CHAPTER 12

Design and Construction Standards for Public Water Supplies

Section 1. Authority.

These standards are promulgated pursuant to Wyoming Statute (W.S.) §§ 35-11-101 through 35-11-2005. Specifically, W.S. § 35-11-302 requires the administrator to establish standards for the issuance of permits for construction, installation, or modification, or operation of any public water supply.

Section 2. Applicability.

This Chapter applies to all permits to construct, install, modify, or operate a public water system that are required pursuant to Wyoming Water Quality Rules and Regulations, Chapter 3.

Section 3. Definitions.

The following definitions supplement those contained in W.S. § 35-11-103 of the Wyoming Environmental Quality Act (Act).

(a) “Auxiliary source of supply” means any water supply on or available to the water user’s system other than an approved public water supply acceptable to the water supplier. These auxiliary waters may include water from another supplier’s public potable water supply or any natural source(s), such as a well, spring, river, stream, harbor, and so forth; used waters; or industrial fluids. These waters may be contaminated or polluted, they may be objectionable or they may be from a water source that the water supplier is uncertain of sanitary control.

(b) "Average daily demand" means the total annual water use divided by the number of days the system was in operation.

(c) "Backflow" means the undesirable reversal of flow of water or mixtures of water and other liquids, gases, or other substances into the distribution system of the public water supply from any other source or sources.

(d) “Backflow incident” means any identified backflow to a public water supply distribution system or to the potable water piping within the water user’s system benefitting from a water service connection to the public water supply distribution system.

(e) “Back-pressure” means a form of backflow caused when the pressure of the water users’ system is greater than that of the water supply system whether caused by a pump, elevated tank, elevated piping, boiler, pressurized process, pressurized irrigation system, or air .

(f) “Back-siphonage” means a form of backflow caused by negative or reduced pressure in the water supply system. This situation can be caused by loss of pressure due to high water demands, a line break, excessive firefighting flows, etc.

(g) “Containment” means the practice of installing approved backflow prevention devices at the water service connection of the water user in order to protect the public water supply from any backflow from the water users system.

(h) “Contamination” means an impairment of a public water supply by the introduction or admission of any foreign substance that degrades the quality of the potable water or creates a health hazard.

(i) “Cross-connection” means any actual or potential connection between a potable water supply and any other source or system through which it is possible to introduce contamination into the system.

(j) “Degree of hazard” means either a high or low hazard situation where a substance may be introduced into a public water supply through a cross-connection. The degree of hazard or threat to public health is determined by a hazard classification.

(k) “Domestic services” means services using potable water for ordinary living processes.

(l) “Dual check” means a device conforming to American Association of Sanitary Engineers (ASSE) Standard #1024 consisting of two (2) independently acting check valves.

(m) "Groundwater source" includes all water obtained from dug, drilled, bored, jetted or driven wells; springs that are developed so that the water does not flow on the ground and protected to preclude the entrance of surface contamination; and collection wells.

(n) “Hazard classification” means a determination by a Hazard Classification Surveyor as to high hazard or low hazard and the potential cause of backflow as either back-pressure or back-siphonage.

(o) “Hazard Classification Survey” means inspection of a premises to identify the potable water systems, the location of any potential cross-connections to the potable water

systems, the hazard of the potential backflow, the physical identification of any backflow devices or methods present and the inspection status of any backflow devices or methods recorded and certified by a qualified hazard classification surveyor.

(p) “Hazard Classification Surveyor” means an individual certified by the USC-Foundation for Cross-Connection Control and Hydraulic Research as Cross-Connection Control Specialist (USC-FCCCHR), the ASSE as a Cross -Connection Control Surveyor, or by another state certification program submitted with the permit application and approved by the Administrator, or an individual who is a water distribution system operator also certified as a backflow device tester employed by the public water supplier for the service where the survey is being conducted.

(q) “High hazard” means a situation created when any substance that is or may be introduced into a public water supply poses a threat to public health through poisoning, the spread of disease or pathogenic organisms, or any other public health concern.

(r) “Isolated” when referring to cross-connections means the proper approved backflow prevention devices have been installed at each point of cross-connection within the water user's system.

(s) “Low hazard” means a situation created when any substance that is or may be introduced into a public water supply does not pose a threat to public health but that does adversely affect the aesthetic quality of the potable water.

(t) "Maximum daily demand" means the demand for water exerted on the system over a period of 24 consecutive hours, for the period during which such demand is greatest.

(u) "Maximum hourly demand" means the highest single-hour demand exerted on the system. This may or may not occur on the maximum day.

(v) “Mechanical sludge equipment” means the equipment used to physically remove solids from a water treatment process. This may include mechanically driven drives that use scrapers or differential water levels to collect the sludge.

(w) "Mineralized water" means any water containing more than 500 mg/L total dissolved solids.

(x) "Offstream reservoir" means a facility into which water is pumped for future release to treatment facilities.

(y) "Safe annual yield" means the quantity of water available from the source during the average and driest years of record.

(z) "Surface water source" includes all tributary streams and drainage basins, natural lakes and artificial reservoirs or impoundments upstream from the point of the water supply intake.

(aa) "Water service connection" means any water line or pipe connected to a distribution supply main or pipe for the purpose of conveying water to a water user's system.

(bb) "Water supplier" means any entity that owns or operates a public water supply, whether public or private.

(cc) "Water user" means any entity, whether public or private, with a water service connection to a public water supply and includes customers of a public water supplier.

(dd) "Water user's system" means that portion of the user's water system between the water service connection and the point of use. This system includes all pipes, conduits, tanks, fixtures, and appurtenances used to convey, store or utilize water provided by the public water supplier.

Section 4. Facilities and Systems not Specifically Covered by these Standards.

(a) Each application for a permit to construct a facility under this section shall be evaluated on a case-by-case basis using the best available technology. The Water Quality Division (Division) may approve applications demonstrating the constructed facility can meet the purpose of the Act and this Chapter.

(b) The following information shall be included with the application for a permit to construct, install, modify, or operate a public water supply not specifically covered by these standards:

(i) Data obtained from a full scale, comparable installation that demonstrates the acceptability of the design; or

(ii) Data obtained from a pilot plant operated under the design condition for a sufficient length of time to demonstrate the acceptability of the design; or

(iii) Data obtained from a theoretical evaluation of the design demonstrates a reasonable probability that the facility will meet the design objectives.

(iv) An evaluation of the flexibility of making corrective changes to the constructed facility in the event it does not function as planned.

(c) If an applicant wishes to construct a pilot plant to provide the data necessary to meet the requirements of this Section, then the applicant must obtain a permit to construct.

Section 5. Engineering Design Report.

(a) An engineering design report shall be submitted with each application. The report shall describe and provide technical justification for all aspects of the proposed construction, modifications, and installations. The report shall address existing conditions (if any), known or suspected problems, proposed actions, and the reasoning used to arrive at those proposed actions.

(b) The engineering design report for all new water distribution system extensions shall include:

(i) A description of the service area including scaled vicinity plan map(s) of the project with regard to adjacent and proposed development, elevations, and topographic features;

(ii) Current and projected system water demand for average daily demand, maximum daily demand, maximum hourly demand, needed fire flows, and per capita maximum daily flows;

(iii) Information on fire protection and fire flow capabilities of the proposed system; and

(iv) A description of high service pumping systems and finished water storage facilities.

(c) The engineering design report for all treatment facilities shall include:

(i) A description of the facility site and location, including a scaled site plan, and:

(A) Present and projected facility property boundaries;

(B) Flood protection indicating predicted elevation of 25- and 100-year flood stages;

(C) Present and proposed access for the purpose of operation, maintenance, and compliance inspection;

(D) Distances from:

(I) Current habitation;

(II) The closest major treated water transmission line;

(II) The closest treated water storage facility; and

(IV) The water source;

(E) Fencing and/or security;

(F) Topographic features and contours with indicated datum; and

(G) Soil and subsurface geological characteristics, including a soils investigation report of the proposed site suitable for structural design of the proposed facilities.

(ii) A description of the service area, including scaled vicinity plan map(s) of the project with regard to adjacent and proposed development, elevations, and topographic features;

(iii) A detailed description of the recycle flows and procedures for reclamation of recycle streams;

(iv) A detailed description of disposal techniques for settled solids, including a description of the ultimate disposal of sludge;

(v) A description of the sources of water supply, including:

(A) For groundwater sources:

(I) A description of the geology of the aquifer and overlying strata;

(II) A summary of source exploration data, including test well depth and method of construction; test pumping rates and duration; and water levels and specific yield;

(III) Representative water quality data, including biological, radiological, chemical, and physical data. These data shall be sufficient to determine the necessary process and the ability to meet all drinking water quality standards. The same water quality data for all secondary sources shall also be provided;

(IV) An identification of sources of possible contamination around the groundwater source, and in any known recharge areas, including the location of any waste sites, industrial facilities and wastewater disposal areas; and

(B) For surface water sources:

(I) A statement of the safe annual yield;

(II) Hydrological data, stream flows, and records for diversion dams that may influence stream flows, for the previous ten (10) year period;

(III) Representative water quality data, including biological, radiological, chemical and physical data. These data shall be sufficient to determine the necessary process and the ability to meet all drinking water quality standards. The same water quality data for all secondary sources shall also be provided;

(IV) A description of the watershed noting sources of potential contamination;

(V) A description of any anticipated changes in water quality;

(VI) A description of any diversion dams, impoundments or reservoirs and appurtenances;

(vi) Plant design conditions, including:

(A) Historical and design population;

(B) Existing and projected maximum daily demand flows and demand variations;

(C) Complete description of existing facilities;

(D) Where applicable, a complete description of proposed treatment processes including:

(I) Unit process design criteria addressing flash mixing, flocculation and settling basin size and equipment description; retention times; unit loadings and overflow rates; filter area and proposed filtration rate; backwash rate and volume requirements; chemical feeder capacities and ranges; and disinfection feeder capacities and ranges;

(II) Chemical requirements, including dosages and feed rates;

(III) Chemical delivery, handling, and storage systems;

(IV) Waste generation including types and volumes;

(V) Waste stream recycling, including holding basin capacities, pump sizes and recycle rates;

(VI) Methods of ultimate waste disposal;

(VII) Low service pumping facilities; and

(E) A description of on-site restrooms and sanitary sewer facilities.

(vii) A summary of automatic operation and control systems, including basic operation, manual override operation, and maintenance requirements;

(viii) A description of the on-site laboratory facilities and a summary of those tests to be conducted on-site. If no on-site laboratory is provided, a description of plant control, water quality testing requirements, and where the testing will be conducted shall be included;

(ix) A description of cross-control measures or other relevant protection to be provided at chemical feed tanks, filters, washdown taps, and direct connections to sewers.

(d) The engineering design report shall include a Hazard Classification or specify the default classification identified in Section 13(n)(i)(B) of this chapter that shall be applicable to the project. A hazard classification shall include the following:

(i) A determination of the degree of hazard of all water service connections to be connected to the proposed project; and

(ii) A determination of the potential cause of backflow for all water service connections.

Section 6. Plans and Specifications Content.

(a) Plans for water works and treatment facilities shall have a suitable title showing:

(i) The name of the owner and location of the project;

(ii) North arrow and drawing scale; and

(iii) The name, Wyoming registration number, and seal or signature of the engineer who prepared the plans.

(b) Plans shall contain a site plan of the proposed project with the topography and boundaries of the project. Datum used shall be indicated.

(c) Plans for water transmission and distribution lines shall include:

(i) A detailed plan view at a legible scale of each reach of the water line showing all existing and proposed streets, adjacent structures, physical features, and existing locations of utilities. The location and size of all water lines, valves, access manholes, air-vacuum release stations, thrust blocking, and other appurtenances shall be indicated. Pertinent elevations shall be indicated on all appurtenances;

(ii) Profiles of all water lines shall be shown on the same sheet as the plan view at legible horizontal and vertical scales, with a profile of existing and finished surfaces, pipe size and material, valve size, material, and type. The location of all special features such as access manholes, concrete encasements, casing pipes, blowoff valves, and air-vacuum relief valves shall be shown;

(iii) Special detail drawings scaled and dimensioned to show the following:

(A) At all locations where the water line is within ten (10) feet or crosses streams or lakes, the bottom of the stream, the elevation of the high- and low-water levels, and other topographical features;

(B) A cross-section drawing of the pipe bedding; and

(C) Additional features of the pipe or its installation that are not otherwise covered by specifications.

(iv) The location of any sewer lines within thirty (30) feet horizontally of water lines. Sewers that cross water lines shall be shown on the profile drawings.

(d) Plans for storage tanks, pumping stations and treatment facilities shall show the relation of the proposed project to the remainder of the system. Layouts and detail plans shall show:

(i) The site location and layout, including:

(A) Topographic and physical features, including embankments;

(B) The proposed arrangement of pumping or treatment units;

(C) Existing facilities;

(D) Existing and proposed piping and valving arrangements;

(E) The route to access the facility;

(F) The power supply;

(G) Fencing; and

(H) The proposed location of clearwells, waste ponds, and sludge ponds;

(ii) Schematic flow diagram(s) and hydraulic profile(s) for facility treated water;

(iii) A flow diagram for sludge and wastewater flows; and

(iv) Plan(s) and section view(s) of each treatment facility process unit with specific construction details, features, and pertinent elevations. Details of each unit shall include, but are not limited to: inlet and outlet devices, baffles, valves, arrangement of automatic control devices, mixers, motors, chemical feeders, sludge scrapers, sludge disposal, or other mechanical devices.

(v) The plans or contractor-furnished information shall indicate the registered engineer providing the design.

(e) Plans and profile drawings of well construction shall include:

(i) The diameter and depth of drill holes;

(ii) Casing and liner diameters and depths;

(iii) Assembled order, size, and length of casing and liners;

(iv) Casing wall thickness;

(v) Grouting depths;

(vi) Geological data;

(vii) The well test method and allowable tolerance;

(viii) The locations of all caisson construction joints and porthole assemblies on drawings, if a radial water collector is proposed;

(ix) The elevation and designation of geological formations, water levels, formations penetrated, and other details to describe the proposed well completely;

(x) Screen locations, size of screen openings, and screen intervals; and

(xi) The location of any blast charges; and

(xii) Well test data including:

(A) Test pump capacity- head characteristics;

(B) Static water level;

(C) Depth of test pump setting;

(D) Time of starting and ending each test cycle;

(E) Pumping rate;

(F) Pumping water level;

(G) Drawdown; and

(H) Water recovery rate and levels.

(f) In addition to meeting the requirements of paragraph (e) of this section, plans for wells developed through acidizing activities shall also include:

(i) Information on the geology of the area, including:

(A) Known or potential faults, fractures, springs, karst features (such as sinkholes and other similar features) within a one (1) mile radius of the proposed well; and

(B) Faults and fractures that may extend from the acidized zone into overlying and underlying geologic formations and a description of any measures that will be taken to ensure that the acidized solution does not migrate into any of those geologic formations.

(ii) For wells developed within a radius of one (1) mile of existing wells, applicants shall submit plans that analyze the risk and mitigation measures to be taken to prevent impacts to those wells. The submitted plans shall include the risk and mitigation measures for any potential effects to each existing well;

(iii) Existing information on the location of other wells (such as water supply, oil and gas, mineral development wells) within a one (1) mile radius of the proposed well, including any wells that intercept the acidized zone, and for wells that intercept the acidized zone:

(A) An analysis of whether or not those wells that intercept the acidized zone have been properly plugged and abandoned;

(B) An analysis of whether or not those wells have been properly cased and cemented; and

(C) A description of what measures will be or have been taken to prevent the acidized solution from migrating vertically in the annular space or casing of the existing wells into overlying or underlying geologic formations;

(iv) A description of the borehole drilling phase and what measures will be taken to minimize the introduction of lost circulation materials into aquifers when encountering under-pressured geologic formations or other factors that may lead to a loss of circulation;

(v) A description of the acid injection process and the measures that will be taken to ensure that injection pressures do not create fractures in the overlying and underlying geologic formations and through which the acidized solution may migrate.

(vi) A description of the volume and content of the acid and any other chemical compounds to be used during acidizing activities, including the management of the acid and chemical compounds prior to acidizing and final disposition of any acid, water, or chemical mixtures recovered from the well after acidizing activities are completed;

(vii) A description of the measures that will be or have been taken to ensure that the recovery of the acidized solution is of sufficient duration and volume to eliminate the potential for acidic impacts to other wells completed within the injection zone; and

(viii) A description of the methods to be performed to establish the placement and integrity of the annular seal and casing prior to acidization of the well.

(g) Plans for new water lines, pump stations, treatment facilities, wells, or additions/modifications to existing systems or facilities shall be accompanied by technical specifications. Where plans are for extensions to water distribution systems, the specifications may be omitted, provided it is stated that the work is to be constructed under specifications that have been permitted by the Water Quality Division. Specifications on file must conform to this standard. The specifications accompanying construction drawings shall include:

(i) Identification of construction materials;

(ii) The type, size, strength, operating characteristics, rating or requirements for all mechanical and electrical equipment, including machinery, valves, piping, electrical apparatus, wiring and meters; laboratory fixtures and equipment; operating tools; special appurtenances; and chemicals, when applicable;

(iii) Construction and installation procedure for materials and equipment;

(iv) Requirements and tests of materials and equipment to meet design standards;

(v) Performance tests for operation of completed works and component units; and

(vi) Specialized requirements for tests, analyses, disinfection techniques, and other special needs;

(vii) A requirement that all water service connections will be provided with backflow prevention devices in accordance with the requirements of Section 13(n) of this Chapter.

Section 7. General Design Considerations.

