# CHAPTER 11

# DESIGN AND CONSTRUCTION STANDARDS FOR SEWERAGE SYSTEMS, TREATMENT WORKS, DISPOSAL SYSTEMS OR OTHER FACILITIES CAPABLE OF CAUSING OR CONTRIBUTING TO POLLUTION AND MOBILE HOME PARK AND CAMPGROUND SEWERAGE AND PUBLIC WATER SUPPLY DISTRIBUTION SYSTEMS

## Table of Contents

# CHAPTER 11

# DESIGN AND CONSTRUCTION STANDARDS FOR SEWERAGE SYSTEMS, TREATMENT WORKS, DISPOSAL SYSTEMS OR OTHER FACILITIES CAPABLE OF CAUSING OR CONTRIBUTING TO POLLUTION AND MOBILE HOME PARK AND CAMPGROUND SEWERAGE AND PUBLIC WATER SUPPLY DISTRIBUTION SYSTEMS

## PART A: INTRODUCTION AND GENERAL REQUIREMENTS

### Section 1. Authority.

These standards are promulgated pursuant to W. S. 35-11-101 through 35-11-1207. Specifically, W. S. 35-11-302 requires the Administrator to establish standards for the issuance of permits for construction, installation, or modification of any public water supply and sewerage system, treatment works, disposal system or other facility capable of causing or contributing to pollution.

### Section 2. Purpose.

The purpose of these standards is to:

(a) Ensure that the design and construction of sewerage systems, treatment works, disposal systems and other facilities capable of causing or contributing to pollution meet the purpose of the Environmental Quality Act.

(b) Prevent, reduce and eliminate pollution and enhance the Waters of the State of Wyoming by ensuring design and construction of systems and facilities are capable of the required treatment and/or disposal and continued operation to protect the health, safety and welfare of the environment and its inhabitants.

These standards pertain only to permits required pursuant to Chapter 3 and 9, Wyoming Water Quality Rules and Regulations.

### Section 3. Intent.

The design and construction standards included in these regulations are directed toward conventional wastewater and waste systems. These standards impose limiting values of design for which a construction, installation or modification permit application and plans and specifications can be evaluated by the Division.

The terms “shall” and “must” are used when practice is sufficiently standardized to permit specific delineation of requirements or when safeguarding public health or protection of water quality justifies such definite action. Other terms, such as “should”, “recommend”, and “preferred” indicate desirable procedures or methods that allow deviations provided the purpose of these regulations can be accomplished.

The applicant shall use the date referenced copy of other standards referred to in these regulations. Where no date is listed for the referenced standards, the standards used shall be those in effect when these regulations become effective.

**Section 4. Definitions.**

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

(a) "Affected land" means the area of land from which overburden is removed, or upon which overburden, development waste rock or refuse is deposited, or both, access roads, haul roads, mineral stockpiles, mill tailings, impoundment basins, and all other lands whose natural state has been or will be disturbed as a result of the operations.

(b) "Campground" means a parcel or tract of land under the control of a person at which sites are offered for the use of the public or members of an organization either free of charge or for a fee, for the establishment of temporary living quarters for two or more recreational units.

(c) "Commercial/industrial waste and wastewater facilities" means any facility not defined as a municipal or single family residence facility.

(d) "Construction" shall encompass the materials used, installation procedures and tolerances, and testing and disinfection requirements.

(e) "Feedlot" means the concentrated confinement of animals or poultry in pens or houses for meat, milk, or egg production or the stabling of animals or poultry for a period of forty-five (45) days or more in a twelve (12) month period when forage or crops are not grown in the area of confinement.

(f) "Hazardous substance" means any matter of any description including petroleum related products and radioactive material (substance) that, when discharged into any Waters of the State, presents an imminent and substantial hazard to public health or welfare. This definition includes all materials (substances) so designated by the U. S. Environmental Protection Agency in the Federal Register for March 13, 1978 (Part III), Water Programs, Hazardous Substances.

(g) "Land application/treatment" means the application of wastes or wastewater to the land at a predetermined rate for the purpose of disposal or treatment by any or all of the following processes: degradation, plant uptake, assimilation or accumulation in the soil profile from filtration.

(h) "Maximum daily demand" means the largest daily water use rate that would occur during the calendar year.

(i) "Maximum hourly or peak hourly demand" means the largest water use rate that would occur during any one hour during the year. The maximum hourly demand may or may not occur during the maximum daily demand period.

(j) "Mobile home park" means a parcel or tract of land under the control of a person upon which two (2) or more mobile homes are located on a continual or seasonal nonrecreational basis, regardless of whether a charge is made therefore.

(k) "Off-channel" means the interception of a drainage way that collects runoff only from disturbed areas.

(l) "On-channel" means the interception of a drainage way that collects runoff from both disturbed and undisturbed areas.

(m) "Permanent pool level" means the elevation in a sedimentation pond or sediment control structure below which the water will not be discharged by an outlet structure or by pumping.

(n) "Pond/lagoon" means a manmade or natural basin that is intended for containment, treatment or disposal of wastes or wastewater.

(o) "Rapid infiltration system" means a land treatment system in which treatment is accomplished by the movement of large quantities of wastewater through a coarse or highly permeable soil profile.

(p) "Recreational unit" means a tent or vehicular type structure, primarily designed as temporary living quarters for recreational, camping, or travel use, that either has its own motive power or is mounted on or drawn by a self-powered vehicle. A tent means a collapsible shelter of canvas or other fabric stretched and sustained by a rigid structure(s) and used for camping outdoors.

(q) "Seasonal high groundwater table" is the highest elevation reached by the groundwater during the wet season of the year (usually spring or early summer).

(r) "Sedimentation control facility" means a pond or structure designed to capture runoff from disturbed areas for the purpose of treating water for sediment and suspended solids removal.

(s) "Slow rate land application system" means an irrigation system in which wastewater treatment is achieved due to vegetative uptake and percolation of wastewater through the soil profile by low application rates.

(t) "Sludge" is the accumulation of solids settled from wastewater in a septic tank, aerobic unit, clarifier, or equivalent.

(u) "Soil" means all unconsolidated material overlaying bedrock.

(v) "Toxic characteristics (or wastes)" means those characteristics (or wastes) that are due to the presence of: substances or combinations of substances including disease causing agents that, after discharge and upon exposure, ingestions, inhalation or assimilation into any environmentally significant organism, either directly from the environment or indirectly by ingestion through food chains, may cause death, disease, behavioral abnormalities, cancer, genetic malfunctions, physiological malfunctions (including malfunctions in reproduction) or physical deformation in such organisms or their offspring. This definition shall include all substances designated as toxic or hazardous by the U.S. Environmental Protection Agency in the Federal Register for December 24, 1975, (Part IV), Water Programs, National Interim Primary Drinking Water Regulations; Federal Register for May 19, 1980, (Section 261), Hazardous Waste Management System: Identification and Listing of Hazardous Waste; and the Federal Register for July 16, 1982, Part V, National Oil and Hazardous Substances Contingency Plan.

**Section 5. Facilities and Systems Not Specifically Covered by These Standards.**

This section is provided to encourage new technology and equipment and provide a process for evaluating and permitting designs that deviate from these regulations. The proposed construction of facilities and processes not in compliance with these regulations will be permitted provided that the facility, when constructed, can operate meeting the purpose of these regulations.

(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 following information should be included with the application:

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

(iii) Data obtained from a theoretical evaluation of the design that demonstrates a reasonable probability of the facility meeting the design objectives; and

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

(b) If an applicant wishes to construct a pilot plant to provide the data necessary to show the design will meet the purpose of the act, a permit to construct must be obtained.

**Section 6. Engineering Design Report.**

(a) Scope and purpose. An engineering design report that describes existing conditions, problems, and the proposed solution is required for each project.

(b) Sewerage systems. The engineering design report 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 average, maximum day and peak flows for the design of the project, per capita design flows, extraneous flows, and industrial and/or commercial waste flows.

(iii) Downstream impact on existing sewers, lift stations and treatment facilities. This information shall include existing population, waste loads, existing flows and capacity of downstream facilities.

(iv) A letter of acceptance from the municipality, sewer district, or owner of any affected downstream sewerage, treatment or disposal facilities.

(c) Treatment works and disposal systems. The engineering design report shall include:

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

(A) Present and projected facility property.

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

(C) Present and proposed access.

(D) Distances from current habitation.

(E) Prevailing wind direction.

(F) Fencing and/or security.

(G) Topographic features and contours with indicated datum.

(H) Soil and subsurface geological characteristics. Location of soil borings, rock elevations and groundwater elevations shall be indicated. Provide a soils investigation report of the proposed site.

(ii) A detailed description of the service area for the project including scaled plan showing land use and boundaries.

(iii) A detailed description of the disposal technique for effluent and solids. For lagoons, indicate whether the discharge is continuous, seasonal, or nondischarging.

(iv) Effluent water quality considerations for design of the facility shall be described to include:

(A) Surface discharge. An application shall be submitted to the Water Quality Division for a National Pollution Discharge Elimination System Permit.

(B) Groundwater protection. Pursuant to Chapter 8 of the Water Quality rules.

(v) Design conditions shall be described to include:

(A) Proposed effluent standards.

(B) Design population.

(C) Existing and projected flows and flow variations.

(D) Shock loads, with cause and frequency.

(E) Existing and projected wastewater characteristics including BOD, suspended solids, and pH.

(F) Existing and projected flow, loads and characteristics of industrial wastes and toxic Materials.

(G) Existing or proposed quantity and frequency of septage discharges.

(H) Climate conditions at existing or proposed treatment facility site.

(I) Existing or proposed water supply.

(J) Theory of operation.

(K) Odor control features.

(L) Complete description of existing facilities.

(vi) Specific requirements of any pertinent approved Water Quality Management Plan shall be included.

**Section 7. Plans and Specifications Content.**

(a) All plans for sewerage works shall have a suitable title showing the following:

(i) Name of owner and location of project.

(ii) North arrow and drawing scale.

(iii) Name and seal or signature of the engineer.

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

(b) Sewers. Plans for interceptor sewers, outfall sewers, new collector systems, force mains, sewer extensions, or any combination shall include:

(i) A detailed plan view at a legible scale of each sewer line showing all existing and proposed streets, adjacent structures, physical features, existing and proposed locations of utilities and a North arrow. The location and size of all sewer lines, manholes, cleanouts, and other appurtenances shall be indicated. Pertinent elevations shall be indicated on all appurtenances.

(ii) Profiles of all sewer 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, elevations of the sewer inverts at all manholes, and the slope of the sewer inverts at all manholes, pipe size and material, and the slope of the sewer line. The location of all special features such as inverted siphons, concrete encasements, casing pipes, elevated sewers, etc., shall be shown.

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

(A) Details of all sewer appurtenances such as manholes, cleanouts, inverted siphons, elevated sewers, encasements, casing pipes, force main thrust blocks, outfall structures, etc.

(B) The approximate bottom of the stream, the approximate elevation of the low and high-water levels, and other topographic features at all locations where the project is at streams or lakes.

(C) Cross section drawing of the sewer's bedding.

(D) Additional features not otherwise covered by specifications.

(iv) Location of waterlines within thirty (30) feet (9m) horizontally shall be shown on the plan. Water lines that intersect sewers shall be shown on the profile drawings. Public and/or private water wells within thirty (30) feet (9m) of sewer lines shall be indicated on the plans.

(c) Pumping stations, treatment works and disposal systems. Plans shall be submitted showing the relation of the proposed project to the remainder of the system. Layouts and detail plans shall show the following:

(i) Site location and layout including topographic and physical features, proposed arrangement of pumping or treatment units, existing facilities, existing and proposed piping arrangements, access drive, power supply, fencing, embankments, outfall sewer, outfall structure, and receiving stream with direction of flow.

(ii) Schematic flow diagram(s) and hydraulic profile(s) for treatment works wastewater, sludge and effluent flows.

(iii) Plan and section view(s) of the wetwell and drywell of the pumping station with specific construction details, features and pertinent elevations.

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

(d) Specifications. Technical specifications shall accompany the plans for new sewers, pump stations, treatment works, disposal systems, or additions/modifications to existing systems or facilities. Where plans are for extensions to sewer systems, the specifications may be omitted, provided it is stated that the work is to be constructed under specifications authorized by the Water Quality Division office. Specifications on file must conform to these regulations.

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 where 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.

## PART B: MUNICIPAL AND DOMESTIC SEWERAGE SYSTEMS, TREATMENT WORKS, AND DISPOSAL SYSTEMS

### Section 8. General.

This part contains the minimum standards for the design and construction of sewerage systems, treatment works, and disposal systems for domestic and municipal wastewater. Soil absorption and land application systems are contained in other parts. All facilities shall comply with the purpose of this chapter.

### Section 9. Design of Sewers.

(a) Separate sewers. Separate sewers shall be provided for collection of stormwater and wastewater. Roof, areaway, drive or foundation drains shall not be connected to sanitary sewers.

(b) Pipe materials.

(i) Wastewater characteristics. Pipe materials shall resist acid and alkaline solutions, organic solvents, and other wastewater constituents and environmental conditions encountered.

(ii) Pipe loadings. Pipe materials shall be chosen and the pipeline shall be designed to withstand all trench and superimposed surface live loads with a minimum factor of safety. Rigid pipes shall have a minimum factor of safety of 1.5, and flexible pipes shall have a minimum factor of safety of 1.25.

(iii) Soil characteristics. Pipe materials shall be chosen to resist corrosion due to aggressive soil characteristics by the soil it contacts. Iron or steel pipe shall be protected from corrosion with polyethylene encasement or cathodic protection.

(iv) Joints. Pipe joints shall be flexible, durable and designed to minimize infiltration/exfiltration and exclude roots.

(v) Performance tests. Piping shall be subjected to leakage tests. Leakage tests shall be infiltration, exfiltration, or air tests.

(A) Infiltration. Maximum of 200 gallons per inch diameter per mile per day (1200 liters/cm/km/day) with a minimum of two feet (0.6 m) of head over the top of the pipe.

(B) Exfiltration. Maximum of 200 gallons per inch diameter per mile per day (1200 liters/cm/km/day) with a minimum of two feet (0.6 m) of head over the top of the pipe.

(C) Air. Air tests shall conform to ASTM C-828-80. (D) Deflection. Maximum five percent deflection after flexible pipe is backfilled for thirty (30) days. A mandrel of 95 percent of pipe diameter shall be used. No mechanical pulling of mandrel is permitted.

(vi) Approved pipe material specifications. Type of commercial pipe approved for gravity sanitary systems include:

(A) Extra strength and standard strength vitrified clay pipe: ASTM C700-78a.

(B) PVC sewer pipe and fittings: ASTM D3034-80, SDR35, ASTM F679-81, or ASTM F794-83.

(C) ABS composite sewer pipe: ASTM D2680-80.

(D) Reinforced plastic mortar pipe: ASTM D3262-81.

(E) Asbestos cement nonpressure sewer pipe: ASTM C428-80.

(F) Reinforced concrete sewer pipe: ASTM C76-82.

(G) Concrete Sewer Pipe: ASTM C-14.

(H) Ductile iron sewer pipe: ASTM A746-77.

Types of commercial pipe approved for pressure sanitary sewer systems include:

(I) PVC water pipe: ASTM D2241-80, or AWWA C900.

(J) Asbestos cement pressure pipe: AWWA C400-80.

(K) Ductile iron pipe: AWWA C151-81.

(L) Glass Fiber-Reinforced Thermo-setting-Resin Pressure Pipe: AWWA C950-81.

(c) Collection piping design, construction and testing. A sewage collection line is any conduit that carries wastewater that originates from two (2) or more separate buildings or from a single building that generates more than 2,000 gpd (7.6 $m^3$/d) of average daily flow.

(i) Gravity system.

(A) Depth. Sewers shall be located to protect them from freezing and frost heave as prudently possible.

(B) Size. Sewers to be aligned straight shall be 8-inch (20.3 cm) diameter or larger except 6-inch (15.2 cm) sewers may be used in cul-de-sacs, or other dead end locations where the sewer cannot be extended in the future. 18-inch (45.7 cm) or larger sewers may be laid on curves. Lines shall be sized for 200 percent of maximum daily flow or more. In the absence of data deriving maximum daily flow, the chart on Figure 1-1 shall be used to determine maximum daily flow.

(C) Slope. Sewers shall be laid with uniform slope between manholes. Minimum slopes shall be:

| Sewer Size Inch (cm) | Minimum Slope in Feet Per 100 Feet (m/100 m) |
|---|---|
| 6 (15.2) | 0.60 |
| 8 (20.3) | 0.40 |
| 10 (25.4) | 0.28 |
| 12 (30.5) | 0.22 |
| 14 (35.6) | 0.17 |
| 15 (38.1) | 0.15 |
| 16 (40.6) | 0.14 |
| 18 (45.7) | 0.12 |
| 20 (50.8) | 0.11 |
| 21 (53.3) | 0.10 |
| 24 (61.0) | 0.08 |
| 27 (68.6) | 0.067 |
| 30 (76.2) | 0.058 |
| 33 (83.8) | 0.051 |
| 36 (91.4) | 0.046 |

Maximum slopes without the use of concrete anchors shall be 20 percent. The following spacing of concrete anchors shall apply to slopes greater than 20 percent:

| Slopes (percent) | Concrete Anchor |
|---|---|
| 20-35 | 36 ft (11 m) |
| 35-50 | 24 ft (7.3 m) |
| More than 50 | 16 ft (4.9 m) |

(D) Velocity. Minimum velocities shall be 2 fps (0.6 mps) when flowing full. Velocities greater than 10 fps (3.0 mps) require special design considerations.

(E) Increasing size. All sewer pipe size changes shall be at manholes. Pipe size shall not be decreased in the direction of flow. The energy gradient line should be maintained when a smaller sewer joins a larger one.

(F) Excavation, bedding installation, backfill.

(I) Excavation. Trench width from the trench bottom to a point one foot above the top of the pipe shall be no less than the outside diameter of the pipe plus 8 (8) inches (20.3 cm) but not more than twenty-four (24) inches (61 cm) plus the pipe O.D. The trench bottom shall be excavated for the pipe bell. All rock shall be removed within six (6) inches (15.2 cm) of pipe. The trench shall be dewatered for all work.

(II) Bedding. Bedding shall be designed in accordance with:

(1.) Rigid pipe. Types A, B, C (Water Pollution Control Federation Manual of Practice No. 9) or ASTM C12-81.

(2.) Flexible pipe. Types I, II, III, ASTM D2321-74.

(III) Backfill. Backfill shall be performed without disturbing pipe alignment. Backfill shall not contain debris, frozen material, unstable material, or large clods. Stones greater than three (3) inches (7.6 cm) in diameter shall not be placed within two (2) feet (0.6 m) of pipe. Compaction shall be to a density equal to or greater than the surrounding soil.

(ii) Force mains and pressure sewers.

(A) Depth. Force mains shall be located to protect them from freezing and frost heave.

(B) Size. Force mains shall be four (4) inches (10 cm) diameter or greater. Pressure sewer collection system piping shall be one (1) inch (2.5 cm) minimum.

(C) Velocity. Minimum velocity shall be 2.5 fps (0.76 mps).

(D) Air release. Air release facilities shall be provided at the high point in the piping whenever the pipe crown elevation falls below the pipe invert elevation. Access to air release manholes shall not be in traffic-ways.

(E) Cleanouts. Cleanouts shall be provided at 400-foot (122 m) maximum spacing in pressure piping four-inch diameter or less.

(F) Pressure sewer systems. Pressure sewer collection systems shall be preceded by grinder pumps or septic tanks.

(G) Pressure sewer collection system pumps. Pumps shall be provided with isolation and check valves. If a septic tank is not provided before the pump, a grinder pump shall be required. Pump holding sumps shall not be steel, iron, or coated metal. The sump chamber shall be fifty (50) gallon (189 liters) volume, minimum.

(iii) Service connections. A service connection is any conduit that carries wastewater that is not defined as a sewage collection line. Service connections shall conform to the requirements for sewage collection lines (Section 9(c)(i) and (ii)) with the following modifications:

(A) Size: minimum size shall be four (4) inches (10.2 cm).

(B) Slope: minimum slope shall be 2 feet/100 feet (2 m/100 m).

(C) Flow: flow shall be determined from a fixture unit count and the sewage size based on flowing full.

(D) Connections: all service connections to sewage collection lines shall be made with a wye or tee for new construction and a tapping saddle for connection to existing collection lines.

(d) Manholes and cleanouts.

(i) Location. Manholes shall be located at all changes in pipe size, vertical or horizontal alignment, pipe intersections, and the end of lines. Maximum spacing for various line sizes are as follows:

| Line Size (In) | (cm) | Maximum M.H. | Spacing |
|---|---|---|---|
| 15 or less | (38 or less) | 400 ft | 122 m |
| 16 - 30 | (40.6 - 76) | 500 ft | 152 m |
| 31 or more | (78 or more) | 600 ft | 183 m |

Terminal sewer cleanouts may be provided at the end of sewer lines if they are not more than 150 feet (45.7 m) from the nearest downstream manhole. The cleanout shall be constructed using 45-degree bends to the upturned pipe coming to the surface of the ground. The diameter of the cleanout shall be the same as the pipe size. Lampholes shall not be used.

(ii) Size. Minimum manhole interior size is four (4) feet (1.2 m).

(iii) Drop manhole. Drop manholes must be constructed where the change in elevation between two lines is greater than twenty-four (24) inches (0.6 m). Concrete encasement shall be provided around the drop pipe.

(iv) Invert. Manhole inverts shall be constructed to conform to the shape of the sewer. The bench shall drain to the invert. Connections to the manhole shall be watertight and allow differential settlement between the manhole and pipe. Minimum fillet height shall be one half of the pipe diameter.

(v) Cover. The manhole cover shall be suitable to withstand all loads, including impact loading without deformation, slip or rattle. The manhole cover shall be watertight in areas subject to flooding and a bolt-down type in areas subject to unauthorized dumping or vandals.

(vi) Steps. Access to manholes shall be with portable ladders, or with cast iron manhole steps spaced at sixteen (16) inches (40.6 cm) maximum.

(vii) Materials. Manholes shall be constructed watertight and durable using cast-in-place concrete, or precast concrete with gasketed joints. Where precast concrete bases are used, the first twelve (12) inches (30 cm) of wall will be monolithically cast with the base.

(viii) Access. A twenty-two (22) inch (56 cm) minimum diameter clear opening shall be provided on all manholes. All manholes shall be located to be accessible by motorized equipment for maintenance.

(e) Special structures.

(i) Inverted siphons. Inverted siphons shall have a minimum of two (2) six (6) inch (15.2 cm) barrels. The inlet and outlet shall be arranged to cause only one (1) pipe to be used during normal flows. The minimum velocity shall be 3 fps (1 mps) at average flow, and occur at least daily. The siphon shall be designed for flushing and maintenance.

(ii) Aerial crossings. Aerial crossings shall be designed to prevent freezing, leaking, settlement, lateral movement, and damage from expansion/contraction. It shall be located with proper vertical clearances for highway vehicles and the 100-year flood.

(iii) Stream crossings. Stream crossings shall be within 10° of the perpendicular direction of the stream. Pipe shall have a minimum cover of one (1) foot in rock, and three (3) feet under other surfaces. The crossing shall be made with an inverted siphon or without a grade change. Pipe materials shall be steel, cast iron, or ductile iron pipe.

(f) Potable water supply protection.

(i) Cross connections. There shall be no cross-connections between sewer lines and potable water lines.

