4.10.10 Flexibility - Plants treating water that is known to have taste and odor problems should be provided with equipment that makes several of the control processes available so that the operator will have flexibility in operation.

4.11 WASTE DISPOSAL - Provisions must be made for proper disposal of water treatment plant waste such as sanitary, laboratory, clarification, softening and ion sludges, filter backwash, and brines. The quantity of waste produced in water treatment shall be minimized by choice of treatment processes and chemicals. If supernatant water from backwash/sludge holding tanks or lagoons is to be recycled through the treatment plant, potential impacts on the treatment process must be considered. Recycled water must be returned to the head of the treatment plant or to an alternate location approved by the Division of Water Supply. Recycled water should be settled/clarified to reduce contaminants that may be concentrated in sludges and backwash water.

4.11.1 Waste Water and Sludge - The following means of waste and sludge disposal may be considered:

a. Lagoons - Design should provide:

1. location free from flooding,

2. when necessary, dikes, deflecting gutters, or other means of diverting surface water,

3. a minimum usable depth of 4 to 5 feet with adequate freeboard,

4. 3 to 5 years solids storage volume,

5. multiple cells,

6. adjustable decanting devices,

7. convenient cleaning,

8. effluent sampling point,

9. adequate safety provisions.

b. Sludge Beds - Beds for lime softening sludges should provide for an application of slurry of at least 12 inches. Multiple beds should be provided so designed as to permit a minimum of one year's total storage. The storage capacity should be based on assumption that for each part per million of hardness removed there will be two parts per million of dry solids, and the accumulated sludge density being 120 pounds per cubic foot. Distribution channels are required for spreading sludge over the entire area. Provisions must be made for easy access and for paved loading ramps and underdrains. See Section 4.11.1.1 for provisions on flooding and surface water diversion.

c. Disposal to Sanitary Sewer System

1. Approval must be obtained from sewer system officials.

2. Consideration shall be given to the effects the water plant waste will have at the sewer plant including:

i. effect on the sewage treatment process,

ii. additional sludge to be handled.

3. Consideration shall be given to the effects of disposal into the sewage collection system. A schedule for disposal shall be determined in conjunction with sewer system officials.

d. other methods - These include holding tanks, vacuum filters, centrifuging, and recalcining. Detailed studies should be made to justify their use.

4.11.2 Sanitary Waste - The sanitary waste from water treatment plants, pumping stations, etc., must receive treatment. Waste from these facilities must be discharged either directly to a sanitary sewer system or to an individual waste disposal facility providing suitable treatment.

Part 5 - CHEMICAL APPLICATION

5.0 GENERAL - Plans and specifications describing water treatment plants (new, modified or expanded) shall include the chemicals and chemical feed equipment to be used in the treatment process.

5.0.1 These plans and specifications shall include:

a. descriptions of feed equipment, including maximum and minimum feed ranges,

b. location of feeders, piping layout and points of application,

c. storage and handling facilities,

d. specifications for chemicals to be used,

e. operating and control procedures,

f. descriptions of testing equipment and procedures.

5.0.2 Chemical shall be applied to the water at such points and by such means as to:

a. provide maximum flexibility of operation through various points of application, when appropriate, and

b. prevent backflow at all points of feed.

5.1 FEED EQUIPMENT

5.1.1 Number of Feeders

a. Where chemical feed is essential to the production of safe drinking water or necessary for continuous operation

1. a minimum of two feeders shall be provided,

2. a standby unit or combination of units of sufficient capacity should be available to replace the largest unit during shut-downs.

b. Spare parts shall be available for all feeders to replace parts which are subject to wear and damage.

5.1.2 Design and Capacity - Design and capacity shall be such that:

a. feeders will be able to supply, at all times, the necessary amounts of chemical at an accurate rate, throughout the range of feed;

b. feeders are adjustable to handle all plant flow rates;

c positive displacement type solution feed pumps shall be used to feed liquid chemicals, and shall not be used to feed chemical slurries;

d. chemical solutions cannot be siphoned into the water supply;

e. service water supply cannot be contaminated by chemical solutions by:

1. equipping the supply line with backflow prevention devices (see Section 5.l.8.c), or

2. providing an air gap between supply line and solution tank.

f. chemical-contact materials and surfaces are resistant to the aggressiveness of the chemical solution;

g. dry chemical feeders will:

1. measure chemicals volumetrically or gravimetrically,

2. provide effective solution of the chemical in the solution pot,

3. provide gravity feed from solution pots, in open troughs when feasible,

4. completely enclose chemicals to prevent emission of dust to any of the operating areas (see Section 5.2.3d).

h. no direct connection exists between any sewer and a drain or overflow from the feeder or solution chamber or tank.

5.1.3 Location - chemical feed equipment

a. shall be conveniently located near points of application to minimize length of feed lines;

b. shall be readily accessible for

1. servicing, repair and calibration, and

2. observation of operation;

c. shall be located and protective curbing provided, so that chemicals from equipment failure, spillage or accidental drainage shall not enter the water through conduits, treatment or storage basins, or result in hazardous discharge.

5.1.4 Control

a. Feeders may be manually or automatically controlled, with automatic control reverting to manual control as necessary.

b. Process must be manually started following shutdown, unless otherwise approved by the Department.

c. Feed rates proportional to flow must be provided.

d. Automatic chemical dose or residual analyzers may be approved for use and must provide

1. alarms for critical values, and

2. recording charts.