(a) The capacity of the water treatment or water production system shall be designed for the maximum daily demand at the design year. Where water use records are not available to establish water use, the equivalent per capita water use shall be at least 125 gpd and 340 gpd to size facilities for average and maximum daily water demand, respectively.

(b) Treatment facilities shall be located according to the following requirements:

(i) No sources of pollution may affect the quality of the water supply or treatment system;

(ii) The facilities shall not be located within 500 feet of landfills, garbage dumps, or wastewater treatment systems; and

(iii) All treatment process structures, mechanical equipment, and electrical equipment shall be protected from the maximum flood of record or the 100-year flood, whichever is greater. The treatment facilities shall remain fully operational and accessible during the 100-year flood. Flooding resulting from ice jams shall also be considered.

(c) Treatment shall be provided to produce a potable water that is bacteriologically, chemically, radiologically, and physically safe as required by 40 CFR Part 141.

(i) For surface supplies, treatment shall include:

(A) Chemical addition/coagulation, flocculation, sedimentation, filtration and disinfection;

(B) Slow sand filtration and disinfection where the raw water maximum turbidity is less than fifty (50) TU and is not attributable to clay and maximum color is less than thirty (30) TU; or

(C) Diatomaceous earth filters and disinfection where the maximum monthly average raw water turbidity is less than twenty-five (25) TU, the color is less than thirty (30) TU, and fecal coliform organisms are less than 100 mpn/100 mL.

(ii) For groundwater supplies, facilities shall provide disinfection equipment and connections.

(d) Hydraulic and treatment reliability shall comply with the following requirements:

(i) Treatment facilities with capacity of 100,000 gallons per day (gpd) or more shall provide duplicate units, as a minimum, for chemical feed, flocculation, sedimentation, filtration, and disinfection. Treatment facilities with capacity of less than 100,000 gpd shall provide duplicate units as described above or may provide finished water system storage equal to twice the maximum daily demand;

(ii) All treatment facility pumping shall provide the maximum daily demand flow with the largest single-unit not in service. Finished water pumping in combination with finished water storage that floats on the distribution systems shall provide the maximum hourly demand flow with the single largest unit not in service. When fire protection is provided, pumping and finished water storage that floats on the system shall provide the fire demand plus the maximum daily demand, or the maximum hourly demand, whichever is greater; and

(iii) Where the finished water storage volume that floats on the distribution system is not capable of supplying the maximum daily demand, an alternative power source shall be provided for the finished water pumps. The combined finished water storage volume and pumping capacity supplied by alternative power shall be at least adequate to provide the maximum daily demand. Acceptable alternative power sources include an engine generator, engine drive pumps, or a second independent electrical supply.

(e) Process equipment, including filters and appurtenances, disinfection, chemical feed and storage, electrical and controls, and pipe galleries shall be housed.

(f) Electrical service transformers and other critical electrical equipment shall be located above the 100-year flood elevation and above-grade. Transformers shall be located so that they are remote or protected by substantial barriers from traffic. Motor controls shall be located in superstructures and in rooms that do not contain corrosive atmospheres.

(g) Structural components shall comply with the following requirements:

(i) Construction materials shall be selected, apportioned, and protected to provide water tightness, corrosion protection, and resistance to weather variations;

(ii) Coatings used to protect structures, equipment, and piping shall be suitable for atmospheres containing moisture and low concentrations of chlorine. Surfaces exposed in

chemical areas shall be protected from chemical attack. Paints shall not contain lead, mercury, or other toxic metals or chemicals; and

(iii) Structural design shall consider the seismic zone, groundwater, and soil support. Soils investigations shall be made, or adequate previous soils investigations shall be available to develop structural design.

(h) Instrumentation shall comply with the following requirements:

(i) The treatment facility shall have a flow measuring device provided for raw water influent and clear well effluent. The accuracy of the device shall be at least plus or minus two (2) percent of span;

(ii) All flow meters shall provide totalized flow. For plants with a maximum daily flow of 50,000 gpd or more, the meter shall also record the instantaneous flow rate;

(iii) Automatic controls shall be designed to permit manual override; and

(iv) There shall be an alarm for high effluent turbidity and chlorine leaks (when chlorine gas is used). The alarm shall be located at an attended location.

(i) Sample taps shall be provided so that water samples can be obtained from each water source and located to ensure accurate sampling from each treatment unit. Taps shall be consistent with sampling needs and shall not be of the petcock type. Taps used for obtaining samples for bacteriological analysis shall be of the smooth-nosed type without interior or exterior threads, shall not be of the mixing type, and shall not have a screen, aerator, or other such appurtenance.

(j) All enclosed spaces shall be provided with forced ventilation, except pumping station wetwells or clearwells. In areas where there are open treatment units exposed to the room, ventilation shall be provided to limit relative humidity to less than eighty-five (85) percent but not less than six (6) air changes per hour. In electrical and equipment rooms, ventilation shall be provided to limit the temperature rise in the room to less than 15 degrees Fahrenheit above ambient, but not less than six (6) air changes per hour. Rooms housing chlorine storage or feeders shall have provisions for exhausting the room contents in two (2) minutes and continuous ventilation to provide not less than twelve (12) air changes per hour.

(k) All treatment units, channels, basins, clearwells and wetwells shall be provided with drains or sumps that facilitate draining the unit for access and maintenance. Drainage shall be to the process waste system, filter washwater system, or sanitary sewer. Basin slabs shall be

designed to successfully resist the hydrostatic uplift pressure or an area dewatering system shall be provided. The structural design of basins shall account for the possibility of long-span breakage due to the resistance of hydrostatic uplift.

(l) All equipment not required to be in or on open basins (such as clarifier drives and flocculator) shall be housed in heated, lighted, and ventilated structures. Structure entrances shall be above grade. Piping shall be buried below frost level, placed in heated structures, or provided with heat and insulated.

(m) All chemical storage shall be housed or buried. Areas designated for storage of specific chemicals shall be separated from areas designated for other reactive chemicals. Liquid storage containers shall be isolated from other portions of the structure by a curb that will contain ruptured tank contents. Concrete floors, walls, and curbs in chemical storage and feed areas shall be coated to protect the concrete from aggressive chemicals. Floors in polymer feed and storage areas shall be provided with non-slip surfaces. Rooms for chlorine storage and feed equipment shall be gastight and provided with entry from outdoors. All toxic chemical storage areas shall be provided with lighting and ventilation switched from outside the room near the door. All toxic chemical storage areas shall be provided with windows either in the door or near the door to permit viewing the room from outside. Explosive chemicals shall be stored to protect operations personnel and equipment from injury or damage.

(n) The facility water supply service line and the plant finished water sample tap shall be supplied from a source of finished water at a point where all chemicals have been thoroughly mixed, and the required disinfectant contact time has been achieved. There shall be no cross-connections between the facility water supply service line and any piping, troughs, tanks, or other treatment units containing wastewater, treatment chemicals, raw water, or partially treated water. The potable plant water supply line shall prevent backflow.

(o) The plant design capacity shall include maximum daily water demand, filter backwash quantities, and industrial water use. In the absence of data, filter backwash quantity shall be calculated at five (5) percent of the maximum daily demand.

(p) Water treatment plants having a capacity of 0.5 mgd or more shall be provided with continuous finished water turbidimeters (including recorders).

(q) All process piping shall be labeled to identify materials being conveyed.

Section 8. Source Development.

(a) All surface water sources for a public water supply shall meet the following requirements:

(i) Structures associated with surface water sources shall meet the following construction and design requirements:

(A) For reservoir or river intake structures;

(I) Facilities for withdrawal of water from more than one (1) level shall be provided in impoundments if the maximum water depth at the intake is greater than twenty (20) feet. All ports or intake gates shall be located above the bottom of the stream, lake, or impoundment. The lowest intake point shall be located at sufficient depth to be kept submerged at low water levels;

(II) Where water temperatures are 34 degrees Fahrenheit or less, the velocity of flow into the intake structure shall not exceed 0.5 feet per second;

(III) Where intakes are located in shady reaches of a stream, facilities shall be available to diffuse air into the flow stream at a point in front of the intake pipe;

(IV) Inspection manholes shall be located a maximum of every 1,000 feet for pipe sizes twenty-four (24) inches and larger. Where pipelines operate by gravity and the hydraulic gradeline is below the ground surface, concrete manholes may be used. Where the pipeline is pressurized or the hydraulic gradeline is above ground, bolted and gasketed access ways shall be used; and

(V) Devices shall be provided to minimize the entry of fish and debris from the intake structure.

(B) Offstream reservoirs shall be constructed to ensure that:

(I) Water quality is protected by controlling runoff into the reservoir; and

(II) Dikes are structurally sound and protected against wave action and erosion.

(ii) The site of any impoundment or reservoir shall be cleared of all brush, trees, and other vegetation to the high water elevation.

(iii) No customer service connection shall be provided from the raw water transmission line to the treatment plant, unless there are provisions to treat the water to meet these standards, or the sole purpose of the service is for irrigation or agricultural water use.

(b) All groundwater sources for a public water supply shall meet the following requirements:

(i) The total developed groundwater source, along with other water sources, shall provide a combined capacity that shall equal or exceed the design maximum daily demand. A minimum of two (2) wells, or one (1) well and finished water storage equal to twice the maximum daily demand shall be provided. Where two (2) wells are provided, the sources shall be capable of equaling or exceeding the design average daily demand with the largest producing well out of service. Every well shall be protected from and remain operational during the 100-year flood or the maximum flood of record, whichever is greater;

(ii) All wells shall be disinfected before the well is placed in service after construction, repair, or when work is done on the pump. Disinfection procedures shall be those specified in AWWA A100 for disinfection of wells;

(iii) Every well shall meet the following minimum isolation distances:

(A) Wells shall maintain the following minimum isolation distances from wastewater sources of pollution:

(I) If domestic wastewater is the only wastewater present and the domestic sewage flow is less than 2,000 gallons per day, the following minimum isolation distance shall be maintained:

TABLE 1

Source of Domestic Wastewater	*Minimum Distance to Well*
Sewer	50 feet
Septic tank	50 feet
Disposal field	100 feet
Seepage pit	100 feet
Cesspool	100 feet

(II) If domestic wastewater is the only wastewater present and the domestic sewage flow is greater than 2,000 gpd but less than 10,000 gpd, the following minimum isolation distances shall be maintained:

TABLE 2

Source of Domestic Wastewater	*Minimum Distance to Well*
Sewer	50 feet
Septic tank	50 feet
Disposal field	200 feet
Seepage pit	200 feet
Cesspool	200 feet

(III) If domestic wastewater is the only wastewater present and domestic sewage flow is greater than 10,000 gallons per day, the isolation distance shall be determined by a hydrogeological study in accordance with the requirements of Water Quality Rules and Regulations Chapter 3, Section 17, but shall not be less than those listed in Table 1 or Table 2 above.

(IV) For wastewaters other than domestic wastewater, the isolation distance required shall be determined by a hydrogeological study in accordance with the requirements of Water Quality Rules and Regulations Chapter 3, Section 17.

(B) Wells shall maintain the following minimum isolation distances from buildings:

(I) When a well is outside of a building, the well shall be located so that the centerline, extended vertically, will clear any projection from the building by not less than three (3) feet, and will clear any power line by not less than ten (10) feet.

(II) When a well is located inside a building, the top of the casing and any other well opening shall not terminate in the basement of the building, or in any pit or space that is below natural ground surface unless the well is completed with a properly protected submersible pump. Wells located in a structure must be accessible to pull the casing or the pump. The structure shall have overhead access.

(C) Every well shall be located at least ten (10) feet from any property line.

(iv) Wells shall complete testing and maintain records as follows:

(A) Yield and drawdown tests shall be performed on every production well after construction or subsequent treatment and prior to placement of the permanent pump. The test methods shall be clearly indicated in the specifications. The test pump capacity, at maximum anticipated drawdown, shall be at least 1.5 times the design rate anticipated. The test shall provide for continuous pumping for at least twenty-four (24) hours or until stabilized drawdown has continued for at least six (6) hours when test pumped at 1.5 times the design pumping rate.

(B) Every well shall be tested for plumbness and alignment in accordance with AWWA A100.

(C) Prior to operation of wells that penetrate more than one (1) aquifer or encounter mineralized or polluted water, applicants shall submit to the Water Quality Division a cement bond log report that has been certified by a Wyoming-licensed Professional Engineer or Professional Geologist and demonstrates:

(I) The well construction has been evaluated with appropriate geophysical tools for the casing size of the well;

(II) The quality and location of the annular seal(s); and

(III) The well has been constructed to meet the casing and sealing requirements of Sections 8(b)(v) and 8(b)(vi) of this Chapter.

(D) Prior to operation of wells that do not penetrate more than one (1) aquifer and that do not encounter mineralized or polluted water, applicants shall submit to the Water Quality Division a well construction report that has been certified by a Wyoming-licensed Professional Engineer or Professional Geologist and demonstrates:

(I) The quality and location of the annular seal(s); and

(II) The well has been constructed to meet the casing and sealing requirements of Sections 8(b)(v) and 8(b)(vi) of this Chapter.

(v) All wells shall comply with the following construction standards:

(A) During any well construction or modification, the well and surrounding area shall be adequately protected to prevent any groundwater contamination. Surface water shall be diverted away from the construction area;

(B) Dug wells shall be used only where geological conditions preclude the possibility of developing an acceptable drilled well. Additionally, for dug wells:

(I) Every dug well, other than the buried slab type, shall be constructed with a surface curbing of concrete, brick, tile or metal, extending from the aquifer to above the ground surface. Concrete grout, at least six (6) inches thick, shall be placed between the excavated hole and the curbing for a minimum depth of ten (10) feet below original or final ground elevation, whichever is lower, or to the bottom of the hole, if it is less than ten (10) feet;

(II) The well lining in the producing zone shall readily admit water, and shall be structurally sound to withstand external pressures.

(III) The well cover or platform shall be reinforced concrete with a minimum thickness of four (4) inches. The top of the platform shall be sloped to drain to all sides. The platform shall rest on and overlap the well curbing by at least two (2) inches, or it may be cast with the curbing or the concrete grout. Adequately sized pipe sleeve(s) shall be cast in place in the platform to accommodate the type of pump, pump piping or wiring proposed for the well. Pump discharge piping shall not be placed through the well casing or wall;

(IV) A buried slab type of construction may be used if the dug well is greater than ten (10) feet deep. For buried slab type wells:

(1.) The well lining shall be terminated a minimum of ten (10) feet below the original or final ground elevation, whichever is lower;

(2.) A steel-reinforced concrete slab or platform, at least four (4) inches thick, shall rest on and overlap the lining;

(3.) A standard unperforated well casing shall extend from the concrete slab to at least twelve (12) inches above the original or final ground surface, whichever is higher;

(4.) This casing shall be firmly embedded in the slab or connected to a pipe cast in the slab to ensure that the connection is watertight; and

(5.) The excavation above the slab shall be backfilled with a bentonite slurry or clean earth thoroughly tamped to minimize settling.

(C) A drilled well constructed through an existing dug well shall:

(I) Have an unperforated casing that extends to at least twelve (12) inches above the original ground or final surface, whichever is higher;

(II) A seal of concrete, at least two (2) feet thick, shall be placed in the bottom of the dug well to prevent the direct movement of water from the dug well into the drilled well; and

(III) The original dug well shall be adequately protected from contamination as described above.

(D) Every drilled, driven, jetted, or bored well shall have an unperforated casing that extends from a minimum of twelve (12) inches above ground surface to at least ten (10) feet below ground surface. In unconsolidated formations, this casing shall extend to the water table or below. In consolidated formations, the casing may be terminated in rock or watertight clay above the water table.

(E) In sand or gravel wells:

(I) If clay or hard pan is encountered above the waterbearing formation, the permanent casing and grout shall extend through such materials;

(II) If a sand or gravel aquifer is overlaid only by permeable soils, the permanent casing and grout shall extend to at least twenty (20) feet below original or final ground elevation, whichever is lower;

(III) If a temporary outer casing is used, it shall be completely withdrawn as grout is applied.

(F) For gravel pack wells:

(I) The diameter of an oversized drill hole designed for the placement of an artificial gravel pack shall allow a thickness of gravel or sand outside the casing sufficient to block the movement of natural materials into the well;

(II) The size of the openings in the casing or screen shall be based on the size of the gravel or sand used in the gravel pack;

(III) Gravel pack shall be well-rounded particles, ninety-five (95) percent siliceous material, that are smooth and uniform, free of foreign material, properly sized, washed, and then disinfected immediately prior to or during placement. Gravel pack shall be placed in one (1) uniformly continuous operation;

(IV) After completion, the well shall be overpumped, surged, or otherwise developed to ensure free entry of water without sediment. A gravel-packed well shall be sealed in one (1) of the following ways to prevent pollution to the groundwater supply:

(1.) If a permanent surface casing is not installed, the annular opening between the casing and the drill hole shall be sealed in the top ten (10) feet with concrete or cement grout;

(2.) If a permanent surface casing is installed, it shall extend to a depth of at least ten (10) feet. The annular opening between this outer casing and the inner casing shall be covered with a metal or cement seal;

(V) Gravel refill pipes, when used, shall be Schedule 40 steel pipe incorporated within the pump foundation and terminated with screwed or welded caps at least twelve (12) inches above the pump house floor or concrete apron. Gravel refill pipes located in the grouted annular opening shall be surrounded by a minimum of one and one-half (1-1/2) inches of grout. Protection from leakage of grout into the gravel pack or screen shall be provided.

(G) For radial water collectors:

(I) The caisson wall shall be reinforced to withstand the forces to which it will be subjected;

(II) The top of the caisson shall be covered with a watertight floor;

(III) The pump discharge piping shall not be placed through the caisson walls;

(V) Radial collectors shall be essentially horizontal; and

(VI) All openings in the floor shall be curbed and protected from entrance of foreign material.

