatment facility water supplies.**

[7. Grit handling. Grit removal facilities located in deep pits should be provided with mechanical equipment for hoisting or transporting grit to ground level. Impervious, non-slip, working surfaces with adequate drainage shall be provided for grit handling areas. Grit transporting facilities shall be provided with protection against freezing and loss of material.]

(G) Grit Handling and Disposal. Provisions for grit handling and disposal shall be in accordance with paragraph (4)(A)2. of this rule.

(H) Safety. Provisions for safety shall be in accordance with paragraph (4)(A)6. of this rule.

Comment [ETC3]: Is there a generic name for Victaulic fittings?

LEGEND: **DRAFT 08/04/16**
Text to be *[deleted]* is in italics and bracketed.
Black bold text is added from 10 States Standards Chapter 60 2014.
Blue bold text is added from 10 CSR 20-8.020(12).
Orange bold text is added for clarification.
Underline text is added or altered from the previous stakeholder meeting on July 12, 2016.

*[(6)]***(7) Preaeration.** Pre*[-]*aeration of *[sewage]* **wastewater** *[to reduce septicity]* may be required *[in special cases]* **to reduce septicity, separate grease, promote uniform distribution of solids to clarifiers, or as an odor control measure**.

(A) Pre-aeration unit operations shall be designed so that removal from service will not interfere with normal downstream operation of the remainder of the treatment facility.
(B) Inlet and outlet devices shall be designed to ensure proper distribution and help prevent solids deposition, while minimizing any hydraulic short circuiting effects.
(C) The aeration equipment should be capable of obtaining both adequate mixing and self-cleaning velocities within the basin.

*[(7)]***(8) Diurnal** Flow Equalization.

[(A) General. Flow equalization can reduce the dry weather variations in organic and hydraulic loadings at any wastewater treatment plant. It should be provided where large diurnal variations are expected.]

(A) When Required.

1. The use of flow equalization should be considered where significant variations in organic and hydraulic loadings are expected, where peak to average is greater than three to one (3:1). See also 10 CSR 20-8.140(5)(D)4.
2. Flow equalization should be considered at all wastewater treatment facility with department approved pretreatment programs.
3. Flow equalization should be provided at all wastewater treatment facilities utilizing a wet weather flow equalization basin.
4. Flow equalization shall be provided ahead of sequencing batch reactors or other mechanical batch discharging treatment facilities. See also 10 CSR 20-8.180(?).
5. Flow equalization shall be provided ahead of biological treatment facilities that are permitted with effluent limitations less than twenty (20) milligrams per liter of BOD_5 or total suspended solids, or an ammonia of less than 0.6 milligrams per liter, or a total phosphorus of less than two (2) milligrams per liter; unless, engineering analysis shows that absence of flow equalization is more cost effective while maintaining the same degree of reliability and operational control.

(B) Location. Equalization basins should be located downstream of *[pretreatment facilities]* **preliminary treatment components** such as *[bar screens]* **screening devices**, comminutors**,** and grit *[chambers]* **removal facilities**.

(C) Type. Flow equalization can be provided by using separate basins or on-line treatment units**,** such as aeration tanks. Equalization basins may be designed as either in-line or side-line units. **If a wastewater treatment facility has an actual flow of fifty percent (50%) or less of the design average flow,** *[U]***u**nused treatment units, such as *[sedimentation]* **settling** or aeration tanks, may be utilized as equalization basins *[during the early period of design life]*.

(D) Size. Equalization basin capacity should be sufficient to effectively reduce expected flow and load variations to the extent deemed to be economically advantageous. With a diurnal flow pattern, the volume required to achieve the desired degree of equalization can be

Comment [ETC4]: Add citation for SBRs.

Comment [ETC5]: Is this reasonable? It is the EPA mussels present, summer monthly average limit. Or should we select a total nitrogen limit?

It was previously TKN of less than 5 mg/L; however, TKN is not a common effluent limit.

Comment [ETC6]: Should we reduce this to 0.5 mg/L?

determined from a cumulative flow plot over the representative twenty-four (24)-hour period.

(E) Operation.

1. Mixing. Aeration or mechanical equipment shall be provided to maintain adequate mixing. Corner fillets and hopper bottoms with draw-offs should be provided to alleviate the accumulation of sludge and grit.

