IOWA WASTEWATER FACILITIES DESIGN STANDARDS

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IOWA WASTEWAETER FACILITIES DESIGN STANDARDS

CHAPTER 15

SCREENING AND GRIT REMOVAL

15.1 GENERAL

15.1.1 Applicability

This chapter is applicable to construction, installation or modification of any disposal system required to obtain a construction permit from this Department under the Iowa Code, Section 455B.45, and 900--64.2 of the Iowa Administrative Code (IAC).

15.1.2 Variances [900--64.2(9)"c", IAC]

When engineering justification satisfactory to the executive director is provided substantially demonstrating that variation from the design standards or siting criteria will result in either: at least equivalent effectiveness while significantly reducing costs, or improved effectiveness, such a variation from design standards or siting criteria may be accepted by the executive director.

15.1.3 Explanastion of terms

The terms "shall" or "must" are used in these standards when it is required that the standard be used. Other terms such as "should" and "recommend" indicate desirable procedures or methods which should be considered but will not be required.

15.2 SCREENING DEVICES

15.2.1 Location

15.2.1.1 Indoors

Screening or other wet process devices installed in a building where other equipment or offices are located shall be separated from the rest of the building and provided with separate outside entrances.

15.2.1.2 Outdoors

Screening devices installed outside shall be protected from freezing. Fine screens shall not be installed outside.

15.2.1.3 Access

Screening areas shall be provided with stairway access (not ladders), adequate lighting, and a convenient and adequate means for removing the screenings.

15.2.1.4 Ventilation

For indoor installations, uncontaminated air shall be introduced continuously at a rate of 12 air changes per hour, or intermittently at a rate of 30 air changes per hour. Intermittently operated ventilating equipment shall be interconnected with the lighting system.

15.2.2 Electrical

Electrical equipment, fixtures and controls (including ventilators and heaters) in screening areas where hazardous gases may accumulate shall meet the requirements of the National Electrical Code for Class 1, Group C, Division 1 locations. Explosion proof gas detectors shall be provided for such areas.

15.2.3 Servicing

Hosing equipment shall be provided to facilitate cleaning. Provision shall be made for isolating or removing units from their location for servicing.

15.2.4 Bar Racks and Screens

15.2.4.1 When Required

All wastewater treatment plants shall be provided with protection for pumps or other equipment by installing coarse bar racks, bar screens or trash baskets. Protection for comminutors or other grinding devices shall be provided by coarse bar racks.

15.2.4.2 Design and Installation

15.2.4.2.1 Bar Spacing

Clear openings between bars shall be no less than one inch for manually cleaned screens. Clear openings for mechanically cleaned screens may be as small as 5/8 of an inch. Maximum clear openings shall b 1 3/4 inches.

15.2.4.2.2 Slope

Manually cleaned screens, except those for emergency use, shall be placed on a slope of 30 to 60 degrees from the horizontal.

15.2.4.2.3 Velocities

At AWW flow conditions, approach velocities should be no less than 1.25 feet per second to prevent settling; and no greater than 3.0 fps at MWW flow to prevent forcing material through the openings.

15.2.4.2.4 Channels

Channels preceding and following screens shall be shaped to minimize settling of solids. Fillets shall be installed as necessary.

Bypass channels shall be provided and equipped with the necessary gates to isolate flow from any single mechanical screening unit. Provisions shall also be made to facilitate dewatering each mechanical unit. Channels shall be designed for ease of access for cleaning.

Single channels with manually cleaned screens which are removable without dewatering are aceptable for small installations.

15.2.4.2.5 Invert

The screen channel invert shall be 3.0 to 6.0 inches below the invert of the incoming sewer unless impractical due to hydraulic limitations.

15.2.4.2.6 Flow Distribution

Entrance channels shall be designed to provide equal and uniform distribution of flow to the screens.

15.2.4.2.7 Flow Measurement

Screening devices shall not be located such that changes in backwater elevations will interfere with the accuracy of upstream flow measuring equipment.

15.2.4.3 Accessibility

15.2.4.3.1 Railings and Gratings

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

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

15.2.4.3.2 Enclosures

Mechanical screening equpment shall have adequate removable enclosures to protect personnel against accidental contact with moving parts.

15.2.4.3.3 Raking

Manually cleaned screening facilities shall 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 the storage areas.

15.2.4.4 Control Systems

15.2.4.4.1 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 preset high water elevation.

15.2.4.4.2 Manual Switch

Automatic controls should be supplemented by a manual start, stop and/or reverse switch located in view of the equipment.

15.2.4.5 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 except for the material which passes the coarse bar racks required ahead of comminutors or other grinding devices.

15.2.4.6 Auxiliary Screens

Where a single mechanically cleaned screen is used, an auxiliary manually cleaned screen shall be provided. Where two 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 PHWW flow.

15.2.5 Fine Screens

15.2.5.1 General

Moving or rotating fine screens with maximum openings of 0.06 inches may be used in lieu of primary sedimentation (except preceding RBC units) providing that sub-

sequent treatment units are designed on the basis of anticipated screen performance. Fine screens should not be considered equivalent to primary sedimentation. Static fine screens shall not be permitted for continuous duty in lieu of primary sedimentation.

15.2.5.2. Design

15.2.5.2.1 Capacity

A minimum of two fine screens shall be provided, each unit being capable of independent operation. Capacity shall be provided to treat PHWW flow with one unit out of service.

15.2.5.2.2 Cleaning

A continuous cleaning device such as jets or wiper blades shall be incorporated in the design of moving or rotating fine screens, with provisions for automatic conveyance of the material removed from the screen to the sludge treatment processes.

