PUMPS AND CONTROLS
Pumps are used to:

- Move wastewater to a higher elevation or compensate when there is inadequate fall
- Compensate for soil treatment area size or complexity
- Provide uniform distribution
  - Advanced treatment component
  - Soil treatment area
- Equalize flow
Dosing systems overview

- Dosing systems consist of:
  - A dosing tank (in tanks section),
  - Pump or siphon,
  - Discharge assembly,
  - Controls and associated electrical components.
Pump overview
Pump specifications

- **Selection of the pump is based on:**
  - Solids handling capacity
  - Flow (measured in gallons per minute – gpm)
  - Pressure (measured in vertical feet of water)
- **Other important specifications**
  - Electrical ratings (voltage, amperage, horsepower)
Types of pumps (solids handling capacity)

- **Sewage**
  - Passes up to certain diameter solids

- **Effluent**
  - “Clear” effluent

- **Grinder**
  - Grinds sewage before pumping
  - Not typically used
Types of pumps
(flow and pressure relationship)

- **High-head pumps**
  - Pump at much more pressure but relatively lower flow

- **Low-head pumps**
  - Pump relatively larger flows but with less pressure
Single stage low-head

- Motor above single impeller at bottom of unit
- Some solids handling ability
Multi-stage high-head

- Motor with rotating shaft
- Series of impellers
- Need cleaner effluent
Pump curves

- Produced by the manufacturers
- The pump will only operate at the TDH and corresponding flow given on the curve
- These curves help select the right pump for the system
Design flow and pressure

- Choose a pump based on minimum pressure and flow from the “pipe system”

(1 foot of head = 0.433 psi)
What affects pump flow and pressure in a system?

- How high do I need to pump? (feet)
- How much flow do I need? (gpm)
- How long is the pipe?
- What diameter is the pipe?
- How many fittings are there?
- How much pressure is needed at end of pipe?
Dosing regimes – Demand versus Time Dosing
Demand dosing

- A float turns pump on when volume reaches a predetermined level.
- A float turns pump off when liquid level in the tank drops to another predetermined level.
Demand dosing

- Pump operates according to use at the source or in the previous component
- Prescribed volume delivered each time the pump activates
- “Social” dosing
Demand dosing

- Piggy back
- Panel
  - Better connections
  - Additional tools for management
    - Elapsed Time Meter (ETM)
    - Cycle (Event) Counter (CC)
Timed dosing

- Pump operates for set amount of time at prescribed intervals
- Tank must have adequate storage volume
- If not enough liquid in the tank, timer will not activate the pump
Timed dose

- Controlled by timer in panel
- Panel should have meters & event counters
  - Better connections
  - Additional tools for management
    - Timer
    - ETM
    - CC
Control panel

- Housing that holds controls and electrical connections
- Must be watertight/moisture tight and corrosion resistant
- All electrical conduits should be sealed
Elapsed time meters (ETMs)

- Record amount of time a component has operated
- Can’t reset
- Typically log pump operation
Cycle (event) counters (CC)

- Record number of times a component is activated
- Can’t reset
- Used for pumps, special timer events, and alarms
- Provide information on system operation for the service provider
- Recommended for all systems
Analog or electronic (PLC)

Programmable timer for “ON” and “OFF”
- Pump should be easy to access
- Must have a means of removal
  - Pull chain or rope
  - Pump rail
  - Must reach from surface
  - Must not corrode
Pump must be up out of the solids layer
  - unless it is a grinder pump

A block is common
  - hard to find when tank is full of sewage
  - pump torque will move pump
  - no screen

Consider a pump stand
Pump discharge assembly

Typically consists of:

- Sections of pipe
- Union or quick disconnect
- Isolation valve
- Anti-siphon device (if needed)
- Check valve: variations according to climate
  - If freezing is a concern, allow supply line to drain after a dose

Document presence of all components
Quick disconnect

- Necessary for O&M of assembly components
- Must be accessible from the surface
- Types of disconnect
  - Threaded union
  - Cam lock fitting
  - Other device that can withstand pressure
Check valve use dictated by climate

- **Cold climates:**
  - No check valve
  - Supply line drains after dose

- **Warm climates**
  - Check valve prevents drainback to tank
  - Orifice below check valve prevents air lock of pump
Demand dosed float configurations

- Two float simplex
  - Pump controlled by a single wide angle differential float
  - Second float controls alarm
Dose volume

- Dose volume
  - Drawdown in inches x gallons per inch
- GPI
  - Area in sq ft.. x 1 for cu ft.. x 7.5 (gal per cu ft).. / 12
- Setting the Floats for the System
Example

- 4’ x 7’ Tank
Gallons Per Inch

Area x 1’ x 7.5 gal/ft$^3$ ÷ 12 inch/ft = gal/inch \{gpi\}

- 28 ft$^2$ x 1’ x 7.5 gal/ft$^3$ ÷ 12 inch/ft = 17.5 gpi

4’ x 7’ = 28 sqft
Dose Volume (DV)

- Drawdown (in) = Dose Vol. ÷ GPI
- Dose volume ~ 100 gal
- (in) = 100 gal ÷ 17.5 gal/in = 6” between the floats
- Need to add in drain back
- Alarm float then set 2-3 inches above
Questions on Pumps and Controls