2. Aeration. Aeration equipment shall be sufficient to maintain a minimum of **one milligram per liter (**1.0 mg/l**)** of dissolved oxygen in the mixed basin contents at all times. Air supply rates should be a minimum of 1.25 *[cfm]* **cubic feet per minute** per one thousand **(1,000)** gallons *[(1000 gal) (9 l/min/m^3)]* of storage capacity. The air supply should be isolated from other treatment *[plant]* **facility** aeration requirements to facilitate process aeration control*[. Standard process aeration]***, although process air** supply equipment may be utilized as a source of standby aeration.

3. Multiple mixing and aeration spare units should be provided for continuous operability.

*[3.]***4.** Controls. Inlets and outlets for all basin compartments shall be suitably equipped with accessible external valves, stop plates, weirs**,** or other devices to permit flow control and the removal of an individual unit from service. Facilities shall also be provided to measure and indicate liquid levels and flow rates **leaving the basin**.

5. For pumped flow to an equalization basin, the effluent from the basin must be controlled by a flow-regulating device capable of maintaining a flow rate that allows downstream process units to operate as designed.

6. For pumped flow from an equalization basin, a variable-speed pump or multiple pumps are required to deliver a constant flow to downstream treatment units.

(F) Construction Materials. Type of construction materials may be earthen, concrete, or steel basins. See 10 CSR 20-8.200(5)(D)5. for earthen basin construction requirements.

(G) Number of Basins. Flow equalization basins with a storage capacity exceeding twenty thousand (20,000) gallons should be constructed as compartmentalized or as multiple basins.

*[(F)]***(H)** Electrical. All electrical work in housed equalization basins**,** *[shall be suitable for hazardous locations ()]***where hazardous concentrations of flammable gases or vapors may accumulate, shall meet the requirements of the** National Electrical Code*[,]* **for** Class I, *[Group D,]* Division 1**, Group D** location*[)]***s**.

*[(G)]***(I)** Access. Suitable access shall be provided to facilitate *[the]* **cleaning and** maintenance of equipment *[and cleaning]*.

(9) Wet Weather Flow Equalization.

(A) When Required.

1. The use of wet weather flow equalization should be considered where significant variations in organic and hydraulic loadings are anticipated, where the wet weather flow is greater than the dry-weather design peaking factor of the wastewater treatment facility serving separate sanitary sewer systems. Refer to 10 CSR 20-8.110(4)(C)4. Figure 1.

2. Wet weather flow equalization shall be provided at all wastewater treatment

facilities treating wastes from combined sewers.

(B) Basin Type.

1. For gravity inlet systems, provide flow splitting or automated flow diversion devices to divert excess flows to the basin(s).

2. For pumped systems, installation of control valves or dedicated pumps to handle wet weather flow shall be used to divert wet weather flow to the basin.

3. Depending on the elevation of the basin, it may be possible to return the flow to the head of the wastewater treatment facility by gravity. If not, a dedicated pump return system shall be required.

(C) Design. The design of basins requires a thorough evaluation of wet weather flow patterns and volumes. Items to be considered are basin geometry, construction materials, storage capacity and operational controls.

(D) Construction Materials. Type of construction materials may be earthen, concrete, or steel basins. See 10 CSR 20-8.200(5)(D)6. for earthen basin construction requirements.

(E) Basin Layout.

1. Basins designed for storage of five (5) million gallons or more should have a minimum of two (2) compartments designed to operate in series. All flow should be diverted to a basin where solids can settle and, at a predetermined elevation, overflow to additional basins.

2. A single basin equipped with an impervious liner is acceptable where the required storage capacity is less than five (5) million gallons.

(F) Storage Capacity. Design minimum storage to contain the anticipated excess flow during the largest seven (7)-day wet weather period in ten (10) years, with the capability to be emptied in a timely manner. Actual flow data, based on no less than one (1) year of influent flow data, shall be used to develop flow balance or mass diagrams for determining basin capacity. Base the frequency and duration of storms on field data and weather service records.

(G) Pumps and Flow Control Methods. Controls are required to regulate flow to the basin and return flow to the head of the wastewater treatment facility.