5.1.5 Solution Tanks

a. Means shall be provided in a solution tank to maintain uniform strength of solution, consistent with the nature of the chemical solution; continuous agitation is necessary to maintain slurries in suspension.

b. Two solution tanks may be required for a chemical, of specific capacity, to assure continuity of supply in servicing a solution tank.

c. Each tank shall be provided with a drain;

1. No direct connection between any tank or drain and a sewer shall be permitted, and

2. Any drain must terminate at least two pipe diameters above the overflow rim of a receiving sump, conduit or waste receptacle.

d. Means shall be provided to indicate the solution level in the tank.

e. Make-up water shall enter the tank from above the maximum solution level, providing an air gap of two pipe diameters but not less than six inches, or shall be protected with an approved backflow prevention devices (see Section 5.1.8.c).

f. Chemical solutions shall be kept covered. Large tanks with access openings shall have such openings curbed and fitted with tight covers.

g. Subsurface locations for solution tanks shall:

1. be free from sources of possible contamination.

2. assure positive drainage for ground waters, accumulated water, chemical spills and overflows.

h. Overflow pipes, when provided, should:

1. be turned downward, with end screened.

2. have free discharge, and

3. be located where noticeable.

5.1.6 Weighing Scales

a. shall be provided for weighing cylinders, at all plants utilizing chlorine gas; for large plants, indicating and recording type are desirable;

b. shall be provided to measure the amount of fluoride fed with the exception of the use of a saturator, which shall have a water meter;

c. should be provided for volumetric dry chemical feeders;

d. should be accurate to measure increments of 0.5% of load;

5.1.7 Feed Lines

a. should be as short as possible in length of run, and

1. of durable, corrosion-resistant material,

2. easily accessible throughout entire length,

3. protected against freezing,

4. easily cleaned,

5. lime feed lines should be designed so they can be readily replaced, and

6. avoiding sharp bends when possible.

b. should slope upward from chemical source to feeder, when conveying gases;

c. should introduce corrosive chemicals in such manner as to minimize potential for corrosion;

d. shall be designed consistent with scale-forming or solids depositing properties of the water, chemical, solution or mixture conveyed;

e. shall not carry chlorine gas beyond chlorine storage and feeder room(s) except under vacuum;

f. should be color coded.

5.1.8 Service Water Supply

a. Water used for dissolving dry chemicals, diluting liquid chemicals or operating chemical feeders shall be:

1. only from a safe, approved source,

2. protected from contamination by appropriate means (see Section 5.1.8c),

3. ample in supply and adequate in pressure,

4. provided with means for measurement when preparing specific solution concentrations by dilution,

5. properly treated for hardness, when necessary.

b. Where a booster pump is required, duplicate equipment should be provided and, when necessary, standby power.

c. Back-flow prevention shall be achieved by appropriate means such as:

1. an air gap between fill pipe and maximum flow line of solution or dissolving tank equivalent to 2 pipe diameters but not less than 6 inches, or

2. an approved reduced pressure backflow preventer, consistent with the degree of hazard, aggressiveness of chemical solution, back pressure sustained, and available means for maintaining and testing the device, or

3. a satisfactory vacuum relief device.

5.2 CHEMICALS

5.2.1 Quality

a. Chemical containers shall be fully labeled to include:

1. chemical name, purity and concentration,

2. supplier name and address, and

3. expiration date where applicable.

b. Chemicals shall be listed under ANSI/NSF Standard 60(or equivalent) and meet American Water Works Association specifications, where applicable.

c. Provisions should be made for assay of chemicals delivered.

d. Chemicals shall not impart any toxic material to the water under recommended dosages.

5.2.2 Storage

a. Space should be provided for:

1. at least 30 days of chemical supply,

2. convenient and efficient handling,

3. dry storage conditions,

4. a minimum of 1-1/2 truck loads storage volume where purchase is by truck load lots,

5. protection against excessive, damaging or dangerous extremes in temperature.

b. Cylinders of chlorine shall be:

1. isolated from operating areas,

2. restrained in position to prevent upset,

3. stored inside for sufficient time before being connected to chlorinator that temperature has been approximately equalized,

4. provided shade from direct sun and given physical security if stored outside of building.

c. Liquid chemical storage tanks must:

1. have a liquid level indicator,

2. have an overflow and a receiving basin or drain capable of receiving accidental spills or overflows,

3. provide for protection against freezing and/or loss from solution due to temperature drop.

d. Special precautions must be taken with:

1. sodium chlorite, to eliminate any danger of explosion;

2. activated carbon, which is a potentially combustible material, requiring isolated, fireproof storage and explosion-proof electrical outlets, lights and motors in areas of dry handling.

3. calcium hypochlorite and potassium permanganate, which may ignite spontaneously on contact with combustible substances;

4. hydrofluosilicic acid, which is extremely corrosive. Fumes or spillage may damage equipment or structures.

5. liquid caustic (50% sodium hydroxide solution) which is hazardous and may be lost from solution at low temperature.

6. gaseous chlorine (see Sections 5.3.4-5.4).

7. on-site generation of sodium hypochlorite. Provisions must be included for dilution and venting of potentially explosive hydrogen gas.

e. Chemicals shall be stored in covered or unopened shipping containers, unless the chemical is transferred into an approved covered storage unit.

f. Solution storage or day tanks supplying feeders directly should have sufficient capacity for one day of operation.

g. Acid storage tanks must be vented to the outside atmosphere, but not through vents in common with day tanks.

5.2.3 Handling

a. Provisions shall be made for

1. measuring quantities of chemicals used to prepare feed solutions, and

2. for easy calibration of solution pumps measured from the suction side.

b. Storage tanks and pipelines for liquid chemicals shall be specific to the chemicals and not for alternates.

c. Chemicals that are incompatible shall not be fed, stored or handled together.

d. Provisions must be made for the proper transfer of dry chemicals from shipping containers to storage bins or hoppers, in such a way as to minimize the quantity of dust which may enter the room in which the equipment is installed; control should be provided by use of:

1. vacuum pneumatic equipment or closed conveyer systems, or

2. facilities for emptying shipping containers in special enclosures, or

3. exhaust fans and dust filters which put the hoppers or bins under negative pressure.

e. Precautions shall be taken with electrical equipment to prevent explosions, particularly in the use of sodium chlorite and activated carbon.

f. Acids shall:

1. be kept in closed, acid-resistant shipping containers or storage units;

2. not be handled in open vessels, but should be pumped in undiluted form from original containers, through suitable hose, to the point of treatment or to a covered day tank.

g. Carts, elevators and other appropriate means shall be provided for lifting chemical containers to minimize excessive lifting by operators.

h. Provisions shall be made for disposing of empty bags, drums or barrels, by approved procedures which will minimize exposure to dusts.