(ii) Horizontal and vertical separation from water mains. Minimum horizontal separation shall be ten (10) feet (3 m) where the water main is less than 1.5 feet (0.46 m) above the elevation of the sewer. Minimum vertical separation shall be 1.5 feet (0.46 m) at crossing. Joints in sewers at crossing shall be located at least ten (10) feet (3 m) from water mains. The upper line of a crossing shall be specially supported. Where vertical and/or horizontal clearances cannot be maintained, the sewer shall be placed in a separate conduit pipe.

**Section 10. Pumping stations.**

(a) Design conditions.

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

(ii) Grit. Where no grit removal is provided ahead of the pumping station, equipment and piping design shall minimize the deleterious effects of grit in the sewage.

(iii) Screening. Screens or comminutors shall be provided ahead of pumps where the average daily flow is in excess of 1.0 mgd (3,784 $m^3$/d) to prevent solids larger than 2 ½ inches (6.4 cm) from entering the pump.

(iv) Minimum pump opening. Except for grinder pumps, raw sewage pumps shall be capable of passing spheres of at least three (3) inches (7.6 cm) in diameter. Pump suction and discharge piping in all sewage and sludge services shall be no smaller than four (4) inches in diameter (10 cm).

(v) Pump cycle time. Intermittently operated pumps shall be designed to start no more often than once every ten (10) minutes at the minimum operating interval.

(vi) Removal of equipment. Pumping stations shall be designed to permit removal of all items of equipment including pumps, valves, electrical and control equipment. Equipment located in wetwells shall be removable without entering the wetwell.

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

(viii) Net positive suction head. Pumps shall be selected so that the net positive suction head required at maximum flow (NPSHR) is less than the NPSH available minus four feet (1.2 m) based on the hydraulic conditions and altitude of the pumping station.

(ix) Uplift. The pumping station chambers shall resist hydrostatic uplift pressures. Siting requirements.

(b) Siting requirements.

(i) Access. Pumping stations shall be located so that they are readily accessible to operating and maintenance personnel at all times of day or night, and under all weather conditions. Pumping stations shall be located off of traffic ways.

(ii) Flood protection. Pumping stations shall be designed so there is no equipment or structural damage in the 100-year flood, and so the pumping station's operation is uninterrupted by the 25-year flood.

(iii) Security. The pumping station shall be designed to discourage unauthorized entry.

(c) Pumping station types.

(i) Dry wells.

(A) Access. Pumping station dry wells and equipment rooms shall be accessible for equipment inspection, operation and maintenance. Ladder and stair dimensions, locations of landings, and structural design shall comply with the Wyoming OHSA (1982). Equipment shall be removable from pumping stations without making structural changes to the station.

(B) Separation from wetwell. Dry wells and equipment rooms shall be completely separated from wetwells with no hatches, untrapped drains, or other connecting accessways.

(C) Dewatering. Dry pits and below-grade equipment rooms shall be provided with sump pumps sized to remove infiltration of water during normal seepage and leakage.

(ii) Wetwell design. Wetwells shall be designed to prevent vortexing and unstable pump operation. Pumps shall be located below the minimum water level, except suction lift pumps. Suction intakes shall be bell-mouthed. Provisions shall be made for isolating, bypassing and/or dewatering portions of the wetwell for maintenance. Hopper walls of wetwells shall be sloped at no less than 1.75 vertical to one (1) horizontal.

(iii) Submersible pumping stations. Submersible pumping stations shall be designed specifically for totally submerged operation and so that pumps may be readily removed from the wetwell without dewatering the wetwell or disconnecting piping in the wetwell. Submersible pumps shall have an adequate means of indicating motor seal failure. Electrical equipment shall be suitable for Class 1, Division 1, Groups C and D hazardous environments, as defined in the National Electrical Code (1982).

(iv) Suction lift. Pumping stations utilizing suction lift pumps shall have adequate priming means to prime the pumps quickly and shall be designed for priming the pumps when the water level in the wetwell is one (1) foot (0.3 m) below the lead pump starting elevation in the suction wetwell, and for maintaining prime when the wetwell level is one (1) foot (0.3 m) below the lead pump stopping level. Valving shall not be located in the wetwell.

(v) Pneumatic ejectors. Pneumatic ejectors shall be limited to design flows equivalent to 25 residential connections. One standby compressor shall be provided.

(vi) Grinder pumps. Grinder pumps shall be limited to design flows equivalent to 25 residential connections.

(d) Piping and valves.

(i) Suction.

(A) Suction intake. Suctions shall be located so the pump is below the minimum water level. Suction intakes shall be bell-mouthed. Suction intakes shall be located against the far wall from the wetwell inlet.

(ii) Piping.

(A) Size. Sewage and sludge piping shall be no smaller than four (4) inches (10.2 cm) diameter, except as required for metering, or where grinder pumps are provided.

(B) Velocity. Piping and pumping systems shall be designed to maintain a minimum velocity of 2.5 fps (0.76 mps), and a maximum velocity of 5 fps (1.52 mps) for suction piping.

(C) Design pressure. Piping shall be designed for the maximum operating pressure and for the maximum value of any surges (water hammer) that may occur, taking into account any surge protection provided.

(D) Restraints. Piping shall be blocked and otherwise restrained to prevent damaging movement under the maximum anticipated pressure (including test pressure).

(E) Cleanouts. Cleanouts shall be provided in pump suctions.

(iii) Valves. Valves shall not be located in wetwells.

(A) Shutoff. Except on submersible pumps and suction lift pumps, a shutoff valve shall be provided on the suction of all pumps. A shutoff valve shall be provided on the discharge of all pumps, regardless of type or service.

(B) Check. 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.

(C) Air release. Air release valves shall be provided at the high points in piping whenever the pipe crown elevation falls below the pipe invert elevation. On sewage lines, air or air and vacuum release valves shall be specifically designed for sewage service.

(e) Reliability.

(i) Multiple units. Every pumping station shall have not less than two (2) pumping units. The number of units and their size shall be sufficient to permit pumping the maximum design flow with the largest pumping unit out of service.

(ii) One of the following shall be provided:

(A) Alternative power source. Where the pumping station serves more than fifty (50) residential units, alternative power shall be provided. Alternative power shall be permanently installed or portable engine generator sets, permanently installed or portable engine driven pumps or a separate, independent utility source provided. Where manual starting is required, sufficient storage shall be provided to allow notifying the operator and performing whatever tasks are necessary to get the pumping station in service. Where permanently installed engine driven equipment is provided, sufficient fuel shall be provided for at least eight hours operation under the maximum flow condition. Where more than one (1) pumping station is affected by a power outage and portable equipment is planned for alternative power source, sufficient portable equipment shall be provided to provide alternative power to all pumping stations under maximum flow conditions.

(B) Generators. Generators shall be sized to permit starting the largest pump in the pumping station with all other pumps except one running. If the generator is not capable of starting all pumps simultaneously, suitable controls shall be provided to stagger the pump starts to remain within the capabilities of the equipment. Generators shall be diesel-fired, natural gas-fired or bottled gas-fired. The use of gasoline or digester gas-fired generators for permanently installed standby service is unacceptable. Gasoline-fired portable generators are accept able.

(C) Engine driving pumps. Engine driven pumps shall be sized for maximum design flow. Diesel, natural gas and bottled gas are acceptable fuels for portable engines only. Digester gas is unacceptable for standby fuel. Quick connecting couplings shall be provided for portable engine driven pumps.

(D) Storage. Wastewater storage may be provided in the form of underground storage or surface ponds or tanks in lieu of alternative power supplies. Storage shall be sized for the maximum anticipated power outage, but not less than twenty-four (24) hours at average design flow. Storage shall be water tight and arranged to drain back to the pumping station wetwell.

(f) Electrical.

(i) Equipment location. All electrical equipment, including motors, motor starters and controls shall be located so as to be undamaged by the 100-year flood.

(ii) Controls. Controls shall include a separate start/stop device for each pump or for each pumping position in the control sequence. Controls shall be arranged so that the failure of any one control system component will affect only the operation of one pumping unit. Manual override shall be provided for normal pump operating control.

(iii) Code requirements. All electrical work shall comply with the National Electrical Code as adopted and amended by the Wyoming Department of Fire Prevention and Electrical Safety. Electrical equipment in enclosed wetwells, which may be subject to explosive

concentration of hazardous gases or flammable fluids, including all raw sewage wetwells, shall comply with the NEC requirements for Class 1, Division 1, Groups C and D areas.

(iv) Alarms. An alarm system shall be provided for each pumping station. As a minimum, alarms shall include high wetwell level and high water level in the dry well. For pumping stations having a capacity of 0.5 mgd (1890 $m^3$/d) or more, the alarm shall be telemetered to a facility that is manned twenty-four (24) hours a day. For pumping stations having a capacity of 0.5 mgd (1890 $m^3$/d) or less, an audio and visual alarm shall be provided in a conspicuous location.

(g) Safety.

(i) Ventilation. 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 30-minute intervals. Permanently installed dry well ventilation shall provide at least six air changes per hour if continuous, and twelve (12) air changes per hour if intermittent. Permanently installed wetwell ventilation shall provide twelve (12) complete air changes per hour if continuous, and thirty (30) complete air changes per hour if intermittent. Wetwell ventilation shall be positive pressure, forcing air into the wetwell rather than exhaustion from it. All ventilation equipment shall be of a non-sparking design. Intermittent ventilating equipment shall insure starting upon entry of operating personnel. Wetwells may be ventilated by gravity means if normal access by operating personnel is unnecessary. Wetwells that are accessed infrequently shall be designed to permit the use of portable blowers that will exhaust the space and continue to supply fresh air during access periods.

(ii) Hoists. Where required for removing equipment, hoists shall be rated for not less than 50 percent more than the weight of the heaviest single item to be lifted by the hoist.

(iii) Lighting. Lighting levels shall be sufficient to permit safe operation and maintenance of all equipment within the pumping station, but not less than 30 foot-candles. All areas shall be lit in such a manner that the failure of one lighting fixture or lamp will not cause the area to be completely dark.

(iv) Equipment guards. Provide shields to protect from rotating or moving machinery.

(v) Warning signs. Provide warning signs for nonpotable water, electrical hazards, chemical hazards, or other unsafe features. Warning signs shall be permanently attached to the structure or appropriate equipment.

(vi) Safety. Comply with the Wyoming Occupational Health and Safety Rules and Regulations.

**Section 11. General Treatment Plant Considerations.**

(a) Surface water protection. Discharges to surface waters shall meet or exceed quality limitations in the National Pollution Discharge Elimination System permit. Plant configurations and piping shall be arranged to avoid the bypassing of process units that could result in inadequately treated sewage reaching the receiving surface water.

(b) Groundwater protection. Seepage and/or discharge to groundwater shall comply with Chapter 8 of the Water Quality Regulations. Plan configurations and piping shall be arranged to avoid the bypassing of process units that could result in inadequately treated sewage reaching the groundwater.

(c) Siting requirements.

(i) Isolation. Treatment facilities shall be located to minimize public and private nuisances and health hazards on inhabited areas or residential areas. Where treatment plant siting does potentially affect inhabited areas, appropriate measures to minimize nuisances or hazards shall be incorporated in the design.

(ii) Flood protection. All treatment process structures, mechanical equipment, and electrical equipment shall be protected from the 100-year flood. The treatment facilities shall remain fully operational and accessible during the 25-year flood.

(d) Hydraulic and treatment reliability.

(i) Alternative power source. All treatment plants shall have an alternative source of power to provide reliable pumping and disinfection of sewage if required. The alternative source of power shall be sized to provide the capability to pump design maximum day flow rates through the treatment process and to disinfect the sewage if necessary. Acceptable alternative power sources include:

(A) A diesel, natural gas, or propane fueled engine generator.

(B) A second independent electrical supply.

(C) Storage of sewage and subsequent treatment

(ii) Bypass treatment units. Complete by-passing of treatment units is prohibited. Provide means to bypass any duplicate process unit or single unit where adequate downstream process capability is provided. Sewage shall be treated in parallel singular units and/or subsequent processes.

(iii) Multiple units. For average design flows greater than 100,000 gpd (378 $m^3$/d), more than one unit of each unit process shall be provided. For average design flows of less than 100,000 gpd (378 $m^3$/d), one unit of each unit process may be provided if electrical or mechanical equipment or diffusers can be removed while the unit is in operation, or if the unit can be compartmentalized to permit access. There shall be no provision to bypass the entire plant

nor shall bypass provisions be made that will allow inadequately treated sewage to reach the ground or surface waters.

Where more than one parallel unit is provided, positive means of dividing the flow proportionally between units shall be included (such as splitter weirs or valves and meters).

(iv) Multiple equipment. Mechanical process equipment shall be provided in multiple units. All pumping functions shall include sufficient pumping capacity that the peak flow can be pumped with the largest single unit not in service. Blowers and mechanical aerators for process aeration shall include sufficient capacity that the maximum day design capacity can be delivered with the largest single unit not in service. Other equipment shall have standby units where their function is critical to the treatment process.

(e) Electrical.

(i) Equipment location. Service transformers and other critical electrical equipment shall be located above the 100-year flood and above grade. Transformers shall be located in a manner that they are remote from or protected by substantial barriers from traffic. Motor controls shall be located in superstructures and in rooms that do not contain sewage, chemical processes, or corrosive atmospheres.

(ii) Code requirements. All electrical work shall comply with the National Electrical Code as enacted and amended by the Wyoming Department of Fire Prevention and Electrical Safety. Areas in which the occurrence of explosive concentrations of hazardous gases or flammable fluids can occur Class 1, groups C and D, Division 1 locations shall be designed for hazardous locations in accordance with the National Electrical Code.

(f) Structural.

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

(ii) Coatings. Coatings used to protect structures, equipment and piping shall be suitable for atmospheres containing hydrogen sulfide and volatile organics. Surfaces exposed in chemical areas shall be protected from chemical attack. Concrete surfaces in confined spaces containing sewage shall be protected. Paints containing lead or mercury shall not be used.

(iii) Geological conditions. 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.

(g) Safety. The Wyoming Occupational Health and Safety Rules and Regulations shall be complied with. The following items shall also be provided:

(i) Instruction manuals. Instruction manuals shall be provided for all mechanical and electrical equipment describing operation, maintenance, and safety.

(ii) Handrails. In addition to all Wyoming OSHA requirements, barriers around treatment basins shall be provided.

(iii) Warning Signs. Provide warning signs for nonpotable water, electrical hazards, chemical hazards, or other unsafe features. Warning signs shall be permanently attached to the structure or appropriate equipment.

(iv) Equipment guards. Provide shields to protect from rotating or moving machinery.

(v) Lighting. Provisions shall be made to light walkways, paths, and other accessways around basins, in buildings and on the site. All areas shall be lit in a manner that the failure of one lighting fixture will not cause an area to be dark, or the loss of power will not cause a room or enclosed area to be dark.

(vi) Climate conditions. Design of facilities such as exposed stairs, walkways, and sidewalks shall include nonskid surfaces.

(h) Instrumentation.

(i) Location. A flow measuring device shall be provided for the plant effluent unless it is a mechanical plant where an influent flow measuring device will be acceptable.

(ii) Type. For plants having an average design flow of 50,000 gpd (189 $m^3$/d) or more, the flow measuring device shall provide recording of instantaneous flow rate, enable calculation of average daily flow rate and have provisions for calibration and correction.

(iii) Controls. Automatic controls shall be designed to permit manual override.

(iv) Alarms. Conditions that may affect discharge quality or personnel or public safety shall be alarmed at an attended location.

(i) Sampling. Access shall be provided to sample untreated wastewater ahead of the treatment facilities prior to adding any process return flows, and sampling of the effluent after all treatment process units, but before discharge to the receiving stream. An automatic sampler that composites samples in proportion to the flow rate on the effluent shall be provided if required by the NPDES permit.

(j) Ventilation. All enclosed spaces shall be provided with forced ventilation, excepting pumping station wetwells, scum pits, anaerobic process units, and man-holes. In areas where there are open sewage channels, wet pits exposed to the room or process units without gas tight enclosures, ventilation shall be provided to maintain a higher pressure in the room than atmospheric and shall provide twelve (12) air changes per hour. In equipment rooms, ventilation

shall be provided to limit the temperature rise in the room to less than 15° F (8° C) above ambient, but not less than six air changes per hour. Rooms housing chlorine storage and/or feeders shall have provisions for exhausting the room contents in two (2) minutes and continuous ventilation to provide twelve (12) air changes per hour.

(k) Dewatering of treatment units. All treatment units, channels, housing screens, or other embedded equipment, and wetwells shall be provided with drains or sumps that facilitate draining the unit for access and maintenance. Drainage shall be to upstream process units. Basin slabs shall be designed to successfully resist the hydrostatic uplift pressure or relief valves shall be provided.

(l) Cold weather protection. All equipment including pumps, bar screens, grit washers, electrical equipment and other equipment not required to be in or on open basins (such as clarifier drives and surface aerators) 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. Walkways shall be located away from areas of spray and/or ice buildup.

(m) Chemical storage. 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 and/or drain 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 nonslip surfaces. Rooms for chlorine storage and feed equipment shall be gas tight and be provided with entry from outdoors. All toxic chemical storage areas shall be provided with lighting and ventilation that are switched from outside the room, and windows to permit viewing the room from outside.

(n) Design capacities.

(i) Flow. In the absence of flow measurement information, the design average daily flow shall be based on a per capita daily flow rate of 100 gallons (378 liters). Allowances shall be made for return flows from digesters, sludge thickeners and the like, and the infiltration and wet weather inflow into older sewer systems. Significant industrial waste flows shall be added to the per capita flow rate.

(ii) Organic loads. In the absence of wastewater strength data, domestic waste treatment design shall be based on a per capita daily BOD and suspended solids contribution of 0.22 lb (0.10 kg) and 0.25 lb (0.11 kg), respectively. The influence of sidestream return flows and significantly strong industrial wastes shall be considered and included in the design where applicable.

**Section 12. Pretreatment.**

(a) Flow equalization.

(i) Storage requirements. Where mechanical plants experience large diurnal variations in flow rate that will cause mechanical, hydraulic, or biological process upsets, flow equalization shall be provided.

(ii) Location. Pretreatment facilities, such as bar screens, comminutors and grit chambers, and where possible, primary clarifiers should be located ahead of the equalization basin.

(iii) Drainage and cleaning. Provisions shall be made to isolate, drain and clean the basin(s).

(iv) Aeration and mixing. Aeration shall be sufficient to maintain a minimum of 2.0 mg/L of dissolved oxygen in the basin at all times. Air supply rates shall be a minimum of 10 cfm/ 1,000 cubic feet (10 $m^3$/min/1000 $m^3$) of volume for primary treated wastewater and 20 cfm/1,000 cubic feet (20 $m^3$/min/1000 $m^3$) of volume for raw or screened waste water.

(v) Controls. Controls shall be provided to control the flow rate from the flow equalization basin. Flow measurement devices shall be provided.

(b) Screens.

(i) Location. Coarse screens shall be the first unit in the treatment process. Screens shall be housed. The housing shall be heated and ventilated. Access shall be separated from other enclosed spaces. Housing shall be designed for hazardous location (National Electrical Code, Class 1, Groups C and D, Division 1 locations).

(ii) Capacity. The screen capacity shall be capable of handling the maximum anticipated peak hourly flow including inflow and infiltration.

(iii) Types.

(A) Mechanically cleaned. Bar screens shall be mechanically cleaned if the removal of the daily accumulation of screenings results in surging of the flow. Manually cleaned screens shall be provided in parallel channels to permit removal of the mechanically cleaned screen from service. Bars shall be between 45° and 90° measured from the horizontal.

(B) Manually cleaned. Manually cleaned bar screens shall be used for bypass of a mechanically cleaned screen or for treatment installations having an average design capacity of less than 100,000 gpd (378 $m^3$/day). Bars shall be between 30° to 45° from the vertical.

(iv) Bar spacing. Clear spacing on mechanically cleaned bar screens shall range from 1/2 inch to 1 3/4 inches (1.27 cm to 4.45 cm). Manually cleaned screens shall have a

range from one to 1 3/4 inches (2.54 cm to 4.45 cm) clear spacing. Coarse screens may have spacing greater than 1 3/4 inches (4.45 cm).

(v) Velocities. Maximum approach velocity at average flows for a mechanically cleaned screen shall be 3.0 fps (0.91 mps). Maximum velocity for a manually cleaned bar screen shall be 1.5 fps (0.46 mps). Minimum velocities shall be 1.25 fps (0.38 mps).

(vi) Channel. Channels shall be designed to eliminate deposition and permit draining. The channel shall contain a rock trap ahead of mechanically cleaned screens. Multiple channels shall be designed to allow uniform and equal flow to the screens. Slide gates shall be provided to permit isolating sections of channel containing screens.

(vii) Controls. Cleaning operation shall be controlled by one or several of the following methods.

(A) Timers. A timer to start the cleaning operation, and a device to stop the cleaning operation after one cycle.

(B) Differential head. Cleaning device starts and stops on differential head across screen.

(C) High level switch. Cleaning device starts on high level and runs for predetermined length of time.

All screens shall have manual override capability. All controls shall be suitable for use in hazardous location (National Electrical Code, Class 1, Groups C and D, Division 1 locations).

(viii) Handling. Screenings receptacles shall be designed to contain a minimum of one day's screenings. Manually cleaned bar screens shall include an easily accessible and safe working platform. All handling areas should be well drained.

(ix) Disposal. Screenings shall be disposed of in a manner approved by the Department of Environmental Quality, Solid Waste Management section. Grinding of screenings and return to the wastewater flow is not acceptable.

(c) Comminutors.

(i) Location. When used, comminutors shall be located downstream of a coarse screen. Where grit removal is provided, comminutors shall be located downstream.

(ii) Capacity. Comminution or screening capacity shall be adequate with the largest comminutor out of service.

(iii) Number of units. Wherever comminutors are used, a bypass, manually cleaned bar screen shall be installed.

(iv) Channel. Provide stop plates or similar devices to permit isolating a comminutor for maintenance. Provide drainage and washdown facilities. Where grit removal is not provided upstream, provide a gravel trap upstream of each comminutor.

(v) Bypass. An emergency bypass with a manually cleaned bar screen shall be provided. All flow exceeding the operating capacity of the comminutor(s) shall be automatically directed to the emergency bypass.

(vi) Controls. The comminutor shall run continuously. All electrical controls shall be NEC Class 1, Groups C and D, Division 1 rated.

(d) Grit removal and disposal.

(i) Where required. Grit removal shall be provided either by providing for its accumulation in other process units or by removal in a specially designed basin. Where accumulation is provided in other process units, duplicate units shall be provided to permit removal of grit.

(ii) Location. Grit removal shall be placed after bar screens or racks, but before comminutors and other treatment units. Where grit removal facilities can be located at grade, they shall be upstream of raw sewage pumping stations. Grit basins may be located outdoors with proper precautions against freezing, but all grit conveying, washing and handling facilities shall be located indoors.

(iii) Capacity. Grit removal devices shall be designed to effectively remove grit at the peak instantaneous flow rate. The grit handling capacity shall be a minimum of fifteen (15) cubic feet per million gallons (1.12 $m^3$/1,000,000 $m^3$).

(iv) Number of units. A minimum of one mechanically cleaned unit and a bypass pipe or channel shall be provided for plants serving separate sewers. Five hundred thousand gallons per day (500,000 gpd) (1892.7 $m^3$/d) plants or smaller may have a manually cleaned unit and bypass. Plants larger than 1.0 mgd (3784 $m^3$/d), shall have two mechanically cleaned units with capability to isolate each one.

(v) Type.

(A) Aerated.

(I) Air requirements. Air supply must be controllable and capable of varying from 10 to 40 cfm/1,000 cubic feet (10 to 40 $m^3$/m/1,000 $m^3$) of basin. Air diffusers shall be located above the tank bottom and positioned for adequate mixing.