1. Adequate controls with measuring devices are required to divert all flow in excess of the wastewater treatment facility's hydraulic capacity to the basin.

2. Provisions and controls are required to return the basin contents to the head of the wastewater treatment facility after the wet weather event has passed and influent flow returned to normal.

3. Return flow may be manual or automatic, but sufficient flow measurement and instrumentation devices must be included to determine the actual return flow to the head of the wastewater treatment facility.

4. Where basin return flow is automatic, control equipment must limit the combination of influent flow plus the basin return flow to the hydraulic capacity of the wastewater treatment facility.

(10) Grease Interceptors.

(A) Where Required. Grease interceptors shall be provided on kitchen drain lines from institutions, hospitals, hotels, restaurants, schools, bars, cafeterias, clubs, and other establishments from which relatively large amounts of grease may be discharged to a wastewater treatment facility owned by the grease producing entity.

(B) Waste Streams. Grease interceptors should receive only the waste streams from grease-producing fixtures. Sanitary waste streams, garbage grinder waste streams, and other waste streams which do not include grease should be excluded from passing through the grease interceptors.

(C) Size. A grease interceptor must have a minimum capacity of at least one hundred twenty-five (125) gallons or the calculated capacity from Equation 150-1, included herein, or local requirement whichever is highest. Twenty-five percent (25%) of the grease interceptor volume should be provided for freeboard and ventilation.

Equation 150-1. Grease Interceptor Capacity (gallons) = $\left(\frac{M \times G \times D}{C}\right) \times 1.25$

Where:

M = Number of meals per day;
G = Grease production (lbs grease/meal) from Table 150-1;
D = Days per pump-out cycle, minimum of 30 days; and
C = Conversion factor of 7.2 lbs grease equals 1 gallon of grease.

Table 150-1. Grease Production

Grease Output	Example Entities	No Flatware (lbs grease/meal)	With Flatware (lbs grease/meal)
Low	Sandwich shop, convenience store, bar, delicatessen, snack bar, ice cream parlor, hotel breakfast bar	0.005	0.0065
Medium	Coffee house, café, pizza, grocery store (no fryer), cafeteria (no food prep), Greek, Indian, Japanese, Korean, Thai, low grease output entity with fryer	0.025	0.0325
High	Cafeteria, family restaurant, fast food, bar and grill, bakery, Italian, German, buffet, grocery store (with fryer)	0.035	0.0455
Very High	Steak house, seafood, Mexican, Chinese, fried chicken, barbecue	0.058	0.075

(D) Location. Grease interceptors should be located outdoors, in sight of the structure it is serving, and as close to the fixtures being served as possible. Grease interceptors shall be buried with access risers at or above grade with consideration given to accessibility for future maintenance and removal of accumulated grease.

(E) Construction materials.

1. Grease interceptors are typically constructed from fiberglass reinforced polyester, high density polyethylene (HDPE), or concrete. Refer to ASTM F2649 for corrugated HDPE grease interceptors and ASTM C1613 for precast concrete grease interceptors.

2. All pipes and appurtenances within a grease interceptor must be corrosion resistant. For metal components, austenitic stainless steel of type 316 or 304 shall be provided at a minimum. Nylon is degraded by hydrogen sulfide and is not acceptable.

3. Contact between dissimilar metals should be avoided or other provisions made to minimize galvanic action.

(F) Grease interceptors shall be watertight.

(G) Access. A minimum access diameter of twenty-four inches (24") shall be provided for access to all chambers of the grease interceptor. Bolt-down cover assemblies or locked covers shall be provided.

(H) Baffles. The grease interceptor shall be baffled.

(I) Corrosion protection. Corrosion protection on the interior of the grease interceptor shall be provided. All pipes within a grease interceptor must be corrosion resistant.

(J) Inlet and outlet. The inlet shall minimize turbulence and enter below the normal water level. The outlet shall be drawn from near the bottom of the grease interceptor, to remove as much FOG as possible.

(K) Cleanouts. A cleanout shall be installed on the influent and discharge piping of the grease interceptor.

(11) Septage. Septage is normally considered treatable at a wastewater treatment facility. However, unless proper planning and design is provided, septage may represent a shock loading or have other adverse impacts on the facility's processes and effluent quality.

