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**Acronyms used in this chapter:**

- ANSI – American National Standards Institute
- AWWA - American Water Works Association
- CMR – Code of MA Regulations
- MassDEP – MA Dept. of Environmental Protection
- MCL - maximum contaminant level
- MSDS - material safety data sheets
- NFPA - National Fire Protection Association
- NSF – National Sanitation Foundation
- PWS – public water system
- UIC – underground injection control

## Chapter 7

# Pumping Facilities

### 7.0 General

Pumping facilities shall be designed to maintain the sanitary quality of pumped water. Subsurface pump rooms and inaccessible installations should be avoided. No pumping station shall be subject to flooding. Whenever possible, energy star qualified pumps, controls, and appurtenances should be considered for energy conservation.

### 7.1 Location and Site Protection

The proposed site must meet the requirements for sanitary protection of water quality, hydraulics of the system, and protection against interruption of service by fire, flood, or any other hazard. The station shall be:

1. Elevated to a minimum of two feet above the 100-year flood elevation or highest recorded flood elevation, whichever is higher, or protected to such elevations, unless otherwise approved by MassDEP in writing. MassDEP recommends the station be elevated a minimum of three feet above these elevations to address potential climate change conditions;
2. Readily accessible at all times unless permitted to be out of service for the period of inaccessibility;
3. Graded around the station so as to lead surface drainage away from the station;
4. Protected to prevent vandalism, sabotage and entrance by unauthorized persons or animals. The pump station should be located within a secure area, such as, a locked building or inside a chain linked fenced area. Any windows shall be vandal proof.

### 7.2 Pumping Stations

#### 7.2.1 General

Both raw and finished water pumping stations shall:

1. Have adequate space for the installation of additional units if needed, and for the safe servicing of all equipment;
2. Be of durable construction, fire and weather resistant, and with outward-opening doors;
3. Have floor elevation at least 6 inches above finished grade;

4. Have underground structures waterproofed;
5. Provide a suitable outlet for drainage from pump glands without discharging onto the floor;
6. Have all floors drained in such a manner that the quality of the potable water will not be endangered. All floors shall slope to a suitable drain or sump (see section 7.2.11 – *Floor Drains*).
7. Provisions must be made to insure security of the pump station at all times. Incorporation of appropriate intrusion and equipment failure alarms must be provided (see Chapter 6.1.4 - *Water Treatment Facility Design for Non-Critical Chemical Feed Systems* and Chapter 6.1.3 – *Chemical Safety Control Strategy for Critical Chemical Feed Systems*).

### **7.2.2 Wet Wells or Suction Wells**

Wet wells or suction wells shall:

1. Be watertight;
2. Have floors sloped to permit removal of water and entrained solids;
3. Be covered or otherwise protected against contamination;
4. Have two pumping compartments or other means to allow the wet well or suction well to be taken out of service for inspection, maintenance, or repair, unless otherwise approved by MassDEP in writing.

### **7.2.3 Equipment Servicing**

Pump stations shall be provided with:

1. Crane-ways, hoist beams, eyebolts, or other adequate facilities for servicing or removal of pumps, motors, or other heavy equipment;
2. Openings in floors, roofs, or wherever else needed for removal of heavy or bulky equipment;
3. A convenient tool board, or other facilities as needed, for proper maintenance of the equipment;
4. Labels such that the pumps and valves in the station are tagged to correspond to the maintenance record and for proper identification.

### **7.2.4 Stairways and Ladders**

Stairways or ladders shall:

1. Be provided between all floors and in entry pits or compartments;
2. Have handrails on both sides and treads of non-slip material. Stairs are preferred in areas where there is frequent traffic or where supplies are transported by hand. Stairs shall have risers not exceeding seven inches, and treads wide enough for safety.

### **7.2.5 Heating**

Provisions shall be made for adequate heating for:

1. The comfort of the operator;
2. The safe and efficient operation of the equipment. In pump houses not occupied by personnel, sufficient heat must be provided to prevent freezing of equipment or the treatment process.

### **7.2.6 Ventilation**

Ventilation shall conform to existing local, state, and federal codes. Adequate ventilation shall be provided for all pumping stations. Forced ventilation of at least six changes of air per hour with adequate air intake louvers shall be provided for:

1. All confined rooms, compartments, pits, and other enclosures below ground floor where equipment and materials may be damaged by no ventilation;
2. Any area where an unsafe atmosphere may develop or where excessive heat may build up;

### **7.2.7 Dehumidification**

A means for dehumidification should be provided in areas where excess moisture could cause hazards to safety or damage to equipment and materials.

### **7.2.8 Lighting**

The pump station shall be adequately lighted throughout to deter vandalism and facilitate maintenance. All electrical work shall conform to the requirements of the National Electrical Code or to relevant MA state electrical code (237CMR 1.00 – 23.00) and/or local codes as required.

