



CIRCULAR DEQ 3

**STANDARDS
FOR
SMALL WATER SYSTEMS**

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CHAPTER 1 - SUBMISSION OF PLANS

1.0 GENERAL

All reports, final plans and specifications must be submitted at least 60 days prior to the date on which action by MDEQ is desired. The term "MDEQ" as used in this circular refers to the Montana Department of Environmental Quality or a delegated division of local government. Permits for construction, [to take water](#), for waste discharges, for stream crossings, etc., may be required from other federal, state or local agencies. No approval for construction can be issued until final, complete, detailed plans and specifications have been submitted to MDEQ and found to be satisfactory. Three copies of the final plans and specifications must be submitted. An approved set will be returned to the applicant. Documents submitted for formal approval must include, but are not limited to:

- a. a summary of the basic design,
- b. operation requirements, where applicable,
- c. general layout,
- d. detailed plans, and
- e. specifications.
- f. [review fees as specified in ARM 17.38.106](#)

1.1 DESIGN REPORT

The design report for new water works must present the following information. The design report for existing water systems must present the following information detailed in this subsection to the extent it applies to the water system improvements:

1.1.1 General information, including:

- a. A description of the existing water works and sewage facilities,
- b. An identification of the municipality or area served,
- c. The name and mailing address of the owner, developer and official custodian.
- d. Information requested in Appendix A for new non-transient non-community systems and existing system improvements with significant economic impacts.

1.1.2 Extent of water system, including:

- a. Description of the nature and extent of the area or facility to be served,
- b. provisions for extending the water works system to include additional facilities, and
- c. appraisal of the future requirements for service, including existing and potential water supply needs.

1.1.3 Alternate Plans

Where two or more solutions exist for providing water supply facilities, each of which is feasible and practicable, discuss the alternate plans and give reasons for selecting the one recommended, including financial considerations.

1.1.4 Water use data, including:

- a. The estimated population, which will be served by the proposed water supply system or expanded system,
- b. present water consumption (if available) and the projected average and maximum daily demands or peak instantaneous demand where appropriate used as the basis of design, including fire flow demand if provided, and
- c. present and/or estimated yield of the sources of supply.

1.1.5 Sewage system available

Describe the existing or proposed sewage collection system and sewage treatment works with special reference to their relationship to existing or proposed water works structures which may affect the operation of the water supply system, or which may affect the quality of the supply.

1.1.6 Sources of water supply

Describe the proposed source or sources of water supply to be developed, including:

- a. Sites considered,
- b. advantages of the site selected,
- c. elevations with respect to surroundings,
- d. sources of possible contamination such as sewers and sewage treatment/disposal facilities, highways, railroads, landfills, outcroppings of consolidated water-bearing formations, storm water facilities, chemical facilities, waste disposal wells, agricultural uses, etc.
- ~~e.~~ documentation that an application for water rights has been filed with the Department of Natural Resources and Conservation, when applicable. ~~Final system approval will be conditioned on the ability to obtain water rights,~~
- ~~ef.~~ a preliminary assessment for proposed groundwater sources that may be under the direct influence of surface water prepared in accordance with Circular PWS-5, "Assessment of Groundwater Sources Under the Direct Influence of Surface Water," and
- ~~fg.~~ a source water protection plan prepared in accordance with Circular PWS-6.

1.2 PLANS

Plans for water works improvements must, be legible and must provide the following:

1.2.1 General layout including:

- a. suitable title,
- b. name of entity or person responsible for the water supply,

- c. area or facility to be served,
- d. scale, in feet,
- e. north point,
- f. date and name of the designer, and
- g. location, nature and size of existing water facilities, if any.