(II) Equipment requirements. The tank shall be sized for a three (3) minute retention time at peak flows. Grit shall be collected to a hopper for removal by sixty (60) or greater sloped sides or mechanical equipment. The inlet and outlet shall be designed to avoid short-circuiting. Air diffusers shall be removable without taking the basin out of service.

(B) Gravity chamber. Horizontal channel grit basins shall have an outlet control weir and specially shaped channel to maintain velocities from 0.8 to 1.3 fps (0.24 to 0.4 m/s) over the anticipated range of flows. Square basins shall be designed for an overflow rate of 30,000 gpd/sq ft (1220 $m^3/m^2/d$) at the peak instantaneous flow rate.

(vi) Method of grit removal. Grit removal facilities located in pits six (6) feet (1.8 m) or deeper and for plants larger than 500,000 gpd (1892.7 $m^3/d$) shall be provided with mechanical equipment for moving grit to ground level.

Plants having an average design capacity less than 100,000 gpd (378 $m^3/d$) may be provided with manually cleaned grit basins.

(vii) Drains. Each unit in the grit facility shall be capable of being dewatered.

(viii) Grit disposal. Grit disposal methods shall be approved by the Department of Environmental Quality, Solid Waste Management Office.

**Section 13. Primary Treatment.**

(a) Sedimentation.

(i) Number of basins. For plants having an average design capacity greater than 100,000 gpd (378.4 $m^3/d$) and where primary settling is provided, multiple units capable of independent operation shall be provided.

(ii) Design parameters.

(A) Performance. Unless full-scale data is available, primary settling shall be assumed to remove one third of the influent BOD and 55 percent of the influent suspended solids. It is unacceptable to return waste activated sludge to the primary clarifier.

(B) Water depth. The minimum side water depth shall be seven (7) feet (2.1 m).

(C) Surface overflow rates. Surface overflow rates shall not exceed 1,000 gpd/sq ft (41 $m^3/m^2d$) of surface area at the average design flow nor 1,500 gpd/sq ft (61 $m^3/m^2d$) of surface area at the maximum day flow rate. Maximum day flow is the highest flow over a 24 hour period that is projected to occur during the design year.

(D) Weir loading rates. Circular basins (or basins with center inlets) shall be provided with a full periphery weir. Rectangular basins shall be provided with end weirs that provide less than 80,000 gpd/ft (9,920 $m^3/m$ d) weir hydraulic loading at peak instantaneous flow rates.

(iii) Clarifier inlet and outlet.

(A) General. Clarifier inlet structures shall be designed to achieve the following:

(I) Dissipate the inlet kinetic energy.

(II) Distribute the flow evenly into the tank.

(III) Prevent short circuiting.

Inlet channels or piping shall be designed for minimum velocities of one (1) fps (0.3 mps). Where minimum velocities are less, mixing, flushing or other means of resuspending solids shall be provided.

Circular basins shall be provided with symmetrical baffling to distribute flow equally in all radial directions.

Rectangular basins shall be provided with inlet parts uniformly distributed along the entire end of the basin and shall be provided with baffles.

(B) Weirs. Weir plates shall be adjustable for leveling and sealed against the effluent channel.

(C) Baffles. Provide scum baffles at the water surface to intercept all floating materials and scum prior to the weir. Baffles should extend three (3) inches (7.6 cm) above the weir plate elevation and eight (8) inches (20.3 cm) below the water surface.

(D) Clarifier effluent channel.

(I) Size. The effluent channel shall be sized to prevent weir submergence at the peak hourly flow.

(E) Freeboard. The outer walls of sedimentation tanks shall extend at least six (6) inches (0.15 m) above the surrounding ground and shall provide at least twelve (12) inches (0.3 m) of freeboard to the water surface. Where basin walls do not extend four (4) feet (1.2 m) above the surrounding ground, a fence or suitable barrier to prevent debris from entering the basin shall be provided.

(F) Basin equipment and access. Provide walkways and accessways to collector drive units, effluent launders and manual skimmer. Handrail shall be provided.

(b) Fine screens.

(i) Number of units. A minimum of two (2) units shall be provided. Multiple units shall be capable of independent operation. With the largest unit out of service, the remaining units shall be capable of passing the peak flow rate.

(ii) Flow distribution. Positive means of flow distribution shall be provided ahead of the screens to ensure even loading and hydraulic flows.

(iii) Design parameters.

(A) Performance. In the absence of pilot plant data, the removal efficiency of fine screens shall be assumed to be zero percent removal of $BOD_5$ and 15 percent removal of suspended solids.

(B) Preliminary treatment requirement. Prior to the fine screens, removal of large debris shall be provided by coarse screens. Comminution shall not be provided ahead of screens.

(iv) Screenings storage and disposal. Screens with openings of 0.10 inch (2.5 mm) or more shall be disposed of directly to landfill in accordance with the requirements of the Department of Environmental Quality, Solid Waste Management Office. Screens with openings less than 0.10 inch (2.5 mm) shall discharge the screenings (primary sludge) to sludge handling system for organic stabilization.

(v) Cleaning and maintenance. Provide facilities to permit regular cleaning of screens with a high pressure, hot water or steam system.

(vi) Controls. For rotating screens, each screen or series of screens shall be provided with an overflow. An alarm shall be provided when overflowing.

(c) Sludge handling.

(i) Sludge removal. Mechanical sludge collection equipment is required for all primary settling basins. The sludge collection rake arms or flights and the drive assembly shall be designed to withstand the maximum anticipated loads and move sludge to the hopper.

(ii) Scum removal. Provide scum collection and removal facilities for all primary settling basins. Scum shall be removed from the liquid process and not returned.

(iii) Sludge hopper. The minimum side slope of the hopper shall be 1.7 vertical to 1.0 horizontal. Hopper bottoms shall have a maximum dimension of two feet (0.61 m). The sludge removal pipe shall be flush with the hopper bottom, and have a minimum diameter of six inches (15.2 cm).

(iv) Scum box. The scum box shall be located outside and immediately adjacent to the scum collection point (beaching plate). The beaching plate shall be located on the opposite side of the basin from the prevailing wind. Provide for mixing the contents of the scum box, such as a mechanical mixer or air diffusion. Provide access and wash water for washing the scum box.

(v) Controls.

(A) Primary settling sludge facilities. Primary sludge and scum shall be removed using positive displacement pumps. Each basin shall have a separately activated and controlled pump. (The standby pumps may be shared by more than one basin.) Pumps shall be on timers and the pumps should be designed to initiate sludge removal two (2) or more times per hour.

Include devices on the primary sludge piping for sampling the primary sludge flow.

(B) Primary screen sludge facilities. Where sludge pumping is provided, include a means to shut off the pump when insufficient material is being supplied to the pump suction. The controls for the pump shall be designed to match the pumping rate to quantity of sludge. Where conveyors are used, they shall run continuously and alarm when off.

**Section 14. Activated Sludge.**

(a) Pretreatment. Where primary clarification is not provided, screening of the raw sewage to remove debris larger than 3/4 inch (1.9 cm) shall be provided. The screened material shall not be returned to the plant process. Where primary clarifiers are not provided, cleanouts, grinders, or other similar provisions shall be made in the return sludge piping.

(b) Loading rates. Activated sludge systems shall be designed to accommodate peak day loadings at the design year. Permissible loadings are presented in the following table. Where raw sewage $BOD_5$ is less than 200 mg/L, detention times may be reduced.

(i) Conventional, including complete mix, plug flow, step aeration

| | | Average Day |
|---|---|---|
| Detention (*) hrs, | Following primary clarifiers | 6 minimum |
| | Without primary clarifiers | 9 minimum |
| Organic Loading: | lb/1,000 cu ft/day (kg/1000 $m^3$d) | 35 maximum (560 |
| MLSS, mg/L | | 1,000 - 3,000 |

(ii) Contact stabilization.

| | |
|---|---|
| Detention (*) hrs, | |
| Contact Zone | 0.5 - 3 |
| Sludge Stabilization Zone | 6 minimum |

| | | Average Day |
|---|---|---|
| Organic Loading (**) | lb/1,000 cu ft/day | 50 |

| | |
|---|---|
| (kg/1000 $m^3$d) | (800) |
| MLSS, mg/L | |
| Contact Zone | 1,000 - 3,000 |
| Sludge Stabilization Zone | 5,000 - 10,000 |

(iii) Extended aeration, including oxidation ditch.

| | |
|---|---|
| Detention (*) hrs, | 16 minimum |
| Organic Loading, lb/1,000 cu ft/day | 15 maximum (240) |
| (kg/1000 $m^3$d) | |
| MLSS, mg/L | 1,000 - 3,000 |

(*) Based on average day raw sewage flow rate exclusive of recirculation flow.

(**) Based on contact zone and sludge stabilization zone combined.

(c) Number of basins. For all design average flows in excess of 0.1 mgd (378 $m^3$/d), two or more aeration basins shall be provided. For flows less than 0.1 mgd (378 $m^3$/d), one aeration basin may be provided if the aeration devices can be readily removed while the basin is in operation.

(d) Configuration. The basin configuration shall promote mixing, transfer of oxygen, and minimize stagnant zones.

(e) Freeboard. The walls of the aeration shall extend above the normal water surface to provide a minimum freeboard as follows:

| | Minimum Freeboard (*) | |
|---|---|---|
| | inches | cm |
| Diffused air | 18 | 45.7 |
| Surface aeration | 48 | 121.9 |
| Submerged turbine | 18 | 45.7 |
| Brush aeration, less than 10 feet from aeration device | 48 | 121.9 |
| Brush aeration, 10 feet or more from aeration device | 18 | 45.7 |
| Surface aeration, where aeration is 30 or more feet from basin wall | 36 | 91.40 |

(*) Vertical walls. For sloped walls, the runup effect shall be considered.

(f) Inlet and outlet conditions. Inlets may be submerged and shall be baffled or directed away from the outlet to minimize shortcircuiting. Outlets shall be of the overflow type to discourage buildup of foam and floatables on the aeration basins. Pipe and channels shall provide a minimum velocity of 0.5 fps (0.15 m/s).

(g) Aeration requirements.

(i) Carbonaceous BOD. When it can be shown that nitrification will not occur in the activated sludge process, the aeration devices may be sized to meet only the carbonaceous oxygen demand. The oxygen provided by the aeration device shall be selected to be adequate for the projected maximum day loading. In the absence of other data, an oxygen requirement of two (2) times the average design day $BOD_5$ to the aeration basin shall be used.

(ii) Nitrification. Where nitrification is required to meet the effluent requirements or where the process cannot be operated to prevent nitrification, the aeration requirements will be selected to provide oxygen for both carbonaceous BOD and nitrification on the projected maximum day loading. In the absence of other data, an oxygen requirement of two times the average design day $BOD_5$ plus 7.5 times the average day ammonia nitrogen to the aeration basin shall be used.

(iii) Minimum dissolved oxygen. Oxygen supply shall be selected to transfer the design quantity during the maximum day loading while maintaining an aeration basin dissolved oxygen of 2.0 mg/L. The oxygen supply shall be designed for the specific site considering all factors that affect oxygen transfer efficiency.

(h) Mechanical aeration. Mechanical surface aerators shall be designed to maintain all organics in suspension, enhance the oxygen transfer capability of the unit, and minimize mist and spray that escape the basin. Drive units shall be protected from freezing mist and spray.

(i) Diffused aeration.

(i) Diffuser requirements. The number and location of diffusers shall be selected to distribute the design air quantity for efficient aeration and mixing. Diffusers in a basin shall be grouped on control valves to permit varying the air supply to different parts of the basin. Oxygen transfer efficiencies used for design purposes shall be conservatively selected, based on experimentally determined transfer rates of generically similar diffusers. The effect of transferring oxygen to wastewater, in lieu of water, and the effect of altitude shall be considered. The aeration basin mid-depth shall be used to determine the oxygen saturation concentration. Differential head loss to individual diffuser inlets shall not be more than 0.2 psi (14 $gm/cm^2$).

(ii) Blower requirements. Blowers shall be sized to provide the air requirements for the aeration basins and other plant uses of low-pressure air. The inlet air to the blowers shall be filtered or otherwise conditioned to effectively remove dust and other particulate material. Removal of particulate material for fine bubble diffusers shall be designed for 95 percent of 0.3 micron. Filters designed for blowers shall be easily replaceable. Blower intakes shall be located to avoid clogging from drifting snow. Blowers shall be housed. The housing shall be ventilated to prevent more than a 15° F (8° C) temperature rise with all blowers operating, excepting the standby blower. The housing, blowers, and blower piping shall be arranged to permit removal of individual blowers while all other blowers are operating. Noise attenuating materials shall be used in the building interior. Blower systems shall be designed to

permit varying the volume of air delivered. Blower motors shall be of a size to operate the blower throughout the range of ambient air temperatures experienced at the plant site.

(j) Sludge recirculation and waste.

(i) Rates. Sludge recirculation from the secondary settling basin to the aeration basin shall be variable within 25 to 100 percent of the average design flow. Sludge wasting from the activated sludge process may be from the mixed liquor or the return sludge. Sludge wasting shall be variable to enable wasting ½ of the total system solids in one day to zero wasting.

(k) Equipment requirements.

(i) Return sludge. Return sludge pumping shall be variable. The return sludge rate from each secondary settling unit and the rate to each aeration basin shall be controllable. Pumps shall be housed in heated, ventilated space. The pump floor shall be sloped and drained. Valves shall permit isolating each pump. Pumps and piping shall be arranged to allow ready removal of each pump. Check valves shall be provided where backflow through the pump could occur. Check valves shall be located in the horizontal.

Pump suction and discharge shall be three (3) inches (7.6 cm) minimum diameter. Sludge piping diameter shall be four (4) inches (10.2 cm) or larger. Cleanouts and couplings shall be provided in sludge piping to enable cleaning the pipe or to remove pumping equipment. All pipe high points shall be provided with air releases. All sludge piping shall be metallic material. Should air lift pumps be used, the units shall be designed with a minimum of 80 percent static submergence.

(ii) Waste sludge. If separate waste sludge pumps are provided, the rate shall be controlled by timers or variable speed devices. Pumping units shall be housed in heated, ventilated space, with sloped and drained floors. Pump suction and discharge piping shall be three (3) inches (7.6 cm) minimum diameter. Sludge piping shall be four (4) inches diameter (10.2 cm) or larger, except short, easily removable sections that may be required to maintain velocities above one fps (0.3 mps), or for use in conjunction with meters.

(l) Metering.

(i) Return sludge. For treatment plants having an average day design capacity greater than 100,000 gpd (378 $m^3$/d) the return sludge flow rate from each secondary settling unit and to each aeration basin shall be metered to indicate flow rate. Return sludge metering devices shall be suitable for liquids carrying grease and solids, and shall be accurate to within ±5 percent of the actual flow rate. Meters shall be readily field calibrated by plant personnel. Meters shall be arranged to avoid trapping air.

(ii) Waste sludge. For treatment plants having an average day design capacity greater than 100,000 gpd (378 $m^3$/d), waste sludge flows shall be metered to indicate and totalize. Waste sludge meters shall meet the requirements described for return sludge meters.

(iii) Air flow. Low-pressure air used for basin aeration and other plant uses shall be metered. Separate meters shall be used to indicate the flow rate to each aeration basin and to the ancillary uses made of the low-pressure air. Indicators shall be located near the device used to control the air flow rate. Pressure gages shall be provided immediately downstream from each blower and immediately upstream of each aeration basin.

(m) Controls. Facilities for control shall be provided for:

(i) Control of flow split between parallel process units.

(ii) Control of return sludge flow rate to each aeration basin.

(iii) Control of waste sludge quantity.

(iv) Control of air flow rate to each aeration basin.

(v) Control of air distribution to different zones in aeration basin.

(vi) Control of energy imparted with mechanical aeration. Facilities for control shall include a meter or device to measure rate and a device to change the rate such as a valve or adjustable weir.

(n) Prefabricated treatment units. Prefabricated activated sludge units shall conform to the applicable requirements described.

(o) Ancillary facilities. Adequate nonpotable washdown water shall be provided around the aeration basins sludge pumping area and secondary settling basins. Sampling ports, pipes or other access shall be provided on aeration basin inlets, return sludge piping, waste sludge piping and secondary settling basins. Hoisting or other means of equipment removal shall be provided. All subgrade floors shall be drained.

**Section 15. Attached Growth Systems.**

(a) Pretreatment and primary treatment requirements. Attached growth systems shall be preceded by primary settling or fine screening. If fine screening is provided, the screen size shall have 0.06 inch (1.5 mm) or smaller openings.

(b) Trickling filters.

(i) Loading rates. Applied organic loading rates on trickling filters, where not used in series with activated sludge, shall be limited to:

| Applied Liquid Rate to Surface of Filter | | BOD Loading* | |
|---|---|---|---|
| (gpm/sf) | (1pm/m) | (lb/1000ft$^3$/d) | (kg/1000 m$^3$/d) |

| | | | | |
|---|---|---|---|---|
| Rock Media | 0.1 | 4.07 | 10 | 160 |
| | 0.2 | 8.15 | 12 | 192 |
| | 0.3 | 12.22 | 16 | 256 |
| Plastic or Redwood Media | | | 20 | 320 |

*For more than a one-stage trickling filter, the volume of all stages shall be used.

(ii) Recirculation. Recirculated flow to stationary media attached growth systems shall be provided. Recirculated flow shall be sufficient to provide the following minimum wetting rates:

| **Media** | **Minimum Wetting Rate** | |
|---|---|---|
| | **(gpm/sf)** | **(1pm/m²)** |
| Rock | 0.1 | 4.07 |
| Plastic or redwood | 0.75 | 30.5 |

(iii) Media. Media may be rock or specially manufactured material made of redwood or plastic. Rocks shall be durable and free from thin, elongated, flat pieces and should have the following size distribution:

| | |
|---|---|
| Passing 6-inch (15.2 cm) screen | 100% by weight |
| Retained on 4-inch (10.2 cm) screen | 95 - 100% by weight |

Fabricated media shall be resistant to ultraviolet degradation, disintegration, erosion, aging, all common acids, alkalies, organic compounds, fungus and biological attack. Media shall be capable of supporting a man's weight.

(iv) Flow distribution. Wastewater shall be applied to stationary media by a rotary distributor or a fixed nozzle distribution system that provides uniform distribution. Flow distribution between multiple units of stationary or rotating media systems shall be by weirs, meters and valves, or other positive flow split device.

(v) Depth of media. Rock trickling filter depths shall be between five (5) to ten (10) feet (1.52 to 3.04 m), and manufactured media filter depth shall be between ten (10) to thirty (30) feet (3.05 to 9.15 m).

(vi) Underdrain system. The underdrainage system shall cover the entire floor of the filter. Inlet openings into the underdrains shall have an unsubmerged gross combined area equal to at least 15 percent of the surface area of the filter. Underdrains shall have a minimum slope of one percent.

Effluent channels shall be designed to maintain minimum velocity of two (2) feet per second (0.61 mps). Drains, channels and pipe shall be designed to have maximum depth flow of 50 percent.

(vii) Flushing. Provide valves and structurally capable walls to permit flooding rock media filters. Access shall be provided around the periphery of the underdrain system to allow flushing the underdrains.

(viii) Freeboard. The clearance between rotating distributor and the media shall be at least eighteen (18) inches (0.46 m). The surrounding wall shall extend 2.5 feet (0.76 m) above the distributor.

(ix) Ventilation. All trickling filters shall be provided with ventilation openings to the underdrain. Ventilation openings will be provided with dampers or other adjustable devices to permit adjusting the ventilation rate opening. Ventilation openings shall be a minimum of eight (8) square feet (0.74 m²) per 1,000 lb (454 kg) $BOD_5$/day.

Forced ventilation providing 4,000 cfm (113 $m^3$/min) per 1,000 lb (454 kg) $BOD_5$/day shall be provided for covered filters.

(c) Rotating biological contactors (RBC).

(i) Loading rates. The organic loading rate on the first stage of an RBC shall be limited to 140 lb BOD/1,000 cu ft (2240 kg/1,000 $m^3$) of media per day. The organic loading rate on all stages of an RBC shall be limited to 45 lb/1,000 cu ft (720 kg/1,000 $m^3$) of media for media having a specific surface area of 35 sq ft per cu ft (114.8 sq m/$m^3$). When more than ½ of the media has a specific surface area of 50 sq ft per cu ft (164 sq m/$m^3$), the organic loading may be increased to 50 lb/ 1,000 cu ft (800 kg/1,000 $m^3$).

(ii) Number of stages. Rotating biological contactors shall be designed with a minimum of three (3) stages in series. Baffles shall be provided between stages.

(iii) Velocities. The rotational speed of the contactors shall be designed to maintain at least two mg/L of dissolved oxygen in each stage at designed loading rates. Drive units shall provide a rotational speed of one rpm or more.

(iv) Draining. Provide drains from each contactor basin.

(v) Media materials. Media materials shall be special manufactured material suitable and durable for the rotating biological contactor process. Media shall be resistant to disintegration, ultraviolet degradation, erosion, aging, all common acids, alkalies, organic com pounds, fungus, and biological attack. Media shafts shall be designed for unbalanced loads and cycle fatigue.

(vi) Housing. The housing for the RBC'S shall be designed with openings or access to allow removal and replacement of entire shafts.

**Section 16. Combination systems.**

When more than one type of biological treatment process is used in series, the removal through each biological unit shall be calculated as if it were acting alone. No symbiotic effect will be included in the design calculation.

Pretreatment requirements for combinations of biological systems will be the same as for attached growth systems. Final settling and sludge handling will be the same as for activated sludge systems.

**Section 17. Secondary settling.**

(a) Secondary settling. Secondary settling is required after suspended growth and attached growth biological processes such as activated sludge, trickling filters and RBC's.

(b) Configuration. The largest dimension (either diameter or length) of a clarifier shall be eighty (80) feet (24.4 m). Corner sweeps on circular equipment are not acceptable.

(c) Flow distribution. Positive flow splitting shall be provided ahead of multiple sedimentation basins to ensure proportional hydraulic flows and solid loadings to each basin. Flow splitting shall be achieved using positive means such as weirs or valves and meters.

(d) Clarifier inlet and outlet structures.

(i) Clarifier inlet structures shall be designed to dissipate the:

(A) Inlet kinetic energy.

(B) Distribute the flow evenly into the basin.

(C) Minimize hydraulic turbulence.

(D) Prevent short circuiting.

Inlet devices that promote flocculation are encouraged.

The inlet structure for rectangular tanks shall be the full width of the basin, for peripheral feed clarifiers it shall be the entire periphery, and for center feed basins it shall be at least 20 percent of the tank diameter. Baffled scum relief ports shall be provided between the inlet structure and the clarifier.

(ii) Inlet conveyance pipe or channels shall be designed to maintain a minimum velocity of 0.5 fps (0.15 mps) at the design flow. Where channels provide less velocity, provide mixing, flushing, or other means of resuspending solids.

(iii) Clarifier outlet systems shall be designed to minimize vertical velocities and reduce the effect of density currents at the effluent weir. Weir level shall be adjustable.

(e) Freeboard. The outer walls of settling tanks shall extend at least six (6) inches (0.15 m) above the surrounding ground and provide at least twelve (12) inches (0.3 m) of free board to the water surface. Where settling basin walls are less than four (4) feet (1.22 m) above the surrounding ground, a fence or other debris barrier shall be provided on the wall.

(f) Design parameters.

(i) Surface overflow rates.