### **7.2.9 Contingency Planning**

A contingency planning sheet (from the system's Emergency Response Plan (required by 310 CMR 22.04 (13)) must be posted in a readily visible part of the pump house. The plan must display directions, contacts, and phone numbers of the proper persons to contact in case of emergency. At a minimum, the following phone numbers must be posted, and be updated as changes occur:

1. Police and fire chief
2. Water superintendent
3. Water commissioners
4. MassDEP's regional office Drinking Water Program point of contact
5. Ambulance service
6. Closest hospital

7. Consulting engineer or geologist
8. Pump and motor manufacturers

### 7.2.10 Sanitary and Other Conveniences

Except in the cases of small automatic stations or where such facilities are otherwise available, all pumping stations that are manned for extended periods should be provided with potable water, lavatory, and toilet facilities, or as required in MA state plumbing code (248 CMR 10.10 Plumbing Fixtures). Plumbing must be so installed as to prevent contamination of a public water supply. Wastes shall be discharged in accordance with Chapter 5.10.2 *Facility Waste*.

### 7.2.11 Floor Drains

To minimize the threat of a release of hazardous materials or pollutants via floor drains in water supply pump houses, the following criteria will apply:

1. Best Management Practices
  - a. Berm the immediate area surrounding any pumps or engines that require periodic oil changes.
  - b. Keep the pump house floor clean.
  - c. Spills from potential contaminants should be managed and disposed of using dry cleanup methods in accordance with MassDEP regulations.
2. Requirements
  - a. Only hazardous materials necessary for the treatment and maintenance of the drinking water supply may be stored in the pump house. Use or storage of any equipment, such as, pump seals, switches, thermostats, flow meters, pressure gauges, or thermometers containing mercury should be avoided to prevent contamination;
  - b. Hazardous materials must be stored in a bermed area capable of containing 110 percent of the volume of stored chemicals;
  - c. Floor drains located in hazardous material storage areas must connect to the municipal sewer line or to a holding tank;
  - d. Existing oil and sand interceptors connected to a floor drain must be strictly maintained and cleaned;
  - e. Floor drains must be temporarily but securely covered/isolated during any work (*e.g.*, oil changes) that uses potential contaminants;
  - f. A pump house operating with a sump pump and/or an emergency water-cooling system may plumb these systems independently to a drywell or surface stone outfall located outside the Zone I. If the public water system (PWS) does not own land outside the Zone I, discharge may occur within the Zone I at least 100 ft. from the wellhead;

- g. Any facility altering a plumbing system currently discharging to the ground must submit a site plan locating all previous points of discharge to the ground and showing the locations and construction of the proposed new discharge;
- h. Clean water, such as from sample sinks, non-contact cooling water, and condensate from pipes and discharges from inline analyzers may discharge into a 5G30 Special Drainage Well (UIC Class V Well). Such discharges require registration with MassDEP’s Drinking Water Program and compliance with Drinking Water Program Fact Sheet Underground Injection Control Program and titled *Registration of Discharges to the Ground from Pump Houses and Other Public Water System Facilities Including Discharges from In-line Analyzers*.
- i. Material safety data sheets (MSDS) for all reagents used in the on-line analyzers with dosage rate and concentration must be attached to the registration application.

## 7.3 Pumps

### 7.3.1 General

At least two pumping units shall be provided. With any pump out of service, the remaining pump(s) shall be capable of providing the maximum daily pumping demand of the system. Consideration should be given to not locating pump motors in areas subject to flooding. The pumping units shall:

1. Have ample capacity to supply the peak demand against the required distribution system pressure without dangerous overloading;
2. Be driven by a prime mover able to operate against the maximum horsepower condition of the pumps;
3. Have spare parts and tools readily available;
4. Be served by control equipment that has a proper heater and overload protection for the air temperature encountered;
5. For non-community water systems only, one pumping unit may be used with MassDEP approval in writing.

### 7.3.2 Suction Lift

Suction lift shall:

1. Be avoided, if possible;
2. Be within allowable limits, preferably less than 15 feet. If suction lift is necessary, a provision shall be made for priming the pumps.

### **7.3.3 Priming**

Prime water must not be of lesser sanitary quality than that of the water being pumped. Means shall be provided to prevent either backpressure or back siphonage backflow. When an air-operated ejector is used, the screened intake shall draw clean air from a point at least 10 feet above the ground or other source of possible contamination, unless the air is filtered by an apparatus approved by the MassDEP in writing. Vacuum priming may be used.

