Minimum Design Requirements for Trickling Filters

(Compiled from Section 91 of Recommended Standards for Wastewater Facilities, 2004 Edition)

1. The volume of media determined from pilot plant studies or use of acceptable design equations shall be based on the design maximum day BOD_5 organic loading rate. Trickling filter design shall consider peak organic load conditions including the oxygen demands due to recycle flows due to high concentrations of BOD_5 and TKN associated with such flows.
2. All distribution devices, underdrains, channels, and pipes shall be installed so that they may be properly maintained, flushed or drained.
3. Covers shall be provided to maintain operation and treatment efficiencies when climatic conditions are expected to result in problems due to cold temperatures.
4. Forced ventilation should be provided for covered trickling filters to insure adequate oxygen for process requirements. Windows or simple louvered mechanisms so arranged to ensure air distribution throughout the enclosure shall be provided. The design of the ventilation facilities shall provide for operator control of airflow in accordance with outside seasonal temperature.
5. A freeboard of 4-feet or more should be provided for tall, manufactured filters to contain windblown spray.
6. Appropriate valves, sluice gates, or other structures shall be provided to enable flooding of filters comprised of rock or slag media for filter fly control.

Distribution System

1. The wastewater may be distributed over the filter by rotary distributors or other suitable device to ensure uniform distribution to the surface area. Application of the wastewater shall be continuous. The piping system shall be designed for recirculation.
2. The piping system, including dosing equipment and distributor, shall be designed to provide capacity for the design peak hourly flow and recirculation.
3. At design average flow, the deviation from a calculated uniformly distributed volume per square foot of the filter surface shall not exceed plus or minus 10 percent at any point.
4. Reverse reaction nozzles or hydraulic brakes shall be provided to not exceed the maximum speed recommended by the distributor manufacturer and to attain the desired media-flushing rate.
5. For reaction type distributors, a minimum head of 24-inches between low water level in the siphon chamber and center of the arms is required.
6. A minimum clearance of 12-inches between media and distribution arms shall be provided.

Recirculation

1. The piping system shall be designed for recirculation as required to achieve

the design efficiency. The recirculation rate shall be within a range of 0.5:1 up to 4:1 (ratio or recirculation rate versus design average flow).

2. A minimum of two (2) recirculation pumps shall be provided.
3. Devices shall be provided to permit measurement of the recirculation rate.

Underdrain System

1. The underdrain system shall cover the entire floor of the filter and have semicircular inverts or equivalent.
2. Inlet opening into the underdrains shall have an unsubmerged gross combined area equal to at least 15 percent of the surface area of the filter.
3. The underdrains shall have a minimum slope of 1 percent.
4. Effluent channels shall be designed to produce a minimum velocity of 2 ft./sec at design average flow rates of application to the filter, including recirculated flows.
5. The underdrain ventilation ports shall be designed to insure that the interior flow will be retained inside the trickling filter.
6. The underdrain system, effluent channels, and effluent pipe shall be designed to permit free passage of air. The size of the drains, channels, and pipe should be such that not more than 50 percent of their cross-sectional area will be submerged under the design peak instantaneous flow, including proposed or possible future recirculated flows.
7. Provision should be made for flushing the underdrains unless high rate recirculation is utilized.

Media

1. The trickling filter media may be crushed rock, slag, or manufactured material.
2. Media shall have a minimum depth of 6-feet above the underdrains.
3. Rock and/or slag filter media depths shall not exceed 10-feet and manufactured filter media depths should not exceed the recommendations of the manufacturer.
4. Media size and quality shall be in accordance with Chapter 90, Section 91.3.