CHAPTER 50
SCREENING, GRIT REMOVAL, AND FLOW EQUALIZATION

51. SCREENING DEVICES

51.1 Bar Racks and Screens

51.1.1 When Required

___ Protection for influent pumps and other equipment shall be provided by either coarse bar racks or bar screens. Protection for grinding/shredding equipment should be provided by coarse bar racks.

51.1.2 Location

51.1.2.1 Indoors

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

51.1.2.2 Outdoors

___ Screening devices installed outside should be protected from freezing by a temporary protective enclosure or other means as necessary.

51.1.2.3 Access

___ Screening areas shall be provided with stairway access, adequate lighting and positive fresh air ventilation, and a convenient and adequate means for removing the screenings.

51.1.3 Design and Installation

51.1.3.1 Bar Spacing

___ Clear openings between bars should be no less than one inch (2.54 cm) for manually cleaned screens. Clear openings for mechanically cleaned screens may be as small as 5/8 of an inch (1.59 cm). Maximum clear openings should be 1¾ inches (4.45 cm).

51.1.3.2 Slope

___ Manually cleaned screens, except those for emergency use, should be placed on a slope of 30 to 45 degrees from the horizontal.

51.1.3.3 Velocities

___ At normal operating flow conditions, approach velocities should be no less than 1.25 fps (38 cm/s), to prevent settling; and no greater than 3.0 fps (91 cm/s) to prevent forcing material through the openings.

51.1.3.4 Channels

___ Dual channels shall be provided and sized and equipped with the necessary gates to isolate flow from any screening unit. Provisions shall also be made to facilitate dewatering each unit. The channel preceding and following the screen shall be shaped to eliminate stranding and settling of solids.

51.1.3.5 Invert

___ The screen channel invert should be 3.0 to 6.0 inches (7.6 - 15.2 cm) below the invert of the incoming sewer.

51.1.3.6 Flow Distribution

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

51.1.3.7 Flow Measurement

___ Flow measurement devices shall be provided and 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.

51.1.4 Safety

51.1.4.1 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.

51.1.4.2 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.

51.1.5 Control Systems

51.1.5.1 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.

51.1.5.2 Electrical Fixtures and Controls

___ Electrical fixtures and controls in screening areas where hazardous gases may accumulate shall meet the requirements of Section 32.3.5.

51.1.5.3 Manual Override

___ Automatic controls shall be supplemented by a manual override.

51.1.6 Disposal of Screenings

___ Facilities shall be provided for removal, handling, storage, and disposal of screenings in a legal and 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 the storage areas. Such drainage shall be returned to the influent flow at the head of the plant.

51.1.7 Auxiliary Screens

___ Where a single screen is used, an auxiliary manually cleaned screen shall be provided. Where two or more screens are used, the design shall provide for taking any unit out of service without sacrificing the capability to handle the peak design flow. At least one of the screens shall be designed to allow manual cleaning.

51.2 Fine Screens

51.2.1 General

___ Fine screens (about 1/16 inch) may be used in lieu of primary sedimentation providing that subsequent treatment units are designed on the basis of anticipated screen performance. Fine screens should not be considered equivalent to primary sedimentation. Where fine screens are used, additional provision for the removal of floatable oils and greases shall be considered.

51.2.2 Design

___ Tests should be conducted to determine BOD_5 and suspended solids removal efficiencies at the design peak hydraulic and peak organic loadings.

___ A minimum of two fine screens shall be provided, each unit being capable of independent operation at peak design flow.

___ Fine screens shall be preceded by a mechanically cleaned bar screen or other protective device. Grinding/shredding devices shall not be used ahead of fine screens. Freeze protection should be provided, as appropriate.

51.2.3 Electrical Fixtures and Control

___ Electrical fixtures and controls in screening areas where hazardous gases may accumulate shall meet the requirements of Section 32.3.5.

