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4.19.3 Design Requirements

Many considerations need to be made in the design of a pressure distribution system based on site- and flow-specific characteristics. These characteristics will affect several system components depending on each specific design scenario. Typical system design should occur based on the following design procedures:

1. Layout the distribution lateral network.
2. Select the orifice size and spacing.
3. Determine the lateral diameter compatible with the orifice size and spacing.
4. Determine the lateral discharge rate.
5. Determine the manifold diameter based on the number, spacing, and discharge rate of the laterals.
6. All pipe velocities are recommended to be at least 2 feet per second.
7. Determine the total internal volume of the manifold and lateral.
8. Determine the desired dose volume and rate.
9. Calculate the static and dynamic pressure requirements of the piping network and document this in a system performance curve.
10. Select a pump based on the dose volume, discharge rate, friction losses, and total head of the system and the pump manufacturer-supplied performance curve.
    a. Plot the pump performance curve on the system performance curve. The point where the pump curve crosses the system performance curve is where that pump will operate.
    b. The crossing point must exceed the specified minimum operating system pressure and should occur near the center of the pump performance curve.
11. Select the correct size of dosing chamber based on the system design flow and pump selection.
12. Select the pump controls.

4.19.3.1 Piping

Pressure distribution system piping typically consists of several sections including transport piping, manifold, and laterals. Each of these piping selections have components and design factors that are unique to that particular section.

Lateral Piping

Lateral piping is placed within the drainfield and is used to evenly distribute wastewater effluent to the drainfield infiltrative surface. To distribute the effluent, several small diameter orifices are drilled into each lateral. Recommendations for the design of lateral piping and the associated orifices are included below.

Distribution Laterals

1. Lateral length should be shorter than the trench length by at least 6 inches but not more than 36 inches.
2. Laterals in trenches should be placed equidistant from each trench sidewall and from each other.
3. Lateral spacing in beds is recommended to be equal to orifice spacing.
   a. The outside laterals should be placed at one-half the selected lateral spacing from the bed's edge.
   b. Laterals should not be placed farther apart than 3 feet on center in bed designs and should not be placed farther than 1.5 feet from the bed's edge regardless of orifice spacing.
   c. The maximum lateral spacing in sand mounds, intermittent and in-trench sand filters, and recirculating gravel filters is 2.25 feet.
4. Determine the lateral diameter based on distribution lateral network design.
   a. Lateral diameter typically ranges from 0.75 to 4 inches for most system applications.
   b. Lateral diameter for typical individual dwelling systems range from 0.75 to 2 inches.
5. Lateral length should be selected based on the lateral diameter, orifice spacing, and piping schedule/class.

   Lateral length is constrained by the minimum pressure at the distal end of the lateral, which shall not drop below 90% of the manifold pressure. This uniform pressure ensures relatively uniform effluent discharge down the length of the lateral.
6. Individual ball or gate valves shall be installed on each lateral to balance residual head on terraced systems.
7. Sweeping cleanouts should be placed at the terminal end of each lateral and accessible from grade.
   a. Cleanout sweeps should be the same diameter piping as the main lateral.
   b. A ball valve or threaded cap should be located on the end of the cleanout that allows the lateral to be flushed.
   c. Prior to pressurization of the distribution laterals, the system should be flushed with clean water while all of the terminal ball valves are open or caps are removed.
   d. Cleanout access risers shall not extend past the installation depth of the drainfield (i.e., drainrock or gravelless system component) and native soil or medium sand interface.

Orifices

1. Orifice sizing, spacing, and quantity, coupled with each lateral's pressure, establish the flow rate of the distribution network.
2. Orifice placement should occur
   a. Along the same axis of the distribution lateral.
   b. In a staggered location between any two adjoining laterals so they are located half of the orifice spacing from one another along the drainfield length.

   c. Orifices should be placed to serve a circular area as best as possible with limited overlap (e.g., 6-foot wide trench with two laterals and orifice placement to serve an area 3 feet in diameter).

3. Orifice orientation
   a. Is typically toward the bottom of the trench in aggregate-filled drainfields to facilitate lateral drainage and towards the top of the trench in gravelless trench component drainfields.
   b. If the orifices in the distribution laterals are oriented up, the distribution lateral must slope back towards the manifold to aid in drainage. Sloping of the distribution lateral should be as minimal as possible. All manifold and distribution lateral drainage not drained to the drainfield shall drain back to the dosing chamber if not retained in the transport piping below frost levels.
4. Orifice diameter
   a. Typical orifice diameter is 0.25 inch but may be smaller or larger depending upon system design requirements.
   b. Orifices smaller than 0.25 inch may lead to clogging, which should be considered in system design.
   c. Typical discharge rates based on orifice size are provided in Table 4-18
5. Orifice spacing should distribute effluent as evenly and uniformly as possible over the infiltrative surface.
   a. Typical orifice spacing is 30–36 inches but may be closer or farther apart depending upon system design requirements, system flow rate, and soil type.
   b. For most installations, the spacing will be between 18–36 inches.
   c. The maximum orifice spacing for sand mounds, intermittent and in-trench sand filters, and recirculating gravel filters is 2.25 feet.
6. Orifices should be drilled with a sharp bit, and any burs, chips, or cuttings from the drilling process should be removed from the piping prior to assembly.
7. Orifice shields are recommended to be used when orifices are oriented up.