(A) Activated sludge. Settling basins following an activated sludge process shall be designed to both thicken the sludge and clarify the liquid flow entering the tanks. The overflow rate shall not exceed:

| | Design Flow | | Peak Hourly Flow | |
|---|---|---|---|---|
| | $gpd/ft^2$ | $m^3/m^2/d$ | $gpd/ft^2$ | $m^3/m^2/d$ |
| Activated Sludge | 600 | 24.4 | 1,200 | 48.8 |
| Separate Nitrification | 400 | 16.3 | 800 | 32.5 |

(B) Attached growth biological reactors. Overflow rates for settling basins following attached growth processes shall not exceed:

| | Design Flow | | Peak Hourly Flow | |
|---|---|---|---|---|
| | $gpd/ft^2$ | $m^3/m^2/d$ | $gpd/ft^2$ | $m^3/m^2/d$ |
| Trickling Filters and RBC's | 800 | 32.5 | 1,200 | 48.8 |

(ii) Solids loadings. Solids loadings for settling basins following an activated sludge process shall not exceed:

| | Design Flow | | Peak Hourly Flow | |
|---|---|---|---|---|
| | $lbs/d/ft^2$ | $kg/d/m^2$ | $lbs/d/ft^2$ | $kg/d/m^2$ |
| All Activated Sludge Processes | 28 | 136.7 | 50 | 244.1 |
| Separate Nitrification | 25 | 122.1 | 40 | 195.3 |

(iii) Side water depth. Settling basins shall be deep enough to provide adequate distance between the sludge blanket and the effluent weirs to avoid disturbance of settled sludge.

The volume of the settling basin shall provide a minimum detention time of two (2) hours at peak hourly flow rate. The peak hourly flow is the projected maximum flow over a one hour period during the design year. Peak hourly flow shall include all recycle flows entering clarifier.

(iv) Weir overflow rates and placement. Weir loading rates shall not exceed the following values:

| | Design Flow | | Peak Hourly Flow | |
|---|---|---|---|---|
| | gpd/ft² | $m^3/m^2/d$ | gpd/ft² | $m^3/m^2/d$ |
| Launder and weir at outer wall | 12,000 | 489 | 20,000 | 815 |
| Launder and weir at 3/4 point of radius or less | 18,000 | 733 | 36,000 | 1467 |

Where double weirs or serpentine type weirs are used, the weir length shall be computed as the length of the centerline of the launder.

(g) Baffles. Baffles shall be located at the water surface and in such a position as to intercept all floating materials (scum) prior to the weirs. Baffles shall extend three (3) inches (7.6 cm) above the weir level and twelve (12) inches (0.3 m) below the water surface. In circular basins, the baffle shall be a minimum of six (6) inches (0.15 m) inside the weir plate. In rectangular basins, the baffle shall extend across the width of the basin and upstream of the effluent weirs.

(h) Basin and equipment access. Walkways and access ways shall be provided to drive units, effluent launders, and manual scum devices.

(i) Sludge removal. Sludge collection and withdrawal equipment shall provide complete and continuous removal of settled sludge. Rapid sludge removal pipes shall return sludge to a well at the surface that enables visual observation of flow. Mechanical rakes shall move sludge to a hopper at the floor. The tip speed for circular mechanisms shall not exceed 8 fpm (2.4 m/min) and straight line flight speed shall not exceed 1 fpm (0.3 m/min).

The return sludge removal pipes shall be at least four (4) inches (10.2 cm) in diameter. The hydraulic differential between the clarifier water level and the return sludge level shall be sufficient to maintain a 3-fps (0.9 mps) velocity in each rapid return sludge withdrawal pipe. Each sludge withdrawal pipe shall be accessible for rodding or backflushing when the settling basin is in operation.

(ii) Scum removal. Provide effective baffling and scum collection and removal facilities for all secondary settling basins. Equipment shall include a mechanical, positive scum skimmer.

(iii) Sludge hopper. The minimum side slope of the hopper shall be 1.7 vertical to 1.0 horizontal. Hopper bottoms shall have a maximum dimension of two (2) feet (0.61 m). The sludge removal pipe should be flush with hopper bottom, and have a minimum diameter of six (6) inches (0.15 m).

(iv) Scum box. Locate scum box outside settling tank and adjacent to the scum collection point. Provide method for mixing contents of scum box, such as air jets or surface wetting using waste sludge. Provide access and washwater for washing the scum box. The scum box shall be located on the side of the tank opposite the prevailing wind direction.

**Section 18. Lagoons.**

(a) Design requirements.(ii) Wastewater loading rates.

(i) Location. Wastewater lagoons shall be located more than 500 feet (152 m) from existing habitations.

(A) Facultative. The primary cells of a facultative (non-aerated) pond system shall be limited to a maximum BOD application of 40 lb/acre/day (44.8 kg/ha/d) at average design loading conditions.

(B) Aerated. Aerated lagoons shall be designed for an organic loading of less than 10 lb $BOD_5$/day/1,000 cu ft (160 kg/1,000 $m^3$/d) for completely mixed systems, and less than two lb $BOD_5$/day/1,000 cu ft (32 kg/1,000 $m^3$/d) for aerated non-completely mixed systems. Aeration equipment shall be sized to maintain a minimum dissolved oxygen of two mg/L. Completely mixed systems are mixed to provide 1/4 hp/1000 cu ft mechanical mixing or 10 cfm/1000 cu ft of air mixing.

(C) Nonsurface water discharging ponds. Nonsurface water discharging ponds shall be designed on the basis of a water balance that considers evaporation and seepage. Water balance calculations shall be submitted with the plans and specifications. The $BOD_5$ loading for non discharging ponds shall not exceed 14 lb/acre/day (15.7 kg/ha/d) based on the average annual $BOD_5$.

(iii) Detention. Facultative lagoons shall be designed for a minimum detention time of 180 days.

The detention time in aerated lagoons shall be at least one and one half (1 1/2) days for completely mixed primary cells, and seven (7) days for non-completely mixed primary cells. Secondary cells shall increase the overall detention time to thirty (30) days.

(iv) Storage. Nonsurface water discharging lagoons shall be designed to provide sufficient storage to retain all wastewater and rainfall during the wettest year of record during a ten (10) year period of record. Seepage shall be controlled to maintain a minimum water depth of two (2) feet (0.6 m) in the primary cell during the driest occurring year of a ten (10) year period.

(v) Inlet.

(A) Location. The inlet pipe to the primary cell of a facultative lagoon shall be at least thirty (30) feet (9.2 m) from any bank. It shall terminate at a point away from the outlet by a distance of at least equal to or greater than 2/3 of the longest lagoon dimension. In aerated systems, the influent line shall be located in the mixing zone of the aeration equipment.

(C) Apron. Provide a concrete apron at the inlet pipe termination with minimum dimensions of four feet by four feet (1.2 m by 1.2 m).

(D) Influent manhole. An influent man-hole shall be provided prior to the lagoons. The influent pipe in the influent manhole shall be at least six (6) inches (0.15 m) above the normal operating water level of the primary lagoons.

(E) Flow distribution. Flow distribution for multiple primary cells shall be provided to effectively split hydraulic and solids proportionately.

(vi) Inlet and outlet structures.

(A) Location. Inlet and outlet structures shall be easily accessible by plant operators and located to minimize short circuiting within the cell. A level control structure shall be provided at the outlet of each cell.

(B) Level control. Provide controls to permit varying water levels between two (2) feet and six (6) feet (0.6 m to 1.8 m). Provide baffling at the outlet to prevent scum overflow. Multiple draw offs in the final cell shall be provided. At least one (1) shall be located at the two (2) foot (0.6 m) level.

(vii) Interconnecting piping.

(A) Location. Piping between lagoon cells shall connect to the preceding cell outlet control structure and discharge into the subsequent cell. The pipe shall discharge at least ten (10) feet (3.05 m) from the toe of the slope on the lagoon bottom and shall terminate on the concrete apron that is at least four (4) feet by four (4) feet (1.2 m by 1.2 m).

(B) Elevation. The piping shall discharge at the floor of the lagoon.

(C) Material. Interconnecting piping shall be any acceptable pipe designed to resist low pressures and adequately protected from corrosion.

(b) Number of lagoons cells. A lagoon system with a total area greater than one (1) acre (0.4 ha) shall have at least three (3) cells in series. Smaller systems and nondischarge pond systems shall have at least two (2) cells. The maximum size cell shall be twenty (20) acres (8 ha).

(c) Lagoon configuration.

(i) Shape. Rectangular cells shall have a maximum length to width ratio of 5:1. No sharp corners nor dead-end coves are permitted.

(ii) Water depth. Facultative ponds shall be designed to have water depths of not less than two (2) feet, nor more than six (6) feet (0.61 m to 1.8 m). Aerated lagoons shall be

designed to have water depths of not less than four (4) feet nor more than fifteen (15) feet (1.2 m to 4.6 m).

(iii) Removal of lagoon cells from operation. Bypass piping for primary lagoon cells and aerated lagoon cells shall be provided.

(iv) Lagoon freeboard. A minimum freeboard of two (2) feet (0.6 m) shall be provided. Greater freeboard shall be provided for wave runup, where required.

(d) Construction requirements.

(i) Dike.

(A) Material. Dikes and embankments shall be of relatively impervious and stable material, and compacted to at least 95 percent of maximum density (ASTM D698-78). Embankment fill shall be free from organic material, rock larger than six (6) inches (15.2 cm) and construction debris. The area where the embankment is to be constructed shall be stripped of vegetation and roots.

(B) Top width. Dikes and embankments shall be constructed with minimum top width of eight (8) feet (2.4 m).

(C) Slopes. Interior slopes shall be from three (3) to four (4) horizontal to one vertical, and shall be stable under varying water level conditions. Interior slopes that are surfaced with concrete paving or riprap may be constructed at slopes of two (2) or more horizontal to one (1) vertical. Exterior slopes shall be three (3) or more horizontal to one (1) vertical and shall prevent the entrance of surface water to the lagoon.

(ii) Seeding. Exterior slopes and interior slopes that are not riprapped shall be seeded with dryland grasses, unless another equivalent method for soil erosion control is provided.

(iii) Erosion control. Interior embankments except cells smaller than one (1) acre shall be protected from wave action with riprap, paving, or other erosion resistant material, unless it is demonstrated that the ponds are sheltered from wind or where wind velocity is low and erosion will not occur.

(e) Lagoon sealing.

(i) Lagoon sealing. The seepage through the pond bottom and side walls shall not cause a violation of the groundwater standards as described in Chapter 8 (Quality Standards for Wyoming Groundwaters) of the Wyoming Department of Environmental Quality, Water Quality Rules and Regulations. Liners shall be required if the wastewater characteristics or site conditions will not insure the protection of the groundwater for which it is classified.

If the applicant cannot document that the facility poses no threat to groundwater and elects not to perform a subsurface study in accordance with Chapter 3, Section 17 (a) and (b), then the groundwater shall be protected from contamination by the wastewater with a liner equivalent to three (3) feet (1 m) of soil having a permeability of $10^{-7}$cm/sec or less. When an applicant performs a subsurface study, the requirements for the liner shall be determined based on the results of the study and the groundwater protection required. In no instance shall the maximum seepage rate exceed 1/8 inch per day (3.2 mm/day) in the primary pond(s).

Following construction of the lagoons, but prior to startup, a testing program shall be conducted to demonstrate the effectiveness of the sealing program. Should the testing program show the lagoon seal to be less effective than the above requirements, the seal shall be modified and retested until it succeeds.

(ii) Synthetic liners.

(A) Material. Synthetic liners shall be essentially impervious. The minimum lining thickness shall be 30 mils. The liner material shall be resistant to organic materials typical of sewage. The liner shall be resistant to sunlight or shall be covered with 12 inches (30.5 cm) or more of soil at all locations including the lagoon bottom and side slopes.

(B) Liner stabilization. Where the seasonal high groundwater is above the bottom of the lagoon, the liner shall be stabilized to prevent it from rising.

(C) Appurtenances. A leak detection system and/or air release mechanism may be required.

(f) Aerated systems.

(i) Air requirements. Aerated ponds shall be designed to maintain 2 mg/L of dissolved oxygen or more throughout the pond contents.

(ii) Equipment requirements.

(A) Number. Surface aerators shall be provided at intervals of 200 feet (61 m) or less. The lagoon shall be protected from erosion from the aeration equipment. At least two surface aerators or brush aerators shall be provided. With the largest unit out, the remaining units shall be capable of transferring the average day oxygen demand. Each diffused aeration system shall be provided with at least two blowers. With the largest blower out of service, the remainder shall be capable of supplying the design air flow rate.

(B) Removal. All equipment shall be accessible and removable from the edge of the lagoons. Provisions for dewatering shall be made for removal or repair of diffusers.

**Section 19. Tertiary treatment systems.**

(a) Phosphorus removal.

(i) Equipment requirements.

(A) Flash mixing. Chemical addition points shall be at points of high turbulence, such as Parshall flumes, hydraulic jumps, or separate mixing basins.

(B) Flocculation. Inlet and outlet design shall prevent short circuiting and turbulent destruction of floc. Minimum detention time shall be 20 minutes at the average design flow rate.

The velocity of flocculated water to settling basins shall be 0.5 to 1.5 fps (0.15 to 0.46 mps). Changes in direction shall be with long radius elbows or curved channels.

(C) Chemical feed equipment. Storage shall be provided for at least 14 days of chemical supply. Liquid chemical storage tanks shall have a liquid level indicator, an overflow, and a receiving basin capable of holding 110 percent of the stored volume, or a drain capable of receiving accidental spills or overflows. Liquid chemical storage shall be provided with heat.

(b) Ammonia nitrogen reduction.

(i) Activated sludge. Ammonia nitrogen removal by activated sludge processes shall be designed with sludge retention time of at least 15 days and shall provide at least 16 hours of hydraulic detention time. Aeration requirements are described in Section 15.

(ii) Attached growth. Rock media trickling filters shall not be used for ammonia reduction. Fabricated media trickling filters used for ammonia shall be designed using a BOD loading of less than 14 lb/1000 cu ft (224 kg/1,000 $m^3$) of media. Rotating biological contactors used for ammonia reduction shall be designed with hydraulic loadings less than 1.0 gpd/sq ft (40.7 L/$m^2$/d) of media surface area. At least four stages shall be provided for ammonia nitrogen removal.

(iii) Lagoons. The design of facultative lagoons for ammonia removal shall provide a minimum detention of 180 days. Aerated lagoon systems may be designed for 160 days.

(c) Solids reduction.

(i) Filtration.

(A) Filtration rate. The maximum hydraulic loading for 24 inch (61 cm) or deeper media is 5 gpm/sq ft (292.5 $m^3/m^2/d$) of filter area. Filtration rates for shallower media shall be limited to 3 gpm/sq ft (175 $m^3/m^2d$).

(B) Backwash requirements. Provide a minimum backwash rate of 20 gpm per square foot (1170 $m^3/m^2/d$) of filter bed for 24 inch (61 cm) or deeper media and 12 gpm/square foot (702 $m^3/m^2/d$) for shallower media; supply shall be filtered water. A rate of flow regulator on the main backwash line shall be provided. The total backwash water storage capacity shall be adequate for twenty 20 minutes of continuous backwash.

Air scour or surface wash facilities are required. All surface wash devices shall be provided with a minimum flow rate of 0.5 gpm per sq ft (29.3 $m^3/m^2d$) water pressures of 50 psi (3.52 $kg/cm^2$) or greater and use filtered water.

(C) Backwash waste handling and treatment. Waste filter backwash shall be collected in a surge tank and recycled to the treatment plant at a rate not to exceed ten percent of the average plant design flow rate. Waste backwash water may be returned to any point upstream of the biological treatment units.

(D) Number of units. At least two units shall be provided. With one filter out of service, the remaining filters shall be capable of passing the maximum day design flow rate.

(E) Controls. Controls should be provided to remove a filter from service, backwash the filter, and return it to service. Where the control is automatic, there shall also be a means of manually overriding the operating equipment, including each valve essential to filter operation.

In addition, the following shall be provided:

(I) Sampling tap on filter influent and effluent.

(II) Indicating and recording loss of head gauge.

(III) Flow rate indicating and control.

(IV) Means for feeding polymer as a filter aid at a controlled rate to filter influent water when chemically coagulated effluent is being filtered.

(ii) Microscreens.

(A) Pilot testing. Pilot plant testing on the fluid to be screened or data from other similar applications to demonstrate the suitability of the proposed filter fabric, fabric life, proposed loading rates, and other design criteria shall be provided.

(B) Loading rates. Flow equalization facilities shall be included in the design to moderate influent quality and flow variations.

The screening rate shall be selected to be compatible with available pilot plant test results and selected screen aperture, but shall not exceed 1.5 gpm/sq ft (87.8 $m^3/m^2/d$) for lagoon

effluent or 5 gpm/sq ft (292.5 $m^3/m^2/d$) for activated sludge or attached growth effluents based on the maximum hydraulic flow rate applied to the units. The screening rate shall not exceed 0.75 lb/sq ft/day (3.7 kg/ $m^2$/day). The effective screen area shall be considered the submerged screen surface area less the area of screen blocked by structural supports and fasteners.

(C) Backwash requirements. The backwash water shall be at least eight gpm/ linear foot (99 Lpm/m) of screen length at 60 psi (4.2 $kg/cm^2$), obtained from microscreened effluent.

(D) Controls. Each microscreen unit shall be provided with automatic drum speed controls with provisions for manual override.

(d) Rapid infiltration.

(i) Wastewater preapplication requirements. Rapid infiltration shall be preceded by settling or fine screening having 0.6 inch (15.2 mm) or smaller openings.

(ii) Hydraulic loading rates.

(A) Permeability. Hydraulic capacity of the rapid infiltration site shall be based upon soil permeability, basin infiltration tests, or cylinder infiltrometer tests. Design loading rates based on these tests shall be as follows:

| Field Measurement | Annual Loading Rate |
|---|---|
| Basin infiltration test | 10% of minimum measure rate |
| Cylinder infiltrometer | 2% of minimum measured rate |
| Permeability | 5% of conductivity of most restricting soil layer |

(B) Precipitation. The total hydraulic load to the rapid infiltration basins includes precipitation. The one in ten year precipitation event should be used as the basis for design.

(C) Cold weather conditions. The design must recognize that drying rates, oxidation rates, nitrification and denitrification rates all decrease in cold weather. Cold weather loading rates shall be used to determined land requirements or cold weather storage shall be used. Provisions should be made to mow and disc basin surfaces in the fall to prevent ice from freezing the vegetation near the soil surface. Snow fences can be used to keep snow cover on the rapid infiltration basins to insulate the applied wastewater and soil.

(iii) Land requirements.

(A) Storage. A minimum of fourteen (14) days of storage shall be provided. Where applied sewage will be less than 4° C, 160 days of effluent storage shall be provided.

(B) Location. Rapid infiltration basins shall be located more than 500 feet (152 m) from existing habitation.

(iv) Basin size. Individual basin size shall not be greater than five (5) acres (2.0 ha). Basin sizing should be based upon a maximum water depth of twelve (12) inches (30.5 cm) in the rapid infiltration basins.

(v) Subsurface drainage. The capillary fringe above the groundwater mound shall not be closer than two (2) feet (0.6 m) to the bottom of the infiltration basin. The distance to groundwater shall be at least five (5) feet (1.5 m) below the soil surface within two (2) days following wastewater application.

(vi) Groundwater monitoring. Refer to Chapter 3, Section 15, of the regulations.

(e) Intermittent sand filters.

(i) Wastewater preapplications treatment requirements. Intermittent sand filters shall be preceded by settling or fine screens having 0.06 inch (1.5 mm) or smaller openings.

(ii) Hydraulic loading rates. The maximum application rates shall be limited to:

| | Maximum Application Rate | |
|---|---|---|
| Source | gallons/acre/day | ($m^3$/ha/d) |
| Primary Effluent | 130,000 | (1216) |
| Secondary Effluent | 400,000 | (3742) |
| Lagoon Effluent | 300,000 | (2806) |

(iii) Media. The minimum sand depth shall be twenty-four (24) inches (0.6 m). The sand must be free of cementing materials and clay or loam. The sand should have an effective size of not less than 0.2 mm and not greater than 0.5 mm, and a uniformity coefficient of less than 5.

Clean graded gravel shall be placed around the under drains and to a depth of at least twelve (12) inches (0.3 m) over the top of the underdrains.

(iv) Underdrains. All intermittent sand filters shall be provided with underdrains. Underdrains shall be at least four (4) inches (10.2 cm) in diameter. The under-drain pipe shall have a minimum slope of 5 feet per 1,000 feet (5 m/1,000 m).

The groundwater shall be at least two (2) feet (0.6 m) below the bottom of the underdrain pipe.

(v) Number of units. Three (3) or more filters shall be provided.

(vi) Dosing.

(A) In each dosage of an intermittent filter, the hydraulic capacity shall permit covering the bed to a depth of two (2) inches (5 cm), within twenty (20) minutes or less.

**Section 20. Sludge Handling, Treatment and Disposal.**

(a) Pumping.

(i) Design requirements. Sludge pumps shall be provided with a positive suction pressure at the pump impeller, rotor or plunger at dynamic conditions. Discharge pressure shall include static pressure difference and system friction losses based on the higher viscosity of the sludge than water.

(ii) Piping and valves.

(A) Minimum size. Sludge piping and valves shall at least four (4) inches (10.2 cm) in diameter for pressure piping and six inches (15.2 cm) in diameter for gravity pipe. Pump suction and discharge shall not be less than three (3) inches (7.6 cm) in diameter.

(B) Minimum velocity. For sludge pipes larger than four (4) inches (10.2 cm) in diameter, the minimum velocity shall be one fps (0.3 m/sec).

(b) Thickening.

(i) Types.

(A) Gravity. Gravity thickening shall only be used for primary sludge, digested primary sludge, lime sludge, or combinations of lime sludge, trickling filter humus and primary sludge.

(B) Dissolved air flotation. Dissolved air flotation shall only be used for combination of primary and biological sludges, waste biological sludges, and aluminum and iron salt sludges.

(ii) Design parameters.

(A) Influent solids concentration. The design for influent solids concentrations to gravity or flotation thickeners shall be 5,000 mg/L or less, except tertiary lime sludge.

(B) Operating schedule. Sludge thickening facilities shall have the capacity to treat the maximum amount of solids produced. Where intermittent operation is provided, sludge holding tanks ahead of and after the thickening process shall be provided.

(C) Solids loading. Solids loadings (solids applied to the thickener) on thickening devices shall be limited to the following maximum values.

| | Solids Loading lb/sq ft/day | | kg/m²/d | |
|---|---|---|---|---|
| Sludge Type | Gravity | Dissolved Air Flotation | Gravity | Dissolved Air Flotation |
| Primary | 24 | NA | 117.2 | |
| Digested primary | 20 | NA | 97.6 | |
| Waste activated, without polymer | NA | 12 | | 58.6 |
| with polymer | | 48 | | 234.3 |
| Primary and trickling filter | 15 | -- | 73.2 | |
| Anaerobically digested primary and activated | NA | NA | | |
| Primary and lime | 20 | NA | 97.6 | |
| Tertiary lime | 60 | NA | 292.9 | |
| Alum | NA | 12 | | 58.6 |

*NA - Not allowed.

(D) Hydraulic loading. Gravity thickeners shall be designed for 400-800 gpd/ sq ft (16.3 $m^3/m^2/d$ to 32.5 $m^3/m^2/d$) of surface area.

(iii) Number of units. Unless sludge storage capacity for three (3) days is provided, there shall be at least two (2) units of equal capacity provided for sludge thickening.

(iv) Controls. Controls for gravity and flotation sludge thickening operations shall include provision for influent flow rate control. Centrifuge thickening shall include adjustable manual controls for differential scroll speed, pool depth, and influent flow rate. Where chemical conditioning is required, chemical dosage rate shall have adjustable manual controls.