5.3 HOUSING

5.3.1 Structures, rooms and areas accommodating chemical feed equipment shall provide convenient access for

a. servicing and repair,

b. observation of operation.

5.3.2 Floor surfaces shall be smooth and impervious, slip-proof and well-drained with 2.5% slope, minimum.

5.3.3 open basins, tanks and conduits shall be protected from chemical spills or accidental drainage.

5.3.4 Chlorine gas feed and storage shall be:

a. enclosed and separated from other operating areas in order to prevent injury to personnel and damage to equipment; separate chlorine feed and storage rooms may be required for large installations;

b. provided with an inspection window to permit viewing of the interior of the room and the equipment;

c. provided with doors opening outward with a crash bar, assuring ready means of exit; doors opening to the building exterior only shall be provided.

d. provided with locks to prevent general public access.

5.3.5 Where chlorine gas is used, ventilation for each room shall be provided for one complete air change per minute; and

a. The air outlet from the room shall be near the floor and the point of discharge shall be so located as not to contaminate air inlets to any rooms or structures, or adversely affect the surrounding environment;

b. air inlets shall be through louvers near the ceiling, and temperature controlled to prevent adverse affect on chlorinator;

c. switches for fans and lights shall be outside of the room, at the entrance; signal light indicating fan operation shall be provided at each entrance when fan can be controlled from more than one point;

d. vents from feeders and storage shall discharge to the outside atmosphere, above grade.

5.3.6 Chlorinator rooms should be heated to 60 degrees F, but should be protected from excess heat; cylinders and gas lines should be protected from temperatures above that of the feed equipment.

5.3.7 Gaseous feed chlorine installations shall be equipped with a gas detection device connected to an audible alarm to prevent undetected, potentially dangerous leakage of chlorine gas.

5.4 OPERATOR SAFETY

a. Gases from feeders, storage and equipment exhausts shall be conveyed to the outside atmosphere, above grade and remote from air intakes.

b. Special provisions shall be made for ventilation of chlorine feed and storage rooms (see Section 5.3.5).

c. A M-S-A air mask, Model 401, Catalog No. 01-95066 or equal, complete with storage cabinet and 30 minute air cylinder shall be provided along with a 30 minute backup cylinder to prevent loss of utility while the primary air cylinder is being refilled or tested. The air mask shall be cabinet-mounted close by but not inside the chlorine room, and shall be easily accessible to the operator.

d. A bottle of ammonium hydroxide shall be available for chlorine leak detection during cylinder change.

e. All gaseous feed chlorine installations shall be equipped with appropriate leak repair kits.

f. At least one pair of rubber gloves with long gauntlets, a dust respirator of a type approved by the U.S. Bureau of Mines for toxic dusts, and an apron or other protective clothing shall be provided for each operator in any shift who will handle dry chemicals.

g. Rubber gloves with long gauntlets, rubber roots, goggles, rubber apron or other suitable protective clothing shall be provided for each operator preparing chemical solutions, or cleaning up spills.

h. Facilities shall be provided for washing of face, gloves and protective equipment.

i. A safety shower shall be provided in areas where hazardous chemicals are handled.

j. On-site generation of sodium hypochlorite must include dilution and venting of hydrogen gas.

Part 6 - LABORATORY FACILITIES

6.0 GENERAL - Laboratory equipment and facilities shall be compatible with the raw water source, intended design of the treatment plant, and the complexity of the treatment process involved. Recognized laboratory procedures must be utilized. See Parts 4 and 5 for related criteria.

6.1 EQUIPMENT – Laboratory and analytical equipment shall be provided to conduct all daily water quality testing as specified by the Department.

6.2 LABORATORY SPACE AND FACILITIES

6.2.1 Laboratory facilities shall be located in a separate room from office/lunch activities and from the treatment units. Facilities shall be isolated by doors and not be located in the main traffic pattern.

6.2.2 Sufficient bench space, adequate ventilation, adequate lighting, storage room, laboratory sink, and auxiliary facilities shall be provided.

6.2.3 The bacteriological laboratory, if provided, shall have about 6-10 feet of counter space and shall be located in a separate room or area.

6.3 SAMPLE TAPS - Sample taps shall be provided so that water samples can be obtained from each water source and from appropriate locations in each unit operation of treatment. Taps shall be consistent with sampling needs and not be of petcock type. Sample lines and pumps where applicable shall be sized to minimize time lag between point of sampling and point of sample collection.

Part 7 - PUMPING FACILITIES

7.0 GENERAL - Pumping facilities shall be designed to maintain the sanitary quality of pumped water. Subsurface pits or pump rooms and inaccessible installations should be avoided. No pumping station shall be subject to flooding.

7.1 LOCATION - The pumping station shall be so located that the proposed site will meet the requirements of the sanitary protection of the water quality, hydraulics of the system and be protected against interruption of service by fire, flood or any other hazard.

7.1.1 Site Protection - The station shall be:

a. elevated to a minimum of one foot above the 100-year flood elevation, or protected to such elevation;

b. accessible at all times unless permitted to be out of service for period of inaccessibility;

c. graded around station so as to lead surface drainage away from the station;

d. protected to prevent vandalism and entrance by unauthorized persons or animals.