(H) Where an infiltration line is used, the source shall be considered a surface source subject to the requirements of Section 8(a) of this Chapter and shall provide treatment in compliance with Section 7(c)(i) of this Chapter unless;

(I) The water system owner is in complete control of the surrounding property for a distance of 500 feet around the periphery of the infiltration system;

(II) The area is fenced to exclude trespass; and

(II) The infiltration collection lines are a minimum of 40 inches below the ground surface at all points within the infiltration collection system.

(I) In limestone or sandstone wells in consolidated formations, casing shall be driven a minimum of five (5) feet into firm bedrock and cemented into place.

(J) When artesian water is encountered in any well, unperforated casing shall extend into the confining layer overlying the artesian zone. This casing shall be adequately sealed with cement grout into the confining zone to prevent both surface and subsurface leakage from the artesian zone. The method of construction shall be such that during the placing of the grout and the time required for it to set no water shall flow through or around the annular space outside the casing, and no water pressure sufficient to disturb the grout prior to final set shall occur. Drilling operations shall not continue into the artesian zone until the grout has set completely. If leakage occurs around the well casing or adjacent to the well, the well shall be recompleted with any seals, packers, or casing necessary to eliminate the leakage completely.

(K) If water flows at the surface of an artesian well, the well shall be equipped with valved pipe connections, watertight pump connections, or receiving reservoirs set at an altitude so that flow can be stopped completely and there shall be no direct connection between any discharge pipe and a sewer or other source of pollution.

(L) For wells that penetrate more than one (1) aquifer or water-bearing strata, every aquifer or strata shall be sealed off to prevent migration of water from one aquifer or strata to another. Strata shall be sealed off by placing impervious material opposite the strata and opposite the confining formation(s). The seal shall extend above and below the strata no less than ten (10) feet. The sealing material shall fill the annular space in the interval to be sealed and the surrounding void spaces which might absorb the sealing material. The sealing

material shall be placed from the bottom to the top of the interval to be sealed. Sealing material shall consist of neat cement, cement grout, or bentonite clay.

(M) For wells that encounter mineralized or polluted water:

(I) Any time during the construction of a well that mineralized water or water known to be polluted is encountered, the aquifer or aquifers containing such inferior quality water shall be adequately cased or sealed off so that water shall not enter the well, nor will it move up or down the annular space outside the well casing. If necessary, special seals or packers shall be installed to prevent movement of inferior quality water. Mineralized water may be used if it can be properly treated to meet all drinking water quality standards as determined by the administrator. When mineralized water is encountered, it shall not be mixed with any other waters from different aquifers within the well. If a well is penetrating multiple aquifers, mineralized water shall be excluded from the well if water is taken from other non-mineralized aquifers.

(II) In gravel packed wells, aquifers containing inferior quality water shall be sealed by pressure grouting, or with special packers or seals, to prevent such water from moving vertically in gravel packed portions of the well.

(N) Existing oil and gas wells, seismic test holes, or mineral exploration holes may be converted for use as water wells provided that the wells can be completed to conform to the minimum construction standards of this Chapter. This does not relieve the applicant from obtaining appropriate permits. Information on the geologic conditions encountered in the well at the time of the original drilling shall be used to determine what special construction standards shall be met in order to eliminate all movement of pollutants into the well or along the annular space surrounding the casing. If no original geologic information is available, an electric or other geophysical log is required to supplement known information.

(vi) All construction materials used for wells shall meet the following requirements:

(A) Casing shall provide structural stability to prevent casing collapse during installation as well as drill hole wall integrity when installed, be of required size to convey liquid at a specified injection/recovery rate and pressure, and be of required size to allow for sampling.

(I) Temporary steel casing used for construction shall be capable of withstanding the structural load imposed during its installation and removal.

(II) Permanent steel casing pipe shall be new pipe meeting AWWA Standard A100 specifications for water well construction. The casing shall have full circumferential welds or threaded coupling joints to assure a watertight construction.

(1.) Standard and line pipe shall meet one (1) of the following specifications:

a. API Std. 5L;

b. ASTM A53;

c. ASTM A134;

d ASTM A135; or

e AWWA C200.

(2.) Structural steel shall meet one (1) of the following specifications:

a. ASTM A36;

b. ASTM A242;

c. ASTM A283;

d. ASTM A572; or

e. ASTM A1011.

(3.) High-strength carbon steel sheets or "well casing steel"sheets shall contain mill markings that will identify the manufacturer and specify that the material is well casing steel that complies with the chemical and physical properties published by the manufacturer.

(4.) Stainless steel casing shall meet the provisions of ASTM A409.

(III) Nonferrous or plastic material may be used as a well casing. It must be resistant to the corrosiveness of the water and to the stresses to which it will be

subjected during installation, grouting, and operation. The material shall be nontoxic. All joints shall be durable and watertight.

(1.) Thermoplastics shall meet the requirements of ASTM F 480.

(2.) Thermosets shall meet one (1) of the requirements of the following specifications:

a. ASTM D2996;

b. ASTM D2997;

c. ASTM D3517; or

d. AWWA C950.

(3.) Concrete pipe shall meet one (1) of the following specifications:

a. ASTM C14;

b. ASTM C76;

c. AWWA C300; or

d. AWWA C301.

(IV) The casing diameter (inside diameter) shall be a minimum of one (1) size larger than the largest dimension/diameter of the pump or pumping structure. If a reduction in casing diameter is made, there shall be adequate overlap of the casing to prevent misalignment and to prevent the movement of unstable sediment into the well. To prevent the migration of mineralized, polluted, or otherwise inferior quality water, lead or neoprene packers shall be installed to seal the annular space between casings.

(B) Packers shall be material that will not impart taste, odor, toxic substance, or bacterial contamination to the well water.

(C) Screens shall:

(I) Be constructed of materials resistant to damage by chemical action of groundwater or cleaning operations;

(II) Have size of openings based on sieve analysis of formation and gravel-pack materials;

(III) Have sufficient diameter to provide adequate specific capacity and low aperture entrance velocity and the entrance velocity shall not exceed 0.1 feet per second;

(IV) Be installed so that the pumping water level remains above the screen under all operating conditions;

(V) Be provided with a bottom plate or washdown bottom fitting of the same material as the screen;

(V) Be artificial (or shall use an artificial filter) for a nonhomogeneous aquifer having a uniformity coefficient less than 3.0 and an effective grain size less than 0.01 inches.

(D) All permanent well casing, except driven Schedule 40 steel casing, shall be surrounded by a minimum of two (2) inches of grout. All temporary construction casings shall be removed except that where removal is not possible or practical, the casing shall be withdrawn at least five (5) feet to ensure grout contact with the native formation.

(I) Neat cement grout conforming to ASTM Standard C150 and water, with not more than 6 gallons of water per sack of cement, shall be used for 2-inch openings. Additives used to increase fluidity must meet the specifications of ASTM C494.

(II) Concrete grout with equal parts of cement conforming to ASTM Standard C150 and sand, with not more than six (6) gallons of water per sack of cement, may be used for openings larger than two (2) inches. Where an annular opening larger than four (4) inches is available, gravel not larger than one-half (1/2) inch in size may be added.

(III) A clay seal of clean local clay mixed with at least ten (10) percent swelling bentonite may be used where an annular opening greater than six (6) inches is available.

(IV) Prior to grouting through creviced or fractured formations, bentonite or similar materials may be added to the annular opening in the manner indicated for grouting. After cement grouting is applied, work on the well shall be discontinued until the cement or concrete grout has properly set.

(V) Sufficient annular opening shall be provided to permit a minimum of two (2) inches of grout around permanent casings, including couplings.

(VI) When the annular opening is 4 or more inches, the annular opening is less than 100 feet in depth, and concrete grout is used, the grout may be placed by gravity through a grout pipe installed to the bottom of the annular opening in one (1) continuous operation until the annular opening is filled.

(VII) When the annular opening exceeds six (6) inches, and less than 100 feet in depth and a clay seal is used, it may be placed by gravity.

(VIII) The casing shall be provided with sufficient guides welded to the casing to permit unobstructed flow and uniform thickness of grout.

(vii) Upper terminal well construction shall meet the following requirements:

(A) Permanent casing for all groundwater sources shall project at least twelve (12) inches above the pumphouse floor or concrete apron surface and at least eighteen (18) inches above final ground surface. The concrete floor or apron shall slope away from the casing at a slope of one (1) inch per foot;

(B) Where a well house is constructed, the floor surface shall be at least six (6) inches above the final ground elevation and shall slope away from the casing at a slope of one-half (1/2) inch per foot;

(C) Sites subject to flooding shall be provided with an earthen berm surrounding the casing and terminating at an elevation at least two (2) feet above the elevation of the maximum flood of record, or other suitable protection shall be provided;

(D) The top of the well casing at sites subject to flooding shall terminate at least three (3) feet above the 100-year flood elevation or the maximum flood of record, whichever is higher;

(E) The casing and well house shall be protected from entrance by animals; and

(F) The well casing shall be vented to atmosphere. The vent shall terminate in a downturned position at or above the top of the casing or pitless unit. The vent shall have a minimum 1.5 inch diameter opening covered with a 24-mesh corrosion-resistant screen. The pipe connecting the casing to the vent shall be of adequate size to provide rapid venting of the casing.

(viii) Every well shall be developed to remove the native silts and clays, drilling mud or finer fraction of the gravel pack. Development shall continue until the maximum specific capacity is obtained from the completed well. Where chemical conditioning is required, the specifications shall include provisions for blasting and cleaning. If blasting is required to remove contaminants, the grouting and casing shall be inspected before and after to ensure there is no damage from the blasting operation.

(ix) A welded metal plate or a threaded cap shall be used for capping a well. A properly fitted, firmly driven, solid wooden plug may be used for capping a well until pumping equipment is installed. At all times during the progress of work, the contractor shall provide protection to prevent tampering with the well or entrance of surface water or foreign materials.

(x) Well pumps, discharge piping and appurtenances shall meet the following requirements:

(A) Wells equipped with line shaft pumps shall:

(I) Have the casing firmly connected to the pump structure; or

(II) Have the casing inserted into a recess extending at least .5 inches into the pump base; have the pump foundation and base designed to prevent water from coming into contact with the joint, and avoid the use of oil lubrication at pump settings less than 400 feet.

(B) Where a submersible pump is used, the top of the casing shall be effectively sealed against the entrance of water under all conditions of vibration or movement of conductors or cables. The electrical cable shall be firmly attached to the rise pipe at 20-foot intervals or less, and the pump shall be located at a point above the top of the well screen.

(C) Discharge piping shall:

(I) Have control valves and appurtenances located above the well house floor;

(II) Be protected against the entrance of contamination;

(III) Be equipped with a check valve, a shutoff valve, a pressure gauge, a means of measuring flow, and a smooth-nosed sampling tap located at a point where positive pressure is maintained. Additionally:

(1.) Where a submersible pump is used, a check valve shall be located in the casing in addition to the check valve located above ground to prevent negative pressures on the discharge piping; and

(2.) For pipes equipped with an air release-vacuum relief valve, the valve shall be located upstream from the check valve, with exhaust/relief piping terminating in a downturned position at least eighteen (18) inches above the floor and covered with a 24-mesh corrosion-resistant screen. The discharge piping shall be valved to permit test pumping and control of each well.

(IV) Have all exposed piping, valves and appurtenances protected against physical damage and freezing.

(V) Be properly anchored to prevent movement, and shall be protected against surge or water hammer; and

(VI) Be provided with a means of pumping to remove waste that is not directly connected to a sewer.

(D) A pitless adaptor or well house shall be used where needed to protect the water system from freezing. A frost pit may be used only in conjunction with a properly protected pitless adaptor. Pitless well units shall:

(I) Be shop fabricated from the point of connection with the well casing to the unit cap or cover, threaded or welded to the well casing, and of watertight construction throughout. The materials and weight shall be at least equivalent and compatible with the casing;

(II) Have field connection to the lateral discharge from the pitless unit of threaded, flanged or mechanical joint connection;

(III) Terminate at the top of the unit at least 18 inches above final ground elevation or three (3) feet above the 100-year flood elevation or the maximum flood of record elevation, whichever is higher; and

(IV) Include provisions to disinfect the well including:

(1.) Facilities to measure water levels in the well;

(2.) A cover at the upper terminal of the well that will prevent the entrance of contamination;

(3.) A contamination-proof entrance connection for electrical cable;

(4.) An inside diameter as great as that of the well casing, up to and including casing diameters of twelve (12) inches, to facilitate work and repair on the well, pump, or well screen; and

(5.) At least one (1) check valve within the well casing.

(xi) Every well greater than four (4) inches in diameter, except for flowing artesian wells, shall be equipped with an access port that will allow for the measurement of the depth to the water surface and an air line used for level measurement. Flowing artesian wells shall be equipped with a pressure gauge. Installation of water level measuring equipment shall be made using corrosion-resistant materials attached firmly to the drop pipe or pump column and in such a manner as to prevent entrance of foreign materials.

(xii) Every well shall be piped so that a device capable of measuring the total well discharge can be placed in operation at the well for well testing. Every well field (or when only one (1) well is present, every well) shall have a device capable of measuring the total discharge.

(xiii) Observation wells shall be constructed in accordance with the requirements for permanent wells if they are to remain in service after completion of a water supply well. They shall be protected at the upper terminal to preclude entrance of foreign materials.

(xiv) Test wells and groundwater sources that are sealed in accordance with requirements of Chapter 26, Water Quality Rules and Regulations shall be sealed by filling with neat cement grout. The filling materials shall be applied to the well hole through a pipe, tremie, or bailer.

Section 9. Treatment.

(a) The capacity of the water treatment or water production system shall be designed for the maximum daily demand at the design year.

(b) Raw waters that have episodes of turbidity in excess of 1,000 TU for a period of one (1) week or longer shall be presettled. Presettling or presedimentation basins shall comply with the following requirements:

(i) Basins without mechanical sludge collection equipment shall have a minimum detention time of three (3) days. Basins with mechanical sludge collection equipment shall have a minimum detention time of three (3) hours.

(ii) Inlet flow shall be evenly dispersed along the inlet of the basin.

(iii) Basins shall have a minimum of one (1) 8-inch drain line to completely dewater the facility.

(iv) Basins shall have a bottom slope to drain of one-quarter (1/4) inch per foot without mechanical sludge collection equipment and two (2) inches per foot with mechanical sludge collection equipment.

(v) Basin bypass provisions shall be included in the process piping.

(c) Rapid dispersal of chemicals throughout the water shall be accomplished by mechanical mixers, jet mixers, static mixers, or hydraulic jump and shall comply with the following requirements:

(i) For mechanical mixers, the minimum Gt (velocity gradient (sec-1) x t (sec)) provided at maximum daily flow shall be 27,000.

(ii) The detention time in a flash mixing chamber shall not exceed thirty (30) seconds at maximum daily flow conditions.

(iii) Mechanical mixers, jet mixers, static mixers, or hydraulic jump basins shall have a drain.

(d) The low velocity agitation of chemically treated water shall be accomplished by mechanical flocculators and shall comply with the following requirements:

(i) A minimum of ten (10) minutes detention time shall be provided.

(ii) The velocity gradient (G value) imposed shall be adjustable by providing variable speed drives or shall be designed to be 30 sec-1 if a single basin is provided, 20 sec-1 in the final basin of a two-stage system, and 10 sec-1 in the final basin of a three-stage system. For a single speed drive system, the tip speed of the mixer shall not exceed three (3) feet per second Variable speed drives shall provide tip speeds of 0.5 to 3.0 feet per second.

(iii) Flocculation basins shall have a minimum of one (1) drain line to dewater the facility.

(iv) The velocity of flocculated water through pipes or conduits to settling basins shall not be less than 0.5 or greater than 1.5 feet per second.

(e) Sedimentation basins shall comply with the following requirements:

(i) The maximum diameter in circular basins shall be eighty (80) feet.

(ii) The basin overflow rate shall not exceed 1,000 gpd/ft^2 at design conditions.

(iii) Weir loading rates shall not exceed 20,000 gpd/ft of length. The weir length shall be computed as the length of the centerline of the launder. Where the weir is located at 3/4 the radius, the weir may be loaded at 36,000 gpd/ft.

(iv) The minimum basin side water depth shall be 8 feet if mechanical sludge collection equipment is provided or basins or basin sludge hopper segments are less than 100 square feet in surface area. The minimum basin side water depth shall be fifteen (15) feet if basins are manually cleaned.

(v) The outer walls of settling basins shall extend at least twelve (12) inches above the surrounding ground and provide at least twelve (12) inches of freeboard to the water surface. Where basin walls are less than four (4) feet above the surrounding ground, a fence or other debris barrier shall be provided on the wall.

(vi) Inlets shall be designed to distribute the water equally and at uniform velocities. Open ports, submerged ports, and similar entrance arrangements are required. A baffle shall be constructed across the basin close to the inlet end and shall project several feet below the water surface to dissipate inlet velocities and provide uniform flows across the basin.

(vii) The velocity through settling basins shall not exceed 0.5 feet per minute. The basins shall be designed to minimize short-circuiting.

(viii) Sludge collection. If settleable organics are present in the water or if there are customer or other documented complaints within the last five (5) years of organically related taste and odor problems, mechanical sludge collection shall be provided.

(ix) Sludge removal design shall provide that sludge pipes shall be not less than six (6) inches in diameter and arranged to facilitate cleaning. Valves on the sludge line shall be located outside the tank.

(x) Flushing lines or hydrants shall be provided near the basins.

(xi) Basin bottoms shall slope toward the drain at not less than one (1) inch per foot where mechanical sludge collection equipment is provided and one-quarter (1/4) inch per foot where no mechanical sludge collection equipment is provided.