(v) Side stream waste characteristics. The flow, organic load, and solids load in the thickener return flow to the plant shall be included in the plant design loadings.

(vi) Odor control. Provisions shall be made for the continuous chlorination of gravity thickener influent. Any thickening installation for anaerobically digested sludge shall make provisions for enclosing zones where the sludge or decant is exposed to atmosphere, exhausting the zone at an adequate rate to prevent escape of gas, and treating the exhaust air for removal of odor causing agents.

(c) Aerobic digestion.

(i) Solids retention time. Solids shall be retained in the aerobic digester for thirty (30) days for primary sludge and twenty (20) days for waste sludge from conventional activated sludge systems. Waste activated sludge from extended aeration systems shall be retained for a minimum of ten (10) days.

(ii) Mixing and aeration requirements. Aeration requirements shall include the oxygen requirements for BOD stabilization, nitrification of ammonia nitrogen in the sludge, and nitrification of organic nitrogen in raw sewage solids and biological solids. A minimum dissolved oxygen of 2 mg/l shall be maintained. Minimum aeration requirements shall be:

| Sludge | CFM/1,000 lb solids/day | $m^3$/min/1,000 kg/d |
|---|---|---|
| Extended Aeration | 300 | 18.7 |
| Conventional Activated Sludge | 800 | 50.0 |
| Primary Sludge | 2,100 | 131.0 |

The aerobic digester aeration shall be provided with nonclog diffused aeration. Mechanical surface aerators shall not be allowed. Aeration provisions shall be a minimum of 30 cfm/1,000 cu ft (30 $m^3$/min/1,000 $m^3$) of volume.

(iii) Number of digesters. Where aerobic digesters are used, two (2) or more shall be provided for treatment plants having an average design capacity of 100,000 gpd or more. Multiple aerobic digesters shall be arranged to permit either parallel or series operation.

(iv) Supernatant removal and disposal. Supernatant shall be returned prior to the influent of the biological treatment process.

(d) Anaerobic digestion.

(i) Sludge characteristics. The minimum sludge concentration for feed to anaerobic digesters is four percent.

(ii) Number of digesters. Two or more digesters shall be provided for treatment plants having an average design capacity of 100,000 gpd (378.54 $m^3$/d) or more.

(iii) Design requirements.

(A) Temperature. Primary anaerobic digesters shall be heated to provide a minimum temperature of 95°F (35°C). Controls shall maintain the digester temperature within ±5°F (±2° C).

(B) Mixing equipment. Digester mixing shall, as a minimum, provide control of scum accumulation at the gas/liquid interface. Mixing that is designed for increasing the effectiveness of the digester and thereby reducing detention time shall mix the entire tank contents. Mixing devices and their application rate that will be considered to provide high-rate digestion are:

| Volume | Per 1,000 cf | Per 1,000 $m^3$ |
|---|---|---|
| Slow speed turbine mixers | 0.25 hp | 6.7 kw |
| Draft tube mechanical mixers | 0.40 hp | 10.5 kw |
| External pumps and jet nozzles | 500 gpm | 66.7 $m^3$/m |
| Gas mixing applied at bottom of digester | 10 cfm | 10 $m^3$/m |

Less mixing may be provided; however, longer solids retention times than described below shall be required.

(C) Solids retention time. The minimum solids retention time for heated, primary digesters are:

| Unmixed | Completely mixed |
|---|---|
| 30 days | 10 days |

Solids retention time shall be the same as liquid retention time in the primary digester where waste activated sludge is anaerobically digested.

(D) Volatile solids loading. As an alternative design basis to solids retention time, heated primary digesters may be designed for the following maximum volatile solids loading:

Unmixed
0.1 lb/$ft^3$/day (1.6 kg/$m^3$/d)

Completely mixed
0.3 lb $ft^3$/day (4.8 kg/$m^3$/d)

(iv) Sludge piping.

(A) Inlet. Except in completely mixed digesters, multiple inlets shall be provided. The piping shall provide the opportunity to heat undigested sludge prior to entering the digester.

(B) Sludge withdrawal. Except in completely mixed digesters, multiple withdrawal pipes shall be provided. One or more withdrawal pipes shall be from the digester floor.

(C) Supernatant withdrawal. The design basis for facilities using digesters for waste activated sludge shall assume no supernatant withdrawal. Piping for

supernatant withdrawal may be provided. A minimum of three (3) supernatant withdrawal levels shall be provided otherwise.

(v) Gas system. All portions of the gas system, including the space above the tank liquor, storage facilities, and piping shall be designed to be under greater than atmospheric pressure at all times.

(A) Piping. Gas piping shall be 2.5 inches (6.4 cm) diameter or greater. Piping from the digester shall be provided with a flame trap. Piping shall slope to condensate traps. Float controlled condensate traps are not permitted.

(B) Safety equipment. All necessary safety equipment shall be included. Pressure and vacuum relief valves, flame traps and other safety equipment shall be provided. Gas safety equipment and gas compressors shall be housed in a separate room with an exterior entrance.

(C) Metering. A gas meter with bypass shall be provided for measurement of total gas production.

(vi) Heating equipment. Sludge and digester contents shall be heated with an external heat exchanger. Where sludge is heated using digester gas, an auxiliary fuel supply shall be provided. Boilers using digester gas shall be designed to minimize corrosion and to facilitate burner replacement. All digester gas that is not beneficially used shall be incinerated in a waste gas burner.

(vii) Access. The roof of the digester and the top sidewall shall be provided with sealed access hatches.

(viii) Sampling. One and one-half inches (3.8 cm) or larger sampling ports shall be provided for inlet sludge, effluent sludge, supernatant and digester contents.

(ix) Supernatant disposal. Supernatant from secondary digesters or from subsequent thickening or dewatering facilities for digested sludge shall be treated independently or returned immediately preceding the biological process. Supernatant shall not be returned to the primary clarifier.

(e) Dewatering.

(i) Mechanical dewatering. Where provided, mechanical dewatering facilities shall include storage tanks for liquid sludge and shall provide for reliable use.

(ii) Drying beds.

(A) Gravity. Drying beds may be strictly evaporation or evaporation - percolation. Evaporation-percolation beds shall be provided with graded gravel and sand beds over perforated underdrain pipe. Evaporation beds shall be designed for the application of 1.5

feet (0.46 m) of sludge per year. Evaporation - percolation beds shall be designed for the application of four feet (1.2 m) of sludge per year. Storage of sludge in the beds or in separate basins shall provide 180 days of capacity. Percolate shall be returned to the plant ahead of the biological treatment process.

(B) Vacuum. The bed area for vacuum assisted open drying beds shall be based on the application of no more than forty (40) feet (12.2 m) of liquid per year. If the beds are housed, the bed area shall be based on the application of eighty (80) feet (24.4 m) per year. Where beds are not housed, sludge storage shall be provided for 180 days of capacity. Polymer conditioning, chemical feed, chemical storage and facilities for mixing the polymer with the sludge shall be provided. Vacuum pumps, sump pumps, chemical feed equipment and motor control equipment shall be housed.

(iii) Filtrate disposal. Filtrate, centrate or underdrain liquid shall be returned to a point upstream of the biological treatment process. Centrate or filtrate shall not be returned upstream of the primary clarifier.

(f) Disposal.

(i) Degree of stabilization.

(A) Land application. Sludges shall be stabilized. Sludges that are to be used on public lands that are accessed by the public (parks, golf courses, cemeteries) or sludges that are to be made available to the public shall be composted or stabilized and stored for a period of at least one (1) year. Sludges that are to be incorporated into the land shall be stabilized.

"Stabilized sludge" shall have reduced organic content and reduced pathogenic content. Stabilized sludge shall have less than 60 lb of $BOD_5$ per 1,000 lb (60 kg/1,000 kg) of dry weight sludge solids.

(B) Landfill. Sludge processed for incorporation into a landfill shall be (1) a solid or semisolid material that will not release water upon standing, and (2) has been subjected to anaerobic or aerobic digestion, or chemically treated with lime to a pH of 12.0 or chemically treated with chlorine to a free chlorine residual. Waiver of this requirement must be obtained from the Solid Waste Management Section of the Department of Environmental Quality.

(ii) Storage. Sludge storage shall be provided in lined earthen lagoons or structural tanks. The lagoon lining shall be designed to protect the groundwater pursuant to the requirements of Chapter 8 of the Water Quality Divisions rules and regulations. Sludge storage volume shall be sufficiently large to provide for independent operation of the sludge dewatering or disposal facilities from preceding liquid or sludge processes.

**Section 21. Disinfection.**

(a) Chlorination/dechlorination.

(i) Chlorination. The disinfection capacity shall be sized to provide the coliform concentrations required by the discharge permit. Feeders shall be sized to provide the minimum dosage at the minimum flow rate and to the maximum dosage at the maximum flow rate.

(ii) Dechlorination. Dechlorination feeders shall be sized for the final effluent dechlorination dosage required by the discharge permit requirements.

(iii) Chlorination.

(A) Number of units. Feeders shall be able to supply, at all times, the necessary amounts of chemical at an accurate rate (±3%) throughout the range of feed. The number of units shall provide capacity for effluent disinfection with the largest unit out of service and a separate feeder or feeders for ancillary uses, such as prechlorination or intermediate process control chlorination. The number of feeders shall be selected to permit feeding chemicals over the range of required dosage while only varying a single feeder over a 10:1 range.

(B) Chemical storage. Chlorine shall be stored in a heated, ventilated space. Space shall provide at least thirty (30) days of chemical supply, convenient and efficient handling, and dry conditions. Cylinders or other containers of chlorine gas should be isolated from operating areas and restrained in position to prevent upset.

(C) Piping. Piping systems carrying gaseous or liquid 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.

(D) Maximum withdrawal. The maximum withdrawal rate of gaseous chlorine shall be limited to 40 lbs/day (18.1 kg/day) for 100 or 150 lb (45.4 or 68.0 kg) cylinders and 400 lbs/day (181 kg/day) for 2,000 lb (907 kg) cylinders, unless chlorine evaporators are used.

(iv) Dechlorination.

(A) Number of units. Dechlorination equipment shall be provided to permit feeding the design dosage with the largest unit out of service. Feeders shall be sized for a 10:1 feed range.

(B) Chemical storage. Chemical storage shall be in a heated, ventilated room, separate from chlorine cylinder storage. Provisions for heating the storage area or the S0 cylinders shall be provided. Where used, bin storage shall be provided with desiccated vents.

(C) Piping. Piping for liquid or gaseous S0 shall be schedule 80 black steel pipe with forged steel fittings. Bushings shall not be used. Piping for aqueous solutions of dechlorination chemicals shall be PVC, fiber glass, or steel pipe lined with PVC or saran. All valves for liquid and gaseous sulfur dioxide shall be as approved by the Chlorine Institute. Valves for aqueous solution of dechlorination chemicals shall be PVC or saran lined.

(D) Maximum withdrawal.

(I) The maximum withdrawal rate for sulfur dioxide from 2,000 lb (907 kg) cylinders shall be 200 lb (90.7 kg) per day, unless sulfur dioxide evaporators are used.

(v) Makeup water. Water used for dissolving dry chemicals, diluting liquid chemicals or operating chlorine or S0 injectors shall be chlorinated and strained for filtered (65 mesh) final effluent or potable water. Where potable water is used, backflow prevention shall be achieved by (a) a six (6) inch (15.2 cm) air gap between the potable water supply pipe and the maximum water level of a receiving tank; or (b) an approved reduced-pressure-zone backflow preventer.

(vi) Mixing requirements. The feed point for chlorination or dechlorination chemical shall be at a location of high turbulence. At points of critical flow, specially designed static tube mixers or artificial mixing are required.

(vii) Contact basins.

(A) Detention time. The chlorine contact period shall provide a minimum of fifteen (15) minutes contact time at the peak hour design flow. The contact period shall be from the point of chemical injection into the flow to the outfall point or dechlorination feed point.

(B) Baffling. Baffling of the chlorine contact basin shall provide a length-to-width ratio of 5:1 or greater.

(viii) Controls. The minimum control for chlorination-dechlorination facilities shall include manual variation of feed rate and a portable chlorine residual monitor.

(b) Ozonation.

(i) Applied dosage rates. Ozonation system for disinfection shall provide a range of chemical feed as follows:

| | |
|---|---|
| Secondary effluents | 5-15 mg/L |
| Advanced treatment effluents | 5-10 mg/L |

(ii) Piping. 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.

(iii) Mixing requirements. Ozone shall be fed to a contact tank along the length of the tank. The ozone contact tank shall be at least fifteen (15) feet (4.6 m) deep and provided with vertical serpentine baffles. Fine bubble diffusers shall be used in areas where the flow is downward.

(iv) Detention time. The minimum contact time for ozone is 15 minutes at peak hourly flow. Ozone contact basins shall be covered and provided with means to collect and destroy unreacted ozone. The contact basin shall be designed to facilitate maintenance and cleaning without reducing the effectiveness of the ozonation process.

(c) Housing.

(i) Access. Where housing is specially designed for equipment, structures, rooms and areas containing chemical feed equipment used in disinfection, convenient access should be provided. Access to chemical feed rooms shall only be from the outside. Doors shall be provided with panic hardware, and open from the inside to the outside.

(ii) Heating and ventilation. Chemical feed rooms and chemical storage rooms shall be heated and ventilated. Ventilation shall exhaust continuously from near the floor to an outside area that will not contaminate an air inlet to any building. The exhaust shall be screened and turned downward. Continuous ventilation shall provide a complete air change six times per hour. Emergency exhaust ventilation shall provide a complete room air change thirty (30) times per hour. The control for the emergency ventilation fan shall be on the outside of the room.

(iii) Visual inspection. A clear glass, gas-tight window shall be installed in an exterior door or interior wall of the disinfection chemical feed room.

(iv) Isolation. Chemical feed and storage rooms shall be gas-tight. Ventilation, plumbing and access shall be separated from other building parts. When ton cylinders are used for chlorine or sulfur dioxide storage, storage and feed rooms will be separate. Where powdered or granular chemicals are used, they will be stored in separate rooms from the feed room. Switches for fans and lights shall be outside the room at the entrance. Vents from feeders and storage shall discharge to the outside atmosphere above grade. Pipes and feed lines through interior walls shall be gas-tight.

(d) Safety.

(i) Leak detectors. A bottle of ammonium hydroxide shall be available for chlorine leak detection. For plants that store 1,000 lbs (454 kg) or more of chlorine, continuously monitoring leak detectors shall be provided that sound an alarm in the event of an escape of gas.

(ii) Repair kits. Repair kits approved by the Chlorine Institute shall be provided for plants using ton containers or tank cars.

(iii) Personnel equipment. Protective clothing, rubber gloves, and U.S. Bureau of Mines approved industrial canister gas masks shall be provided for each operator who will handle or prepare chemical solutions/mixtures. A respiratory protection program shall be available for all employees.

(iv) Emergency breathing apparatus. Industrial size canister gas masks of the type designed for chlorine gas and approved by U.S. Bureau of Mines shall be available at all installations where chlorine gas is handled. Pressure-demand, self- contained breathing apparatus shall be provided for repairing leaks to chlorine systems. A respiratory protection program shall be available for all employees.

(v) Instruction manuals. Instruction manuals for all elements of the disinfectant storage, preparation and application system shall be provided. These instruction manuals shall describe each component of the system, and provide a complete discussion of the operation and maintenance requirements.

**Section 22. Effluent Structures.**

(a) Location. The location of the effluent discharge shall be at least three (3) miles from public water supply intakes.

(b) Protection from hazards. The outfall sewer shall be constructed and protected against the effects of floodwater, ice, debris, or other hazards as to insure its structural stability and freedom from stoppage. A manhole should be provided at the shore-end of all gravity sewers extending into the receiving waters.

**Section 23. Laboratory requirements.**

(a) Test procedures. Test procedures for analysis of monitoring samples shall conform to regulations published pursuant to Section 304(g) of the Federal Water Pollution Control Act (33 U.S.C. 466 et. seq.).

(b) Testing requirements. All treatment plants shall have capability to perform or contract for the self-monitoring analytical work required by discharge permits or ground water monitoring requirements. All plants shall in addition be capable of performing or contracting out the analytical work required to ensure good management and control of plant operation and performance. Plants operating under requirements of an industrial pretreatment program must have the capability of performing or must contract out the necessary testing to maintain the program as approved by the reviewing agency.

(c) Minimum requirements.

(i) Location and space. 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.

A minimum of 400 square feet (37.2 m²) of floor space shall be provided for the laboratory where an analysis program for a fulltime laboratory chemist is proposed. If more than two persons will be working in the laboratory, 100 square feet (9.3 m²) of additional space shall be provided for each additional person.

(ii) Materials.

(A) Walls. Provide a durable, impervious surface that is easily cleaned.

(B) Doors. Two (2) exit doors or openings shall be located to permit a straight egress from the laboratory; one (1) exit shall be directly to outside of the building. Panic hardware shall be used. Interior doors shall have glass windows.

(C) Cabinets and bench tops. Cabinet and storage space shall be provided for dust-free storage of instruments and glassware.

Bench top height shall be thirty-six (36) inches (0.91 m). Tops should be field joined into a continuous surface with acid, alkali, and solvent-resistant cements.

(D) Hoods. Fume hoods shall be provided where reflux or heating of toxic or hazardous materials is required.

(I) Fume hoods.

(1.) Location. A hood shall not be situated near a doorway, unless a secondary means of egress is provided.

(2.) Fixtures. All switches, electrical outlets, and utility and baffle adjustment handles shall be located outside the hood. Light fixtures shall be explosion proof.

(3.) Exhaust. Twenty-four (24) hour continuous exhaust capability shall be provided. Exhaust fans shall be explosion proof.

(v) Sinks. The laboratory shall have a minimum of two (2) sinks per 400 ft (121.92 m) (not including cup sinks). Sinks shall be double-well with drainboards and shall be made of epoxy resin or plastic. All water fixtures shall be provided with reduced pressure zone backflow preventers. Traps constructed of glass, plastic, or lead and accessibility for cleaning shall be provided.

(vi) Ventilation and lighting. Laboratories shall be separately air conditioned, with external air supply for 100 percent makeup volume. Separate exhaust ventilation shall be provided. Ventilation outlet locations shall be remote from ventilation inlets.
Lighting shall provide 100 foot-candles at the bench top.

(vii) Gas and vacuum. If gas is required in the laboratory, natural gas shall be supplied. Digester gas shall not be used.

(viii) Water still. Distilled water shall conform to the Standard Methods for the Examination of Water and Wastewater, 15th Edition.

(ix) Emergency shower and eye wash. All laboratories shall be equipped with an emergency eye wash and shower.

(d) Portable testing equipment. Portable testing equipment shall be provided where necessary for operational control testing or industrial waste testing. Portable testing may be used for testing as necessary, provided the testing procedure meets the requirements of Section 304(g) of the Federal Water Pollution Control Act, if the results are to be used for permit reporting. Non-EPA certified procedures may be used for operational control or gross data generation.

**Section 24. Operation and Maintenance Manuals.**

(a) Where required. Plant operation and maintenance manuals are required for each new or modified treatment or pumping facility. The manuals shall provide the following information as a minimum:

(i) Introduction.

(ii) Description of facilities and unit processes through the plant from influent structures through effluent structures.

(iii) Plant control system.

(iv) Utilities and systems.

(v) Emergency operation and response.

(vi) Permit requirements and other regulatory requirements.

(vii) Staffing needs.

(viii) Index to manufacturer's manuals.

(b) When required. Draft operation and maintenance manuals shall be submitted to the Department of Environmental Quality at 50 percent completion of construction. Approval of the final operation and maintenance manuals is required prior to plant startup.

(c) Description and facilities. The description of facilities and unit processes shall include the size, capacity, model number (where applicable) and intended loading rate.

(i) Each unit. The manual shall describe each unit, including the function, the controls, the lubrication and maintenance schedule, as well as the following:

(A) Startup operations.

(B) Routine operations.

(C) Abnormal operations.

(D) Emergency or power outage operations.

(E) Bypass procedures.

(F) Safety.

(ii) Flow diagrams. The manual shall provide flow diagrams of the entire process, as well as individual unit processes. The flow diagrams shall show the flow options under the various operational conditions listed above.

(d) Operating parameters. The O&M manual shall provide the design criteria for each unit process. The data shall include the number, type, capacity, sizes, etc., and other information, as applicable.

(e) Troubleshooting guide. Each equipment maintenance manual shall include a section on troubleshooting. These manuals are to be indexed in the plant O&M manual. The troubleshooting guide shall include a telephone number for factory troubleshooting assistance.

(f) Emergency procedures. The plant O&M manual shall detail emergency operations procedures for possible foresee able emergencies, including power outage, equipment failure, development of unsafe conditions, oil and hazardous substances discharge into the plant, and other emergency conditions. The details shall include valve positions, flow control settings, and other information to insure continued operation of the facility at maximum possible efficiency.

The manual shall also detail emergency notification procedures to be followed to protect health and safety under various emergency conditions.

(g) Safety. The manual shall provide general information of safety in and around the plant and its components. Each unit process discussion shall include applicable safety procedures and precautions. For unit processes or operations having extreme hazards (i.e., chlorine, closed tanks, etc.) the discussion shall detail appropriate protection, rescue procedures, and necessary safety equipment.

(h) Compliance submittals. The O&M manual shall summarize the monitoring and the reporting requirements of the discharge permit. These requirements will be modified from time-to-time, and should, therefore, be placed in an appendix to the O&M manual.

(i) Maintenance manuals. Maintenance manuals shall be required for each piece of equipment. These manuals must meet the requirements of the engineer and contractor for installation and startup of equipment. The information included in the manufacturers' manuals shall not be included in the O&M manual.

(i) General content of manuals.

(A) Neatly typewritten table of contents for each volume, arranged in a systematic order.

(B) Product data.

(C) Drawings.

(D) Written text as required to supplement product data for the particular installation.

(E) Copy of each warranty, bond and service contract issued.

(ii) Manuals for equipment and systems.

(A) Description of unit and component parts.

(B) Operating procedures.

(C) Maintenance procedures and schedules.

(D) Service and lubrication schedule.

(E) Sequence of control operation.

(F) Parts list.

(G) Recommended spare parts.

## PART C: COMMERCIAL/INDUSTRIAL WASTE AND WASTEWATER FACILITIES

### Section 25. General.

This part contains the minimum standards for the design and construction of commercial/ industrial wastewater facilities. The applicant shall demonstrate to the Administrator that any discharge or seepage from the wastewater facility will not cause a violation of the Surface and/ or Groundwaters of the State in accordance with Chapter 1, "Quality Standards for Wyoming Surface Waters" and Chapter 8, "Quality Standards for Wyoming Groundwaters." Due to the wide variety of wastes, wastewater and site conditions, the latest available scientific information shall be used to demonstrate that violations will not occur.

### Section 26. Discharge to Public Sewerage System.

The discharge of commercial/industrial wastewater to a public sewerage system shall be allowed provided a letter of verification from the public sewerage system manager is submitted to the Department of Environmental Quality stating that the municipal system is capable of handling the added organic and/or hydraulic loads. The applicant shall demonstrate (1) that the wastewater will not adversely impact the treatment works and/or discharge or (2) that pretreatment of the wastewater shall be provided to eliminate the adverse impacts. The design and construction of any pretreatment device shall reduce the pollutants to the limits imposed by the public sewerage system manager.