7.2 GROUND WATER FACILITIES - Where pumping facilities are used, wells and springs shall be vented by properly hooded and screened pipe extending at least 12 inches above the pump floor. Where necessary, provision shall be made for lubricating the pump from a point at least 6 inches above the top of the well cover, by means which will prevent contamination of the water supply.

7.2.1 Drilled Wells - Pumping stations located over drilled wells shall;

a. have riser pipe or casing extending at least 6 inches, and preferably 12 inches, above the floor, and be equipped with flange or suitable stuffing box;

b. have riser pipe or casing firmly connected to the pump structure to provide a water tight connection.

c. have base of pump not less than 6 inches above pump room floor;

d. have pump foundation and base designed to prevent water from coming into contact with the joint.

7.2.2 Submersible Pumps - Where a submersible pump is used, the top of the casing shall be effectively sealed against entrance of water under all conditions of vibration or movements of conductors or cables.

7.2.3 Discharge Piping - Discharge piping should be provided with means to pump to waste but shall not be directly connected to a sewer. The discharge line shall:

a. have control valves located above pump floor;

b. be protected against freezing;

c. be valved to permit testing and control of each well;

d. have watertight joints;

e. have all exposed valves protected.

7.3 SURFACE WATER FACILITIES - Pump stations normally associated with surface water sources, either as raw or finished water pump stations, shall:

a. have adequate space for the installation of additional units if needed, and for the safe servicing of all equipment;

b. be of durable character, fire and weather resistant and with outward opening doors;

c. have floor elevation of at least 6 inches above finished grade;

d. have underground structure waterproofed;

e. have all floors drained without impairing the quality of water being handled and if equipment is contained on the floor, the floor shall have sufficient slope to drain adequately.

f. provide suitable outlet for drainage from-pump glands without discharging onto the floor.

7.3.1 Suction Well - Suction wells shall:

a. be watertight;

b. have floors sloped to permit removal of water and entrained solids;

c. be covered or otherwise protected against contamination; including pump lubricant.

7.3.2 Equipment Servicing - Pump facilities shall be provided with;

a. crane-ways, hoist beams, eye bolts, or other adequate facilities for servicing or removal of pumps, meters or heavy equipment;

b. openings in floors, roofs or wherever else needed for removal of heavy or bulky equipment;

c. a convenient tool board or other facilities as needed for proper maintenance of the equipment.

7.3.3 Stairways and Ladders - Stairways or ladder shall

a. be provided between all floors, in pits or compartments which must be entered.

b. have handrails on both sides, and treads of non-slip material.

Stairs are preferred in areas where there is frequent traffic or where supplies are transported by hand. They shall have risers not exceeding 9 inches and treads wide enough for safety.

7.3.4 Heating - Provision shall be made for adequate heating for:

a. comfort of the operator;

b. the safe and efficient operation of the equipment.

In pump houses not occupied by personnel, only enough heat need be provided to prevent freezing of equipment or treatment process.

7.3.5 Ventilation - Adequate ventilation shall be provided for all pumping stations. Forced ventilation of at least 6 changes of air per hour shall be provided for:

a. all rooms, compartments, pits and other enclosures below grade floor;

b. any area where unsafe atmosphere may develop or where excessive heat may be built up.

7.3.6 Dehumidification - In areas where excess moisture could cause hazards to safety or damage to equipment means for dehumidification shall be provided.

7.3.7 Lighting - Pump stations shall be adequately lighted throughout. All electrical work shall conform to the requirements of the American Insurance Association and related agencies and to relevant State and/or local codes.

7.3.8 Sanitary and Other Conveniences - Pumping stations which are manned for extended periods shall be provided with potable water, lavatory and toilet facilities. Plumbing must be so installed as to prevent contamination of a public water supply. Wastes shall be discharged in accordance with Section 4.11 of these standards.

7.3.9 Pumps - At least 2 pumping units shall be provided. Each pumping unit shall be capable of carrying the peak demand. If more than 2 units are installed, they shall have sufficient capacity so that any 1 pump can be taken out of service and the remaining pumps are capable of carrying the peak demand. The pumping units shall:

a. have ample capacity to supply the peak demand without dangerous overloading;

b. be driven by a prime mover able to operate against the maximum head and air temperature which may be encountered;

c. have spare parts and tools readily available.

3600 RPM pumps are not desirable and should be avoided if at all possible.

7.3.10 Suction Lift - Suction lift pumps will be considered on an individual basis based on justification of design engineer.

7.4 BOOSTER PUMPS - Booster pumps shall be located or controlled so that:

a. they will not produce negative pressure anywhere in the distribution system;

b. the pressure in the suction line shall be maintained at or above 20 psi by the use of a pressure sustaining valve or low pressure cutoff device.

c. automatic or remote control devices shall have a range between the start and cutoff pressure which will prevent excessive cycling.

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

7.4.2 The criteria in this section also apply to fire pumps.

7.4.3 Booster pumps shall not serve more than 50 service connections unless gravity storage is provided or service pressure can be maintained above 20 psi without the pumps running.

7.5 AUTOMATIC AND REMOTE CONTROLLED STATIONS - All automatic stations should be provided with automatic signaling apparatus which will report when the station is out of service. All remote controlled stations shall be electrically operated and controlled and shall have signaling apparatus of proven performance. Installation of electrical equipment shall conform with the National Electrical Code.

7.6 APPURTENANCES

7.6.1 Valves - Pumps shall be adequately valved to permit satisfactory operation, maintenance and repair of the equipment. If foot valves are necessary they shall have a net valve area of at least 2½ times the area of the suction pipe and they shall be screened. Each pump shall have a positive acting check valve on the discharge side between the pump and shutoff valve.