1.2.2 Detailed plans, including:

- a. arrangement of present or planned wells or structures,
- b. plan and profile drawings of well construction, showing diameter and depth of drill holes, casing and liner diameters and depths, grouting depths, elevations and designation of geological formations, water levels and other details to describe the proposed well completely,
- c. location of all existing and potential sources of pollution which may affect the water source or underground treated water storage facilities,
- d. location, size and length of existing or proposed streets; water sources, including ponds, lakes and drains; storm, sanitary, combined and house sewers; septic tanks, disposal fields and cesspools; and abandoned wells,
- e. piping in sufficient detail to show flow through the water system, including waste lines,
- f. locations, dimensions and elevations of all proposed water system facilities,
- g. locations of sampling taps, and
- h. adequate description of any features not otherwise covered by the specifications.

1.3 SPECIFICATIONS

Complete, detailed, technical specifications must be supplied for the proposed project.

1.4 DEVIATIONS FROM STANDARDS

Deviations from the mandatory requirements of these standards, may be granted by the Department, on a case-by-case basis for specific projects.

1.4.1 Procedure

- a. A person desiring a deviation must make a request in writing on the *Department of Environmental Quality Deviation Form*. The request must identify the specific section and deviation of the standards to be considered. Adequate justification for the deviation must be provided. "Engineering judgment" or "professional opinion" without supporting data is not considered adequate justification.
- b. A panel of three persons from the Department shall review the request, and make a final determination on whether or not a deviation may be granted.

c. A file of all deviations will be maintained by the Department.

d. Deviations to standards will not be approved if they would cause a violation of a Statute or Administrative Rule.

CHAPTER 2 GENERAL DESIGN CONSIDERATIONS

2.0 DISINFECTION

All wells, pipes, tanks, and equipment that can convey or store potable water must be disinfected in accordance with current AWWA procedures. Plans or specifications must outline the procedure and include the disinfection dosage, contact time, and method of testing the results of the procedure.

2.1 OTHER CONSIDERATIONS

Consideration must be given to the design requirements of other federal, state, and local regulatory agencies for items such as safety requirements, special designs for the handicapped, plumbing and electrical codes, construction in the flood plain, etc. All equipment must be designed to operate within manufacturer's recommended range.

CHAPTER 3 - SOURCE DEVELOPMENT

3.0 GENERAL

In selecting the source of water to be developed, the designer must demonstrate to the satisfaction of MDEQ that an adequate quantity of water will be available, and that the water that is to be delivered to the consumers will meet the current requirements of the Department.

3.1 SURFACE WATER

Surface Water sources must comply with the applicable sections of Circular DEQ-1, Standards for Water Works, including Section 3.1.

3.2 GROUND WATER

A ground water source includes all water from dug, drilled, bored or driven wells, and infiltration lines. Prior to construction of a well intended to serve a public water supply, the proposed location and the plans and specifications must be approved by MDEQ in accordance with the requirements of this section. In order to assess the available water quality and quantity, MDEQ may require construction and testing of the well in accordance with the approved plans and specifications and at the approved location prior to approval of other system components. All wells must be constructed by a licensed water well contractor in accordance with Title 37, Chapter 43, MCA, and Title 36, Chapter 21, ARM, current edition, (Water Well Contractor rules) with the following additional requirements.

3.2.1. Quantity

3.2.1.1 Source capacity

The total developed ground water source capacity must equal or exceed the design maximum day demand. Adequate storage per DEQ-1 Section 7.0.1 will be required if source capacity is inadequate to meet peak instantaneous demand.

3.2.1.2 Water use estimates for design purposes

- a. Domestic use – for non-public multi-user systems, 100 gpcd must be provided for average domestic use unless the designer has sufficient data, acceptable to MDEQ, to show a lesser quantity to be adequate.
- b. Commercial/Industrial use – for non-residential public water systems, the system must be capable of meeting peak demands. This is typically calculated from a Fixture Unit analysis per the UPC, AWWA Fixture Value Method, or by applying a peaking factor to the Average Day Demand in gallons per minute, or other means acceptable to MDEQ.
- c. Irrigation - when irrigation water is provided, information must be submitted to show that adequate water will be available. Such information must include:
 1. the area to be irrigated in acres or square feet,
 2. water requirements in inches/week,
 3. proposed methods of controlling irrigation beyond the capacity of the system.