### Section 27. Domestic Wastes from Commercial/Industrial Facilities.

Commercial/industrial facilities that generate waste that is entirely domestic waste shall be designed in compliance with Part B of Chapter 11 or Chapter 25. When the commercial/industrial facility generates a combined domestic and commercial/industrial waste, the facility may be designed in compliance with Chapter 25 or Part B of this chapter provided the applicant can demonstrate that the commercial/ industrial waste will not interfere or adversely impact the treatment works or the discharge.

### Section 28. Biological Treatment Ponds.

This section includes the standards for ponds that accept commercial/ industrial waste and wastewater that is primarily organic and utilizes biological organisms for treatment and do not meet the requirements of Section 27. The presence of toxic wastes, hazardous substances, and/or petroleum products shall not interfere or adversely impact the treatment process or disposal system.

(a) Location.

(i) Extraneous surface water and groundwater shall be excluded from entering the wastewater pond or entering the wastewater flow into the pond.

(ii) Ponds shall not be located within the ordinary high water mark of perennial rivers, streams, or creeks; nor in the bottoms of rivers, streams, creeks, draws, coulees, or other natural drainages into which natural runoff may flow and/or enter.

(iii) Ponds shall be protected from structural damage during the 100-year flood event.

(b) Basis of design.

(i) Aerobic, facultative, and anaerobic ponds shall be designed based on the type, strength characteristics, and anticipated flow rates of the wastewater. Loading rates shall be determined on a case-by-case basis using the best available technology, reference, and/or pilot studies. The effect of any toxic wastes, hazardous substances, and/or petroleum products on the wastewater treatment works and disposal system shall be evaluated. All anaerobic ponds shall be followed by an aerobic process if the system discharges to Surface Waters of the State.

When seepage is considered part of the design, the potential effect of groundwater mounding on the seepage rate shall be evaluated.

(ii) In addition to the above, all nonsurface water discharging ponds shall be designed on the basis of a water balance that considers net evaporation and seepage. They shall be designed to provide sufficient storage for retention of all wastewater and rainfall during the wettest occurring year of a ten-year period. Seepage shall be controlled to maintain a minimum water depth of two feet in the primary cell during the driest occurring year of a ten-year period.

(c) Pond layout.

(i) Discharging treatment systems and ponds that require liners to protect groundwater shall consist of a minimum of two (2) cells. The largest cell shall not contain more than 55 percent of the total waste volume at the design capacity.

(ii) Inlet structures shall be submerged and located to properly distribute the wastewater flow throughout the pond(s) and shall prevent short circuiting. Influent wastewater shall not erode or disturb the liner, seal, or dike. Submerged multiple inlets are recommended. The pipe shall discharge at least ten (10) feet from the toe of the slope.

(iii) Outlet structures from discharging treatment systems shall be capable of multilevel drawoff and have an overflow device. Outlet structures shall prevent short circuiting, prevent floating debris from discharging, and keep outlet velocities at a minimum so as not to erode or disturb the receiving channel. Erosion control material shall be designed based on flow velocities and quantities. Ice formation shall neither stop the overflow nor damage the outlet structure.

(iv) All pipe protruding through a dike or embankment shall have adequate seepage controls. Capabilities shall exist to drain the ponds for maintenance purposes. Bypass piping for each individual pond cell shall be provided.

(v) A manhole or vented cleanout wye shall be installed prior to the entrance of the influent pipe into the primary pond(s) and shall be located as close to the dike as topography permits. The influent pipe invert should be at least six (6) inches above the maximum operating level of the pond.

(vi) The maximum water depth shall be six (6) feet in the primary cell(s) of non-aerated aerobic or facultative systems. The maximum water depth shall be fifteen (15) feet in aerated cells. The maximum water depth for subsequent cells or other types of ponds shall be determined on a case-by-case basis.

The minimum water depth shall be three (3) feet in the primary cell(s) and two feet in subsequent cell(s). Cells designed for high-rate infiltration may be allowed to be dry periodically provided that the applicant can demonstrate that vegetation will be controlled and a regular maintenance program is provided.

(vii) Free board shall be provided to protect embankments and dikes from overtopping from wave action, and shall be a minimum of three (3) feet above the high water level. For ponds less than two (2) acres, two (2) feet of freeboard may be acceptable.

(d) Pond construction.

(i) Soils used in constructing the pond bottom and dike cores (not including the liner) shall be relatively incompressible, have a low permeability, and be free from organic material or trash. The soil shall be compacted at a water content that will insure structural stability, minimize hydraulic seepage, and minimize settling. The soil shall provide an adequate foundation for the liner, if used.

(ii) On ponds that are not specified to receive an artificial liner, no rocks larger than six (6) inches in length shall be permitted in any of the designated embankment.

On ponds that are specified to be lined with an artificial liner, rocks larger than six (6) inches in length shall not be placed within five (5) feet of the interior slope of any pond embankment. Material containing by volume less than 25 percent of rock larger than six (6) inches and less than twelve (12) inches in length may be placed in the remainder of the embankment.

(iii) Outer dike slopes shall not be steeper than one vertical to two horizontal. Flatter slopes may be required to maintain slope stability. Outer dike slopes shall prevent surface runoff from entering the ponds.

Inner dike slopes shall be sloped between one (1) vertical to four (4) horizontal and one (1) vertical to three (3) horizontal. Flatter inner slopes may be allowed where vegetation due to the shallower slopes will not interfere with treatment or the dike's integrity. Interior slopes surfaced with concrete paving or riprap may be constructed at slopes of one (1) vertical to two (2) horizontal.

(iv) The minimum top dike width shall be eight (8) feet to permit access of maintenance vehicles. Top dikes wider than eight (8) feet shall be required when necessary to ensure structural stability.

(v) The pond bottom shall be sufficiently flat to insure a minimum water depth as required in Section 28 (c)(vi).

(e) Dike protection.

(i) Interior embankments shall be protected from wave action with riprap, paving, or other erosion resistant material. The following conditions may be exempted from the riprap requirements:

(A) Ponds of one (1) surface acre or less;

(B) Ponds with an artificial liner;

(C) Embankments cut into natural slopes when a soil liner is not provided; or

(D) Ponds that are sheltered from wind or where winds are slow enough that significant erosion will not occur.

(ii) Exterior of dikes, top of dikes, and all interior dike surfaces where riprap or a seal is not provided shall be covered with topsoil and seeded with suitable dryland grasses to prevent erosion. A uniform coarse graded gravel may be substituted for the vegetation requirement.

(f) Liners.

(i) Seepage limits. The seepage through the pond bottom and side walls shall not cause a violation of the groundwater standards as described in Chapter 8 (Quality Standards for Wyoming Groundwaters) of the Wyoming Department of Environmental Quality, Water Quality Rules and Regulations. Liners shall be required if the wastewater characteristics or site conditions will not insure the protection of the groundwater for which it is classified.

If the applicant cannot document that the facility poses no threat to groundwater and elects not to perform a subsurface study in accordance with Chapter 3, Section 15(a) and (b), then the groundwater shall be protected from contamination by the wastewater with a liner equivalent to three (3) feet of soil having a permeability of $10^{-7}$ cm/sec or less. When an applicant performs a subsurface study, the requirement for the liner shall be determined based on the results of the study and the groundwater protection required. In no instance shall the maximum seepage rate exceed 1/8 inch per day in the primary pond(s).

(ii) Soil and bentonite liners. The specifications for a soil or bentonite liner shall be based upon the results of a preliminary testing program and shall contain at a minimum the type of material, optimum and acceptable range in water content, acceptable range for compaction, and maximum allowable particle size.

Soil or bentonite liners used to protect groundwater quality shall meet the following criteria: Written certification that the soil liner was constructed in accordance with specifications shall be provided by a Wyoming registered professional engineer or an independent soils laboratory. Tests for water content and density shall be taken during application of each lift. Additionally, either permeability testing of undisturbed core samples from the in-place seal, or detailed tests such as particle size distribution and Atterburg limits confirming that the soil used in the liner construction was the same soil initially tested, shall be provided. In all cases, at least one test shall be provided per acre per lift, except for core sampling of the in-place liner, where one core of the completed liner shall be tested per acre.

(iii) Synthetic liners. The thickness requirements for synthetic liners shall be determined on a case-by-case basis but shall not be less than 30 mil. The type of liner shall be compatible with the wastewater characteristics. The synthetic liner shall have a permeability equivalent to that required in Section 28(f)(i).

Synthetic liners shall be anchored to prevent movement, slippage, and flotation. The synthetic liner shall be protected from degradation by ultraviolet light, ice damage and settling of underdrain trenches. An air venting system may be required beneath the synthetic liner to expel gases trapped during installation, produced by decomposing organic material, or produced by a fluctuating water table.

(iv) Uniformity. The pond bottom shall be smooth with a maximum tolerance of ± 6 inches.

(v) Prefilling. All ponds shall be prefilled to the two foot level to protect the liner, to prevent weed growth, to encourage rapid startup of the biological process and discourage odor, to reduce freeze up problems for late fall startups, to confirm the seal's integrity and to maintain the water of the seal at or above optimum conditions. The raw wastewater shall not be used for prefilling purposes except for anaerobic ponds.

(vi) Exfiltration evaluation. All ponds designated with a maximum exfiltration rate shall be tested for exfiltration. A maximum exfiltration rate not in excess of the design rate shall be deemed acceptable. If the exfiltration rate is deemed excessive, the seal shall be repaired and the test procedure repeated. This procedure shall be repeated until the maximum exfiltration rate criteria is met. Results of all testing shall be submitted to DEQ.

(g) Miscellaneous. A permanent flow measuring device shall be installed at the outfall of discharging pond sites and shall measure the effluent under all climatic conditions. The accuracy of the flow measuring device must be within ten percent of the actual flow. Ponds with a maximum daily discharge of less than 50,000 gallons per day may be exempted from installing a permanent flow measuring device.

**Section 29. Feedlots.**

This section includes the standards for wastewater retention systems for feedlot runoff. The basic concept of retention systems is to intercept and collect runoff and wastes from the animal feeding area until it can be disposed of via land application. Although retention systems are usually the most economical method of treatment, other systems will be evaluated on a case-by-case basis.

(a) Location.

(i) Groundwater shall be excluded from entering the wastewater pond or the wastewater flow into the pond.

(ii) Ponds shall not be located within the ordinary highwater mark of perennial rivers, streams, or creeks. Ponds not containing hazardous or toxic wastes may be located within the ordinary high water mark of intermit tent rivers, streams, creeks, draws, coulees, or other natural drainages provided a by-pass ditch is installed capable of passing the 24-hour - 100 -year precipitation event.

(iii) The wastewater retention system shall be as near to the animal feeding operation as possible to keep construction to a minimum. The retention ponds shall be located outside the pen area for safety and maintenance purposes. Sufficient space must be left between streams or drainage areas to allow construction of the necessary collection ditches and retention ponds.

(b) Basis of design. All livestock confinement areas, alleyways, etc., shall be graded to prevent accumulation of surface waters and to drain all contaminated water to the retention system. Collection ditches shall be provided when necessary to intercept contaminated water. The wastewater retention system shall be designed to contain the 25-year, 24-hour precipitation event. Wastewater in the retention pond shall be removed and disposed of as soon as possible after a precipitation event. The applicant shall demonstrate that equipment is available for removing the wastewater.

(i) Diversion ditches. The animal feeding area shall be protected with diversion ditches that will direct uncontaminated runoff from areas above and adjacent to the site away from the ponds and shall be capable of diverting the 25-year, 24-hour precipitation event.

(ii) Collection ditches. Collection ditches shall be constructed around the feeding area to intercept the contaminated runoff and transport it to the settling and/or retention pond. The depth shall be adequate to handle the design flow and shall have a bottom slope sufficient to produce a velocity of not less than two (2) feet per second. Side slopes shall not be steeper than eight (8) horizontal to one (1) vertical.

(iii) Settling pond. A settling pond ahead of the retention pond is recommended to accumulate the solids in the waste flow and to simplify their removal and final

disposal. The surface area shall be sized to reduce the flow velocity below one (1) foot per second to allow settling of solids. The pond shall be between three (3) to six (6) feet deep to allow sufficient capacity for holding the solids and yet allow easy removal of the solids. The outlet structure shall minimize the overflow of solids into the retention pond.

(iv) Retention pond. The retention pond shall be capable of containing all runoff from the feeding area for the design storm until the contaminated runoff can be disposed. If a settling pond is not provided before the retention pond, the design volume shall be increased by 10 percent to accommodate collection of solids.

(c) Retention pond layout.

(i) The shape and depth shall facilitate ease of cleaning and maintenance. A minimum freeboard of 1.5 feet shall be required above the high water level of the spillway.

(ii) Spillways shall be provided on all retention ponds to pass flows in excess of the 25 year, 24-hour precipitation event. The spillway shall be placed above the design high water level.

(d) Retention pond construction. The retention pond construction shall meet the following requirements:

(i) Soils used in constructing the pond bottom and dike cores (not including the liner) shall be relatively incompressible, have a low permeability, and be free from organic material or trash. The soil shall be compacted at a water content that will insure structural stability, minimize hydraulic seepage, and minimize settling. The soil shall provide an adequate foundation for the liner, if used.

(ii) On ponds that are not specified to receive an artificial liner, no rocks larger than six inches in length shall be permitted in any of the designated embankments.

On ponds that are specified to be lined with an artificial liner, rocks larger than six (6) inches in length shall not be placed within five (5) feet surface of the interior slope of any pond embankment. Material containing by volume less than 25 percent of rock larger than six (6) inches and less than twelve (12) inches in length may be placed in the remainder of the embankment.

(iii) Outer dike slopes shall not be steeper than one (1) vertical to two (2) horizontal. Flatter slopes may be required to maintain slope stability.

Inner dike slopes shall be sloped between one (1)vertical to four (4) horizontal and one (1) vertical to three (3) horizontal. Flatter inner slopes may be allowed where vegetation due to the shallower slopes will not interfere with treatment or the dike's integrity. Interior slopes surfaced with concrete paving or riprap may be constructed at slopes of one (1) vertical to two (2) horizontal.

(iv) The minimum top dike width shall be eight (8) feet to permit access of maintenance vehicles. Top dikes wider than eight feet (8) shall be required when necessary to ensure structural stability.

(v) The pond bottom may be sloped to facilitate pumping but shall not exceed a 0.5 percent slope.

(e) Liners.

(i) Seepage limits. The seepage through the pond bottom and side walls shall not cause a violation of the groundwater standards as described in Chapter 8 (Quality Standards for Wyoming Groundwaters) of the Wyoming Department of Environmental Quality, Water Quality Rules and Regulations. Liners shall be required if the wastewater characteristics or site conditions will not insure the protection of the groundwater for which it is classified.

If the applicant cannot document that the facility poses no threat to groundwater and elects not to perform a subsurface study in accordance with Chapter 3, Section 15(a) and (b), then the groundwater shall be protected from contamination by the wastewater with a liner equivalent to three (3) feet of soil having a permeability of $10^{-7}$ cm/sec or less. When an applicant performs a subsurface study, the requirement for the liner shall be determined based on the results of the study and the groundwater protection required. In no instance shall the maximum seepage rate exceed 1/8 inch per day in the primary pond(s).

(ii) Soil and bentonite liners. The specifications for a soil or bentonite liner shall be based upon the results of a preliminary testing program and shall contain at a minimum the type of material, optimum and acceptable range in water content, acceptable range for compaction, and maximum allowable particle size.

Soil or bentonite liners used to protect groundwater quality shall meet the following criteria: Written certification that the soil liner was constructed in accordance with specifications shall be provided by a Wyoming registered professional engineer or an independent soils laboratory. Tests for water content and density shall be taken during application of each lift. Additionally, either permeability testing of undisturbed core samples from the in-place seal, or detailed tests such as particle size distribution and Atterburg limits confirming that the soil used in the liner construction was the same soil initially tested, shall be provided. In all cases, at least one test shall be provided per acre per lift, except for core sampling of the in-place liner, where one core of the completed liner shall be tested per acre.

(iii) Synthetic liners. The thickness requirements for synthetic liners shall be determined on a case-by-case basis but shall not be less than 30 mils. The type of liner shall be compatible with the wastewater characteristics. The synthetic liner shall have a permeability equivalent to that of Section 29(e)(i).

Synthetic liners shall be anchored to prevent movement, slippage, and flotation. The synthetic liner shall be protected from degradation by ultraviolet light, ice damage and settling of underdrain trenches. An air venting system may be required beneath the synthetic liner to expel

gases trapped during installation, produced by decomposing organic material, or produced by a fluctuating water table.

(iv) Exfiltration evaluation. All ponds designated with a maximum exfiltration rate shall be tested for exfiltration. A maximum exfiltration rate not in excess of the design rate shall be deemed acceptable. If the exfiltration rate is deemed excessive, the seal shall be repaired, and the test procedure repeated. This procedure shall be repeated until the maximum exfiltration rate criteria is met. Results of all testing shall be submitted to the Department of Environmental Quality.

**Section 30. Non-biological Treatment Ponds.**

This section includes the standards for non-biological treatment ponds or ponds that accept commercial/industrial waste or wastewater that is primarily non-biological in nature and does not utilize biological organisms for treatment. Radiological effects considered by the Nuclear Regulatory Commission (NRC) from non-surface discharging treatment works within a NRC licensed permit boundary are exempt from this section.

(a) Location.

(i) Extraneous surface water and groundwater shall be excluded from entering the wastewater pond or entering the wastewater flow into the pond.

(ii) Ponds shall not be located within the ordinary high water mark of perennial rivers, streams, or creeks. Ponds not containing hazardous or toxic wastes may be located within the ordinary high water mark of intermit tent rivers, streams, creeks, draws, coulees, or other natural drainages provided a by-pass ditch is installed capable of passing the 24-hour - 100-year precipitation event. All other ponds shall be protected from structural damage during the 100-year flood event.

(b) Basis of design.

(i) Ponds shall be designed based on the type of wastewater, the wastewater strength characteristics, and the anticipated flow rates. Loading rates shall be determined on a case-by-case basis using the best available technology, reference, and/or pilot studies. The effect of any toxic wastes, hazardous substances, and/or petroleum products on the wastewater treatment process and disposal system shall be evaluated.

Where seepage is considered part of the design, the potential effect of groundwater mounding on the seepage rate must be evaluated.

(ii) In addition to the above, non-surface water discharging ponds shall be designed on the basis of a water balance that considers net evaporation and seepage. Non-discharging ponds shall be designed to provide sufficient storage to retain all wastewater and rainfall during the wettest occurring year of a ten year period.

(c) Pond layout.

(i) Discharging treatment systems and ponds that require liners to protect groundwater shall consist of a minimum of two cells. The largest cell shall not contain more than 55 percent of the total waste volume at the design capacity.

(ii) Inlet and intracell structures for discharging treatment systems shall prevent short circuiting, and shall not erode or disturb the liner, seal or dike.

(iii) Outlet structures from a discharging treatment system shall have an overflow device, prevent short circuiting, prevent floating debris from discharging, and keep outlet velocities to a minimum so as not to erode or disturb the receiving channel. Erosion control material shall be designed based on flow velocities and quantities. Ice formation shall neither stop the overflow nor damage the outlet structure.

(iv) All pipe protruding through a dike or embankment shall have adequate seepage controls. Capabilities shall exist to drain the ponds for maintenance purposes.

(v) A manhole or vented cleanout wye shall be installed prior to the entrance of the influent pipe into the primary pond(s) and shall be located as close to the dike as topography permits. The influent pipe invert should be at least six (6) inches above the maximum operating level of the pond.

(vi) The maximum and minimum water depth shall be determined on a case-by-case basis. However, the design engineer must demonstrate that ponds with less than two (2) feet water depth will not have vegetation problems.

(vii) Free board shall be provided to protect embankments and dikes from overtopping from wave action, and shall be a minimum of three (3) feet above the high water level. For ponds less than two (2) acres, two (2) feet of freeboard may be acceptable.

(d) Pond construction.

(i) Soils used in constructing the pond bottom and dike cores (not including the liner) shall be relatively incompressible, have a low permeability, and be free from organic material or trash. The soil shall be compacted at a water content that will insure structural stability, minimize hydraulic seepage, and minimize settling. The soil shall provide an adequate foundation for the liner, if used.

(ii) On ponds that are not specified to receive an artificial liner, no rocks larger than six (6) inches in length shall be permitted in any of the designated embankment.

On ponds that are specified to be lined with an artificial liner, rocks larger than six (6) inches in length shall not be placed within five (5) feet of the interior slope surface of any pond embankment. Material containing by volume less than 25 percent of rock larger than six (6)

inches and less than twelve (12) inches in length may be placed in the remainder of the embankment.

(iii) Outer dike slopes shall not be steeper than one (1) vertical to two (2) horizontal. Flatter slopes may be required to maintain slope stability. Outer dike slopes shall prevent surface runoff from entering the ponds.

Inner dike slopes shall be sloped between one (1) vertical to four (4) horizontal and one (1) vertical to three (3) horizontal. Flatter inner slopes may be allowed where vegetation due to the shallower slopes will not interfere with treatment or the dike's integrity. Interior slopes surfaced with concrete paving or riprap may be constructed at slopes of one (1) vertical to two (2) horizontal.

(iv) The minimum top dike width shall be eight (8) feet to permit access of maintenance vehicles. Top dikes wider than eight (8) feet shall be required when necessary to ensure structural stability.

(e) Dike protection.

(i) Interior embankments shall be protected from wave action with riprap, paving, or other erosion resistant material. The following conditions may be exempted from the riprap requirements:

(A) Ponds of one (1) surface acre or less:

(B) Ponds with an artificial liner;

(C) Embankments cut into natural slopes where a soil liner is not provided; or

(D) Ponds that are sheltered from wind or where winds are slow enough that significant erosion will not occur.

(ii) Exterior of dikes, top of dikes, and all interior dike surfaces where riprap or a seal is not provided shall be covered with topsoil and seeded with suitable dryland grasses to prevent erosion. A uniform coarse graded gravel may be substituted for the vegetation requirement.

(f) Liners.

(i) Seepage limits. The seepage through the pond bottom and side walls shall not cause, a violation of the groundwater standards as described in Chapter 8 (Quality Standards for Wyoming Groundwaters) of the Wyoming Department of Environmental Quality, Water Quality Rules and Regulations. Liners shall be required if the wastewater characteristics or site conditions will not insure the protection of the groundwater for which it is classified.

If the applicant cannot document that the facility poses no threat to groundwater and elects not to perform a subsurface study in accordance with Chapter 3, Section 15(a) and (b), then the groundwater shall be protected from contamination by the wastewater with a liner equivalent to three (3) feet of soil having a permeability of $10^{-7}$ cm/sec or less. When an applicant performs a subsurface study, the requirement for the liner shall be determined based on the results of the study and the groundwater protection required. In no instance shall the maximum seepage rate exceed 1/8 inch per day in the primary pond(s).

(ii) Soil and bentonite liners. The specifications for a soil or bentonite liner shall be based upon the results of a preliminary testing program and shall contain at a minimum the type of material, optimum and acceptable range in water content, acceptable range for compaction, and maximum allowable particle size.

Soil or bentonite liners used to protect groundwater quality shall meet the following criteria. Written certification that the soil liner was constructed in accordance with specifications shall be provided by a Wyoming registered professional engineer or an independent soils laboratory. Tests for water content and density shall be taken during application of each lift. Additionally, either permeability testing of undisturbed core samples from the in-place seal, or detailed tests such as particle size distribution and Atterburg limits confirming that the soil used in the liner construction was the same soil initially tested, shall be provided. In all cases, at least one test shall be provided per acre per lift, except for core sampling of the in-place liner, where one core of the completed liner shall be tested per acre.