7.6.2 Piping - In general, piping shall:

a. be designed so that the friction head will be minimized;

b. not be subject to contamination;

c. have watertight joints;

d. be protected against surge or water hammer;

e. be such that each pump has an individual suction line or the lines shall be so manifolded that they will insure similar hydraulic and operation conditions.

7.6.3 Gauges and Meters - Each pump shall:

a. shall have a standard pressure gauge on its discharge line;

b. shall have a compound gauge on its suction line;

c. shall have recording gauges in larger stations;

d. should have a means for measuring the discharge.

The larger stations should have indicating, totalizing and recording metering of the total water pumped.

7.6.4 Water Seals - Water seals shall not be supplied with water of a lesser sanitary quality than that of the water being pumped.

7.6.5 Controls - Pumps, their prime movers and accessories, shall be controlled in such a manner that they will operate at rated capacity without dangerous overload. Where two or more pumps are installed, provision shall be made for proper alternation. Provision shall be made to prevent operation of the pump during the backspin cycle. Electrical controls should be located above grade.

7.6.6 Power - When power failure would result in cessation of minimum essential service, power supply shall be provided from at least two independent sources or standby or auxiliary source shall be provided.

7.6.7 Auxiliary Power Supply - When automatic pre-lubrication of pump bearings is necessary, and an auxiliary power supply is provided, the pre-lubrication line shall be provided with a valved by-pass around the automatic control.

Part 8 - FINISHED WATER STORAGE

8.0 GENERAL - The materials and designs used for finished water storage structures shall provide stability and durability as well as protect the quality of the stored water. Steel structures shall follow the current AWWA standards concerning steel tanks, standpipes, reservoirs, and elevated tanks wherever they are applicable. Prestressed concrete tanks shall meet applicable AWWA Standards. Other materials of construction are acceptable when properly designed to meet the requirements of this part.

8.0.1 Location

a. The bottom of ground-level reservoirs should be placed at the normal ground surface and above maximum flood level.

b. Where the bottom must be below normal ground surface, it should be placed above the ground water table. Sewers, drains, standing water, and similar sources of contamination must be kept at least 50 feet from the reservoir. Mechanical-joint water pipe, pressure tested in place to 50 psi without leakage, may be used for gravity sewers at lesser separations.

c. The top of a ground-level reservoir should not be less than 2 feet above normal ground surface and any possible flood level. Clearwells constructed under filters may be excepted from this requirement when the total design gives the same protection.

8.0.2 Protection - All new finished water storage structures shall have suitable watertight roofs or covers which exclude birds, animals, insects, and excessive dust.

8.0.3 Protection from Trespassers - Fencing, locks on access manholes, and other necessary precautions shall be provided to prevent trespassing, vandalism, and sabotage.

8.0.4 Drains - No drain on a water storage structure may have a direct connection to a sewer or storm drain. Splash pad and drainway shall be provided to prevent erosion.

8.0.5 Overflow - The overflow pipe of a water storage structure should be brought down near the ground surface and discharged over a drainage inlet structure or a splash plate and flow onto a drainway which is rip-rapped or otherwise protected to minimize erosion. No overflow may be connected directly to a sewer or storm drain.

a. When an internal overflow pipe is used, it shall be located in the access tube.

b. The overflow of a ground-level structure shall be high enough above normal or graded ground surface to prevent the entrance of surface water.

c. The overflow shall be protected with a twenty-four mesh non-corrodible screen and a flap valve.

8.0.6 Access - Finished water storage structures shall be designed with reasonably convenient access to the interior for cleaning and maintenance. Manholes on scuttles above waterline:

a. shall be framed at least 4 inches, and preferably 6 inches, above the surface of the roof at the opening; on ground-level structures manholes should be elevated 24 to 36 inches above the top or covering sod;

b. shall be fitted with a solid watertight cover which overlaps the framed opening and extends. down around the frame at least 2 inches;

c. should be hinged at one side;

d. shall have a locking device,

e. shall be a minimum of 20 inches in diameter or equivalent.

8.0.7 Vents - Finished water storage structures shall be vented by special vent structures. Open construction between the side wall and roof is not permissible. These vents:

a. shall prevent the entrance of surface water;

b. shall exclude birds and animals;

c. shall exclude insects and dust, as much as this function can be made compatible with effective venting; for elevated tanks and standpipes, 4-mesh non-corrodible screen may be used;

d. shall, on ground-level structures, terminate in an inverted U construction, the opening of which is 24 to 36 inches above the roof of sod and is covered with 24-mesh non-corrodible screen cloth.

8.0.8 Roof and Sidewall - The roof and sidewalls of all structures must be watertight with no openings except properly constructed vents, manholes, overflows, risers, drains, pump mountings, control ports, or piping for inflow and outflow.

a. Any pipes running through the roof or sidewall of a finished water storage structure must be welded or properly gasketed in metal tanks, or should be connected to standard wall castings which were poured in place during the forming of a concrete structure; these wall castings should have flanges embedded in the concrete.

b. openings in a storage structure roof or top, designed to accommodate control apparatus or pump columns, shall be curbed and sleeved with proper additional shielding to prevent the access of surface or slop water to the structure.

c. Valves and controls should be located outside the storage structure so that valve stems and similar projections will not pass through the roof or top of the reservoir.

8.0.9 Drainage for Roof or Cover - The roof or cover of the storage structure should be well drained, but downspout pipes shall not enter or pass through the reservoir; parapets, or similar construction which would tend to hold water and snow on the roof will not be approved.

8.0.10 Safety - The safety of employees must be considered in the design of the storage structure. As a minimum, such matters shall conform to pertinent laws and regulations.

a. Ladders, ladder guards, balcony railings, and safe location of entrance hatches shall be provided where applicable.

b. Elevated tanks with riser pipes over 8 inches in diameter shall have protective bars over the riser openings inside the tank.