- ed. Fire flows - fire flows must meet the recommendations of the agency in which the water system is being developed, or in the absence of such a recommendation, the fire code adopted by the State of Montana.

3.2.2. Quality

The Department will determine the minimum treatment required for a groundwater source serving a public water supply to ensure compliance with Title 17, Chapter 38, Sub-Chapter 2, ARM.

3.2.2.1 Microbiological quality

- a. Disinfection of every new, modified or reconditioned ground water source must be provided in accordance with ARM 36.21.662(1) prior to and after placement of permanent pumping equipment.
- b. More than 72 hours after disinfection, two or more water samples must be submitted to a laboratory certified by the Department of Public Health and Human Services for microbiological analysis with satisfactory results reported to MDEQ prior to placing the well into service.
- c. If MDEQ determines from the required application materials that the source may be groundwater under the direct influence of surface water in accordance with Circular PWS-5, then further assessment or treatment may be required.

3.2.2.2 Physical and chemical quality

- a. Every new, modified or reconditioned ground water source must be examined for applicable physical, and chemical characteristics by tests of representative samples in laboratories certified by the Department of Public Health and Human Services, with the results reported to MDEQ.
 - 1. Testing must include nitrate/nitrite and total dissolved solids or conductivity as a minimum for ~~individual-multi-user non-public~~ systems and transient non-community, public water systems. Additional testing may be required for other parameters where MDEQ has information suggesting they may be present in harmful quantities or where additional regulatory requirements apply.
 - 2. Testing must include the constituents of ARM 17.38.216 for non-transient, non-community public water systems.
 - 3. The above testing may be waived where information submitted confirms water quality will be acceptable.
- b. Samples must be collected at the conclusion of the test pumping procedure prior to disinfection and examined as soon as practical. MDEQ may require sample results to be submitted to the Department for review and approval to demonstrate conformance with Title 17, Chapter 38, Sub-chapter 2, ARM, prior to use of a new source or construction of a new system.

3.2.3 Location

3.2.3.1 Well location

Regarding a proposed well location, MDEQ must be consulted prior to design and construction as the location relates to required separation between existing and potential sources of contamination and ground water development. Wells must be located at least 100 feet from sewer lines, septic tanks, holding tanks, and any

other structures used to convey or retain industrial, storm or sanitary waste and state or federal highway rights-of-way. Well location(s) must be based on a source water ~~protection-delineation and~~ assessment conducted in accordance with Section 1.1.6 of this circular.

3.2.3.2 Continued protection

Continued protection of the well site from potential sources of contamination must be provided either through ~~ownership~~, zoning, easements, ~~deed notices leasing~~ or other means acceptable to MDEQ. Easements and deed notices must be filed with the County Clerk and Records Office. Such protection must extend for at least a 100-foot radius around the well (continued protection zone). In addition, separation distances between proposed wells and potential sources of contamination must be defined and justified by the applicant in accordance with Section 1.1.6 of this Circular. The ~~zone-of-influence-continued protection zone~~ of a proposed or existing well may not be in a groundwater mixing zone as defined in ARM 17.30.517. Fencing of the site may be required by MDEQ.