(xi) Where a groundwater supply is softened, the sedimentation requirements may be modified as follows:

(A) The basin overflow rate at the design flow shall not exceed 2,100 gpd/ft^2; and

(B) Mechanical sludge removal shall be provided and shall be designed to handle a load of forty (40) lbs/foot of collector scraper arm length.

(f) Solids contact units are acceptable for combined softening and clarification of well water where water quality characteristics are not variable and flow rates are uniform.

(i) Solids contact units may be considered for use as clarifiers without softening when they are designed to meet the criteria detailed in the paragraph (e) of this Section.

(ii) Solids contact units may also be used for other treatment purposes, such as rapid mixing, or flocculation, when the individual components of the solids contact units are

designed in accordance with the design criteria for that individual treatment process as described in paragraphs (c) and (d) of this Section.

(g) Shallow depth sedimentation devices or tube clarifier systems of the essentially horizontal or steeply inclined types may be used when designed as follows:

(i) Sludge shall be removed using 45 degree or steeper hoppered bottoms, mechanical devices that move the sludge to hoppers, or devices that remove settled sludge from the basin floor using differential hydraulic level.

(ii) A method of tube cleaning shall be provided. This may include a provision for obtaining a rapid reduction in clarifier water surface elevation, a water jet spray system, or an air scour system. Where cleaning is automatic, controls shall be provided to cease clarifier operation during tube cleaning and a 20-minute rest period.

(iii) Tops of tubes shall be more than twelve (12) inches from the underside of the launder and more than eighteen (18) inches from the water surface.

(iv) The maximum overflow rate shall be less than 2.0 gpm/sq ft based on the surface area of the basin covered by the tubes.

(v) The spacing between effluent launderers shall not exceed three (3) times the distance from the water surface to the top of the tube modules.

(h) Filtration systems shall comply with the following requirements:

(i) Pressure granular media filters vertical pressure filters, or horizontal pressure filters shall not be used for filtration of surface waters. Pressure filters may be used for groundwater filtration, including iron and manganese removal.

(ii) Gravity filters shall comply with the following requirements:

(A) Slow rate sand filters may be used when maximum raw water turbidity is less than fifty (50) TUs, the turbidity present is not attributable to colloidal clay, and. maximum color does not exceed thirty (30) units. Additionally, for slow rate sand filters:

(I) The allowable loading rates at maximum daily demands shall not exceed 0.1 gpm/ft^2 unless satisfactory pilot testing is completed prior to design that shows a higher rate is appropriate.

(II) At least two (2) filter units shall be provided. Where only two (2) units are provided, each shall be capable of meeting the plant design capacity at the maximum filtration rate. Where more than two (2) filter units are provided, the filters shall be capable of meeting the plant design at the maximum filtration rate with one (1) filter removed from service.

(III) Each filter unit shall be equipped with a main drain and an adequate number of lateral underdrains to collect the filtered water. The underdrains shall be so spaced that the maximum velocity of the water flow in the lateral underdrain will not exceed 0.75 feet per second. The maximum spacing of the laterals shall not exceed 12 feet.

(IV) Filter sand shall be placed on graded gravel layers for a minimum sand depth of 30 inches. The effective size shall be between 0.15 mm and 0.35 mm. The uniformity coefficient shall not exceed 2.0. The sand shall be clean and free from foreign matter. The supporting gravel shall conform to the size and depth distribution provided for rapid rate gravity filters.

(V) Design shall provide a depth of at least three (3) feet of water over the sand. Influent water shall enter the water surface at a velocity of less than two (2) feet per second. An overflow shall be provided at the maximum water surface elevation.

(VI) Each filter shall be equipped with loss of head gauge; an orifice, Venturi meter, or other suitable metering device installed on each filter to control the rate of filtration; and an effluent pipe designed to maintain the water level above the top of the filter sand.

(B) Rapid rate filters shall comply with the following requirements:

(I) The maximum allowable loading rates at maximum daily demands shall not exceed three (3) gpm/ft^2 for single media filters or five (5) gpm/ft^2 for dual or mixed media filters. Each filter shall have a rate limiting device to prevent the filter from exceeding the maximum rate.

(II) The filter media compartment shall be constructed of durable material not subject to corrosion or decay and structurally capable of supporting the loads to which it will be subjected.

(1.) There shall be an atmospheric break between filtered and non-filtered water, accomplished by double wall construction.

(2.) The compartment walls shall be vertical and shall not protrude into the filter media.

(3.) There shall be a minimum of two and one-half (2½) feet of headroom above the top of the filter compartment walls.

(4.) Neither floor nor roof drainage shall enter the filter. If the top of the filter compartment is at floor level, a minimum 4-inch curb shall be constructed around the box.

(5.) Walkways or observation platforms shall be provided for each filter compartment.

(6.) Effluent line shall be trapped or submerged below the low water level in the clearwell to prevent air from entering the filter bottom. The velocity in the filter influent line shall not exceed four (4) feet per second. An overflow from the influent of the filter compartment shall be provided.

(7.) The distance between the operating water level in the filter and the high water level in the clearwell or effluent trap shall be ten (10) feet minimum. The minimum operating water level over the media shall be three (3) feet, and the minimum depth of the filter box shall be eight and one-half (8-1/2) feet.

(III) Washwater troughs shall be constructed to provide for not more than six (6) feet clear distance between troughs. The troughs shall not cover more than twenty-five (25) percent of filter area.

(1.) Minimum clearance between the bottom of trough and top of unexpanded media shall be twelve (12) inches.

(2.) Minimum distance between the weir of the trough and the unexpanded media shall be thirty (30) inches.

(3.) The trough and washwater waste line shall be sized to carry a filter backwash rate of twenty (20) gpm/ft^2 plus a surface wash rate of 2.0 gpm/ft^2.

(IV) Backwash systems shall comply with the following requirements:

(1.) The backwash system shall be sized to provide a minimum backwash flow rate of twenty (20) gpm/ft^2. Washwater storage shall be designed to provide two (2) 20-minute washes in rapid succession. Where multiple units are not required and only one (1) filter compartment is present, backwash storage capabilities may be reduced to provide one (1) 20-minute backwash. Where pumps are used to provide backwash to the filter or to supply water to a washwater tank, two identical pumps shall be provided.

(2.) The backwash and surface wash washwater supply shall be filtered and disinfected.

(3.) Washwater rate shall be controlled by a separate valve on the main washwater line. Washwater flow rates shall be metered and indicated.

(4.) Air-assisted backwash systems may be used when the design precludes disturbing the gravel support.

(5.) A surface wash system shall be provided. The system shall be capable of supplying, at a minimum pressure of fifty (50) psi, 0.5 gpm/ft^2 for system with rotating arms and 2.0 gpm/ft^2 for a system with fixed nozzles. The surface wash shall use filtered and disinfected water or air and filtered disinfected water. The supply system shall be provided with adequate backflow prevention.

(V) For rapid rate filters, coarse-to-fine beds of mixed or dual media or fine-to-coarse single media beds may be used.

(1.) The following types of filter media may be used in rapid rate filter beds:

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a. Clean crushed anthracite or a combination of anthracite and other media shall have an effective size of 0.45 mm - 0.55 mm with uniformity coefficient not greater than 1.65 when used alone, or an effective size of 0.8 mm - 1.2 mm with a uniformity coefficient not greater than 1.65 when used as a cap. The anthracite shall meet the requirements of AWWA B100.

b. Sand shall have an effective size of 0.45 mm to 0.55 mm, a uniformity coefficient of not greater than 1.65, and meet the requirements of AWWA B100.

c. Granular activated carbon (GAC) media may be used in place of anthracite. There must be means for periodic treatment of granular

activated carbon filter material for control of bacterial and other growths. Provisions must be made for replacement or regeneration if GAC is used for filtration.

d. A layer of torpedo sand or garnet shall be used as a supporting media for filter sand.

(2.) Single media beds shall use either:

a. Clean silica sand having a depth of not less than 24 inches, an effective size of from 0.45 mm to 0.55 mm, and a uniformity coefficient not greater than 1.65. A 3-inch layer of torpedo sand or other high-density material shall be used as a supporting media for the filter sand. The material shall have an effective size of 0.8 mm to 2.0 mm, and a uniformity coefficient not greater than 1.7; or

b. Clean crushed anthracite or a combination of sand and anthracite. Such media shall have an effective size from 0.45 mm to 0.55 mm, and a uniformity coefficient not greater than 1.65.

(3.) Multi-media filter beds shall contain a depth of fine media made up of anthracite, specific gravity 1.5; silica sand, specific gravity 2.6; and garnet sand or ilemite, specific gravity 4.2 - 4.5.

a. Bed depths and distribution of the media shall be determined by the water quality, but shall not be less than ten (10) inches of fine sand and twenty-four (24) inches (0.61 m) of anthracite. The relative size of the particles shall be such that hydraulic grading of the material during backwash will result in a filter bed with pore space graded progressively from coarse to fine in the direction of filtration (down).

b. The multi-media shall be supported on two (2) layers of special high-density gravel placed above the conventional silica gravel supporting bed. The special high-density gravel shall have a specific gravity not less than 4.2. The bottom layer shall consist of particles passing No. 5 and retained on No. 12 U.S. mesh sieves and shall be one and one half (1-1/2) inches thick. The top layer shall consist of particles passing No. 12 and retained on No. 20 U.S. mesh sieves, and shall be one and one-half (1-1/2) inches thick.

(4.) Dual media or coal sand filters shall consist of a coarse coal layer above a layer of fine sand. The media shall consist of not less than eight (8) inches of sand and fifteen (15) inches of coal on a torpedo sand or garnet layer support of not less than three (3) inches on the gravel support.

(5.) When gravel is used as a supporting media, gravel shall consist of coarse aggregate in which the majority of the particles are rounded and tend toward a generally spherical or equidimensional shape. It shall possess sufficient strength and hardness to resist degradation during handling and use, be substantially free of harmful materials, and exceed the minimum density requirement. The gravel shall meet the requirements of AWWA B100.

(VI) Acceptable filter bottoms and strainer systems shall be limited to pipe, perforated pipe laterals, tile block, and perforated tile block. Perforated plate bottoms or plastic nozzles shall not be used.

(VII) Every filter shall:

(1.) Have influent and effluent sampling taps;

(2.) Have indicating loss of head gauge;

(3.) Have indicating effluent turbidimeter;

(4.) Have a waste drain for draining the filter compartment to waste;

(5.) Have a filter rate flow meter;

(6.) Provide polymer feed facilities including polymer mixing and storage tank and at least one (1) feed pump for each filter compartment; and

(7.) On plants having a capacity in excess of 0.5 MGD, recorders shall be provided on the turbidimeters.

(VIII) Filter rate control shall be such that the filter is not surged. Filter rate of flow shall not change at a rate greater than 0.3 gpm/ft^2 per minute. Filters that stop and restart during a cycle shall have a filter to waste system installed. Declining flow rate filters shall not be used unless the flow rate for each filter is controlled to rates less than allowed in Section 9(h)(ii)(B)(I) of this Chapter and there are four (4) or more individual filters.

(IX) A filter to waste cycle shall be provided after the filter backwash operation. The filter to waste cycle shall be at least ten (10) minutes.

(i) Diatomaceous earth filters shall comply with the following requirements:

(i) Diatomaceous earth filters may be used:

(A) To remove turbidity from surface waters where turbidities entering the filters do not exceed twenty-five (25) TU and where total raw water coliforms do not exceed 100 organisms/100 mL;

(B) Where the raw water quality exceeds twenty-five (25) TU or where total raw coliforms exceed 100 organisms/100 mL if flocculation and sedimentation are used preceding the filters; or

(C) For removal of iron from groundwater.

(ii) Diatomaceous earth filtration units shall be of the pressure or vacuum type.

(iii) A precoating system shall be provided.

(A) A uniform precoat shall be applied hydraulically to each septum by introducing a precoat slurry to the filter influent line and employing a filter to waste or recirculation system.

(B) Diatomaceous earth in the amount of 0.20 lb/ft^2 minimum of filter area shall be used with recirculation. When precoating is accomplished with a filter to waste system, 0.3 lbs/ft^2 minimum shall be provided.

(iv) A body feed system to apply diatomaceous earth slurry continuously during the filter run shall be provided. Continuous mixing of the body feed slurry tank during the filter cycle shall be provided.

(v) The maximum rate of filtration shall not exceed 1.5 gpm/ft^2 of septum area. The filtration rate shall be controlled by a positive means.

(vi) The head loss shall not exceed thirty (30) psi for pressure diatomaceous earth filters, or a vacuum of fifteen (15) inches of mercury for vacuum system.

(vii) A recirculation or holding pump shall be provided to maintain differential pressure across the filter when the unit is not in operation in order to prevent the filter cake from dropping off the filter elements. A minimum recirculation rate of 0.1 gallons per minute per

square foot of filter area shall be provided. The filter control system shall prevent automatic restart after power failure.

(viii) The filter elements shall be structurally capable of withstanding maximum pressure and velocity variations during filtration and cleaning cycles, and shall be spaced so that not less than two (2) inches are provided between elements or between any element and a wall.

(ix) The filter influent shall be designed to prevent scour of the diatomaceous earth from the filter element.

(x) Every filter shall provide sampling taps for raw and filtered water; loss of head or differential pressure gauge; rate of flow indicator, with totalizer; and a throttling valve used to reduce rates during adverse raw water conditions.

(xi) For plants treating surface water, a continuous monitoring turbidimeter is required on the filter effluent from each diatomaceous earth filter unit.

(j) Disinfection equipment shall comply with the folowing requirements:

(i) Chlorine, chlorine dioxide, ozone or other disinfectant, described in the permit application and, as approved by the Administrator, may be used for disinfection.

(ii) Where the primary disinfectant is ozone, chlorination equipment shall be provided so that the distribution system is able to completely maintain a residual disinfectant.

(iii) Automatic proportioning of disinfectant feed to flow rate is required where the plant flow control is automatic.

(iv) Chlorination equipment shall comply with the following requirements:

(A) Chlorinators shall be solution feed gas chlorinators or hypochlorite feeders of the positive displacement type.

(B) The chlorinator capacity shall be such that a minimum five (5) mg/L disinfection dose can be added at maximum daily demand. The equipment shall be of such design that it will operate accurately over the desired feeding range.

(C) Standby equipment of sufficient capacity shall be available to replace the largest chlorinator unit. Well water systems providing no treatment other than

disinfection are exempt from the requirements of this paragraph (C) and are not required to provide standby chlorination equipment.

(D) Automatic switch-over of chlorine cylinders shall be provided.

(E) The chlorine solution injection/diffuser shall provide a rapid and thorough mix with all the water being treated. If the application point is to a pipeline discharging to a clearwell, the chlorine shall be added to the center of the pipe at least ten (10) pipe diameters upstream of the discharge into the clearwell.

(F) For gas feed chlorinators, the injector/eductor shall be selected based on solution water pressure, injector waterflow rate, feed point backpressure, and chlorine solution line length and size. The maximum feed point backpressure shall not exceed 110 psi. Where backpressure exceeds 110 psi, a chlorine solution pump shall be used. Gauges shall be provided for chlorine solution pressure, feed water pressure and chlorine gas pressure, or vacuum.

(G) Equipment shall provide for the following points of application:

(I) At plants treating surface water, provisions shall be made for applying disinfectant to the raw water, filter influent, and filtered water.

(II) For plants treating groundwater, provisions shall be made for applying disinfectant to a point in the finished water supply line prior to any commercial, industrial, or municipal user.

(H) Equipment shall provide the following minimum contact time:

(I) Where free chlorine residual is provided, one-half (1/2) hour contact time shall be provided for groundwaters and two (2) hours for surface waters.

(II) Where combined residual chlorination is provided, two (2) hours contact time for groundwater and three (3) hours contact for surface water shall be provided.

(III) Where chlorine is applied to a groundwater source for the sole purpose of maintaining a residual, no minimum contact time is required.

(I) Chlorine residual test equipment recognized in the *Standard Methods for the Examination of Water and Wastewater* shall be provided and shall be capable of

measuring residuals to the nearest 0.1 mg/L in the range below 0.5 mg/L, to the nearest 0.3 mg/L between 0.5 mg/L and 1.0 mg/L and to the nearest 0.5 mg/L between 1.0 mg/L and 2.0 mg/L.

(J) Chlorinator piping shall comply with the following requirements:

(I) The chlorinator water supply piping shall be designed to prevent contamination of the treated water supply. At all facilities treating surface water, pre- and post- chlorination systems shall be independent to prevent possible siphoning of partially treated water into the clearwell. The water supply to each eductor shall have a separate shutoff valve. No master shutoff is allowed. Chlorine solution feed water shall be finished water.

(II) The pipes carrying liquid or gaseous chlorine shall be Schedule 80 black steel pipe with forged steel fittings. Bushings shall not be used. Vacuum piping for gaseous chlorine may be polyethylene tubing. Gas piping between the chlorine pressure reducing valve of the chlorinator and the ejector shall be PVC or polyethylene. Piping for aqueous solutions of chlorine beyond the ejector shall be PVC, fiberglass or steel pipe lined with PVC or saran.

(K) The maximum withdrawal rate of gaseous chlorine shall be limited to 40 lbs/day for 100 or 150 lb cylinders and 400 lbs/day for 2,000 lb cylinders. There are no daily rate limits for chlorine evaporators.

(v) Ozonation equipment shall comply with the following requirements;

(A) The ozonator capacity shall be such that an applied dose of at least ten (10) mg/L can be attained at the maximum daily flows. The equipment shall be of such design that it is capable of operating five (5) percent over the desired feeding range.