8.0.11 Freezing - All finished water storage structures and their appurtenances, especially the riser pipes, overflows, and vents, shall be designed to prevent freezing which will interfere with proper functioning.

8.0.12 Grading - The area surrounding a ground-level structure should be graded in a manner that will prevent surface water from standing within 50 feet of the structure.

8.0.13 Silt stop - The discharge pipe of the reservoir shall be located in a manner that will prevent the flow of sediment into the distribution systems. Either a permanent or removable silt stop shall be provided at least 4 inches above the bottom of the storage structure.

8.0.14 Painting and/or Cathodic Protection - Proper protection should be given to metal surfaces by paints or other protective coatings, by cathodic protective devices, or by both.

a. Paint systems consistent with current American Water Works Association standards, or otherwise acceptable to the Department shall be used. All paints must be acceptable to FDA and EPA for contact with potable water.

b. Cathodic protection should be designed and installed by competent technical personnel.

8.0.15 Turnover of water - If the storage reservoir is sized larger than required for initial demand and there is more than 2 days storage, provisions shall be made for turnover of the water in the tank and/or booster chlorination. Internal piping arrangements to prevent water stratification in ground level standpipes are recommended. For large, ground level tanks/reservoirs, piping and/or check valves can be installed to force water in and out of the tank at different locations in order to minimize dead/stagnant water zones.

8.0.16 Sampling - A suitable sampling tap should be provided on all storage structures and be protected from public access.

8.0.17 Disinfection - Finished water storage structures shall be disinfected in accordance with AWWA Standard C652 before being put in service.

8.1 PLANT STORAGE - The applicable design standards of this part shall be followed for plant storage.

8.1.1 Washwater Tanks - If washwater tanks are used, they shall be sized, in conjunction with available pump units and finished water storage, to give the back wash water required by Section 4.2.1.K.

a. Consideration must be given to the possibility of having to wash more than one filter at a time, or several filters in succession.

8.1.2 Clearwell - Clearwell storage should be sized, in conjunction with distribution system storage, to relieve the filters from having to follow fluctuations in water use to meet peak demands, including filter backwash water. Design shall include features to minimize short circuiting.

a. When finished water storage is used to provide proper contact time for chlorine, (see Section 4.4.2), special attention must be given to size and baffling.

b. An overflow shall be provided and must be protected with a screen and flap valve.

8.1.3 Adjacent Compartments - finished water must not be stored or conveyed in a compartment adjacent to unsafe water when the two compartments are separated by a single wall.

8.1.4 Basins and Wet-Wells - Receiving basins and pump wet-wells for finished water shall be designed as finished water storage structures.

8.2 PRESSURE TANKS - Hydropneumatic (pressure) tanks may be acceptable in some circumstances where the number being served is 50 connections or less. When used, they shall meet ASME code requirements or

equal which comply with the requirements of state and local laws and regulations for the construction and installation of unfired pressure vessels.

8.2.1 Location - The tank should be located above normal ground surface and be completely housed, or earth-mounted with one end projecting into an operating house, to prevent freezing.

8.2.2 Bypass - tank should have bypass piping to permit operation of the system while the tank is being repaired or painted.

8.2.3 Appurtenances - Each tank should have an access manhole, a drain, a control equipment consisting of pressure gage, water sight glass, automatic or manual air blow-off, mechanical means for adding air, and pressure-operated start-stop controls for the pumps.

8.2.4 Sizing -

a. The capacity of each well and/or pump in a hydropneumatic system should be at least ten times the average daily consumption rate of the community or the maximum peak demand whichever is greater.

b. The gross volume of the hydropneumatic tank, in gallons, should be at least 20 times the capacity of the largest pump, rated in gallons per minute.

8.2.5 Auxiliary power - Auxiliary power with automatic takeover capability shall be provided when positive pressures are not available from system gravity flow.

8.3 DISTRIBUTION STORAGE - The applicable design standards of this part shall be followed for distribution storage.

8.3.1 The purpose of system storage is to have sufficient water available to provide adequate flow and pressure at peak demand as well as to provide for fire flows when needed. For most water systems a satisfactory rule-of-thumb to meet these needs is to provide at least the average 24-hour demand in elevated storage. In the absence of an acceptable engineering study of the amount of water the system needs to meet customer demand and to provide for fire emergencies, the projected 24-hour demand at the end of the planning period will be the minimum requirement for elevated storage. This requirement may be reduced when the source, treatment facilities and pumps have sufficient capacity with standby power capability to supplement peak demands of the system.

8.3.2 Pressure Variation - System pressure variation on account of changes in level of water in storage structures should be minimized. Elevated storage tanks or large diameter ground tanks located on high ground should be the usual choices. Standpipes will not normally be approved and must be completely justified if proposed.

8.3.3 Drainage - Storage structures which float on the distribution system should be designed to drain for cleaning or maintenance without necessitating loss of pressure in the distribution system. The drains should discharge to the ground surface with no direct connection to a sewer or storm drain. (See Section 8.0.4). A nearby fire hydrant may be considered as a drain as long as service is not interrupted and suitable erosion protection is provided.

8.3.4 Level Controls - Adequate controls shall be provided to maintain levels in distribution system storage structures.

a. Telemeter equipment should be used when pressure-type controls are employed and any appreciable head loss occurs in the distribution system between the source and the storage structure.

b. Altitude valves or equivalent controls may be required for a second and subsequent structures on the system.

c. Overflow and low-level warnings or alarms should be located at places in the community where they will be under responsible surveillance on a 24-hour basis.