(A) General. Data for local septage to be received should be collected for design of septage receiving and treatment systems. The characteristics of septage should be expected to vary widely from load to load depending on the source.

(B) Supplement to the facility plan. The facility plan shall contain the following information in addition to that required in 10 CSR 20-8.110(4)(C):

1. The uninterrupted and satisfactory treatment (within the permitted effluent limits) of waste loads from the sewer system shall not be adversely affected by the addition of septage to the wastewater treatment facility;

2. In general, the smaller the facility design capacity relative to the septage loading, the more subject the facility will be to upset and potential violation of permitted effluent limits;

3. Allocation of organic capacity originally planned for future growth;

4. For wastewater treatment facilities to be expanded or upgraded, the sensitivity of the treatment process to receiving septage and the impact on permitted effluent limits should be jointly considered;

5. An evaluation of available facility personnel and the staffing requirements necessary when septage is to be received. Facility personnel should be present when septage is received and unloaded. Added laboratory work associated with receiving septage for treatment should be included in the staffing and laboratory facilities evaluation;

6. The space for constructing septage receiving facilities that are to be offline from the raw wastewater from the sewer system. Other facility activity and traffic flow should be considered when locating the septage receiving facility and the septage hauler unloading area; and

7. The impact of the septage handling and treatment on the facility sludge handling and processing units and ultimate sludge disposal procedures.

(C) Design. The design of the septage receiving station at the wastewater treatment facility should provide for the following elements:

1. A hard surface haul truck unloading ramp sloped to a drain to allow ready cleaning of any spillage and washing of the haul tank, connector hoses, and fittings. The ramp draining shall be tributary to treatment facilities and shall exclude excessive stormwater;

2. A flexible hose fitting with easy connect coupling to provide for direct connection from the haul truck outlet to minimize spillage and help control odors;

3. Washdown water with ample pressure, hose, and spray nozzle for convenient cleaning of the septage receiving station and haul trucks. Refer to 10 CSR 20-8.140(80(D) for wastewater treatment facility water supplies;

4. An adequate off-line septage receiving tank designed to provide complete draining and cleaning by means of a sloped bottom equipped with a drain sump should be provided. The design should give consideration to adequate mixing for testing, uniformity of septage strength, chemical addition (if necessary), for treatability, and odor control. The capability to collect a representative sample of any truck load of waste accepted for discharge at the facility shall be provided. Facility personnel shall have authority to prevent and stop any disposal that is likely to cause an effluent violation;

5. Screening, grit, and grease removal of the septage as appropriate to protect the treatment units;

6. Pumps for handling the septage should be nonclogging and capable of passing three (3)-inch diameter solids;

7. Valving and piping for operational flexibility to allow the control of the flow rate and point of septage discharge to the facility;

8. Safety features to protect the facility personnel. Refer to 10 CSR 20-8.140(9); and

9. Laboratory and staffing capability to determine the septage strength and toxicity to the treatment processes and provisions for operation reports to include the

wastewater treatment facility load attributed to septage. Refer to 10 CSR 20-8.140(11).

(12) Septic Tanks. Septic tanks may be accepted as a satisfactory means of primary treatment for wastewater treatment facilities with a design average flow of twenty-two thousand five hundred (22,500) gallons per day or less.

(A) Size. The capacity of the septic tank should be determined based on the design average flow of the facility with a thirty-six (36)-hour detention time at a minimum. A septic tank must have a minimum capacity of at least one thousand (1,000) gallons. Twenty percent (20%) of the septic tank volume should be provided for freeboard and ventilation.

(B) Construction materials.

1. Septic tanks are typically constructed from fiberglass reinforced polyester, high density polyethylene, or concrete.

2. All pipes and appurtenances within a septic tank must be corrosion resistant. For metal components, austenitic stainless steel of type 316 or 304 shall be provided at a minimum. Nylon is degraded by hydrogen sulfide and is not acceptable.

3. Contact between dissimilar metals should be avoided or other provisions made to minimize galvanic action.

(C) Septic tanks shall be watertight.

(D) Access. A minimum access diameter of twenty-four inches (24") shall be provided to service the tank. Bolt-down cover assemblies or locked covers shall be provided.