(B) Injection equipment and piping in contact with ozonated air and air-water emulsions shall be of stainless steel, teflon, or other material resistant to ozone. Valves carrying ozonized air shall be made of metal coated with ozone-resistant materials.

(C) Ozone may be applied to the water directly as a gas or by an injector system similar to a chlorine injector system. In gas applications, depth of submergence of the diffusers shall be a minimum of ten (10) feet. Diffusion shall be fine bubble or mixed.

(D) Ozone shall be applied at a point that will provide contact time not less than thirty (30) minutes. At plants treating surface water, provisions shall be made for applying a disinfectant to the raw water, filter influent, filtered water and final contact basin. At plants treating groundwater, provisions shall be made for applying ozone to the clearwell inlet.

(E) Testing equipment shall enable measurement of residuals to the nearest 0.1 mg/L in the range below 0.5 mg/L and to the nearest 0.2 mg/L above 0.5 mg/L.

(F) An ozone destruct device shall be provided to destruct all ozone contractor off gases.

(G) The use of ozone for disinfection is allowed only if a chlorine or combined chlorine residual is provided in the distribution system.

(k) The following methods of softening are permissible:

(i) Lime or lime soda process, subject to the following requirements:

(A) Design standards for rapid mix, flocculation and sedimentation are the same as for conventional treatment as outlined in Section(s) 10 (c) through 10 (e) of this Chapter.

(B) Lime or lime soda softened effluent shall be filtered:

(C) When split treatment is used, the bypass line shall be sized to carry total plant flow, and a means of measuring and splitting the flow shall be provided;

(D) Lime and recycled sludge shall be fed directly into the rapid mix basin;

(E) Provisions shall be made to chemically stabilize waters softened by the lime or lime-soda process;

(F) Mechanical sludge removal equipment shall be provided in the sedimentation basin. Sludge recycling to the rapid mix shall be provided; and

(G) The use of excess lime shall not be considered a substitute for disinfection. Disinfection, as previously outlined, shall be provided; or

(ii) Cation exchange process subject to the following requirements:

(A) Pretreatment is required when the content of iron, manganese, or a combination of the two, is one (1) mg/L or more. Water with five (5) units or more turbidity (TU) shall not be applied directly to the cation exchange softener.

(B) The units shall be of pressure or gravity type, of either an upflow or downflow design. Automatic regeneration based on volume of water softened shall be used. A manual override shall be provided on all automatic controls;

(C) The design capacity for hardness removal shall not exceed 20,000 grains per cubic foot when resin is regenerated with 0.3 pounds of salt per kilograin of hardness removed;

(D) The depth of the exchange resin shall not be less than two (2) feet;

(I) Silica gel resins shall not be used for waters having a pH above 8.4, containing less than six (6) mg/L silica, or when iron is present;

(II) When the applied water contains a chlorine residual, the cation exchange resin shall be a type that is not damaged by residual chlorine; and

(III) Phenolic resin shall not be used.

(E) The flow applied to the softening unit shall not exceed seven (7) gpm/ft^2 of bed area. The minimum backwash rate shall be six (6) gpm/ft^2 of bed area or shall provide a minimum of 150 percent bed expansion at winter water temperatures. A positive means of controlling flow shall be present;

(F) The bottoms, strainer systems and support for the exchange resin shall conform to criteria provided for rapid rate gravity filters in Sections 9(h)(ii)(B)(II) and (VI) of this Chapter;

(G) Facilities shall be included for even distribution of the brine over the entire surface of both upflow and downflow units;

(H) Backwash, rinse and air relief discharge pipes shall be installed in such a manner as to prevent any possibility of back-siphonage;

(I) A bypass shall be provided around softening units to produce a blended water of desirable hardness. Totalizing meters must be installed on the bypass line and on each softener unit. An automatic proportioning or regulating device and shutoff valve shall be provided on the bypass line;

(J) Brine and salt storage tanks shall comply with the following requirements:

(I) Salt dissolving or brine tanks and wet salt storage tanks shall be covered and constructed of corrosion-resistant materials;

(II) The makeup water inlet shall be protected from back siphonage. Water for filling the tank shall be distributed over the entire surface by pipes above the maximum brine level in the tank. The tanks shall be provided with an automatic declining level control system on the makeup water line;

(III) Wet salt storage basins shall be equipped with manholes or hatchways for access and for direct dumping of salt from truck or railcar. Openings shall be provided with raised curbs and watertight covers having overlapping edges similar to the requirements for finished water storage in Section 12 (a)(ix) of this Chapter;

(IV) Overflows, if provided, must be turned down, have a proper free fall discharge and be protected with corrosion-resistant screens or self-closing flap valves;

(V) Two (2) wet salt storage tanks or compartments designed to operate independently shall be provided; and

(VI) The salt shall be supported on graduated layers of gravel under which is a means of collecting the brine.

(K) Total salt storage capacity shall provide for at least thirty (30) days of operation;

(L) An eductor may be used to transfer brine from the brine tank to the softeners. If a pump is used, a brine measuring tank or means of metering shall be provided to obtain proper dilution;

(M) Facilities for stabilizing corrosion control shall be provided;

(N) Pipes and contact materials shall be resistant to the aggressiveness of salt. Plastic and red brass are acceptable piping materials. Steel and concrete shall be coated with a non-leaching protective coating that is compatible with salt and brine; and

(O) Bagged salt and dry bulk salt storage shall be enclosed and separated from other operating areas in order to prevent damage to equipment.

(l) If used, aeration shall comply with the following requirements:

(i) Aeration may be used to:

(A) Help remove tastes and odors due to dissolved gases from decomposing organic matter;

(B) Reduce or remove objectionable amounts of carbon dioxide, and hydrogen sulfide;

(C) Introduce oxygen to assist in iron or manganese removal; and

(D) Strip volatile organic compounds for controlling the formation of trihalomethanes by removing the trihalomethane precursors.

(ii) The following types of aeration devices may be used:

(A) Natural draft aeration - tray type, subject to the following requirements:

(I) The aerator's design shall provide perforations in the distribution pan to provide uniform distribution of water over the top tray;

(II) The discharge shall be through a series of three (3) or more trays;

(III) Tray material shall be resistant to aggressiveness of the water and dissolved gases; and

(IV) The loading rate shall not exceed five (5) gpm/ft^2 of total tray area.

(B) Forced or induced draft aeration devices, subject to the following requirements:

(I) Be constructed and located so that air introduced into the column shall be free from obnoxious fumes, dust, and dirt;

(II) Be constructed so that all sections of the aerator shall be easily reached or removed for maintenance;

(III) Provide distribution of water uniformly over the top tray and discharge through a series of five (5) or more trays;

(IV) Be constructed so that the water outlet is adequately sealed to prevent unwarranted loss of air;

(V) Be constructed of material that is resistant to the aggressiveness of the water and dissolved gases; and

(VI) Provide loading at a rate not to exceed five (5) gpm/ft^2 of total tray area.

(C) Pressure aeration, provided that it shall be used only for oxidation purposes and shall not be used for removing dissolved gases.

(iii) All aerators except those discharging to lime softening or clarification plants shall be protected from contamination by birds and insects by using louvers and 24-mesh screen.

(iv) Disinfection must be provided as a final treatment to all waters receiving aeration treatment.

(v) A bypass shall be provided around all aeration units.

(vi) Volatile organic compounds may be stripped by packed tower or diffused aeration methods.

(m) Iron and manganese control, when used solely as treatment processes designed specifically to control iron and manganese, shall comply with the following requirements:

(i) Where iron and manganese removal is by oxidation, detention, and filtration:

(A) Oxidation may be accomplished by aeration or by chemical oxidation using chlorine, potassium permanganate, ozone, hydrogen peroxide, or chlorine dioxide;

(B) A minimum detention time of twenty (20) minutes shall be provided following aeration. The detention basin shall be designed as a holding tank with sufficient baffling to prevent short-circuiting. Sedimentation basins shall be provided when treating water with iron or manganese above two (2) mg/L, or where chemical coagulation is used to reduce the load on the filters. Provisions for sludge removal shall be made; and

(C) Gravity or pressure filters shall be provided. Where gravity or pressure filters are used, they shall comply with the following criteria in addition to the requirements of Section 9(h) of this Chapter:

(I) The rate of filtration shall not exceed three (3) gpm/ft^2 of filter area;

(II) The filters shall have a minimum side wall shell height of five (5) feet and an air release valve on the highest point of each filter; and

(III) Each filter shall have a means to observe the wastewater during backwashing and also a manhole to facilitate inspection and repairs.

(ii) Iron and manganese removal by the lime soda softening process shall conform to the lime soda process in Section 9(k)(i) of this Chapter.

(iii) Removal by manganese greensand filtration shall:

(A) Provide feed capability of potassium permanganate to the influent of a manganese greensand filter;

(B) Provide an anthracite media cap of at least six (6) inches over manganese green-sand;

(C) Have a filtration rate that shall not exceed four (4) gpm/ft^2;

(D) Provide a minimum backwash capability of twelve (12) gpm/ft^2, with a rate control device; and

(E) Provide air washing or surface washing.

(iv) Iron and manganese removal by the ion exchange process may not be used:

(A) For water containing more than 0.3 mg/L of iron, manganese, or combination of the two; or

(B) Where either the raw water or washwater contains dissolved oxygen.

(v) Sequestration by polyphosphates process may be used only for water containing 1.0 mg/L or less of iron, manganese, or a combination of the two as exceeds 1.0 mg/L. Additionally, where the sequestration by polyphosphates process is used:

(A) The total phosphate applied shall not exceed 10 mg/L as PO_4.

(B) Where phosphate treatment is used, facilities shall be provided for maintaining a 0.5 mg/L free or combined chlorine residual throughout the distribution system.

(C) The stock phosphate solution tank shall:

(I) Be covered;

(II) Include facilities for disinfecting the tank; and

(III) Be capable of providing a minimum of ten (10) mg/L free chlorine residual in the tank in order to prevent bacterial overgrowth in the phosphate solution.

(D) Polyphosphates shall not be applied ahead of iron and manganese removal treatment. The point of application shall be prior to any aeration, oxidation, or disinfection if no iron or manganese removal treatment is provided.

(vi) Where the sodium silicate sequestration of iron and manganese process is used:

(A) For groundwater supplies, the following requirements apply:

(I) The point of application shall be prior to air contact;

(II) Rapid oxidation of the metal ions by chlorine, chlorine dioxide, ozone, hydrogen peroxide, or other strong oxidant must accompany or closely precede the sodium silicate addition;

(III) Injection of sodium silicate shall not occur at a point more than fifteen (15) seconds after oxidation feed point;

(IV) Feed and dilution equipment shall be sized on the basis of feed solutions stronger than five (5) percent silica as SiO_2;

(V) Sodium silicate addition may be used only on water containing up to two (2) mg/L of iron, manganese, or a combination of the two; and

(VI) Sodium silicate addition shall not be used on waters where twenty (20) mg/L or more SiO_2 is required or where the amount of added and naturally occurring silicate will exceed sixty (60) mg/L as SiO_2.

(B) Facilities shall be provided for maintaining a chlorine residual of 0.5 mg/L throughout the distribution system; and

(C) Sodium silicate shall not be applied ahead of iron or manganese removal treatment.

(vii) Testing equipment shall be provided for all iron and manganese control plants and shall conform to the following requirements:

(A) The equipment shall have the capacity to measure the iron content to a minimum of 0.1 mg/L and the manganese content to a minimum of 0.05 mg/L; and

(B) Where polyphoshate sequestration is practiced, phosphate testing equipment shall be provided.

(n) Fluoridation and defluoridation shall comply with the following requirements:

(i) Fluoride compound storage tanks shall be covered. All fluoride compound storage shall be inside a building. Storage tanks for hydrofluosilic acid shall be vented to the atmosphere at a point outside the building.

(ii) Fluoride feed equipment shall meet the following requirements;

(A) Scales or loss of weight recorders shall be provided for dry chemical feeds. Feeders shall be accurate to within five (5) percent of any desired feed rate.

(B) The point of application of hydrofluosilic acid, if into a horizontal pipe, shall be in the lower half of the pipe. Fluoride compound shall not be added before lime soda softening or ion exchange softening.

(C) A fluoride solution shall be applied by a positive displacement pump having a stroke rate not less than twenty (20) nor more than ninety-five (95) strokes per minute. Fluoride solutions shall not be injected to a point of negative pressure.

(D) All fluoride feed lines and dilution water lines shall be isolated from potable water supplies by either an air gap above the solution tank or a reduced pressure principal backflow preventor.

(E) Water used for sodium fluoride dissolution shall have a hardness not exceeding fifty (50) mg/L. Softening shall be provided for the solution water where hardness exceeds forty-five (45) mg/L.

(F) Flow meters for treated flow rate and fluoride solution water shall be provided.

(iv) Provisions shall be made to allow the transfer of dry fluoride compounds from shipping containers to storage bins or hoppers in such a way as to minimize the quantity of fluoride dust that may enter the room in which the equipment is installed.

(A) The fluoride enclosure shall be provided with an exhaust fan and dust filter that places the hopper under a negative pressure.

(B) Air exhausted from fluoride handling equipment shall discharge through a dust filter to the atmosphere outside of the building. The discharge shall not be located near a building fresh air intake.

(C) A floor drain shall be provided to facilitate removal of any water on the floor.

(v) Equipment shall be provided for measuring the quantity of fluoride in the water.

(vi) Where the source water quality requires fluoride removal, the following methods are acceptable:

(A) Activated alumina, subject to the following requirements:

(I) Activated alumina may be employed in open gravity filter tanks or pressure filter tanks. The minimum media depth shall be five (5) feet. The units shall not be loaded at a rate exceeding four (4) gallons per minute per square foot;

(II) The activated alumina media shall be in mesh sizes ranging from #28 to #48; and

(III) Regeneration facilities, including both weak caustic and weak acid systems, shall be provided to regenerate the media.

(B) Bone char filtration or lime softening with magnesium addition.

(o) Stabilization treatment shall comply with the following requirements:

(i) Stabilization by carbon dioxide addition shall comply with the following requirements:

(A) Recarbonation basin design shall provide a minimum total detention time of twenty (20) minutes. Two (2) compartments consisting of a mixing compartment having a detention time of at least three (3) minutes and a reaction compartment are required. Each compartment shall have a minimum depth of eight (8) feet;

(B) Plants generating carbon dioxide from combustion shall have top recarbonation tanks in order to dissipate carbon monoxide gas. Care shall be taken to prevent the basin off-gases from entering any treatment plant structure; and

(C) The recarbonation basin shall be sloped to a drain.

(ii) Where stabilization is by acid addition, facilities shall be provided for feeding both acid and alkalinity, such as sodium carbonate, lime, or sodium bicarbonate.

(iii) The feeding of polyphosphates may be used for sequestering calcium in lime softened water, for corrosion control, and in conjunction with alkali feed following ion exchange softening. Chlorination equipment and feed points shall be available to chlorinate the phosphate solution tank to maintain a ten (10) mg/L free chlorine residual and to maintain a 0.5 mg/L residual in the distribution system.

(iv) Unstable water created by ion exchange softening shall be stabilized by an alkali feed. An alkali feeder shall be provided for all ion exchange water softening plants.

(v) Laboratory equipment shall be provided for determining the effectiveness of stabilization treatment. This shall include testing equipment for hardness, calcium, alkalinity, pH and magnesium, as a minimum.

(p) Provision shall be made for the control of taste and odor at all surface water treatment plants. Taste and odor control equipment shall comply with the following requirements:

(i) The following control processes may be used to control taste and odor:

(A) Chlorination may be used for the removal of some objectionable odors. Two (2) hours of contact time must be provided to complete the chemical reactions involved;

(B) Chlorine dioxide may be used in the treatment of any taste and odor that is treatable by an oxidizing compound. Provisions shall be made for proper storing and handling of the sodium chlorite to eliminate any danger of explosion;

(C) Powdered activated carbon may be used, subject to the following requirements:

(I) Provisions shall allow the addition of carbon to the presedimentation basin influent, rapid mix basin, and clarifier effluent;

(II) Carbon feed equipment shall be capable of feeding from zero (0) to forty (40) mg/L at plant design flows.; and

(III) Provision shall be made for adequate dust control. Powdered activated carbon shall be handled as a potentially combustible material. It shall be stored and used in a building or compartment as nearly fireproof as possible. Carbon feeder rooms shall be designed in accordance with the requirements of the National Electric Code for hazardous locations, Class 1, Groups C and D, Division 1;

(D) Granular activated carbon adsorption units by open or closed carbon contacting may be used for taste and odor control by adsorption of organics. The loading rate shall not exceed ten (10) gpm/ft^2. The minimum empty bed contact time shall be twenty (20) minutes. Provisions shall be made for moving carbon to and from the contactors.

(E) Potassium permanganate may be used. The application point shall be in the raw water or ahead of the clarifier influent. Facilities shall be capable of feeding not less than ten (10) mg/L of permanganate; or

(F) Ozone may be used. Thirty (30) minutes of contact time must be provided to complete the chemical reactions involved. The facilities shall be capable of an applied ozone feed rate of fifteen (15) mg/L minimum.

(ii) Plants treating water that have documented taste and odor problems shall be provided with equipment that makes available at least two (2) of the control processes listed in paragraph (i) of this Section 9(p).

(q) A microscreen may be used as a mechanical supplement to treatment. The microscreening shall be capable of removing suspended matter from the water by straining. It may be used to reduce nuisance organisms and organic loadings. It shall not be used in place of filtration or coagulation.

(i) Screens shall be of a corrosion-resistant material, plastic or stainless steel.

(ii) Bypass piping shall be provided around the screen unit.

(iii) Protection against back siphonage shall be provided when potable water is used for washing the screen.