Part 9 - DISTRIBUTION SYSTEMS

9.0 SYSTEM DESIGN

9.0.1 Minimum Pipe Size

a. The minimum size of pipe for principal water mains and for water mains where fire hydrants are to be attached shall be 6-inch diameter.

b. Size of water mains shall be justified by hydraulic analysis. 2-inch water mains will only be considered for short cul-de-sacs and permanent dead-ends where future growth is not feasible. The length of 2-inch mains shall be restricted to 3000 feet in any one direction.

c. All water mains including those not designed to provide fire protection shall be sized after a hydraulic analysis based on flow demands and pressure requirements. The system shall be designed to maintain a minimum pressure of 20 psi at ground level at all points in distribution system under all conditions of flow.

d. Wide variations in pressure above the minimum requirement of 20 psi may be inherent in the design of a distribution system but pressures no greater than 100 psi should be delivered to the customer (unless higher pressures are requested.). Main line pressure reducing valves can be used to reduce pressures below 100 psi where feasible. Where water pressures over 100 psi are necessary to the operation of the distribution system, customers must have individual pressure reducing valves.

e. All assumptions and any flow data used must be clearly documented and submitted with the hydraulic analysis. if actual flow data is not available theoretical calculations shall be based on all storage facilities half-full and the Hazen-Williams friction factor appropriate for type of pipe being used but in no case greater than 130.

f. Water distribution lines should be designed and sized for an instantaneous peak demand of 2 gpm per connection for water lines serving up to 100 residential connections. Peak design demands can be reduced to 1.5 gpm per connection for 150 residential connections, 1.0 gpm per connection for 300 residential connections, 0.75 gpm per connection for 500 residential connections, and 0.5 gpm per connection for 1000 or more residential connections.

9.0.2 Fire Protection

a. The minimum pipe size to which a fire hydrant may be connected is 6-inch.

b. Ordinarily fire hydrants shall not be connected to water mains which are not capable of providing a flow of 500 gpm at 20 psi. When a municipality or county enacts a restrictive use ordinance prohibiting pumper trucks from connecting to restricted fire hydrants which are painted a distinctive color and when a copy of this ordinance in on file at this office, we will permit fire hydrants to be connected to 6-inch mains which do not have the required pressure and flow.

c. When fire protection is to be provided, system design should consider the recommendations of the state Insurance Services Organization.

d. Fire hydrants shall meet current AWWA Standard C502.

9.0.3 Dead Ends

a. Dead ends shall be minimized.

b. Where dead-end mains occur they should be provided with a fire hydrant, when fire flows are available, or blow-off for flushing purposes. The blow-off shall be at least 2 inches in diameter, but should provide flushing velocities of 2 feet per second or greater.

c. No flushing device shall be directly connected to any sewer nor be subject to flooding or plugging.

9.1 INSTALLATION OF MAINS

9.1.1 Adequate support shall be provided for all pipes.

9.1.2 A continuous and uniform bedding shall be provided in the trench for all buried pipe.

9.1.3 Rock Excavation - Stones found in the trench shall be removed for a depth of at least six inches below the bottom of the pipe.

9.1.4 Cover - All distribution mains shall be provided with sufficient earth or other suitable cover to prevent freezing. This shall not be less than 30 inches measured above the top of the pipe.

9.1.5 Hydrostatic Tests

a. Pressure and leakage tests shall be performed in accordance with current AWWA Standard C600 and/or manufacturer's installation procedures.

b. The test pressure of the installed pipe shall be a minimum of 150 psi or 1.5 times the working pressure, whichever is greater.

c. Allowable leakage shall be no greater than as calculated in $L = SD /P/133,200$ where L is allowable leakage in gallons/hour, S is the length of pipe tested in feet, D is pipe diameter in inches and P is test pressure in psi.

9.1.6 Disinfection of New Water Mains - The specifications shall include detailed procedures for the adequate flushing, disinfection, and (Total Coliform) bacteriological testing of all new water mains. Disinfection as described in current AWWA Standard C651 will be accepted.

9.1.7 Disinfection When Cutting into or Repairing Existing Mains:

a. Shall be performed when mains are wholly or partially dewatered;

b. Shall follow current AWWA C651 procedures including trench treatment, swabbing with hypochlorite solution, flushing and/or slug chlorination as appropriate;

c. Bacteriological testing should be done after repairs are complete but the water main may be returned to service prior to completion of testing to minimize the time customers are out of water;

d. Leaks or breaks that are repaired with clamping devices while mains remain full of water under pressure require no disinfection.

9.1.8 When non-metallic pipe is installed, detection tape or other acceptable means of detection shall be installed.

9.2 SEPARATION OF WATER MAINS AND SEWERS

9.2.1 General - The following factors should be considered in providing adequate separation:

a. materials and type of joints for water and sewer pipes;

b. soil conditions;

c. service and branch connections into the water main and sewer line;

d. compensating variations in the horizontal and vertical separations;

e. space for repair and alterations of water and sewer pipes;

f. off-setting of pipes around manholes;

g. water mains and sanitary or storm sewers shall not be laid in the same trench.

9.2.2 Parallel Installation

a. Normal conditions - Water mains shall be laid at least 10 feet horizontally from any sanitary sewer, storm sewer or sewer manhole, whenever possible; the distance shall be measured edge-to-edge.

b. Unusual conditions - When local conditions prevent a horizontal separation of 10 feet, a water main may be laid closer to a storm or sanitary sewer provided that:

1. the bottom of the water main is at least 18 inches above the top of the sewer;

2. where this vertical separation cannot be obtained, the sewer shall be constructed of materials and with joints that are equivalent to water main standards of construction and shall be pressure tested to assure water-tightness prior to backfilling.