(E) Baffles. The septic tank shall be baffled. The baffle wall shall have a minimum three inch (3") air gap from the lid of the septic tank for ventilation.

(F) Corrosion protection. Corrosion protection on the interior of the septic tank shall be provided. All pipes within a septic tank must be corrosion resistant.

(G) Inlet and outlet tees. Inlet and outlet tees shall be provided to maximize removal and retention of solids within the septic tank.

(H) Ventilation. Septic tanks must be ventilated.

(I) Outlet screen. The septic tank outlet shall have an effluent screen to reduce large solids.

(J) Location. Septic tanks shall be buried with access risers at or above grade. The location should consider accessibility for future maintenance and removal of accumulated solids.

(13) Pump and Haul. Pump and haul systems are not to be used in lieu of traditional onsite wastewater treatment facilities or connection to a centralized collection system operated and maintained by one (1) of the continuing authorities listed in 10 CSR 20-6.010(3)(B). Pump and haul systems shall be reviewed and approved by the department on a case-by-case basis. Pump and haul systems are not a form of wastewater treatment. Therefore, prevention of the discharge of raw wastewater to any waters of the state and to protect public health is necessary.

(A) General.

Comment [ETC7]: Septic tanks are considered primary treatment. Should this be moved to 10 CSR 20-8.140 or 8.180 under recirculating media filters?

Comment [ETC8]: We will move this to 10 CSR 20-8.140, but want to provide an opportunity for comments.

1. Accessibility. Pump and haul systems shall be readily accessible by maintenance vehicles during all weather conditions. Pump and haul systems should be located off the traffic way of streets and alleys. Also refer to 10 CSR 20-8.140(3)(D).

2. Security. Access hatches and electrical control panels shall be provided with locks. The pump and haul site shall be fenced. Refer to 10 CSR 20-8.140(9)(A)1. for fencing requirements.

3. Buoyancy. Where high groundwater conditions are anticipated, buoyancy of the piping and wastewater structures shall be considered and, if necessary, adequate provisions shall be made for protection.

4. Protection of Water Supplies. The separation and crossing of water supplies shall be in accordance with 10 CSR 20-8.120(10).

(B) Septic Tank Design. The septic tank design shall meet the requirements of 10 CSR 20-8.150(12) with the exception of the detention time as a minimum of 30 days.

(C) Earthen Basin Design. Refer to 10 CSR 20-8.200(?).

Comment [ETC9]: Which section of the 8.200 should be cited?

(D) Controls. Water level control sensing device should be located to prevent undue affects from turbulent flows entering the septic tank or earthen basin. Water level controls must be accessible without entering the septic tank or earthen basin.

(E) Alarm system. Alarm system with a backup power source shall be provided for pump and haul systems. The alarm shall be activated in cases of high water levels. The alarm system shall transmit and identify alarm conditions to the responsible personnel in charge of the pump and haul system. Also refer to 10 CSR 20-8.140(8)(C).

(14) Supplement to the Summary of Design. The summary of design shall contain the following information in addition to that required in 10 CSR 20-8.110(5).

Comment [ETC10]: Is there anything additional that needs to be included from 8.110(5) (i.e. sizing, rates, velocities, diagrams, etc. for all individual process units)? If so, ideas of what to include?

(A) Screening Devices. Provide the number of units, type, clear opening size, and the velocity at average design flow and peak hourly flow.

1. Fine screens. Provide the head loss across the fine screening device at a blinding factor of fifty percent (50%). Use of a lower blinding factor shall be justified.

2. Provide the design screenings volume rate in cubic feet per gallons.

(B) Comminutors.

(C) Grit Removal Facilities. Provide the number of units, type, and size. Provide the flow rate (average design flow and peak hourly flow). Provide the detention time during average design flow and peak hourly flow.

(D) Preaeration.

(E) Diurnal Flow Equalization.

(F) Wet Weather Flow Equalization.

(G) Grease Interceptors.

(H) Septage.

(I) Septic Tanks.

(J) Pump and Haul.

AUTHORITY: section 644.026, RSMo Supp. 1988. Original rule filed Aug. 10, 1978, effective March 11, 1979.*