3.2.4 Testing and Records

3.2.4.1 Yield and drawdown tests must

- a. be performed on every production well after construction or subsequent treatment and prior to placement of the permanent pump,
- b. have the test methods clearly indicated in specifications,
- c. provide data of the following at one-hour intervals or less as may be required by MDEQ:
 1. Pumping rate,
 2. pumping water levels,
 3. static water level,
 4. water recovery rate and levels, and
 5. time of starting and ending each test cycle,
- d. Provide for continuous constant rate pumping at ~~1.5 times~~ the design pump capacity for at least ~~2472~~ hours. Data collection must begin at time zero. The test may be terminated if stabilized drawdown occurs for at least ~~six~~eight hours during the test. ~~If the design pumping rate is 35 gpm or greater, the minimum stabilized drawdown period must be at least eight hours.~~ Stabilized drawdown is defined as a water level that does not fluctuate plus or minus 0.5 feet for every 100 feet of drawdown at the design pumping rate. When sufficient historical information is available, a step drawdown test, may be approved by MDEQ. ~~The maximum test pumping rate may be reduced to the capacity of the design pump for both the step drawdown test and constant rate test for wells sized to provide peak instantaneous demand.~~

3.2.4.2 Results must be reported electronically to MDEQ on the appropriate DNRC form.

3.2.4.3 Geological data must be determined in accordance with ARM 36.21.667. A copy of the well log must be submitted to MDEQ. For public water supply systems, an accurate geological location such as latitude and longitude or GIS coordinates as determined by GPS to an accuracy of +/- 25 feet must be provided.

3.2.5 General well construction

3.2.5.1 Minimum protected depths for public water systems.

- a. Wells must have unperforated casing to a minimum depth of 25 feet or full time microbial treatment continuous disinfection must be provided.
- b. Full time ~~disinfection microbial treatment~~ is required where the water source is an aquifer with a seasonal high static water table level that is within 25 feet of ground surface. ~~A deviation of this standard may be granted by MDEQ in accordance with the procedures of Section 1.4.~~
- c. Microbial treatment required under a. or b. must provide 4-log inactivation and/or removal of viruses. A deviation of this standard may be granted by MDEQ in accordance with the procedures of Section 1.7 if the applicant shows there are no existing or approved sources of viral contamination within the 200-day time of travel zone of influence for the well and that new sources of contamination will not be introduced for this area.
- d. If the water source is from a confined aquifer, microbial treatment is not required. The applicant must demonstrate an aquifer is confined and the well casing is effectively sealed into a confining unit using the methods outlined in the *Nondegradation Guidance Manual, Appendix M*.

3.2.5.2 Permanent steel casing pipe must

- a. be in accordance with ARM 36.21.640,
- b. be equipped with a drive shoe when driven, and
- c. have joints in accordance with ARM 36.21.642.

3.2.5.3 Nonferrous casing materials

Plastic well casing must be in accordance with ARM 36.21.645 and ARM 36.21.646.

3.2.5.4 Packers

Packers must be of material that will not impart taste, odor, toxic substance or bacterial contamination to the well water. Lead packers must not be used.

3.2.5.5 Grouting requirements

- a. All permanent well casing must be sealed in accordance with ARM 36.21.654 through ARM 36.21.660.
- b. The casing must be provided with centralizers in accordance with ARM 36.21.649.

3.2.5.6 Upper terminal well construction.

- a. Permanent casing for all ground water sources must be in accordance with ARM 36.21.647.
- b. Where a well house is constructed, the floor surface must be at least 6 inches above the final ground elevation.
- c. Sites subject to flooding must be provided with an earth mound surrounding the casing and terminating at an elevation at least two feet above the 100-year flood level or highest known flood elevation

- d. The top of the well casing at sites subject to flooding must terminate at least three feet above the 100-year flood level or highest known flood elevation.
- e. Protection from physical damage and tampering must be provided.

3.2.5.7 Development

Every well must be developed in accordance with ARM 36.21.653.

3.2.5.8 Capping requirements

Temporary capping requirements must be in accordance with ARM 36.21.661.

3.2.5.9 Well abandonment

All wells that have no further use must be abandoned in accordance with ARM 36.21.670 through ARM 36.21.678.

3.2.6 Aquifer types and construction methods - special conditions

The following special aquifer types and construction methods must be reviewed by MDEQ on a case-by-case basis to assure proper design and protection of public health:

- a. sand or gravel wells,
- b. gravel pack wells,
- c. radial wells,
- d. infiltration lines,
- e. dug wells,
- f. limestone or sandstone wells and
- g. flowing wells.