(iv) Washwaters shall be wasted and not recycled to the microscreen.

(r) Granular carbon adsorption may be used for organics removal.

(i) Water to be treated may be contacted with granular activated carbon. The pH of the water to be treated shall be less than 9.0. The turbidity of the applied water shall be less than two (2) TU when packed beds are used.

(ii) The carbon beds or columns shall provide a minimum of twenty (20) minutes of empty bed contact time at design flow. Surface loading rates shall not exceed 10 gpm/ft^2.

(iii) Carbon beds or columns shall be designed as follows:

(A) If an upflow countercurrent contactors is used, it may be either packed or expanded and a single unit is acceptable. If a downflow contactor is used, two or (2) more beds in parallel are required.

(B) Contactors may be designed as open gravity units, or pressure beds. They may be constructed of concrete, steel, or fiberglass-reinforced plastic. Steel vessels shall be protected against corrosion by coaltar epoxy coating, rubber or glass lining, or other means.

(C) All carbon beds or columns shall be equipped with provisions for flow reversal and bed expansion. Combination downflow filter contactors shall have backwashing facilities to provide up to fifty (50) percent bed expansion and shall meet the same backwash criteria as rapid rate filters in Section 9(h)(ii)(B)(IV) of this Chapter.

(D) Inlet and outlet screens shall be #304 or #316 stainless steel or other suitable materials.

(E) Carbon beds and columns shall have a means for removing spent carbon and introducing makeup or regenerated carbon.

(F) Pressure contactors shall be equipped with air-vacuum release valves fitted with a stainless steel screen, slot size 0.14 inches, to prevent plugging with carbon.

(s) Wastes shall be handled and disposed of as follows:

(i) The sanitary and laboratory wastes from water treatment plants, pumping stations, or simple well systems, shall not be recycled to any part of the water plant. Waste from these facilities must be discharged directly to a sanitary sewer system when feasible, or to an on-site waste treatment facility permitted by the Wyoming Department of Environmental Quality.

(ii) The brine waste from ion exchange plants, demineralization plants, and other similar facilities, may not be recycled to the plant. Where discharging to a sanitary sewer, a holding tank shall be provided to prevent the overloading of the sewer or interference with the waste treatment processes. The effect of brine discharge to sewage lagoons may depend on the rate of evaporation from the lagoons. Where disposal to an offsite waste treatment system is proposed, the sewer and treatment facility shall have the required capacity and dilution capability. The impact of any treatment system discharge will be evaluated by the Wyoming Department of Environmental Quality reviewing engineer.

(iii) Acceptable methods of treatment and disposal of lime softening sludge are:

(A) Sludge lagoons, provided that:

(I) Lagoons shall provide a surface area of 0.7 acres per million gallons per day (average daily demand) per 100 mg/L of hardness removed, based on a usable lagoon depth of five (5) feet;

(II) At least two (2) lagoons shall be provided;

(III) An acceptable means of final sludge disposal shall be provided;

(IV) Provisions must be made for lagoon cleaning that requires a minimal amount of equipment and procedures;

(V) Lagoons shall be located above the 100-year flood elevation or adequately protected from the 100-year flood;

(VI) There shall be means of diverting surface water runoff so that it does not flow into the lagoons;

(VII) Minimum free-board of three (3) feet shall be present in the lagoons;

(VIII) An adjustable decanting device for recycling the overflow shall be present; and

(IX) There shall be an accessible effluent sampling point.

(B) Land application of liquid lime softening sludge;

(C) Disposal at a landfill;

(D) Mechanical dewatering of sludge; or

(E) Recalcination of sludge; and

(F) Lime sludge drying beds shall not be used.

(iv) Acceptable methods of treatment and disposal of alum sludge are as follows:

(A) Lagooning may be used as a storage and interim disposal method for alum sludge. The volume of alum sludge storage lagoons shall be at least 100,000 gallons per 1,000,000 gpd of treatment plant capacity.

(B) Discharge of alum sludge to sanitary sewers may be used only when the sewage system has the capability to adequately handle the flow and sludge.

(C) Mechanical dewatering of sludge may be employed.

(D) Alum sludge drying beds may be used.

(E) Alum sludge may be acid treated and recovered.

(F) Disposal at a landfill.

(v) Waste filter washwater from iron and manganese removal plants may be disposed of as follows:

(A) By sand filters, provided that:

(I) Sand filters should have a total filter area of not less than 100 square feet in a minimum of two (2) compartments. The filter shall have sufficient surface area and capacity to contain, in a volume of two (2) feet above the level of the sand, the entire volume of washwater produced by washing the production filters;

(II) The filter shall not be subject to flooding by surface runoff or flood waters;

(III) Finished grade elevation shall be such as to facilitate maintenance, cleaning and removal of surface sand as required;

(IV) The filter media shall consist of a minimum of twelve (12) inches of sand, 3 inches of supporting small gravel or torpedo sand, and nine (9) inches of gravel in graded layers. All sand and gravel shall be washed to remove fines. Filter sand shall have an effective size of 0.3 to 0.5 mm and a uniformity coefficient not to exceed 3.5;

(V) The filter shall be provided with an underdrain collection system, and provision shall be made for an accessible sample point;

(VI) Overflow devices from these filters shall not be permitted;

(VII) Where freezing may occur, provisions shall be made for covering the filters during the winter months; and

(VIII) Iron and manganese waste filters shall provide an atmosphere air break between adjacent compartments that contain finished water and unfiltered water.

(B) By washwater recovery lagoons provided that:

(I) Decanted filter backwash wastewater from the lagoons shall be recycled to the head of the plant;

(II) Lagoons shall provide 250,000 gallons of storage for each 1,000,000 gallons per day of treatment capacity; and

(III) Lagoons shall have a minimum usable depth of three (3), a length four (4) times the width, and a width of at least three (3) times the water depth.

(C) By discharge to a sewer system.

Section 10. Chemical Application.

(a) Chemicals shall be applied by such means as to prevent backflow or back siphonage between multiple points of feed through common manifolds.

(b) General design of chemical application equipment shall be such that:

(i) Feeders will be able to supply the necessary amounts of chemical throughout the feed range at all times;

(ii) Chemical contact materials and surfaces are resistant to the aggressiveness of the chemical solution;

(iii) Corrosive chemicals are introduced in such a manner as to minimize potential for corrosion;

(iv) Chemicals that are incompatible are not stored or handled together;

(v) All chemicals are conducted from the feeder to the point of application in separate conduits;

(vi) Chemical feeders and pumps operate at no lower than twenty (20) percent of the feed range; and

(vii) Slurry type chemicals, especially lime, are fed by gravity where practical.

(c) Chemical application facility design shall comply with the following requirements:

(i) A separate feeder shall be provided for each chemical applied;

(ii) Feeders:

(A) May be manually or automatically controlled, but:

(I) Automatic controls shall be designed to allow override by manual controls; and

(II) Where plant flow rates are not manually controlled, chemical feed rates shall be automatically proportioned to flow.

(B) Shall have calibration cylinders for each chemical system, enabling exact measurement of chemical feed dose; and

(C) Dry chemical feeders shall:

(I) Measure chemicals volumetrically or gravimetrically;

(II) Be provided with a solution water system and mixer in the solution tank; and

(III) Completely enclose chemicals to prevent emission of dust to the operating room.

(iv) Positive displacement pumps shall be sized for the maximum pressure at the point of injection. A backpressure valve shall be provided in instances where chemicals can flow by gravity through the pump and pump check valves.

(v) Liquid chemical feeders shall not allow chemical solutions to siphon into the water supply.

(vi) Cross-connection control shall ensure the service water lines discharging to solution tanks are protected from backflow and that liquid chemical solutions cannot be siphoned through solution feeders into the water supply. No direct connection shall exist between any sewer and a drain or overflow from the feeder, solution chamber, or tank. All drains shall terminate at least six (6) inches or two (2) pipe diameters, whichever is greater, above the overflow rim of a receiving sump, conduit or waste receptacle.

(vii) The in-plant water supply shall:

(A) Be of sufficient quantity and pressure to meet the chemical system needs;

(B) Provide a minimum capability of fifteen (15) gpm at fifty (50) psi;

(C) Provide an alternate means of controlling and measuring the water when used for preparing specific solution concentrations by dilution such as a rotometer and control valve; and

(D) Shall be properly treated for hardness when hardness affects the chemical solution.

(viii) Storage of chemicals shall comply with the following requirements:

(A) Storage space or tank volume shall be provided for at least thirty (30) days of chemical supply. The storage shall provide protection from intermixing of two (2) different chemicals;

(B) Storage tanks and pipelines for liquid chemicals shall be specific to the chemical and not for alternates;

(C) Liquid chemical storage tanks shall:

(I) Have a liquid level indicator;

(II) Have an overflow;

(III) Have a receiving basin or drain capable of receiving accidental spills or overflows;and

(IV) Be located in a contained area sized to store the total contents of a ruptured tank.

(D) All chemical storage tanks shall be constructed of materials that are resistant to the chemical that they store. The tank shall not lose its structural integrity through chemical action or be subject to corrosion.

(ix) Solution and slurry tanks shall comply with the following requirements:

(A) Feed and dilution systems shall be designed to maintain uniform strength of solution in solution tanks. A mixer shall be provided to mix the tank contents when batching solutions. Continuous agitation shall be provided to maintain slurries in suspension. A means shall be provided to measure the solution level in the tank. Chemical solution tanks shall have a cover. Large tanks with access openings shall have such openings curbed and fitted with overhanging covers;

(B) Subsurface locations for solution tanks shall be free from sources of possible contamination and shall ensure positive drainage for groundwaters, accumulated water, chemical spills and overflows;

(C) Overflow pipes, when provided, shall be turned downward, with the end screened. They shall have a free fall discharge and be visibly located;

(D) Acid storage tanks shall be vented to the outside atmosphere, but shall not be vented through vents shared with any other material; and

(E) Each tank shall be provided with a valved drain that is protected against backflow by an air gap of six (6) inches or two (2) pipe diameters, whichever is greater.

(x) Day tanks shall comply with the following requirements:

(A) Day tanks shall be provided where:

(I) Bulk storage of liquid chemical is provided and a dilute solution is to be fed; or

(II) Chemicals are manually batched;

(III) Day tanks shall meet the requirements for solution tanks in paragraph (ix) of this Section 10(c);

(IV) Tanks shall be properly labeled to designate the chemical contained.

(B) Hand pumps may be used to transfer chemicals from a carboy or drum. A tip rack may be used to permit withdrawal into a bucket from a spigot. Where motor-driven transfer pumps are provided, a liquid level limit switch and an overflow from the day tank shall be provided; and

(C) Continuous agitation shall be provided to maintain chemical slurries in suspension. A mixer shall be provided to mix the initial dilution.

(xi) Feed lines shall:

(A) Be of durable material, resistant to the chemical handled;

(B) Be readily accessible for maintenance when located within structures;

(C) Be protected against freezing;

(D) Be readily cleanable by using plugged crosses for 90 degree bends;

(E) Slope upward from the chemical source to the feeder when conveying gases;

(F) Be designed consistent with scale-forming or solids-depositing properties of the water, chemical, solution, or mixtures conveyed;

(G) Be color coded; and

(H) Have a connection for a flushing line.

(xii) Equipment for lifting chemical containers shall be provided.

(xiii) Provisions shall be made for the transfer of dry chemicals from shipping containers to storage bins or hoppers to minimize the quantity of dust that may enter the room in which the equipment is installed. Provisions shall also be made for disposing of empty bags, drums or barrels that will minimize exposure to dusts. Control may be provided by using:

(A) Vacuum/pneumatic equipment or closed conveyor systems;

(B) Facilities for emptying shipping containers in special enclosures;

(C) Exhaust fans and dust filters that put the hoppers or bins under negative pressure.

(xiv) Provision shall be made for measuring quantities of chemicals used to prepare feed solutions.

(xv) Floor surfaces shall be smooth and impervious, slip-resistant, well-drained, and have 2.5 percent minimum slope. Vents from feeders, storage facilities, and equipment exhaust shall discharge to the outside atmosphere above grade and remote from air intakes.

(d) Facilities used for the following specific chemicals shall comply with these additional requirements:

(i) For chlorine gas:

(A) Respiratory protection equipment, meeting the requirements of the National Institute of Occupational Safety and Health (NIOSH), shall be available where chlorine gas is handled, and shall be stored at a convenient location, but not inside any room where chlorine is used or stored. The units shall use compressed air, have at least a 30-minute capacity, and be compatible with or exactly the same as units used by the fire department responsible for the plant;

(B) Where ton containers are used, or where plants store more than 1000 lbs of chlorine, continuous electronic chlorine leak detection equipment shall be provided;

(C) Repair kits that meet the requirements at 49 CFR 173.3(e) shall be provided for plants employing chlorine gas chlorination. The chlorine repair kits shall be available for each size container stored at the facility;

(D) Chlorine gas feed and storage shall be enclosed and separated from other operating areas. The chlorine room shall be provided with a shatter resistant window installed in an interior wall. The room shall be constructed in such a manner that all openings between the chlorine room and the remainder of the plant are sealed. The doors shall be equipped with panic hardware, assuring ready means of exit and opening outward only to the building exterior;

(E) Where chlorine gas is used, the room shall have an exhaust ventilating system that complies with the following requirements:

(I) The ventilating system shall have a capacity that provides one (1) complete air change every two (2) minutes;

(II) The ventilating system shall take suction within eighteen (18) inches of the floor, as far as practical from the door and air inlet, with the point of discharge so located as not to contaminate air intakes to any rooms or structures;

(III) Air intakes shall be through louvers near the ceiling. Louvers for chlorine room air intake and exhaust shall facilitate airtight closure;

(IV) Separate switches for the fan and lights shall be located outside of the chlorine room and at the inspection window. Outside switches shall be protected from vandalism. A signal light indicating fan operation shall be provided at each entrance when the fan can be controlled from more than one (1) point;

(V) Vents from feeders and storage shall discharge to the outside atmosphere, above grade. The room location shall be on the prevailing downwind side of the building away from entrances, windows, louvers, and walkways; and

(VI) Floor drains shall discharge to the outside of the building and shall not be connected to other internal or external drainage systems.

(F) Full and empty cylinders of chlorine gas shall be isolated from operating areas, restrained in position to prevent upset, stored in rooms separate from ammonia storage, and stored in areas not in direct sunlight or exposed to excessive heat;

(G) Chlorinator rooms shall be heated to 60 degrees Fahrenheit and be protected from excessive heat. Cylinders and gas lines shall be protected from temperatures above that of the feed equipment; and

(H) Pressurized chlorine feed lines shall not carry chlorine gas beyond the chlorinator room.

(ii) For acids and caustics:

(A) Acids and caustics shall be kept in closed corrosion-resistant shipping containers or in covered bulk storage units;

(B) Acids and caustics shall be pumped in undiluted form from original containers or bulk storage units through suitable pipe or hose to the point of treatment or to a covered day tank; and

(iii) For sodium chlorite, provisions shall be made for proper storage and handling of sodium chlorite to eliminate any danger of explosion. No hydrocarbons or organics shall be stored with sodium chlorite.

Section 11. Pumping Facilities.

(a) The total dynamic head rating of pumping units shall be based on pipe friction, pressure losses from piping entrances, exits, appurtenances (such as bends and valves), and static head at the design flow.

(b) Pumping stations shall be located so that:

(i) The pumping station shall be elevated or protected to a minimum of three (3) feet above the 100-year flood elevation or three (3) feet above the maximum flood of record elevation, whichever is higher;

(ii) The station shall be accessible to operating personnel at all times, and during all weather;

(iii) The site around the station shall be graded to lead surface drainage away from the station; and

(iv) The station shall have security installed to prevent vandalism and entrance by unauthorized persons or animals.

(c) Pumping stations for raw and finished water shall:

(i) Have outward opening doors;

(ii) Have a floor elevation or a main level entry at least six (6) inches above finished grade. All floors shall slope at least two and one-half (2-1/2) inches in every ten (10) feet to a suitable drain;

(iii) Provide pumps with an outlet for drainage from pump glands without discharging onto the floor; and

(iv) Have any underground structures waterproofed.

(d) Finished water wetwells shall:

(i) Be covered;

(ii) Have all vents turned down and screened;

(iii) Be located above the groundwater table; and

(iv) Ensure that the top of the walls from the wetwell are at least eighteen (18) inches above finished grade.

(e) Pump stations shall be provided with craneways, hoist beams, eyebolts, or other facilities for servicing or removing pumps, motors or other heavy equipment. They shall be rated for at least 1.5 times the weight of the heaviest single item to be lifted. Openings in floors and roofs shall be provided as needed for removal of heavy or bulky equipment.

(f) Stairways or ladders shall be provided in pumping facilities between all floors and in pits or compartments that must be entered.

(g) Pumping facilities shall be heated to maintain a minimum temperature of 40 degrees Fahrenheit if not typically occupied and 50 degrees Fahrenheit if occupied.

(h) All accessible pumping station areas shall be ventilated. Ventilation may be continuous or intermittent. If intermittent, ventilation in areas normally visited by operating personnel shall be started automatically at not greater than thirty (30) minute intervals. Permanently installed drywell ventilation shall provide at least six (6) air changes per hour if continuous, and twelve (12) air changes per hour if intermittent. Intermittent ventilating equipment shall ensure starting upon entry of operating personnel. Wetwells shall be designed to permit the use of portable blowers that will exhaust the space and continue to supply fresh air during access periods.

(i) In below ground pumping stations, a means for dehumidification shall be provided. The facilities shall be sized to maintain the dewpoint at least 2 degrees Fahrenheit below the coldest anticipated temperature of water to be conveyed in the pipes.