## **7.4 Booster Pumps**

### **7.4.1 Location, Metering, Number, and Controls**

Booster pumps shall be designed so that:

1. They will not produce negative pressure in their suction lines;
2. The intake pressure shall be at least 20 psi when the pump is in normal operation; Pumps taking suction from storage tanks shall be provided adequate net positive suction head;
3. The automatic shutoff or low pressure controller shall maintain at least 20 psi in the suction line under all operating conditions, unless otherwise acceptable to MassDEP in writing. Pumps taking suction from ground storage tanks shall be equipped with automatic shutoffs or low pressure controllers as recommended by the pump manufacturer;
4. Automatic or remote control devices shall have a range between the start and cutoff pressure which will prevent excessive cycling;
5. A bypass is available;
6. Each booster pumping station contains not less than two pumps with capacities such that peak demand can be satisfied with the largest pump out of service;
7. All booster pumping stations are fitted with a flow rate indicating and totalizer meter;
8. Consideration is given for installation of a blind flange(s) for future expansion.

### **7.4.2 In-Line Booster Pumps**

In addition to the other requirements of this section, in-line booster pumps shall be accessible for servicing and repairs.

### **7.4.3 Individual Home Booster Pumps**

Individual home booster pumps, where required, shall be approved in writing by the water supplier and local plumbing inspector. Refer to state plumbing/gas code 248 CMR 10.14 Water Supply and the Water Distribution System.

## **7.5 Automatic and Remote Controlled Stations**

All automatic stations should be provided with automatic signaling apparatus which will report when the station is out of service. All remote controlled stations shall be electrically operated and controlled and shall have signaling apparatus of proven performance. Installation of electrical equipment shall conform to the requirements of the National Electrical Code or to relevant state MA state electrical code (237 CMR 1.00 – 23.00) and/or local codes as required.

## **7.6 Appurtenances**

### **7.6.1 Valves**

Pumps shall be adequately valved to permit satisfactory operation, maintenance and repair of equipment. Each pump shall have a positive-acting check valve on the discharge side between the pump and the shutoff valve.

### **7.6.2 Piping**

In general, piping shall:

1. Be designed so that the friction losses will be minimized;
2. Not be subject to contamination;
3. Have watertight joints;
4. Be protected against surge or water hammer and provided with suitable restraints where necessary;
5. Have an individual suction line for each pump or the lines shall be manifolded to insure similar hydraulic and operating conditions;
6. Have a spare corporation stop, injection nozzle with safety chain, and ball check located on the inside discharge line in case of any needed emergency disinfection;
7. Have a representative sampling tap located 100 feet downstream of pump station, unless otherwise approved by MassDEP in writing.



### **7.6.3 Gauges and Meters**

Each pump shall have:

1. A standard pressure gauge on its discharge line such that the upper limit is at least 25-50 percent above the estimated maximum,
2. A compound gauge on its suction line,
3. Indicating, totaling, and recording metering of the total water pumped.

### **7.6.4 Water Seals**

Water seals shall not be supplied with water of a lesser sanitary quality than that of the water being pumped. Where pumps are sealed with potable water and are pumping water of lesser sanitary quality, the seal shall be properly protected against backflow.

### **7.6.5 Controls**

Pumps, their prime movers, and accessories shall be controlled in such a manner that they will operate at rated capacity without dangerous overload. Where two or more pumps are installed, provisions shall be made for alternation. Provisions shall be made to prevent energizing the motor in the event of a backspin cycle. Electrical controls shall be located above grade.

### **7.6.6 Oil or Grease Lubrication**

All lubricants which may come into contact with the potable water shall be certified for conformance to ANSI/NSF Standard 60.

### **7.6.7 Hydrants**

A hydrant and gate valve shall be provided on the discharge line for flushing so that any undesirable water may be pumped to waste, and not into the distribution system, unless otherwise approved by MassDEP in writing.

## **7.7 Standby Power**

When power failure would result in cessation of minimum essential services, standby power consisting of a dedicated portable or in-place auxiliary power of adequate supply and connectivity shall be provided.

The use and storage of fuel to power pumps, related power distribution equipment, and treatment systems within the Zone I and Zone A shall be evaluated, and subject to MassDEP approval in writing. Carbon monoxide detectors are required when generators are housed within pump stations. Following is a preferred list of fuels to use:

1. Natural gas, if available, is the most preferred source of fuel;
2. Propane gas is the second most preferred fuel type. It must be stored in approved above or below ground tanks. Above ground tanks must be anchored to a concrete platform with dimensions comparable to the tank size and constructed to below local frost line. Underground propane storage containers must be installed according to the National Fire Protection Association Guidance (NFPA)-58 Liquefied Petroleum Gas Code 2004 Edition and state plumbing and gas code (248 CMR 4.00);
3. Liquid fossil fuels shall only be stored on site if natural gas or propane is not a viable option. Liquid fossil fuel tanks shall be double-walled and constructed above-ground and shall be surrounded by an impermeable containment wall of greater capacity than the fuel storage tank. Leak detection devices shall be installed. If fossil fuel storage within Zone I is proposed, an explanation for why natural gas or propane is inappropriate shall be submitted in writing to MassDEP's regional office.