3.2.7 Well pumps, discharge piping and appurtenances

3.2.7.1 Submersible pumps:

Where a submersible pump is used the top of the casing must be effectively sealed against the entry of water under all conditions of vibration or movement of conductors or cables.

3.2.7.2 Discharge piping

- a. The discharge piping and appurtenances must:
 - 1. have control valves and appurtenances located above the pumphouse floor when an aboveground discharge is provided,
 - 2. be protected against the entry of contamination,

3. be equipped with a check valve in or at the well, a shutoff valve, a pressure gauge and a smooth nosed sampling tap located at a point where positive pressure is maintained,
 4. where applicable, be equipped with an air relief valve located upstream from the check valve, with exhaust/relief piping terminating in a down-turned position at least 18 inches above the floor and covered with a 24 mesh corrosion resistant screen. Air release vacuum relief valves located in valve pits must meet the relief valve piping requirements in Circular DEQ-1, Section 8.5.2,
 5. be valved to permit test pumping and control of each well, and
 6. have all exposed piping, valves and appurtenances protected against physical damage and freezing.
- b. The discharge piping must be provided with a means of pumping to waste, but may not be directly connected to a sewer.

3.2.7.3 Pitless well units and adapters

Pitless units and pitless adapters submitted as a part of a system need to be specified using manufacturer's name and model number.

3.2.7.4 Casing vent

- a. Provisions must be made for venting the well casing to atmosphere. Venting must be provided by factory manufactured vented well cap or fabricated vent assembly. All vents must be screened with corrosion resistant material to prevent entry of insects and oriented to prevent entry of rainwater.
- b. Fabricated vents must terminate in a downturned position, at or above the top of the casing or pitless unit in a minimum 1 1/2 inch diameter opening covered with a 24-mesh screen. The pipe connecting the casing to the vent must be of adequate size to provide rapid venting of the casing. Fabricated vent assemblies must be of such design and strength as to be vandal resistant.

3.2.7.5 Water level measurement

- a. Provisions (i.e. probe access tube or air line) should be made for periodic measurement of water levels in the completed well.
- b. Where pneumatic water level measuring equipment is used it must be made using corrosion resistant materials attached firmly to the drop pipe or pump column and in such a manner as to prevent entry of foreign materials.

3.3 SPRINGS

Springs must be designed in accordance with Circular DEQ-12.

3.4 CISTERNS

Hauled water cisterns must be designed in accordance with Circular DEQ-18.

CHAPTER 4 - TREATMENT

4.0 GENERAL

The need for and design of treatment processes and devices will depend on evaluation of the nature and quality of the water to be treated and the desired quality of the finished water. ~~MDEQ shall use the Department Circular DEQ-1, "Standards for Water Works," as a guide for the review and approval of treatment processes and equipment.~~

~~In accordance with ARM 17.38.101, treatment processes and equipment are required to be designed by a registered professional engineer. In accordance with ARM 17.38.101 treatment processes or equipment used for compliance with Maximum Contaminant Levels (MCL) or for disinfection of public water systems are required to be designed by a registered professional engineer. Treatment processes installed for reasons other than MCL compliance or disinfection are not required to be designed by a professional engineer if the following conditions are met:~~

- ~~a. Chemicals must meet NSF Standard 60, and~~
- ~~b. Equipment components meet NSF Standard 61, and~~
- ~~c. All cross connection hazards are eliminated in accordance with the requirements of ARM 17.38.300-312.~~

4.1 DISINFECTION

Disinfection of non-community systems may follow the standard below in lieu of those listed in DEQ-1.