(j) All pumping stations that are manned for four (4) or more hours per day shall be provided with potable water, lavatory and toilet facilities. Wastes shall be discharged to the sanitary sewer or to an on-site waste treatment system.

(k) At least two (2) pumping units shall be provided. With the largest pump out of service, the remaining pump or pumps shall be capable of providing the maximum pumping rate of the system.

(l) Pumps shall be selected so that the net positive suction head required at maximum flow (NPSHR) is less than the net positive suction head available (NPSHA) minus four (4) feet based on the hydraulic conditions and altitude of the pumping station. If this condition is not met, then priming shall be provided subject to the following requirements:

(i) Priming water must not be of lesser sanitary quality than that of the water being pumped; and

(ii) Vacuum priming may be used. When an air operated ejector is used, the screened intake shall draw clean air from a point at least ten (10) feet above the ground or other source of possible contamination.

(m) Piping systems for pumping facilities shall be designed to withstand the maximum possible surge (water hammer) from the pumping station, or adequate surge control shall be provided to protect the piping. Pressure relief valves are not acceptable surge control.

(n) Booster pumps shall comply with the following requirements:

(i) Booster pumps shall not produce a pressure less than five (5) psi in suction lines. Where the suction line has service connections, booster pump intake pressure shall be at least thirty-five (35) psi when the pump is in normal operation and shall be provided with a low pressure cutoff switch if the suction line pressure is a minimum of twenty (20) psi.

(ii) Automatic or remote control devices shall have a range between the start and cutoff pressure that will prevent cycling of more than one (1) start every fifteen (15) minutes.

(iii) In-line booster pumps shall be accessible for servicing and repairs. The access opening and vault shall be large enough to remove the pump.

(iv) Individual home booster pumps shall not be allowed for any individual service from the public water supply main.

(o) Operating conditions that may affect continuous delivery of water for automatic and remotely controlled pumping facilities shall have an alarm at a location that is attended.

(p) Pumping facility valves shall comply with the following requirements:

(i) All pumps except submersibles shall have a suction and discharge valve to permit satisfactory operation, maintenance and repair of the equipment. Submersible pumps shall have a check valve and discharge valve to permit satisfactory operation, maintenance and repair of the equipment.

(ii) If foot valves are necessary, they shall have a net valve area of at least two and one-half (2-1/2) times the area of the suction pipe and they shall be screened.

(iii) Each pump shall have an individual suction line or the lines shall be manifolded to ensure similar hydraulic and operating conditions.

(iv) All pumps shall be provided with a check valve located between the pump and the discharge shutoff valve, except where arranged so that backflow is not possible under normal operating conditions.

(v) Air release valves shall be provided where the pipe crown is dropped in elevation.

(q) Each pump shall have a standard pressure gauge on its discharge line. All pumps (except wet pit type pumps) shall have a compound gauge on their suction line.

(r) 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 supplied from a break tank open to atmospheric pressure. The tank shall have an air gap of at least six (6) inches or two (2) pipe diameters, whichever is greater, between the feeder line and the spill line of the tank.

(s) Pumps, their prime movers, and their accessories shall be controlled in such a manner that they will operate at rated capacity without overload. Provision shall be made to

prevent energizing the motor in the event of a backspin cycle. Electrical controls shall be located above grade.

Section 12. Finished Water Storage.

(a) Finished water storage structrues shall comply with the following requirements:

(i) Finished water storage tanks may be made of materials other than steel, but steel finished water storage structures shall meet the requirements of the AWWA D100 or AWWA D103.

(ii) All tank design and foundation design shall be performed by a registered professional engineer and the plans or contractor-furnished information shall designate the registered engineer providing the design.

(iii) Storage facilities shall have the capacity to meet domestic demands, and where required, fire protection storage. Additionally:

(A) Water systems serving less than 50,000 gallons on the design average daily demand shall provide clearwell and system storage capacity equal to the average daily demand;

(B) Water systems serving from 50,000 to 500,000 gallons on the design average daily demand shall provide clearwell and system storage capacity equal to the average daily demand plus fire storage.

(C) Water systems serving more than 500,000 gallons on the design average daily demand shall provide clearwell and system storage capacity equal to twenty-five (25) percent of the design maximum daily demand, plus added fire storage.

(D) Storage need not be provided in a well supply system where a minimum of two (2) wells are provided and the maximum hourly demand or fire demand, whichever is greater, can be supplied with the largest well out of service.

(iv) Ground level reservoirs shall:

(A) Have the bottom of reservoirs and standpipes located above or protected from the 100-year flood or the maximum flood of record, whichever is greater;

(B) Have the bottom of reservoirs placed above the groundwater table where the bottom is below normal ground surface. Where the bottom of the reservoir is below normal ground surface:

(I) Sewers, drains, standing water, and similar sources of possible contamination must be kept at least fifty (50) feet from the reservoir; and

(II) Watermain pipe, pressure tested in place to fifty (50) psi without leakage, may be used for gravity sewers at distances greater than twenty (20) feet and less than fifty (50) feet.

(C) Have the top of the reservoir walls located at least eighteen (18) inches above normal ground surface. Clearwells constructed under filters are exempted from the requirements of this paragraph (C) when the total design gives the same protection.

(v) All finished water storage structures shall have suitable watertight roofs that exclude birds, animals, insects, and excessive dust.

(vi) Security-type fencing, locks on access manholes, and other precautions shall be provided to prevent trespassing, vandalism, and sabotage at above ground storage facilities. Below-ground storage facilities are exempt from this fencing requirement.

(vii) No drain on a water storage structure may have a direct connection to a sewer or storm drain. Water storage structures drained to sewer or storm drains shall be drained through piping that allows an air gap such that the drain pipe is at least three (3) pipe diameters above the ground level at the drain point to the sanitary or storm drain.

(viii) All water storage structures shall be provided with an overflow that complies with the following requirements:

(A) The overflow shall be brought down to an elevation between twelve (12) and twenty-four (24) inches above the ground surface;

(B) The overflow shall discharge over a drainage inlet structure or a splash plate.

(C) No overflow may be connected directly to a sewer or a storm drain;

(D) All overflow pipes shall be located:

(I) So that any discharge is visible;

(II) When an internal overflow pipe is used on elevated tanks, it shall be located in the access tube. For vertical drops on other types of storage facilities, the overflow pipe shall be located on the outside of the structure;

(III) The overflow of a ground level structure shall open downward and be screened with noncorrodible screen installed within the pipe at a location least susceptible to damage by vandalism; and

(E) The overflow pipe shall be of sufficient diameter to permit wasting of water in excess of the filling rate.

(ix) Finished water storage structures shall be designed with access to the interior for cleaning and maintenance. Manholes shall:

(A) Be framed at least four (4) inches above the surface of the roof at the opening for manholes above the waterline;

(B) Be elevated a minimum of twenty-four (24) inches above the top of the structure for ground-level structures;

(C) Be fitted with a solid watertight cover that:

(I) Overlaps the framed opening;

(II) Extends down around the frame at least two (2) inches;

(III) Is hinged at one (1) side; and

(IV) Has a locking device;

(D) Have a minimum inside opening diameter of twenty-four (24) inches.

(x) Finished water storage structures shall be vented. Overflows shall not be considered as vents. Open construction between the sidewall and roof is not permissible. Vents shall prevent the entrance of surface water and rainwater, and shall exclude birds and animals.

(A) For elevated tanks and standpipes, 24-mesh noncorrodible screen may be used for vents.

(B) For ground-level structures, the vents shall terminate in an inverted U construction with the opening a minimum of twenty-four (24) inches above the roof and covered with 24-mesh noncorrodible screen installed within the pipe at a location least susceptible to vandalism.

(xi) The roof and sidewalls of all structures shall be watertight with no openings except properly constructed vents, manholes, overflows, risers, drains, pump mountings, control ports, or piping for inflow and outflow.

(xii) Protection shall be given to metal surfaces by paints or other protective coatings, by cathodic protective devices, or by both. Materials and procedures shall conform to AWWA D102. Paint systems, after proper curing, shall not transfer any substance to the water that is toxic, causes tastes, or causes odors. Paints containing lead or mercury shall not be used. All paints and other protective coatings shall be compatible with the water and the water chemistry.

(xiii) Finished water storage structures shall be designed to be disinfected in accordance with AWWA C652. Sampling shall be specified.

(b) Finished water plant storage shall comply with the following requirements:

(i) Washwater tanks shall be sized, in conjunction with available pump units and finished water storage, to provide the backwash water required by Section 9(h)(ii)(B)(IV) of this Chapter.

(ii) Clearwell storage shall be sized, in conjunction with distribution system storage, to relieve the filters from having to follow fluctuations in water use. Where water is pumped from clearwater storage to the system, an overflow shall be provided.

(iii) If unfinished water is stored in compartments adjacent to finished water, the unfinished and finished water shall be separated by double walls.

(iv) Receiving basins and pump wetwells for finished water shall be designed as finished water storage structures and shall comply with the requirements of Section 13(a) of this Chapter.

(c) Hydropneumatic (pressure) tanks:

(i) May be used as the only storage facility when the system serves fewer than fifty (50) homes; when the system serves more than fifty (50) homes, ground or elevated storage shall be provided and shall comply with the requirements of Section 12(a) of this Chapter;

(ii) Shall not be used for fire protection purposes;

(iii) Shall meet ASME Boiler and Pressure Vessel Code BPVC-17 requirements for unfired pressure vessels;

(iv) Shall be located above normal ground surface and be completely housed;

(v) Shall have a capacity, including wells and pumps in a hydropneumatic system, of at least ten (10) times the average daily demand. The gross volume of the hydropneumatic tank, in gallons, shall be at least ten (10) times the capacity of the largest pump, rated in gallons per minute.

(vi) Shall be plumbed with bypass piping;

(vii) Shall have an access manhole;

(viii) Shall have a drain; and

(ix) Shall have control equipment consisting of

(A) A pressure gauge;

(B) Water tight glass;

(C) Automatic or manual air blowoff;

(D) A means for adding air; and

(E) Pressure-operated start-stop controls for the pumps.

Section 13. Distribution Systems.

(a) Distribution systems shall be constructed of one (1) of the following materials:

(i) Types of commercial pipe that conform to the following standards:

(A) PVC water pipe:

(I) Less than four (4) inches diameter: ASTM D2241; or

(II) Four (4) inches and larger diameter: AWWA C900.

(B) Asbestos cement pressure pipe: AWWA C400;

(C) Ductile iron pipe: AWWA C151;

(D) Glass fiber - reinforced thermosetting - resin pressure pipe: AWWA C950; or

(E) Polyethelyene: AWWA C901.

(ii) Watermains and valves that have been used previously provided they are in good working order and can meet these standards. No other used materials may be used;

(iii) Joints of pipe shall meet the following requirements:

(A) Packing and jointing materials used in the joints of pipe shall be flexible and durable;

(B) Flanged piping shall not be used for buried service except for connections to valves; and

(C) Push-on or mechanical joints shall be used.

(iv) Service connections shall be constructed in conformance with the Uniform Plumbing Code;

(v) All types of installed distribution system pipe shall be specified to be pressure tested and leakage tested in accordance with AWWA C600.

(b) Watermains shall meet the following design requirements:

(i) All watermains, including those not designed to provide fire protection, shall be sized after a hydraulic analysis based on flow demands and pressure requirements. The system shall be designed to maintain a minimum pressure of twenty (20) psi at ground level at all

points in the distribution system under all conditions of flow. The normal working pressure in the distribution system shall be not less than thirty-five (35) psi.

(ii) The minimum size of a watermain for providing fire protection and serving fire hydrants shall be:

(A) Six (6) inches diameter where service is provided from two (2) directions;

(B) Six (6) inches diameter where the maximum length of pipe serving the hydrant from 1 direction does not exceed 250 feet; or

(C) Eight (8) inches diameter where service is provided from one (1) direction only.

(iii) Larger size mains than those requried by paragraph (ii) of this Section 13(b) shall be provided as necessary to allow the withdrawal of the required fire flow while maintaining the minimum residual pressure of twenty (20) psi;

(iv) Any main smaller than six (6) inches shall be justified by hydraulic analysis and future water use;

(v) Where fire protection is to be provided, system design shall be such that fire flows can be served;

(vi) Only watermains designed to carry fire flows shall have fire hydrants connected to them;

(vii) Deadends shall be minimized by looping;

(viii) Where deadend mains occur they shall be provided with a flushing hydrant or blowoff for flushing purposes. Flushing devices shall be sized to provide flows that will give a velocity of 2.5 feet per second minimum in the watermain being flushed. No flushing device shall be directly connected to any sewer;

(ix) Valves shall be provided on watermains so that inconvenience and sanitary hazards will be minimized during repairs. Valves shall be located at not more than 500 foot intervals in business districts and at not more than one (1) block or 800 foot intervals in residential districts;

(x) All watermains shall be located to protect them from freezing and frost heave; and

(xi) All new, cleaned, repaired, or reused watermains shall be specified to be disinfected in accordance with AWWA C601. Specifications shall include detailed procedures for the adequate flushing, disinfection, and microbiological testing of all watermains.

(c) Hydrants shall:

(i) Have hydrant leads a minimum of six (6) inches in diameter;

(ii) Have valves installed in all hydrant leads;

(iii) Be protected from from freezing at hydrant leads and barrels. Where groundwater levels are above the gravel drain area, hydrants shall be pumped dry or otherwise dewatered and hydrant weep holes shall not be used; and

(iv) Have drains that are not be connected to or located within ten (10) feet of sanitary sewers or storm drains.

(d) In all transmission lines and in distribution lines sixteen (16) inches and larger at high points (where the water pipe crown elevation falls below the pipe invert elevation), provisions shall be made for air relief. Fire hydrants or active service taps may be substituted for air relief valves on 6- and 8-inch lines. Manholes or chambers for automatic air relief valves shall be designed to prevent submerging the valve with groundwater or surface water.

(e) Chambers, pits or man-holes containing valves, blowoffs, meters, or other such appurtenances to a distribution system shall not be connected directly to any storm drain or sanitary sewer, nor shall blowoffs or air relief valves be connected directly to any sewer. Such chambers or pits shall be drained to the surface of the ground where they are not subject to flooding by surface water or to absorption pits underground. Where drainage cannot be provided, a sump for a permanent or portable pump shall be provided.

(f) Where excavation is performed for distribution systems:

(i) The trench bottom shall be excavated for the pipe bell;

(ii) All rock shall be removed within six (6) inches of the pipe; and

(iii) The trench shall be dewatered for all work.

(g) Distribution system bedding shall be designed in accordance with ASTM C12 - types A, B, C - for rigid pipe and ASTM D2321 - types I, II, III - for flexible pipe.

(h) Distribution system pipe shall be joined to ensure a watertight fitting. Ductile iron pipe shall be installed in accordance with AWWA C600 and PVC pipe shall be installed in accordance with AWWA M23.

(i) Backfill for distribution systems shall:

(i) Be performed without disturbing pipe alignment;

(ii) Not contain debris, frozen material, unstable material, or large clods;

(iii) Not place stones greater than three (3) inches in diameter within two (2) feet of pipe; and

(iv) Be compacted to a density equal to or greater than the surrounding soil.

(j) All tees, bends, plugs, and hydrants in distribution systems shall be provided with reaction blocking, tie rods, or joints designed to prevent movement.

(k) Distribution systems shall meet the following requirements for separation of watermains, sanitary sewers, and storm sewers:

(i) Minimum horizontal separation from sewer lines shall be ten (10) feet where the invert of the watermain is less than 1.5 feet above the crown of the sewer line;

(ii) Minimum vertical separation from sewer lines shall be 1.5 feet at crossings;

(iii) Joints in sewers at crossings shall be located at least ten (10) feet from water mains;

(iv) The upper line of a sewer crossing shall be specially supported; and

(v) Where the minimum vertical or horizontal separation distances required by this Section 13(k)(i) and (ii) cannot be maintained, the sewer or water line shall be placed in a separate conduit pipe.

(l) No water pipe shall pass through or come in contact with any part of a sewer manhole.

(m) Distribution systems that cross surface water shall comply with the following requirements:

(i) At above-water crossings, the pipe shall be adequately supported and anchored, protected from damage and freezing, and accessible for repair or replacement.

(ii) At underwater crossings, a minimum cover of two (2) feet shall be provided over the pipe.

(iii) When crossing water courses that are greater than fifteen (15) feet in width, the following shall be provided:

(A) The pipe shall have flexible watertight joints.

(B) Valves shall be provided at both ends of water crossings so that the section can be isolated for testing or repair; the valves shall be easily accessible and not subject to flooding; and the valve closest to the supply source shall be located in a manhole.

(n) Cross-connections shall comply with the following requirements:

(i) There shall be no water service connection installed or maintained between a public water supply and any water user whereby unsafe water or contamination may backflow into the public water supply.

(A) In order to protect all public water supplies from the possibility of the introduction of contamination due to cross-connections, the water supplier shall require backflow prevention devices for each water service connection in accordance with Table 1, which appears at the end of this Section 13, with the exception of (B)(I) residential water service connections and (B)(II) domestic non-residential water service connections. The water supplier shall take appropriate actions that may include immediate disconnection for any water user that fails to maintain a properly installed backflow prevention device or comply with other measures as identified in this Section.

(I) Any high hazard non-residential connection to any public water supply shall be protected by the backflow prevention device required by Table 1.

(II) Water suppliers shall establish record keeping and management procedures to ensure that requirements of this regulation for installation and maintenance of backflow prevention devices are being met.

(B) The method of backflow control, selected from Table 1, shall be determined based upon the degree of hazard of the cross-connection and the cause of the potential backflow. Hazards shall be classified as high hazard or low hazard. The potential cause of the backflow shall be identified as being back-siphonage or back-pressure.