51.2.4 Servicing

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

52. GRINDING/SHREDDING (GS) EQUIPMENT

52.1 GENERAL

___ Provisions for location shall be in accordance with those for screening devices, Section 51.1.2.

52.2 When Required

___ G/S equipment should 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.

___ G/S equipment is not required for SDG, STEP, or GP/PS collection systems.

52.3 Design Considerations

52.3.1 Location

___ G/S equipment should be located downstream of any grit removal equipment.

52.3.2 Size

___ G/S equipment capacity shall be adequate to handle peak hourly flow.

52.3.3 Installation

___ A screened bypass channel shall be provided. The use of the bypass channel should be automatic in case of equipment failure and at depths of flow exceeding the design capacity of the G/S equipment.

___ Each G/S device that is not preceded by grit removal equipment should be protected by a 6.0 inch (15.2 cm) deep gravel trap.

___ Gates shall be provided in accordance with Section 51.1.3.4.

52.3.4 Servicing

___ Provision shall be made to facilitate servicing units in place and removing units from their location for servicing.

52.3.5 Electrical Controls and Motors

___ Electrical equipment in G/S equipment chambers where hazardous gases may accumulate shall meet the requirements of Section 32.3.5. Motors in areas not governed by this requirement may need protection against accidental submergence.

53. GRIT REMOVAL FACILITIES

53.1 General

___ Grit removal facilities should be provided as needed for all sewage treatment plants.

___ Grit removal facilities should be located ahead of pumps and grinding/shredding devices. Coarse bar racks should be placed ahead of grit removal facilities.

53.1.1 Housed Facilities

53.1.1.1 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. Odor control facilities may also be warranted.

53.1.1.2 Access

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

53.1.1.3 Electrical

___ All electrical work in enclosed grit removal areas where hazardous gases may accumulate shall meet the requirements of Section 32.3.5.

53.1.2 Outside Facilities

___ Grit removal facilities located outside shall be protected from freezing by a temporary protective enclosure or other means.

53.3 Type and Number of Units

___ A single manually cleaned or mechanically cleaned grit chamber with a bypass is acceptable for small (under 1 MGD) sewage treatment plants serving separate sanitary sewer systems. Minimum facilities for larger (1 MGD or more) plants serving 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.

53.4 Design Factors

53.4.1 General

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

53.4.2 Inlet

___ Inlet turbulence shall be minimized.

53.4.3 Velocity and Detention

___ Channel-type chambers shall be designed to limit velocities during normal variations in flow as close as possible to one fps (30 cm/s). The detention period shall be based on the size of particle to be removed. All grit removal facilities should be provided with adequate automatic control devices to regulate detention time, agitation, and air supply.

53.4.4 Grit Washing

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

53.4.5 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.

54. PREAERATION

___ Preaeration of sewage to reduce septicity may be required in special cases.

55. FLOW EQUALIZATION

55.1 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.

55.2 Location

___ Equalization basins should be located downstream of pretreatment facilities such as bar screens, grinding/shredding equipment, and grit chambers.

55.3 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. Unused treatment units, such as sedimentation or aeration tanks, may be utilized as equalization basins during the early design life. Return flow from side-line equallization basin (s) back to the treatment process should occur at a point that will result in compliance with the NPDES permit. This may only require disinfection of the equalized flow.

55.4 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 determined from a cumulative flow plot over a representative 24-hour period.

55.5 Operation

55.5.1 Mixing

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

55.5.2 Aeration

___ Aeration equipment shall be sufficient to maintain a minimum of 1.0 mg/1 of dissolved oxygen in the mixed basin contents at all times. Air supply rates should be minimum of 1.25 cfm/1000 gallons (0.15 1/s*m^3) of storage capacity. The air supply should be isolated from other treatment plant aeration requirements to facilitate process aeration

control, although process air supply equipment may be utilized as a source of standby aeration.

55.5.3 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 should also be provided to measure and indicate liquid levels and flow rates.

55.6 Construction and Materials

All basins must comply with Section 44.4.