4.1.1 Minimum treatment.

a. Systems that are required to provide treatment under Standard 3.2.5.1, the Groundwater Rule, or have other indicators of potential viral contamination must provide adequate treatment to ensure 4-log virus inactivation and/or removal. Contact time must be based on tables in Appendix E of the EPA document, "Guidance Manual for Compliance with the Filtration and Disinfection Requirements for Public Water Systems Using Surface Water Sources", March 1991 Edition. Baffling factors must be determined in accordance with Appendix E of the EPA document, "Guidance Manual for Compliance with the Filtration and Disinfection Requirements for Public Water Systems Using Surface Water Sources", March 1991 Edition.

b. Systems that have nuisance bacteria in distribution must provide adequate disinfection to ensure a minimum chlorine residual of 0.2 mg/l can be met at the furthest extents of the distribution system. No minimum contact time is required.

4.1.2 Raw Water Quality

Estimates of chlorine demand must be provided and dose calculations adjusted for:

1. Iron
2. Manganese
3. Hydrogen Sulfide
4. Nitrite
5. Ammonia
6. Organic Nitrogen
7. Total Organic Carbon

To limit precipitation and objectionable water quality, the need for pretreatment must be addressed where the following levels are exceeded:

1. Iron > 0.3 mg/L
2. Manganese > 0.05 mg/L

4.1.3 Chlorinator Capacity

The chlorinator capacity must be such that the minimum required chlorine residual as estimated under 4.3.1 can be maintained in the water when maximum flow rate coincides with anticipated maximum chlorine demand. It is recommended that the chlorinator have the capacity such that a free chlorine residual of 2 mg/l can be maintained.

4.1.4 Testing equipment

Chlorine residual test equipment, recognized in the latest edition of Standard Methods for Examination of Water and Wastewater, must be provided and must be capable of measuring residuals to the nearest 0.1 milligrams per liter. All systems must use the DPD colorimetric method or amperometric titration. It is recommended that systems using the DPD method have a digital readout and self contained light source.

4.1.5 Specifications

Chlorine liquid, powder or pellets must meet AWWA standards and ANSI/NSF Standard 60.

4.1.6 Protective equipment

- a. Protective equipment as required by OSHA regulations must be provided.
- b. An eye washing device meeting ANSI Z358.1 must be provided.

4.2 LIQUID HYPOCHLORINATORS

- a. Positive displacement type solution feed pumps must be provided.
- b. Pumps must be capable of operating at the required maximum rate against the maximum head conditions found at the point of injection.
- c. To avoid air locking small diameter suction lines must be used with foot valves and degassing pump heads.
- d. A flooded suction line should be considered for all positive displacement pumps.

4.2.1 Injector/diffuser

The chlorine solution injector/diffuser must be compatible with the point of application to provide a rapid and thorough mix with all the water being treated. The center of a pipeline is the preferred application point. If a variable frequency drive well pump is used, the chlorine dose must be proportional to flow.

4.2.2 Pipe material

Rubber, PVC, polyethylene, or other materials recommended by the Chlorine Institute must be used for chlorine solution piping and fittings. Nylon products are not acceptable for any part of the chlorine solution piping system.

4.2.3 Siphon control

Liquid chemical feeders must be such that chemical solutions cannot be siphoned into the water supply, by

- a. assuring discharge at a point of positive pressure, or
- b. providing vacuum relief, or
- c. providing a suitable air gap, or anti-siphon device, or
- d. other suitable means or combinations as necessary.

4.2.4 Liquid chemical storage tanks must

1. have a liquid level indicator, and
2. have an overflow and a receiving basin or drain capable of receiving accidental spills or overflows without uncontrolled discharge; a common receiving basin may be provided for each group of compatible chemicals, that provides sufficient containment volume to prevent accidental discharge in the event of failure of the largest tank.
3. Have ventilation that discharges to the outside atmosphere above grade and remote from air intakes.
4. Must be stored in compatible liquid storage tanks or the original shipping containers.
5. Reusable sodium hypochlorite storage containers must be reserved for use with sodium hypochlorite only and must not be rinsed out or otherwise exposed to internal contamination.