(iii) Synthetic liners. The thickness requirements for synthetic liners shall be determined on a case-by-case basis but shall not be less than 30 mils. The type of liner shall be compatible with the wastewater characteristics. The synthetic liner shall have a permeability equivalent to that of Section 30(f)(i).

Synthetic liners shall be anchored to prevent movement, slippage, and flotation. The synthetic liner shall be protected from degradation by ultraviolet light, ice damage and settling of underdrain trenches. An air venting system may be required beneath the synthetic liner to expel gases trapped during installation, produced by decomposing organic material, or produced by a fluctuating water table.

(iv) Prefilling. For soil or bentonite liners, a method of maintaining the seal at or above optimum moisture conditions is required.

(v) Exfiltration evaluation. All ponds designated with a maximum exfiltration rate shall be tested for exfiltration. A maximum exfiltration rate not in excess of the design rate shall be deemed acceptable. If the exfiltration rate is deemed excessive, the seal shall be repaired and the test procedure repeated. This procedure shall be repeated until the maximum exfiltration rate criteria is met. Results of all testing shall be submitted to the Department of Environmental Quality.

(g) Miscellaneous. A permanent flow measuring device shall be installed at the outfall of discharging pond sites and shall measure the effluent under all climatic conditions. The

accuracy of the flow measuring device must be within ten percent of the actual flow. Ponds with a maximum daily discharge of less than 50,000 gallons per day may be exempted from installing a permanent flow measuring device.

**Section 31. Sedimentation Control Facilities.**

This section includes the standards for sedimentation control facilities. Those sedimentation control facilities that are regulated under Water Quality Rules and Regulations, Chapter 2, Appendix J, "Additional Requirements Applicable to Coal Mining Operations" are exempted from this section.

(a) Location. The sedimentation control facilities shall be as near to the affected lands as possible to keep construction and containment volumes to a minimum. Sedimentation control facilities shall be located off-channel when possible. Runoff from unaffected lands should be by-passed around the containment area. All affected lands must drain to a sedimentation control facility.

(b) Basis of design. Sedimentation control facilities shall control all runoff from areas that drain into the facility from a 10-year 24-hour precipitation event in addition to the estimated sediment storage volume for one (1) year be always available. The pond shall be drained down to the permanent pool level as soon as the effluent meets the discharge parameters. The applicant shall demonstrate that equipment or outlet structures are available for draining the pond.

(c) Layout.

(i) Inlet ditches or structures shall not erode or disturb the pond bottom.

(ii) Outlet structures, if used, shall have an overflow device, prevent short-circuiting, prevent floating debris from discharging and shall not erode or disturb the dike. All pipe protruding through a dike shall have adequate seepage control. The point of discharge into a channel shall be protected against erosion and erosion control devices shall be designed based on flow velocities.

(iii) Spillways. Sedimentation control facilities that individually contain more than 2.0 acre-feet of runoff or that individually have more than 2.0 acres of surface area or that are located on-channel shall have a spillway to by-pass precipitation events in excess of the design event. Spillways shall safely pass the 25-year flood event except when the impoundment height is greater than twenty feet or capacity exceeds twenty acre-feet; in which case the spillway shall safely pass the 100-year flood event.

(iv) By-pass ditches. If by-pass ditches are provided to transport runoff from unaffected lands, they shall be designed to pass the runoff from a 25-year precipitation event.

(v) Freeboard. Freeboard shall be provided to protect embankments and dikes from overtopping from wave action and shall be a minimum of one (1) foot above the high water level. For ponds less than two (2) acres, one-half (1/2) foot of freeboard may be acceptable.

(d) Construction.

(i) Soils used in constructing the pond bottom and dike cores shall be relatively incompressible, have a low permeability, and be free from organic material or trash. The soil shall be compacted at a water content that will insure structural stability, minimize hydraulic seepage, and minimize settling.

Rocks larger than six (6) inches in length shall not be placed within five (5) feet of the interior slope surface of any pond embankment. Material containing by volume less than 25 percent of rock larger than six (6) inches and less than twelve (12) inch in length dimension may be placed in the remainder of the embankment.

(ii) Outer dike slopes shall not be steeper than one (1) vertical to two (2) horizontal. Flatter slopes may be required to maintain slope stability. Inner dike slopes shall be sloped between one (1) vertical to four (4) horizontal and one (1) vertical to three (3) horizontal.

(iii) The minimum top dike width shall be sufficient to provide structural stability.

(iv) Riprap or other acceptable erosion control shall be installed on the inner dike slopes at all anticipated levels of water. Dikes cut into existing ground shall be exempted from riprap requirements. Ponds that have less than 2.0 acres of surface area shall also be exempted.

## PART D: SEPTIC TANK AND/OR SOIL ABSORPTION SYSTEMS AND OTHER SMALL WASTEWATER SYSTEMS

**Section 32. Reserved.**

**Section 33. Reserved.**

**Section 34. Reserved.**

**Section 35. Reserved.**

**Section 36. Reserved.**

**Section 37. Reserved.**

**Section 38. Reserved.**

**Section 39. Reserved.**

**Section 40. Reserved.**

**Section 41. Reserved.**

**Section 42. Reserved.**

**Section 43. Reserved.**

**Section 44. Reserved.**

**Section 45. Reserved.**

**Section 46. Reserved.**

**Section 47. Reserved.**

## PART E: STANDARDS FOR THE APPLICATION OF BIOSOLIDS AND THE REUSE OF TREATED NON-DOMESTIC WASTEWATER

### Section 48. General.

This part contains the minimum standards for the design and construction of waste and wastewater land application facilities.

The permitting of biosolids facilities or the land application of biosolids is regulated by the U.S. Environmental Protection Agency (EPA) under the Code of Federal Regulations at 40 CFR Part 503. In cases where the EPA does not issue a permit under 40 CFR 503, the Wyoming Department of Environmental Quality, Water Quality Division (WDEQ/WQD) will issue a permit. The WQD will require applicants to comply with the requirements of 40 CFR § 503.12, § 503.13, and § 503.14. The permit applications and permits will be reviewed and processed according to Chapter 3 of the Water Quality Rules and Regulations.

### Section 49. Definitions Specific to Part E.

(a) "Overland flow land application system" is a system in which treatment is accomplished by the application of wastewater to a sloping, largely impermeable site. Treatment mechanisms include filtration, sedimentation, microbial oxidation, and crop uptake. Typical application rates range from 0.0392-0.3136 $yd^3/yd/hr$.

(b) "Primary treatment level" (as related to pathogenic organism reduction) is that level of fecal coliform reduction (a minimum of 25 percent reduction) achievable by primary sedimentation in single cell discharging lagoons operated within the limits described in Part B, Section 13(c).

(c) "Biosolids" are solid, semi-solid, or liquid residue generated during the treatment of domestic sewage in a treatment works. Biosolids include, but are not limited to, domestic septage; scum or solids removed in primary, secondary, or advanced wastewater treatment processes; and a material derived from biosolids. Biosolids do not include ash generated during the firing of biosolids in a biosolids incinerator or grit and screenings generated during preliminary treatment of domestic sewage in a treatment works.

### Section 50. Site Requirements.

(a) The method for determining the size of a particular land site for accomplishing the treatment level necessary to comply with an NPDES permit or to maintain a groundwater aquifer within its present class shall be based on the number of acres (hectares) required to reduce the waste constituent identified as requiring the largest land area, based on soil assimilative capacity. The ratio used for this determination is expressed as:

Required Land Treatment Area = G/C

Where:

G = generation rate = the yearly amount of the controlling constituent to be applied for land treatment. G is listed in kilograms per year (kg/yr) or pounds per year (lbs/yr).

C = plant-soil assimilative capacity = the yearly amount of the controlling constituent that can be assimilated by plant uptake, soil adsorption and accumulation, transformation or degradation, and allow survival and maintenance of indigenous or crop plant species. C is listed in kilograms per hectare per year (kg/ha/yr) or pounds per acre per year (lbs/ac/yr).

Wastewater constituents or categories of constituents from which the land-limiting factor will be selected are generally grouped as:

| | |
|---|---|
| Organics | Nitrogen |
| Phosphorus | Heavy metals |
| Salts, acids and bases | Water |
| Oil and grease | |

(b) Slope. Slow rate irrigation systems (generally less than 4.0 inches/wk application rate) will not be developed on slopes greater than 15 percent unless the site is terraced, gated pipe is placed on the contour, or vegetation, application rate and soil infiltration rate are such that runoff and erosion would not result.

Overland flow systems will not be developed on sites having less than two percent or greater than eight percent slope.

(c) Soil profile. The minimum depth of unsaturated soil strata on which a land treatment system may be developed is five (5) feet for a slow rate system and ten (10) feet for a rapid infiltration system, unless underdrains or pumped recovery wells are employed for lowering the water table. The applicant should refer to Part A, Section 5 for innovative technology permit requirements.

(d) Runoff and erosion. All land treatment sites will be protected from upslope runoff by diversion ditches capable of intercepting the overland flow from a 10-year 24-hour storm event, unless it is otherwise demonstrated that a storm of this size will not have an impact on the site. A runoff collection ditch is required at the base of overland flow slopes or on sloping irrigation sites where site conditions are such that over application of wastewater and/or seasonal precipitation events may threaten to pollute Surface Waters of the State. Provisions for storage, return and reapplication are required where a runoff collection ditch is required.

**Section 51. Pretreatment Water Quality Requirement.**

Pretreatment of wastewater shall provide sufficient organic and inorganic solids reduction, maintaining the estimated infiltration rate of the soil surface.

**Section 52. Reserved.**

**Section 53. Reserved.**

**Section 54. Reserved.**

**Section 55. Irrigation Water Quality.**

(a) The surface infiltration rate and hydraulic conductivity of the soil profile shall be approximated by the appropriate tests and used in determining an average annual application rate.

(b) Indigenous or crop plant species shall be capable of survival and maintenance under the conditions of increased soil moisture, salinity, and alkalinity, the classes of which will be determined by use of Figure 1, Tables 1-3 and a soil textural analysis. Waste and wastewater analyses required for this evaluation include electrical conductivity (EC in umhos/cm @ 25°C), sodium ($Na^{+}$), calcium ($Ca^{2+}$), magnesium ($Mg^{2+}$), bicarbonate ($HCO^{3}$), chloride ($Cl^{-}$), sulfate ($SO_4^{2-}$), Boron (B) and Selenium (Se), and calculation of the Sodium Adsorption Ratio (SAR) by use of the formula:

$$SAR = \frac{Na^{+}}{\sqrt{\frac{([Ca^{2+}]+[Mg^{2+}])}{2}}}$$

(c) Numerical water quality criteria for special situations.

(i) For continuous and unrestricted irrigation of direct human consumption food crops or of parks, playgrounds, highway rest areas and rights-of-way (R.O.W.s), or domestic, commercial and industrial grounds with treated municipal wastewater effluent, the following quality criteria shall not be exceeded:

| | |
|---|---|
| pH | 4.5 - 9.0 s.u. |
| BOD | 10.0 mg/L Daytime |
| BOD | 30 mg/L Dusk-Dawn |
| TSS | 5.0 mg/L Daytime |
| TSS | 100 mg/L Dusk-Dawn |
| Fecal Coliforms | 200/100 mL<br>(positive disinfection) |

| | |
|---|---|
| TDS | 480.0 mg/L |
| Electrical Condutivity, (EC) | 750 micromhos/cm@25°C |
| Sodium Adsorption Ratio (SAR) | 10 |
| Chlorides ($Cl^-$) | 213 mg/L |
| Sulfates ($SO_4^{2-}$) | 192 mg/L |
| Bicarbonates ($HO_3^-$) | Not greater than 50 percent of the total anion concentration in meq/L |
| Aluminum (Al) | 5.0 mg/L |
| Arsenic (As) | 1.0 mg/L |
| Beryllium (Be) | 0.1 mg/L |
| Boron (B) | 0.6 mg/L |
| Cadmium (Cd) | 0.01 mg/L |
| Cobalt (Co) | 0.5 mg/L |
| Chromium (Cr) | 0.1 mg/L |
| Copper (Cu) | 0.2 mg/L |
| Iron (Fe) | 5.0 mg/L |
| Lead (Pb) | 5.0 mg/L |
| Lithium (Li) | 0.1 mg/L |
| Manganese (Mn) | 10.0 mg/L |
| Nickel (Ni) | 0.2 mg/L |
| Selenium (Se) | 0.1 mg/L |
| Vanadium (V) | 0.1 mg/L |
| Zinc (Zn) | 2.0 mg/L |

(ii) For disposal of limited volumes of industrial wastewater and sludge of less than 10 percent solids, the following criteria shall not be exceeded:

| | |
|---|---|
| pH | 4.5 - 9.0 s.u. |
| Electrical Conductivity (EC) | 3,250 micromhos/cm @25°C |
| Total Dissolved Solids | 2,100 mg/L |
| Sodium Adsorption Ratio (SAR) | 26 |
| Potassium | In combination with sodium, will not produce an SAR greater than 26 |
| Chlorides ($Cl^-$) | 1,500 mg/L |
| Sulfates (SO42-) | 960 mg/L |
| Bicarbonates (HCO3- ) | Not greater than 50 percent of the total anion concentration, meq/L |
| Arsenic (as $H_3AsO_4$, Arsenious Acid) | 0.1 mg/L |

| | |
|---|---|
| Boron (as $H_3BO_3$, Boric Acid) | 2.0 mg/L |
| Chromium (Cr) | 1.0 mg/L |
| Copper (Cu) | 1.0 mg/L |
| Nickel (Ni) | 0.2 mg/L |
| Selenium (Se) | 0.2 mg/L |
| Zinc (Zn) | 2.0 mg/L |
| Oil and grease | 20,000 lbs/ac when soil incorporated (surface 6 inches)<br>2,000 lbs/ac when surface applied |

(iii) All other continuous disposal land application systems will be approved on a site specific, case by case basis by use of the applicable standards and guidelines.

**Section 56. Effluent Quality.**

(a) Surface water protection. Discharge from a land treatment system to a surface water body will be regulated by the NPDES permit process.

(b) Groundwater protection. Percolation water from land treatment of waste or wastewater shall not degrade groundwater quality to the point at which it is no longer suitable for its current or potential use as described in Chapter 8 of the Wyoming Water Quality Regulations.

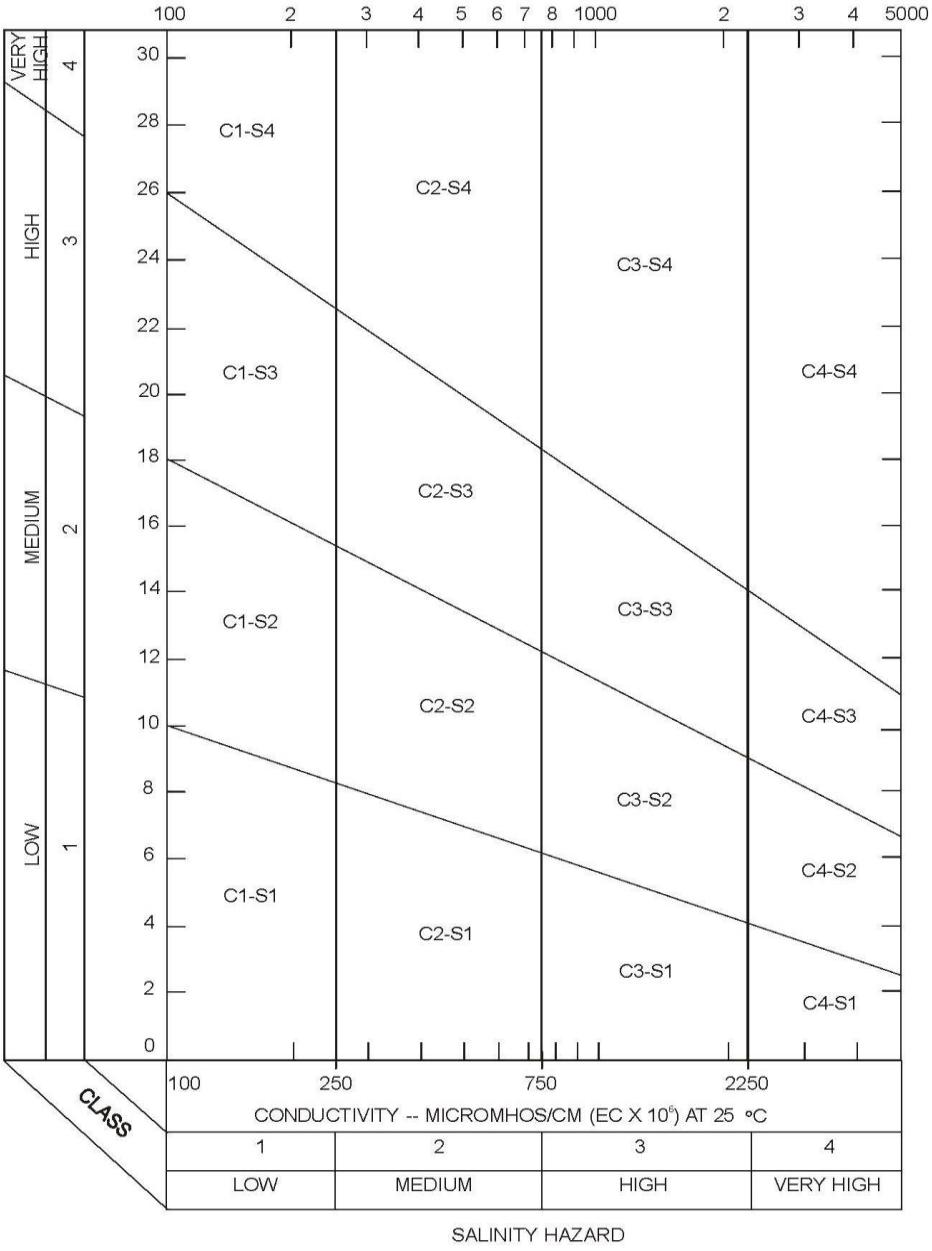


Figure I - Diagram for the classification of irrigation waters

## IRRIGATION WATER QUALITY

Permissibility Classes for Salinity

Class C1, low salinity: --
Good water with little or no likelihood of salt accumulation under the leaching provided by average irrigation practices, except where sub-surface drainage is inadequate.

Class C2, medium salinity: --
Can be used if a moderate amount of leaching occurs. Plants with moderate salt tolerance can be grown in most cases without special practices for salinity control.

Class C3, high salinity: --
Cannot be used on soils with restricted drainage. With adequate drainage, considerable excess water must be applied to each irrigation; irrigations must be made more frequently, and plants with a good salt tolerance should be selected.

Class C4, very high salinity: --
Not usable under ordinary conditions. On very light and permeable soils with excellent drainage, water may be usable with a large amount of excess leaching water, frequent irrigations, and very salt-tolerant crops.

Permissibility Classes for Alkalinity

Class S1, low sodium: --
Good for almost all soils and all Wyoming crops.

Class S2, medium sodium: --
Can cause alkali problems on heavy clayey soils, with low leaching, unless gypsum (or equivalent soil amendments) are present or added to the soils.

Class S3, high sodium: --
May create harmful levels of exchangeable sodium in all soils and will require special management--good drainage, high leaching, and organic matter additions. Soils containing natural gypsum may not develop alkali troubles. Chemical amendments may be necessary, but are not feasible with waters of very high salinity.

Class S4, very high sodium: --
Generally unsuited for irrigation. Special conditions of low salinity water, favorable gypsum content of soils, tolerant crops, and special management may permit use of these waters.

These water classes are based on recommendations of the United States Regional Salinity Laboratory and numerous state agricultural experiment stations.

TABLE 1 - Boron Class Limits

| Class | Limits -- parts per million | | | Description |
|---|---|---|---|---|
| | Sensitive crops | Semi-tolerant crops | Tolerant crops | |
| 1 | Below 0.33 | Below 0.67 | Below 1.00 | Very low. No effect on crops. |
| 2 | 0.33 to 0.67 | 0.67 to 1.33 | 1.00 to 2.00 | Low. Very slight effect on crops. |
| 3 | 0.67 to 1.00 | 1.33 to 2.00 | 2.00 to 3.00 | Moderate. Significant yield depression. |
| 4 | 1.00 to 1.25 | 2.00 to 2.50 | 3.00 to 3.75 | High. Large yield depression anticipated. |
| 5 | Over 1.25 | Over 2.50 | Over 3.75 | Very high. Non-usable. |

TABLE II - Selenium Class Limits

| Class | Limits -- parts per million | Description |
|---|---|---|
| 1 | 0.00 to 0.10 | Low. No plant toxicity anticipated. |
| 2 | 0.11 to 0.20 | Medium. Usable -- possible long-term accumulation under particular conditions and should be watched |
| 3 | 0.21 to 0.50 | High. Doubtful -- probably toxic accumulation in plants except under especially favorable conditions |
| 4 | Over 0.50 | Very High. Non-usable under any conditions. |

TABLE III. CHLORIDE AND SULFIDE LIMITS FOR THREE CLASSES OF IRRIGATION WATERS

| Class | | Chlorides | | Sulfates | |
|---|---|---|---|---|---|
| | | meq/L | mg/L | meq/L | mg/L |
| I- | Excellent to good; or suitable for most plants under most conditions | less than 2-5.5 | 71.1 - 195.5 | 4 - 10 | 192 - 480 |
| II- | Good to injurious; harmful to some under certain conditions of soil, climate and practices | 2 -16 | 71.1 - 568.0 | 4 - 20 | 192 - 960 |

| | | | | | |
|---|---|---|---|---|---|
| III- | Injurious to unsatisfactory; unsuitable under most conditions | 6 -16 | 213 - 568 | 12 - 20 | 576 - 960 |

## PART F: MOBILE HOME PARK AND CAMPGROUND SEWERAGE AND PUBLIC WATER SUPPLY DISTRIBUTION SYSTEMS

### Section 57. General.

This part contains the minimum standards for the design and construction of mobile home park and/or campground wastewater facilities and public water supply systems.

### Section 58. Sewage System Standards.

(a) If sewerage system services are to be provided by a second person, a letter of verification from the system manager stating that they are capable of handling added organic and/or hydraulic loads shall be provided by the owner/operator of the system.

(b) A mobile home park or campground sewerage system, treatment works and disposal system shall comply with Part A, B, C, and/or D of Chapter 11 except as follows:

(i) Mobile home park sewerage systems, treatment works and disposal systems shall be designed on the basis of not less than 350 gallons per site per day. Camp ground sewerage systems, treatment works and disposal systems shall be designed on the basis of not less than 100 gallons per site per day for all sewered sites or 75 gallons per site per day for all unsewered sites.

(ii) Sanitary sewers shall not be smaller than six inches in diameter. They shall be installed at a slope equal to or greater than 0.6 feet per 100 feet.

(iii) Not more than two mobile homes or campground sites shall be served by a sanitary sewer service connection pipe of a least four (4) inches in diameter, provided the main branch of the service pipe is served by a cleanout and provided it is not longer than fifty (50) feet. It shall be installed at a minimum slope of 1/4 inch per foot. The riser portion of the service connection pipe shall be constructed of cast iron or schedule 40 plastic pipe. The riser shall be terminated at least four (4) inches above finished grade and shall not be located closer than five (5) feet from a potable water service riser. The service connection pipe shall connect to the sewerage system at a maximum 45-degree bend in the direction of sewage flow.

(iv) Not more than one mobile home shall be served by a sanitary sewer service riser pipe. The riser shall be located so as to minimize the length of pipe required to connect the mobile home drain. The riser pipe shall be capped or plugged when not in use.

(v) The connection of the mobile home drain to the riser pipe shall be sealed.

(vi) If sewer service is provided to sites in a campground, the sanitary sewer service connection pipe shall comply with subsections (iii) and (iv) above.