15.2.5.2.3 Preceding Units

Continuously operated fine screens shall be preceded by a bar screen, by grit removal facilities and by facilities for the removal of floatable oils and greases. Comminuting devices are not necssary ahead of fine screens.

15.3 COMMINUTORS

15.3.1 Location

Provisions for location shall be in accordance with those for screening devices, Section 15.2.1.

15.3.2 Design Considerations

15.3.2.1 Location

Comminutors should be located downstream of any grit removal requipment.

15.3.2.2 Size

Comminutor capacity shall be adequate to handle PHWW flow.

15.3.2.3 Installation

A screened bypass channel shall be provided with capacity to handle the PHWW flow. The use of the bypass channel should be automatic at depths of flow exceeding the design capacity of the comminutor.

Bypass channels will not be required where two comminutors are installed. Each comminutor shall be capable of comminuting the PHWW flow.

Channels shall be provided with the necessary gates to insolate flow from any comminutor unit, and provisions shall be made to facilitate dewatering each unit.

15.3.2.4 Downstream Clogging

Provisions shall be made to minimize the problem of downstream clogging caused by formation of rag ropes if comminutors are proposed for plants with digesters or jet type aerators for activated sludge.

15.3.2.5 Servicing

Provisions shall be made to facilitate servicing units in place or removing units from their location for servicing.

15.3.2.6 Electrical

Electrical equipment, fixtures and controls (including ventilators and heaters) in comminutor chambers where hazardous gases may accumulate shall meet the requirements of the National Electrical Code for Class 1, Group C, Division 1 locations. Explosion proof gas detectors shall be provided for such areas. Motors in areas not governed by this requirement may need protection against accidental submergence. Control switches or a disconnecting device for the comminutor shall be located in view of the comminutor.

15.4 GRIT REMOVAL FACILITIES

15.4.1 When Required

Grit removal facilities shall be provided for all wastewater treatment facilities serving systems with combined sewers or systems receiving substantial quantities of grit. Grit removal facilities shall also be provided ahead of continuously operated fine screens.

15.4.2 Location

15.4.2.1 General

Grit removal facilities should be located ahead of pumps and comminuting devices. Coarse bar racks should be placed ahead of grit removal facilities.

15.4.2.2 Housed Facilities

15.4.2.2.1 Ventilation

Uncontaminated air shall be introduced continuously at a rate of 12 air changes per hour, or intermittently at a rate of 30 air changes per hour. Intermittently operated ventilating equipment shall be interconnected with the lighting system. Odor control facilities may also be warranted.

15.4.2.2.2 Access

Adequate stairway access to above- or below-grade facilities shall be provided.

15.4.2.2.3 Electrical

All electrical equipment, fixtures and controls (including ventilators and heaters) in enclosed grit removal areas where hazardous gases may accumulate shall meet the requirements of the National Electrical Code for Class 1, Group C, Division 1 locations. Explosion proof gas detectors shall be provided for such areas.

15.4.2.3 Outside Facilities

Grit removal facilities located outside shall be protected from freezing.

15.4.3 Type and Number of Units

Plants treating wastes from combined sewers and plants utilizing fine screens shall have at least two mechanically cleaned grit removal units, with provisions for bypassing. Adequate capacity for the MWW flow shall be provided with the largest unit out of service. A single manually cleaned or mechanically cleaned grit chamber with bypass is acceptble for small sewage treatment plants serving separate sanitary sewer systems. Minimum facilities for larger plants serving separate sanitary sewers should be at least one mechanically cleaned unit with a bypass. Facilities other than channel-type are acceptable if provided with adequate and flexible controls for agitation and/or air supply devices and with grit collection and removal equipment.

15.4.4 Design Factors

15.4.4.1 General

Design of grit chambers shall be based on the size and specific gravity of the grit particle to be removed. If this information is not obtained from actual field

surements, then the design shall assume removal of all particles retained on a 65 mesh sieve (0.21 mm opening) and having a minimum specific gravity of 2.65.

15.4.4.2 Channel-type Chambers

Positive hydraulic control shall be provided through the use of a parabolic cross-section controlled by a downstream Parshall flume or a rectangular cross-section controlled by a downstream proportional weir to maintain a channel velocity of one foot per second through the expected flow range.

The length of the channel shall be sufficient for the grit to reach the bottom plus a safety factor of 2 times the maximum depth for entrance and exit disturbances.

15.4.4.3 Aerated Grit Chambers

Air rates should be adjustable in the range of 3 to 8 cubic feet per minute per foot of tank length.

The detention time at the MWW flow rate should be in the range of 3 - 5 minutes.

Inlets and outlets shall be designed to prevent short circuiting. The inlet to the chamber should introduce the wastewater directly into the circulation pattern caused by the air diffusion. The outlet should be at a right angle to the inlet, and consideration should be given to installing a baffle near the outlet.

The grit chamber shall be designed to avoid producing dead spaces.

15.4.4.4 Detritus Style Grit Chambers

Hydraulics shall be controlled by adjustable deflectors that insure a relatively uniform velocity across the entire tank.

Design shall consider the size particle to be removed by settling and the MWW flow rate. The depth of flow shall be such that the flow is non-turbulent, with an additional allowance of depth to allow for the raking mechanisms.

15.4.4.5 Grit Washing

The need for grit washing shall be determined by the method of final grit disposal.

15.4.4.6 Drains

Provision shall be made for isolating and dewatering each unit. Drainage from grit washing facilities carrying organic solids washed from the grit shall be added to the plant flow downstream of the grit removal facilities.

15.4.4.7 Water

An adequate supply of water under pressure shall be provided for cleanup.

15.4.4.8 Grit Handling

Grit removal facilities located in deep pits shall be provided with mechanical equipment for hoisting or transporting grit to ground level. Impervious, nonslip, 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.