4.2.5 General equipment design

General equipment design must be such that

- a. feeders will be able to supply, at all time, the necessary amounts of chemicals at an accurate rate, throughout the range of feed,
- b. chemical-contact materials and surfaces are resistant to the aggressiveness of the chemical solution,
- c. corrosive chemicals are introduced in such a manner as to minimize potential for corrosion,
- d. chemicals that are incompatible are not stored or handled together,
- e. all chemicals are conducted from the feeder to the point of application in separate conduits,
- f. chemical feeders are as near as practical to the feed point,
- g. chemical feeders and pumps operate at no lower than 20 percent of the feed range unless two fully independent adjustments mechanisms such as pump pulse rate and stroke length are fitted when the pump operates at no lower than 10 percent of the rated maximum, and

h. gravity may be used where practical.

4.3 WELLHEAD PELLET CHLORINATORS

a. Must be installed in accordance with manufacturer recommendations.

b. Must have a frost-free hydrant or other means of evacuating the well volume so source water samples can be collected. Frost-free hydrants should be located more than 25 feet from the wellhead.

c. Consideration should be given to lining of the well casing if iron precipitation is expected.

CHAPTER 5 - CHEMICAL APPLICATION

5.0 GENERAL

~~Chemicals may not be applied to drinking water unless specifically permitted or required by the Department. Chemical application must be designed to meet the requirements of Department Circular DEQ-1, "Standards for Water Works,".~~

~~In accordance with ARM 17.38.101, treatment processes and equipment are required to be designed by a registered professional engineer. In accordance with ARM 17.38.101 treatment processes or equipment used for compliance with Maximum Contaminant Levels (MCL) or for disinfection of public water systems are required to be designed by a registered professional engineer. Treatment processes installed for reasons other than MCL compliance or disinfection are not required to be designed by a professional engineer if the following conditions are met:~~

- ~~a. Chemicals must meet NSF Standard 60, and~~
- ~~b. Equipment components meet NSF Standard 61, and~~
- ~~c. All cross connection hazards are eliminated in accordance with the requirements of ARM 17.38.300-312.~~

CHAPTER 6 - PUMPING FACILITIES

6.0 GENERAL

Pumping facilities must be designed to maintain the sanitary quality of pumped water. Subsurface pits or pump rooms and inaccessible installations must be avoided. Pumping stations may not be subject to flooding.

6.1 LOCATION

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

6.2 PUMPS

At least two pumping units must be provided. With ~~any~~ the highest capacity pump out of service, the remaining pump or pumps must be capable of providing the maximum daily pumping demand of the system, - exclusive of fire flow. With all pumps in service, the pumps must be capable of providing the maximum daily demand plus fire flow demand of the system. Additional capacity may be required if storage for the pump station service area is inadequate per Section 7 of this circular. If only hydropneumatic storage is provided for the pump station service area, the pumping units must be sufficient to equal or exceed the peak instantaneous demand with the largest pump out of service. For hydropneumatic pumping stations serving 50 or less equivalent dwelling units, MDEQ may allow a reduction in total pumping capacity provided the system can maintain the minimum pressures required in Section 8.1.1 with the largest pump out of service.

~~Each booster pumping station must contain not less than two pumps with capacities such that peak demand can be satisfied with the largest pump out of service.~~

6.3 APPURTENANCES

6.3.1 Valves

~~Pumps must be adequately valved~~ Each pump must have an isolation valve on the intake and discharge side of the pump to permit satisfactory operation, maintenance and repair of the equipment. If foot valves are necessary, they must have a net valve area of at least 2 1/2 times the area of the suction pipe and they must be screened. Each pump must have a positive-acting check valve on the discharge side between the pump and the shut-off valve. Surge relief valves, slow acting check valves, or other means to minimize hydraulic transients must be incorporated in the system design.