9.2.3 Crossings

a. Normal conditions - Water mains crossing house sewers, storm sewers or sanitary sewers shall be laid to provide a separation of at least 18 inches between the bottom of the water main and the top of the sewer, whenever possible.

b. Unusual conditions - when local conditions prevent a vertical separation as described in Section 9.2.3a, the following construction shall be used:

1. Sewers passing over or under water mains should be constructed of the materials described in Section 9.2.2b2.

2. Water mains passing under sewers shall, in addition, be protected by providing:

i. a vertical separation of at least 18 inches between the bottom of the sewer and the top of the water main;

ii. adequate structural support for the sewers to prevent excessive deflection of joints and settling on and breaking the water mains;

iii. that the length of water pipe be centered at the point of crossing so that the joints will be equidistant and as far as possible from the sewer.

iv. both the sewer and the water main shall be constructed of water pipe and tested in accordance with Section 9.1.5.

9.2.4 Sewer manholes - No water pipe shall pass through or come into contact with any part of a sewer or sewer manhole.

9.3 SURFACE WATER CROSSINGS - Surface water crossings, both over and under water, present special problems which should be discussed with the Department before final plans are prepared.

9.3.1 Above-water crossings - The pipe shall be:

a. adequately supported;

b. protected from damage and freezing;

c. accessible for repair or replacement.

9.3.2 When crossing water courses which are greater than 15 feet in width:

a. The pipe shall be of special construction, having flexible, watertight joints;

b. Valves shall be provided at both ends of water crossing so that the section can be isolated for test or repair; the valves shall be easily accessible and not subject to flooding;

c. Sampling taps should be available at each end of the crossing;

d. Permanent taps should be made for testing and locating leaks.

9.4 CROSS CONNECTIONS

a. There shall be no physical connection between the distribution system and any pipes, pumps, hydrants, or tanks whereby unsafe water and other contaminating materials may be discharged or drawn into the system.

b. The approval of the Department shall be obtained for interconnections between potable water supplies.

c. Neither steam condensate nor cooling water from engine jackets or other heat exchange devices shall be returned to the potable water supply.

9.5 WATER SERVICES AND PLUMBING - Water services and plumbing shall conform to relevant local and/or state plumbing codes, or to the Standard Plumbing Code.

9.6 MATERIALS - GENERAL

a. Pipe selected shall have been manufactured in conformity with the latest standards issued by the American Water Works Association, if such standards exist, and be acceptable to the Department.

b. in the absence of such standards, pipe meeting applicable ASTM and ANSI criteria and acceptable to the Department may be selected.

c. Used water mains that meet these standards may be used again, after the pipe has been thoroughly cleaned and restored practically to its original condition.

d. Packing and jointing materials used in the joints of pipe shall meet the standards of the American Water Works Association or the Department.

e. Mechanical joints or slip-on joints with rubber gaskets are preferred.

9.7 PIPE

9.7.1 Ductile iron and cast iron pipe shall meet the latest requirements of ANSI/AWWA - C106 or CIO8 for cast iron pipe and C151 for ductile iron pipe.

9.7.2 Concrete pressure pipe shall meet the latest requirements of AWWA C300 or AWWA C301.

9.7.3 PVC pipe - 2 inch through 12 inch

a. PVC pipe meeting the standards set forth in AWWA C-900 (latest edition) will be accepted for those working pressures as designated by class. (Note that C-900 refers only to 4-inch through 12-inch pipe).

b. SDR 21, Class 200 pressure rated pipe may be used where the working pressure does not exceed 135 psi. The pipe must meet all the requirements set forth in ASTM Standard D 2241 for 2-inch through 12-inch pipe designated SDR 21. The pipe must bear the National Sanitation Foundation Testing Laboratories, Inc. seal of approval for potable water, or an approved equal.

c. Provision must be made for contraction and expansion at each joint with flexible ring gaskets made from rubber or other suitable material. Gasket materials shall meet the requirements established in ASTM F477.

d. Joints for PR 200 (pressure rated) pipe (ASTM D2241) shall be manufactured in accordance with ASTM D3139. Section 5.3.1 of this standard refers to 2000-hour tests. If pipe is manufactured in accordance with that section, the testing must be done by an independent laboratory with the results being furnished to this Department. Note also that a separate test is required for each different type of gasket provided.

e. All fittings such as tees, ells, etc. using welded joints shall be factory welded and shall meet the same specifications as the welded bell section.

f. Lubricants shall be non-toxic and shall not promote biological growth.

g. Solvent cemented joints in the field are not permitted.

h. Forty-foot lengths will be permitted when the engineering specifications contain special conditions for handling such pipe lengths. These conditions shall include provisions for transporting pipe from storage areas to the installation area on specially designed racks to prevent the ends of the pipe from dragging.

i. This policy does not apply to plastic service lines.

9.7.4 Fiberglass Composite Pipe shall be composed of an inner core of PVC overwrapped with fiberglass bonded with epoxy. 350 Pressure Rated shall be in accordance with ASTM D-2992 and D-2996.

9.7.5 Polyethylene pipe for water distribution lines shall meet the requirements of AWWA C906.

9.7.6 Molecular oriented PVC pipe shall meet the requirements of AWWA C909.

9.7.7 Any pipe material which is not specifically covered in this section will be considered on an individual basis.

9.8 VALVE, AIR RELIEF, METER AND BLOW-OFF CHAMBERS

a. Sediment accumulations may be removed through a standard fire hydrant, and compressed air and pumping may be used for dewatering mains through hydrants.

b. At high points in water mains where air can accumulate, provisions shall be made to remove the air by means of hydrants or air relief valves. Automatic air relief valves shall not be used in situations where flooding of the manhole or chamber may occur.

c. Chambers of pits containing valves, blow-offs, meters or other such appurtenances to a distribution system, shall not be connected directly to any storm drain or sanitary sewer, nor shall blowoffs or air-relief valves be connected directly to any sewer.

d. Such chambers or pits shall be drained to the surface of the ground where they are not subject to flooding by surface water, or to absorption pits underground.

e. Valves are to be placed at all intersections of water mains but at no time greater than 4000 feet apart.

f. Gate valves shall meet current AWWA standards.