(I) Residential water service connections shall be considered to be low hazard back-siphonage connections, unless determined otherwise by a Hazard Classification.

(II) Domestic non-residential water service connections (such as schools without laboratories, churches, office buildings, warehouses, and motels) shall be considered to be low hazard back-pressure connections, unless determined otherwise by a Hazard Classification conducted by the water supplier.

(III) Any water user’s system with an auxiliary source of supply shall be considered to be a high hazard, back-pressure cross-connection. A reduced pressure principle backflow device shall be installed at the water service connection to any water user’s system with an auxiliary source of supply.

(IV) All water loading stations shall be considered high hazard connections. A device, assembly, or method consistent with Table 1 shall be provided.

(V) Non-domestic commercial or industrial water service connections (such as restaurants, refineries, chemical mixing facilities, sewage treatment plants, mortuaries, laboratories, laundries, dry cleaners, irrigation systems,and facilities producing or utilizing hazardous substances) shall be considered to be high hazard back-pressure connections, unless determined otherwise by a Hazard Classification. For some of these service connections, a Hazard Classification may result in a determination of a back-siphonage or low hazard classification. The backflow prevention device required shall be appropriate to the degree of hazard established by the Hazard Classification. Where potential high hazards exist within the non-residential water user's system, even though such high hazards may be isolated at the point of use, an approved backflow prevention device shall be installed and maintained at the water service connection.

(C) Determination of the hazard classification of a water service connection is the responsibility of the water supplier. The water supplier may require the water user to furnish a Hazard Classification Survey to be used to determine the Hazard Classification.

(D) All backflow prevention devices shall be in-line serviceable (repairable), in-line testable except for devices meeting ASSE 1024, and installed in accordance with manufacturer instructions and applicable plumbing codes.

(E) All backflow prevention devices must have a certification by an approved third party certification agency. Approved certification agencies are:

(I) American Society of Sanitary Engineers (ASSE);

(II) International Association of Plumbing/Mechanical officials (IAPMO); and

(III) Foundation for Cross-Connection Control and Hydraulic Research, University Of Southern California (USC-FCCCHR).

(F) Backflow prevention devices at water service connections shall be inspected and certified by a certified backflow assembly tester at the time of installation. Certification of the assembly tester shall be by one (1) of the following:

(I) The American Society Sanitary Engineers (ASSE); or

(II) American Backflow Prevention Association (ABPA);

(G) Backflow prevention devices installed at high hazard non-residential cross-connections shall be inspected and tested on an annual basis by a certified backflow assembly tester.

(H) If any device is found to be defective or functioning improperly, it shall be immediately repaired or replaced. Failure to make necessary repairs to a backflow prevention device will be cause for the water service connection to be terminated.

(I) All public water suppliers shall report any high hazard backflow incident within seven (7) days to the Wyoming Department of Environmental Quality, Water Quality Division. The backflow incident shall be reported on a form provided by the administrator.

(ii) Neither steam condensate nor cooling water from engine jackets or other heat exchange devices shall be returned to the public water supply after it has passed through the water service connection.

TABLE 1

Backflow Prevention Devices, Assemblies and Methods

	Degree of Hazard				
Device, Assembly or Method	Low Hazard		High Hazard		Notes
	Back-Siphonage	Back-Pressure	Back-Siphonage	Back-Pressure	
Airgap	X		X		See Note 1
Atmospheric Vacuum Breaker	X		X		Not allowed under continuous pressure
Spill-proof Pressure-type Vacuum	X		X		
Double Check Valve Backflow Preventer	X	X			
Pressure Vacuum Breaker	X		X		
Reduced Pressure Principle Backflow	X	X	X	X	See Note 2
Dual Check	X				Restricted to residential services

Note 1: Minimum Airgap for Water Distribution. For spouts with an effective opening diameter of one-half (1/2) inch or less, the minimum airgap when the discharge is not affected by side walls shall be one (1) inch. The minimum airgap when the discharge is affected by sidewalls shall be one and one-half (1 1/2) inches. For effective openings greater than one-half (1/2) inch, the minimum airgap shall be two (2) times the effective opening diameter when the discharge is

not affected by side walls. The minimum airgap when the discharge is affected by sidewalls shall be three (3) times the effective opening diameter.

Note 2: Extreme Hazards. In the case of any water user's system where, in the opinion of the water supplier or the administrator, an undue health threat is posed because of the presence of extremely toxic substances or potential back pressures in excess of the design working pressure of the device, the water supplier may require an air gap at the water service connection to protect the public water system.

Section 14. Laboratory Requirements.

(a) Test procedures for analysis of monitoring samples shall conform to the *Standard Methods for the Examination of Water and Wastewater*.

(b) All treatment plants shall have the capability to perform or contract for the self-monitoring analytical work required by the Safe Drinking Water Act, 42 U.S.C. §300f et seq. All plants shall, in addition, be capable of performing or contracting the analytical work required to ensure good management and control of plant operation and performance.

(c) All laboratories used for the tests, analysis, and monitoring required by this Section shall meet the following requirements:

(i) The laboratory shall be located away from vibrating machinery or equipment that might have adverse effects on the performance of laboratory instruments or the analyst and shall be designed to prevent adverse effects from vibration.

(ii) Where a full-time chemist is proposed to work in the laboratory, a minimum of 400 square feet of floor space shall be provided in the laboratory. If more than two (2) persons will be working in the laboratory, 100 square feet of additional space shall be provided for each additional person.

(iii) Walls shall have an easily cleaned, durable and impervious surface.

(iv) Two (2) exit doors or openings shall be located to permit a straight exit from the laboratory; at least one (1) exit shall be directly to the outside of the building. Panic hardware shall be used. Interior doors shall have glass windows.

(v) Cabinet and storage space shall be provided for dust-free storage of instruments and glassware. Bench top height shall be thirty (30) inches. Bench tops shall be field joined into a continuous surface with acid, alkali, and solvent resistant cements.

(vi) Fume hoods shall be provided where reflux or heating of toxic or hazardous materials is required. A hood shall not be situated near a doorway, unless a secondary means of exit is provided. All fume hood switches, electrical outlets, and utility and baffle adjustment handles shall be located outside the hood. Light fixtures shall be explosion-proof. Twenty-four-hour continuous exhaust capability shall be provided. Exhaust fans shall be explosion-proof.

(vii) The laboratory shall have a minimum of two (2) sinks per 400 ft^2 (not including cup sinks). Sinks shall be double well with drainboards and shall be made of epoxy resin or plastic. All water fixtures shall have reduced pressure zone backflow preventers. Traps shall be constructed of glass, plastic, or lead and be accessible for cleaning.

(viii) Laboratories shall be separately heated and cooled, with external air supply for 100 percent makeup volume. Separate exhaust ventilation shall be provided. Ventilation outlet locations shall be remote from ventilation inlets.

(ix) Lighting shall provide 100 foot candles at the bench top.

(x) If gas is required in the laboratory, natural gas shall be supplied.

(xi) Distilled water shall conform to the quality specified by *Standard Methods for the Examination of Water and Wastewater.*

(ii) All laboratories shall be equipped with an emergency eye wash and shower located within the laboratory.

(d) Portable testing equipment shall be provided where necessary for operational control testing.

Section 15. Operation and Maintenance Manuals.

(a) Each new or modified treatment or pumping facility shall have an operation and maintenance manual (O & M Manual) located at the facility. The manuals shall provide the following information as a minimum:

(i) Introduction;

(ii) Description of facilities and unit processes within the plant from influent structures through effluent structures;

(A) The size, capacity, model number (where applicable), and intended loading rate of facilities and unit processes;

(B) A description of each unit, including the function, the controls, the lubrication and maintenance schedule;

(C) A description of shall start-up operations, routine operations, abnormal operations, emergency or power outage operations, bypass procedures, and safety;

(D) Flow diagrams of the entire process, as well as individual unit processes that show the flow options under the various operational conditions listed in Section 15(a)(ii) above; and.

(E) The design criteria for each unit process, including the number, type, capacity, sizes, and other relevant information.

(iii) Plant control system;

(iv) Utilities and systems;

(v) Emergency procedures, including:

(A) Details of emergency operations procedures for possible foreseeable emergencies, such as power outage, equipment failure, development of unsafe conditions, and other emergency conditions;

(B) Emergency operations valve positions, flow control settings, and other information to ensure continued operation of the facility at maximum possible efficiency during emergencies; and

(C) Emergency notification procedures to be followed to protect health and safety under various emergency conditions.

(vi) Permit requirements and other regulatory requirements;

(vii) Staffing needs;

(viii) Index of manufacturers' manuals;

(ix) Index of equipment maintenance manuals; and

(x) General information on safety in and around the plant and its components, including the following safety information:

(A) Each unit process discussion shall include applicable safety procedures and precautions; and

(B) For unit processes or operations having extreme hazards (such as chlorine and closed tanks), the discussion shall detail appropriate protection, rescue procedures, and necessary safety equipment.

(b) Administrator approval of the final O & M Manual is required prior to plant startup.

(c) Public water supply facilities shall have an equipment maintenance manual located at the facility for each piece of equipment. Each equipment maintenance manual shall:

(i) Have a typewritten table of contents for each volume arranged in a systematic order;

(ii) Include the following general contents:

(A) Product data;

(B) Drawings;

(C) Written text as required to supplement product data for the particular installation;

(D) A copy of each warranty, bond, and service contract issued;

(E) A description of unit and component parts;

(F) Operating procedures;

(G) Maintenance procedures and schedules;

(H) Service and lubrication schedule;

(I) Sequence of control operation;

(J) A parts list; and

(K) A recommended spare parts list.

(iii) Include a section on troubleshooting that shall include:

(A) Typical operation problems and solutions; and

(B) A telephone number for factory troubleshooting assistance; and

(iv) Meet the requirements of the engineer and contractor for installation and startup of equipment.

Section 16. Incorporation by Reference.

(a) The following codes, standards, rules, and regulations referenced in this Chapter are incorporated by reference:

(i) American Petroleum Institute Specification 5L, *Line Pipe*, Forty-Sixth Edition (2018), referred to as "API Std. 5L;"

(ii) American Water Works Association Standard A100, *Water Wells*, A100-15 (2015), referred to as "AWWA A100;"

(iii) American Water Works Association Standard B100, *Granular Filter* Material, B100-16 (2016), referred to as "AWWA B100;"

(iv) American Water Works Association Standard C151, *Ductile-Iron Pipe*, Centrifugally Cast, C151-09 (2009), referred to as "AWWA C151;"

(v) American Water Works Association Standard C200, *Steel Water Pipe*, 6 In. (150 mm) and Larger, C200-17 (2017), referred to as "AWWA C200;"

(vi) American Water Works Association Standard C300, *Reinforced Concrete Pressure Pipe, Steel-Cylinder Type*, C300-11 (2011), referred to as "AWWA C300;"

(vii) American Water Works Association Standard C301, *Prestressed Concrete Pressure Pipe, Steel-Cylinder Type*, C301-14 (2014), referred to as "AWWA C301;"

(viii) American Water Works Association Standard C400, *AWWA Standard for Asbestos-Cement Pressure Pipe, 4 In. Through 16 In. (100 mm Through 400 mm), for Water Distribution Systems*, C400-93 (1998), referred to as "AWWA C400;"

(ix) American Water Works Association Standard C600, *Installation of Ductile-Iron Mains and Their Appurtenances*, C600-10 (2010), referred to as "AWWA C600;"

(x) American Water Works Association Standard C601, *AWWA Standard for Disinfecting Water Mains*, C601-81 (1981), referred to as "AWWA C601;"

(xi) American Water Works Association Standard C900, *Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 12 In. (100 mm through 300 mm), for Water Transmission and Distribution*, C900-07 (2007), referred to as "AWWA C900;"

(xii) American Water Works Association Standard C901, *Polyethylene (PE) Pressure Pipe and Tubing, 3/4 In. (19 mm) Through 3 In. (76 mm), for Water Service*, C901-17 (2017), referred to as "AWWA C901;"

(xiii) American Water Works Association Standard C950, *Fiberglass Pressure Pipe, C950-13 (2013)*, referred to as "AWWA C950;"

(xiv) American Water Works Association Standard D100, *Welded Carbon Steel Tanks for Water Storage, D100-11 (2011)*, referred to as "AWWA D100;"

(xv) American Water Works Association Standard D102, *Coating Steel Water-Storage Tanks, D102-17 (2017)*, referred to as "AWWA D102;"

(xvi) American Water Works Association Standard D103, *Factory-Coated Bolted Carbon Steel Tanks for Water Storage, D103-03 (2009)*, referred to as "AWWA D103;"

(xvii) American Water Works Association Standard C652, *Disinfection of Water Storage Facilities, C652 (2011)*, referred to as "AWWA C652;"

(xviii) American Water Works Association Standard M23, *PVC Pipe – Design and Installation, Second Edition, M23 (2002)*, referred to as "AWWA M23;"

(xix) American National Standards Institute ASSE Standard 1024, *Dual Check Backflow Preventers, ASSE 1024-17 (2017)*, referred to as "ASSE 1024;"

(xx) American Society of Mechanical Engineers, ASME *Boiler and Pressure Vessel Code, BPVC-17* (2017).

(xxi) ASTM International Standard A36, *Standard Specification for Carbon Structural Steel, A36M-19 (2019)*, referred to as "ASTM A36;"

(xxii) ASTM International Standard A53, *Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless, A53M-18 (2018)*, referred to as "ASTM A53;"

(xxiii) ASTM International Standard A134, *Standard Specification for Pipe, Steel, Electric-Fusion (Arc)-Welded (Sizes NPS 16 and Over), A134M-18 (2018)*, referred to as "ASTM A134;"

(xxiv) ASTM International Standard A135, *Standard Specification for Electric-Resistance-Welded Steel Pipe, A135M-19 (2019)*, referred to as "ASTM A135;"

(xxv) ASTM International Standard A242, *Standard Specification for High-Strength Low-Alloy Structural Steel, A242M-13 (2018)*, referred to as "ASTM A242;"

(xxvi) ASTM International Standard A283, *Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates, A283M-18 (2018)*, referred to as "ASTM A283;"

(xxvii) ASTM International Standard A409, *Standard Specification for Welded Large Diameter Austenitic Steel Pipe for Corrosive or High-Temperature Service, A409M-15 (2015)*, referred to as "ASTM A409;"

(xxviii)ASTM International Standard A572, *Specification for High-Strength Low-Alloy Collumbium Vanadium Structural Steel, A572 (2018)*, referred to as "ASTM A572;"

(xxix) ASTM International Standard A1011, *Standard Specification for Steel, Sheet and Strip, Carbon, Hot-Rolled, A1011 (2018)*, referred to as "ASTM A1011;"

(xxx) ASTM International Standard C12, *Standard Practice for Installing Vitrified Clay Pipe Lines, C12-17 (2017)*, referred to as "ASTM C12;"

(xxxi) ASTM International Standard C14, *Standard Specification for Nonreinforced Concrete Sewer, Storm Drain, and Culvert Pipe, C14-15a (2015)*, referred to as "ASTM C14;"

(xxxii) ASTM International Standard C76, *Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe, C76-19a (2019)*, referred to as "ASTM C76;"

(xxxiii)ASTM International Standard C150, *Standard Specification for Portland Cement, C150M-19a (2019)*, referred to as "ASTM C150;"

(xxxiv)ASTM International Standard C494, *Standard Specification for Chemical Admixtures for Concrete,* C494M-17 (2017), referred to as "ASTM C494;"

(xxxv) ASTM International Standard D2241, *Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series), D2241-15 (2015),* referred to as "ASTM D2241;"

(xxxvi)ASTM International Standard D2321, *Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications, D2321-18 (2018)*, referred to as "ASTM D2321;"

(xxxvii) ASTM International Standard D2996, *Standard Specification for Filament-Wound "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe, D2996-17 (2017)*, referred to as "ASTM D2996;"

(xxxviii) ASTM International Standard D2997, *Standard Specification for Centrifugally Cast "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe, D2997-15 (2015)*, referred to as "ASTM D2997;"

(xxxix)ASTM International Standard D3517, *Standard Specification for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pressure Pipe, D3517-19 (2019),* referred to as "ASTM D3517;"

(xl) ASTM International Standard F480, *Standard Specification for Thermoplastic Well Casing Pipe and Couplings Made in Standard Dimension Ratios (SDR), SCH 40 and SCH 80, F480-14 (2014)*, referred to as "ASTM F480;"

(xli) *National Electric Code,* published by National Fire Protection Association, 2017 Edition, referred to as "National Electric Code;"

(xlii) *Standard Methods for the Examination of Water and Wastewater*, published by American Public Health Association, American Water Works Association, and

Water Environment Federation, 23rd Edition (2018), referred to as "Standard Methods for the Examination of Water and Wastewater;" and

(xliii) *Uniform Plumbing Code*, published by International Association of Plumbing and Mechanical Officials, 28th Edition (2018), referred to as "Uniform Plumbing Code."

(xliv) Code of Federal Regulations 40 CFR Part 141, in effect as of July 1, 2011, available at: http://www.ecfr.gov.

(xliv) Code of Federal Regulations 40 CFR 173.3(e), in effect as of November 7, 2018, available at: http://www.ecfr.gov.

(b) For these rules incorporated by reference:

(i) The Environmental Quality Council has determined that incorporation of the full text in these rules would be cumbersome or inefficient given the length or nature of the rules;

(ii) This Chapter does not incorporate later amendments or editions of incorporated codes, standards, rules, and regulations.

(iii) All incorporated codes, standards, rules, and regulations are available for public inspection at the Department's Cheyenne office. Contact information for the Cheyenne office may be obtained at http://deq.wyoming.gov or from (307) 777-7937.