(vii) Service connection pipes for campgrounds shall be trapped below the frost line.

**Section 59. Potable Water Supply Standards.**

(a) The potable water distribution system serving any building, mobile home lot, campground site or other appurtenance within a mobile home park or campground that is connected to a public water supply shall be considered an extension or modification of the public supply.

(b) If water is to be obtained from a public water supply, a letter of verification shall be provided from the public water supply system manager stating that the required flow can be supplied at a minimum pressure of twenty (20) pounds per square inch under all conditions of flow throughout the proposed distribution system. A normal working pressure of thirty-five (35) pounds per square inch shall be maintained in the distribution system.

(c) The public water supply serving mobile home sites, buildings and other facilities within a mobile home park shall be designed, constructed or installed and protected in accordance with Chapter 12 of the Water Quality Rules and Regulations, except as follows:

(i) The water supply source shall be capable of supplying the peak water demand to a mobile home park distribution system according to the following table:

| Homes | Gallons per Minute |
|---|---|
| 25 | 65 |
| 50 | 105 |
| 75 | 145 |
| 100 | 180 |
| 150 | 235 |
| 200 | 285 |
| each additional mobile home over 200 | 1 gpm |

(ii) If fire protection is provided, the flow required shall be in addition to the requirements of subsection (i) above.

(iii) Each mobile home shall be provided with a potable water service connection pipe. It shall be 3/4 inch nominal pipe size or larger. The riser portion of the pipe shall be constructed of type K copper or steel pipe from a point below the frost line to the point of connection to the mobile home piping. The riser shall terminate at least four (4) inches above finished grade and shall be protected from damage. The service connection pipe shall be provided with a curb stop below frost penetration. A stop and waste valve with a weep hole below grade shall not be used.

(iv) The distribution system shall be of sufficient size to supply the required volume of water at a minimum pressure of twenty (20) pounds per square inch under all conditions of demand. A working pressure of thirty-five (35) pounds per square inch shall be maintained under average day demand conditions. The distribution system mains shall not be

smaller than 1 1/2 inches in diameter. If fire protection is provided, the distribution system shall meet the requirements of Chapter 12 of the Water Quality Rules and Regulations.

(v) If the potable water is pumped to the distribution system from wells or storage facilities, the pumps shall be capable of meeting the maximum day demand with the largest pumping unit out of service.

(vi) Water storage facilities shall be provided when the potable water source cannot meet the peak demand.

(d) The public water supply serving campground sites, buildings and/or other facilities within a campground shall be designed, constructed and protected in accordance with Chapter 12 of the Water Quality Rules and Regulations except as follows:

(i) The public water supply source shall be capable of supplying water to a campground distribution system at a rate of 0.5 gpm/site.

(ii) Below ground stop and waste valves with weep holes below ground shall not be permitted.

(iii) A minimum pressure of twenty (20) pounds per square inch shall be maintained throughout the distribution system under all conditions of flow. A working pressure of thirty-five (35) pounds per square inch shall be maintained under average day demand conditions.

(iv) The distribution piping shall not be smaller than one inch in diameter. Service pipes shall not be smaller than 1/2 inch in diameter.

## PART G: WELL CONSTRUCTION

**Section 60. Reserved.**

**Section 61. Reserved.**

**Section 62. Reserved.**

**Section 63. Reserved.**

**Section 64. Reserved.**

**Section 65. Reserved.**

**Section 66. Reserved.**

**Section 67. Reserved.**

**Section 68. Reserved.**

**Section 69. Reserved.**

**Section 70. Reserved.**

## PART H: STANDARDS FOR THE REUSE OF TREATED DOMESTIC WASTEWATER

### Section 71. Authority and Purpose.

(a) These regulations establish standards that address the primary health concerns associated with the reuse of treated wastewater. The regulations establish criteria to address the risk of pathogen exposure and infectious disease risks associated with various specified uses of treated wastewater. The regulations establish standards for the following:

(i) The level of wastewater treatment required;

(ii) Treatment reliability requirements;

(iii) Upper limits for water quality parameters;

(iv) Site access restrictions; and

(v) Management practices.

(b) In addition, the standards in this part include the parameters to be monitored, frequency of monitoring, record keeping and reporting requirements when treated wastewater is reused.

(c) These regulations establish the degree of control required for wastewater reuse through site access limitations, management practices and crop restrictions that will be commensurate with the level of treatment provided, reliability of the treatment process, quality of the wastewater and the intended use. As the quality of the wastewater and the reliability of the treatment process increases, the regulatory controls are reduced to a level consistent with protecting public health and the environment.

(d) Pathogen reduction and public health impacts related to infectious disease agents are the major concerns associated with the reuse of treated wastewater. Chemical and toxic pollutants in treated domestic sewage are generally not a concern and are not targeted for state regulation in this chapter. There are additional constituents, such as total dissolved solids, that should be considered as part of an overall irrigation management program but are not regulated by this chapter.

### Section 72. Applicability.

(a) These regulations apply to any person who prepares or applies treated wastewater from domestic sewage.

(b) These regulations are not applicable if the primary intent is to provide treatment and/or disposal of a wastewater. Treatment and disposal are regulated under appropriate sections of Chapter 11, Wyoming Water Quality Rules and Regulations.

(c) If the reuse of treated wastewater involves the construction of facilities for the disinfection, delivery, storage or land application, a construction permit is required in accordance with the provisions of Chapters 3 and 11, Wyoming Water Quality Rules and Regulations. Such a permit constitutes approval to reuse the treated wastewater. This permit is not an operational permit and does not require periodic renewal. If there are no structural facilities requiring a construction permit, the reuse of wastewater will be authorized by a land application permit issued in accordance with these regulations. The land application permit is not an operational permit and does not require periodic renewal.

(d) These regulations are not applicable to the discharge of a treated wastewater that is subject to a discharge permit issued pursuant to Chapter 2, Wyoming Water Quality Rules and Regulations.

(e) These regulations are not applicable to treated wastewater reused at reclamation sites regulated by the Land Quality Division under Article 4 of the Wyoming Environmental Quality Act.

(f) These regulations are not applicable to treated wastewater reused for irrigation of grass, shrubs and trees at the treatment works.

(g) These regulations are not applicable to the disposal of gray water.

(h) These regulations are not applicable to groundwater recharge projects that are regulated by the Underground Injection Control Program of the Department of Environmental Quality, Water Quality Division.

**Section 73. Definitions Specific to Part H.**

The following definitions supplement those definitions contained in Section 35-11-103 of the Wyoming Environmental Quality Act.

(a) "Agricultural land" is land on which a food crop, a feed crop, or a fiber crop is grown. This includes range land and land used as pasture.

(b) "Agronomic rate" is the wastewater application rate designed to: (1) provide the amount of nitrogen needed by the food crop, feed crop, fiber crop, cover crop, or vegetation grown on the land; and (2) minimize the amount of nitrogen in the treated wastewater that passes below the root zone of the crop or vegetation grown on the land to the groundwater.

(c) "Class A wastewater" is treated wastewater that has received advanced treatment and/or secondary treatment and a level of disinfection so that the maximum number of fecal coliform organisms is 2.2/100 mL or less.

(d) "Class B wastewater" is treated wastewater that has received the equivalent of secondary treatment and a level of disinfection so that the maximum fecal coliform level is greater than 2.2/100 mL but less than 200/100 mL.

(e) "Class C wastewater" is treated wastewater that has received the equivalent of primary treatment and a level of disinfection so that the maximum fecal coliform level is 200/100 mL or greater but less than 1000/100 mL.

(f) "Contaminate a groundwater aquifer" means to introduce a substance that causes the maximum contaminant level for water quality parameters specified in Chapter 8, Wyoming Water Quality Rules and Regulations to be exceeded or that causes the existing concentration of pollutants in groundwater to increase when the existing concentration of the parameters in the groundwater exceeds the maximum contaminant level specified in Chapter 8, Wyoming Water Quality Rules and Regulations.

(g) "Direct human consumption food crops" are crops consumed directly by humans. These include, but are not limited to fruits, vegetables and grains grown for human consumption.

(h) "Domestic sewage" is waste and wastewater that is primarily from human or household operations that is discharged to or otherwise enters a treatment works.

(i) "Forest" is a tract of land thick with trees and underbrush.

(j) "Groundwater" is subsurface water that fills available openings in rock or soil material such that they may be considered water saturated under hydrostatic pressure.

(k) "Indirect human consumption crop" are crops utilized by grazing animals and are thereby one step removed from human consumption.

(l) "Land with a high potential for public exposure" is land that the public uses frequently and there are no restrictions or limitations on public access during irrigation periods. This includes, but is not limited to public parks, ball fields, cemeteries, plant nurseries, turf farms, golf courses and a reclamation site located in a populated area (e.g., a construction site located in a city).

(m) "Land with moderate potential for public exposure" is land that is accessible to the public but access is limited during irrigation periods. This would include the facilities in (n) where signing and fencing is provided to restrict access.

(n) "Land with a low potential for public exposure" is land that the public uses infrequently. This includes, but is not limited to agricultural land, forest, and a reclamation site located in an unpopulated area (e.g., a strip mine located in a rural area).

(o) "Municipal wastewater" means the discharge from a publicly owned or controlled treatment system receiving primarily domestic wastewater or a combination of domestic, commercial and industrial wastewater that is normally treated in a primary, secondary or advanced wastewater treatment process.

(p) "Pathogenic organisms" are disease-causing organisms. These include, but are not limited to certain bacteria, protozoa, viruses, and viable helminth ova.

(q) "Pasture" is land on which animals feed directly on feed crops such as legumes, grasses, grain stubble, or stover.

(r) "Permitting authority" is the Department of Environmental Quality, Water Quality Division.

(s) "Pollutant" is an organic substance, an inorganic substance, a combination of organic and inorganic substances, or a pathogenic organism that, after discharge and upon exposure, ingestion, inhalation, or assimilation into an organism either directly from the environment or indirectly by ingestion through the food chain, could, on the basis of information available to the permitting authority, cause death, disease, behavioral abnormalities, cancer, genetic mutations, physiological malfunctions (including malfunctions in reproduction), or physical deformations in either organisms or offspring of the organisms.

(t) "Pollutant limit" is a numerical value that describes the amount of a pollutant allowed per unit amount of wastewater (e.g., milligrams per liter).

(u) "Range land" is open land used for grazing by livestock and/or wildlife on which the natural potential plant community is dominated by grasses, grasslike plants, forbs and shrubs.

(v) "Reclamation site" is drastically disturbed land that is reclaimed using waste-water. This includes, but is not limited to, strip mines and construction sites.

(w) "Runoff" is rainwater, leachate, or other liquid that drains overland on any part of a land surface and runs off of the land surface.

(x) "Treated wastewater" is domestic sewage discharged from a treatment works after completion of the treatment process.

(y) "Treatment works" is either a publicly or privately owned device or system used to treat either domestic sewage or a combination of domestic sewage and commercial or industrial waste of a liquid nature.

**Section 74. Compliance with Other Laws and Regulations.**

Nothing in these regulations or the permits issued pursuant to these regulations shall be construed to relieve the recipient of a permit of the need to comply with any other law, rule or regulation. It is the duty of the permittee to comply with all applicable federal, state and local laws or regulations in the exercise of activities authorized pursuant to these regulations.

Specifically, the permittee is responsible for complying with the water right requirements of the Wyoming State Engineers Office.

**Section 75. Compliance Period.**

(a) Compliance with the standards in these regulations shall be achieved as expeditiously as practicable, but in no case later than one (1) year after final adoption. When compliance with the standards requires construction of new or modified treatment facilities, compliance with the standards shall be achieved as expeditiously as practicable, but in no case later than two years after final adoption.

(b) Water reuse facilities operating under authority granted by the Department of Environmental Quality are required to notify the Department of the nature and requirements of the existing authorization. Existing authorized facilities are not required to comply with the requirements of these regulations unless the Administrator determines it is necessary to revise the existing authorization in order to protect public health and the environment. Existing facilities are required to comply with the monitoring and reporting requirements of Sections 83, 84, 85 and 86.

**Section 76. Permits, Enforceability and Applications.**

(a) The requirements in these regulations may be implemented through:

(i) A land application permit issued by the Department of Environmental Quality, Water Quality Division in accordance with these regulations;

(ii) A construction and operation permit issued by the Department of Environmental Quality, Water Quality Division in accordance with Chapters 11 and 3, Wyoming Water Quality Rules and Regulation; or

(iii) A general statewide operation permit issued by the Water Quality Division, Department of Environmental Quality for the Land Application of Treated Waste-water.

(b) No person shall prepare or use treated wastewater except in accordance with the requirements of these regulations.

(c) Applications for permits shall be submitted to the Department of Environmental Quality, Water Quality Division in accordance with the requirements of Chapter 3, Wyoming Water Quality Rules and Regulations. The application materials submitted shall be adequate to demonstrate compliance with all requirements of this part. It shall be the responsibility of the applicant to demonstrate that the proposed reuse of treated wastewater will not endanger public health or the environment.

(d) The person who prepares treated wastewater and makes it available to another person for reuse shall provide, as part of the application required by Section 76 (c), a demonstration that all of the requirements of this chapter will be met. This will include access restrictions, management practices, record keeping and reporting requirements that may be the responsibility of another person who will apply the treated wastewater. This demonstration may

be in the form of either a written agreement with the applier specifying his or her responsibilities or a separate permit application from the applier. If the method selected is an agreement, the agreement must cover appropriate access restrictions, management practices, record keeping and reporting requirements of this chapter. If the method selected is a separate permit for the applier the permit application by the applier must address the same requirements.

(e) Any person who prepares treated wastewater outside of the State to be applied within the State must either obtain a permit to land apply in accordance with this chapter or provide the wastewater to a person who has a permit.

(f) Any person who prepares treated wastewater outside of the State of Wyoming that is to be applied to land within the State of Wyoming and opts not to obtain a permit shall provide written notice, prior to the initial application of treated wastewater to the reuse site by the applier, to the Department of Environmental Quality, Water Quality Division. The notification shall include the following:

(i) The location, by either street address or latitude and longitude, of each reuse site;

(ii) The approximate time period the treated wastewater will be applied to the site;

(iii) The name, address, telephone number, and National Pollutant Discharge Elimination System permit number (if appropriate) for the person who prepares the treated wastewater;

(iv) The name, address, telephone number of the person who will reuse the treated wastewater; and

(v) Documentation that the requirements of this regulation have been met.

**Section 77. Exclusions.**

(a) Treatment processes. These regulations do not establish requirements for processes used to treat wastewater.

(b) Selection of a reuse practice. This chapter does not require the selection of a reuse practice. The determination of the manner in which treated wastewater is to be reused is a local determination.

**Section 78. General Management Practices.**

(a) Treated wastewater shall be applied for the purpose of beneficial reuse and shall not exceed the irrigation need or demand of the vegetation at the site. Winter irrigation is considered to be beneficial reuse.

(b) Treated wastewater shall not be applied to agricultural land, forest, a public contact site, or a reclamation site at an application rate that is greater than the agronomic rate for the vegetation at the site.

(c) Treated wastewater shall not be applied in a manner that will contaminate a groundwater aquifer.

(d) Treated wastewater will be applied in a manner and time that will not cause any surface runoff to leave the application site and enter Surface Waters of the State.

(e) Direct human consumption food crops shall not be harvested for thirty (30) days after application of treated wastewater.

(f) Animals shall not be allowed to graze on the land for thirty (30) days after application of Class C treated wastewater.

(g) Fencing and signing shall be provided at sites where Class B treated wastewater is proposed for reuse on land with a moderate potential for public exposure.

(h) Signing shall be provided at sites where Class B or Class C treated wastewater is proposed for reuse on land with a low potential for public exposure in order to protect the health and safety of workers.

**Section 79. Site Isolation Requirements.**

No person shall reuse treated wastewater on an application site except in accordance with the restrictions specified below.

(a) Isolation of spray irrigation systems.

(i) Wind drift shall not leave the application site.

(ii) If Class A or Class B wastewater is reused for irrigation, a 30-foot buffer zone is required between the reuse site and adjacent property lines. Public right-of-ways may be utilized to meet this requirement for a buffer zone.

(iii) If Class C wastewater is reused for irrigation a 100-foot buffer zone is required between the reuse site and adjacent property lines and any public right-of-way.

(iv) A 30-foot separation distance is required between reuse sites and all surface waters.

(v) A 100-foot separation distance is required between reuse sites and all potable water supply wells.

(vi) Surface runoff shall not leave the application site.

(b) Isolation distances between reuse sites irrigated by flood irrigation systems.

(i) Surface runoff shall not leave the application site.

(ii) If Class A or Class B wastewater is reused for irrigation, a 30-foot buffer zone is required between the reuse site and adjacent property lines. Public right-of-ways may be utilized to meet this requirement for a buffer zone.

(iii) If Class C wastewater is reused for irrigation, a 30-foot buffer zone is required between the reuse site and adjacent property lines and any public right-of-way.

(iv) A 30-foot separation distance is required between reuse sites and all surface waters.

(v) A 100-foot separation distance is required between reuse sites and all potable water supply wells.

(c) Drip irrigation systems. The buffer zone requirements of Section 79(a)(ii) and 79(b)(ii) for Class A and B wastewaters may be met by the use of drip irrigation systems.

**Section 80. Minimum Level of Wastewater Treatment.**

Treated wastewater must receive the equivalent of primary treatment and a maximum fecal coliform value of less than 1000/100 ml in order to be reused in accordance with these regulations.

**Section 81. Treatment Reliability.**

(a) The ability of the treatment process to deliver the class of treated wastewater required for a particular use will be considered by the permitting authority when approving or denying wastewater reuse in accordance with Section 76. The criteria for evaluating treatment reliability may include the following as appropriate:

(i) Multiple units and equipment;

(ii) Alternative power sources;

(iii) Alarm systems and instrumentation;

(iv) Operator certification and stand-by capability;

(v) Bypass and dewatering capability;

(vi) Frequency of sampling;

(vii) Hydraulic and organic loading design capabilities; and

(viii) Emergency storage.

(b) Where treatment reliability cannot be provided by existing facilities, the reuse may be approved based upon the preparer's ability to dispose of the treated wastewater in an acceptable alternative manner or to reuse the treated wastewater for a less restrictive authorized reuse as indicated in Section 82.

**Section 82. Authorized Reuse.**

(a) Class A wastewater may be used for the following purposes:

(i) Irrigation of land with a high potential for public exposure;

(ii) Irrigation of land with a moderate potential for public exposure;

(iii) Irrigation of land with a low potential for public exposure;

(iv) Irrigation of direct human consumption food crops; and

(v) Irrigation of indirect human consumption food crops.

(b) Class B wastewater may be used for the following purposes:

(i) Irrigation of land with a moderate potential for public exposure;

(ii) Irrigation of land with a low potential for public exposure;

(iii) Irrigation of direct human consumption food crops; and

(iv) Irrigation of indirect human consumption food crops.

(c) Class C wastewater may be used for the following purposes:

(i) Irrigation of land with a low potential for public exposure; and

(ii) Irrigation of indirect human consumption food crops.

**Section 83. Monitoring.**

(a) Sampling. Representative samples of the treated wastewater that is to be reused shall be collected and analyzed by the person who prepares the wastewater.

(b) Methods. Waste constituents shall be analyzed in accordance with 40 CFR Part 136, Guidelines Establishing Test Procedures for the Analysis of Pollutants.

(c) Parameters. The treated wastewater shall be analyzed for the following:

(i) Fecal coliform;

(ii) Nitrate as N;

(iii) Ammonia as N;

(iv) pH;

(v) Parameters identified in 40 CFR Part 122, Appendix D, Table III, when required by the NPDES permit; and

(vi) Other parameters identified in the permit.

(d) Frequency for monitoring for these pollutants shall be:

(i) For lagoon systems, once per month or the frequency specified in the NPDES discharge permit whichever is more frequent;

(ii) For mechanical plants, once per week or the monitoring frequency specified in the NPDES discharge permit whichever is more frequent; and

(iii) For monitoring of parameters identified in Section 83 (c) (v), shall be conducted at the frequency specified in the NPDES discharge permit.

**Section 84. Noncompliance Actions, Reporting and Monitoring Requirements.**

In the event that the monitoring program identified in Section 83 indicates noncompliance with the fecal coliform levels associated with the class of wastewater and the appropriate authorized reuse identified in Section 82, the responsible party shall take the following actions.

(a) Discontinue the reuse of treated wastewater immediately. The responsible party may discharge in compliance with the requirements of an NPDES permit or convert to any authorized reuse that is consistent with the quality of the treated wastewater.

(b) Report the noncompliance to the permitting authority as soon as possible, but no later than the next working day.

(c) Initiate monitoring of the parameter in noncompliance on a daily or more frequent basis in order to adequately demonstrate that the treated wastewater can reliably meet the reuse criteria.

(d) Report the results on the noncompliance monitoring to the permitting authority. Upon adequate demonstration by the responsible party that the reuse criteria can be reliably met, the permitting authority may grant verbal and written authorization to re-institute the discontinued reuse.

(e) The responsible party shall provide a written report within fifteen (15) days of the resolution of the event that will contain the following:

(i) A description of the noncompliance and its cause;

(ii) The period of the noncompliance, including dates and times;

(iii) All monitoring data related to the noncompliance and the return to compliance; and

(iv) Steps taken or planned to reduce, eliminate or prevent reoccurrence of the noncompliance.

**Section 85. Record Keeping.**

(a) A person who prepares treated wastewater shall develop the following information and shall retain the information for five (5) years.

(i) The concentration of each applicable pollutant listed in Section 83 (c) in the treated wastewater at the frequency specified in Section 83 (d).

(ii) A description of how the minimum level of treatment requirements in Section 80 are met.

(iii) A description of how the treatment reliability requirements in Section 81 are met.

(iv) The following certification statement: "I certify, under penalty of law, that the level of treatment requirements in Section 80 of Chapter 11, Wyoming Water Quality Rules and Regulations, the treatment reliability requirements in Section 81 and the water quality parameters have been met. This determination has been made under my direction and supervision. I am aware that there are significant penalties for false certification."

(b) A person who prepares treated wastewater shall obtain the following information from any person who reuses the treated wastewater and shall retain the information for five years.

(i) The location, by either street address or latitude and longitude, of each site on which treated wastewater is applied.

(ii) The number of acres on each site on which treated wastewater is applied.

(iii) The date and time treated wastewater is applied to each site.

(iv) The cumulative amount of treated wastewater applied to each site.

(v) The following certification statement: "I certify, under penalty of law, that the general management practices in Section 78 of Chapter 11, Wyoming Water Quality Rules and Regulations, and the site isolation requirements in Section 79 have been met. This determination has been made under my direction and supervision. I am aware that there are significant penalties for false certification."

**Section 86. Reporting.**

(a) A person preparing treated wastewater shall submit the information in Section 85 (a) and (b) to the permitting authority on an annual basis.

(b) A person who reuses treated wastewater shall submit the information in Section 85 (b) to the person who prepares the treated wastewater on an annual basis if he or she is operating under an agreement with the applier. If the application is regulated by a permit, the information shall be submitted to the permitting authority.

**Section 87. Operation and Maintenance Manual.**

(a) Any person responsible for the application of treated wastewater shall provide an operation and maintenance manual as part of the agreement or permit application required by Section 75 (d).

(b) The operation and maintenance manual shall include the following:

(i) Description of the facilities;

(ii) Description of the application system;

(iii) Procedures for emergency operation and spill events;

(iv) Procedures for meeting permit and regulatory requirements;

(v) Maintenance and operation requirements for any mechanical equipment; and

(vi) Description of how the monitoring, record keeping and reporting requirements of this chapter will be met.