6.3.2 Piping

In general piping must:

- a. be designed so that friction losses will be minimized,
- b. not be subject to contamination,
- c. have watertight joints,
- d. be protected against surge or water hammer, and provided with suitable restraints where necessary, and

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

6.3.3 Gauges and meters

Each pump:

- a. must have a standard pressure gauge on its discharge line,
- b. should have a compound gauge on its suction line, and
- c. must have a means for measuring the discharge.

CHAPTER 7 - FINISHED WATER STORAGE

7.0 GENERAL

The materials and designs used for finished water storage structures must provide stability and durability as well as protect the quality of the stored water. Steel, concrete, fiberglass-reinforced plastic, and flexible membrane water storage facilities must follow current AWWA Standards. Other materials of construction are acceptable when properly designed to meet the requirements of Chapter 7 of Department Circular DEQ-1, "Standards for Water Works". Porous material, including wood and concrete block, are not suitable for potable water contact applications.

7.1 PRESSURE TANKS

Hydropneumatic (pressure) tanks, when provided as the only storage facility, are acceptable only in very small water systems. Pressure tanks must meet applicable ASME code requirements. Pressure tanks for which the ASME code does not apply (i.e., those with nominal water containing capacity of 120 gallons or less) must meet ASME code requirements or must satisfactorily pass a hydrostatic test of 1.5 times the maximum allowable working pressure of the tank. The maximum allowable working pressure must be marked on each tank.

7.1.1 Location

The tank must be located above normal ground surface and be completely housed.

7.1.2 System design and sizing

- a. The capacity of the wells and pumps in a hydropneumatic system must be equal to the peak instantaneous demand. The active storage volume of the hydropneumatic tanks must be sufficient to limit pump cycling to the manufacturer's and industry recommendations. Maximum cycling frequency for pumps not using a variable speed drive must be determined for each pump and for any combination of pumps operated by the same pressure switch when consumer demand is equal to half (0.5) of the capacity of the pump(s) capacity. Maximum cycling frequency for pumps using a variable speed drive programmed to either maintain constant pressure, constant flow, or match the system design curve, must be determined when the customer demand is one-half (.5) of the minimum pumping rate. Reduction of required tank volume for systems with alternating pump controls will not be allowed.
- b. Sizing of hydropneumatic storage tanks must consider the need for chlorine contact time, as applicable, independent of the requirements in 7.1.2.a above. Tanks with a common inlet and outlet will not be given any credit for chlorine contact time.

7.1.3 Piping

Each tank in a multiple tank system must have bypass piping or valves to permit operation of the system while the tank is being repaired or painted.

7.1.4 Appurtenances

- a. Each tank must have a means of draining, automatic or manual air blow-off, and a means for adding air.
- b. Control equipment consisting of a pressure gage, pressure relieving device, and pressure operated start-stop controls for the pumps must be provided for the hydropneumatic tank system. Installing a shut-off valve between the pump and the pressure operated start-stop controls must be avoided when possible.

- c. The pressure relieving device must prevent the pressure from rising more than 10 percent above the maximum allowable working pressure. The discharge capacity of the pressure relieving device must be adequately sized. Pressure gages must have a range of no less than 1.2 times the pressure at which the pressure relieving device is set to function.

7.2 OTHER STORAGE SYSTEMS

Other storage systems must be designed to meet the requirements of Chapter 7 of Department Circular DEQ-1, "Standards for Water Works."

7.3 CISTERNS

Cisterns designed according to Circular DEQ-178, Montana Standards for Cisterns, ~~(Water Storage Tanks) for Individual Non-public Systems, and provided with an appropriate air gap on the service line discharge, may be used on individual service connections.~~

CHAPTER 8 - DISTRIBUTION SYSTEMS

8.0 MATERIALS

8.0.1 Standards

All materials including pipes, fittings, valves and fire hydrants must conform to the latest standards issued by the [ASTM](#), AWWA and ANSI/NSF where such standards exist and be acceptable to MDEQ. In the absence of such standards, materials meeting applicable product standards and acceptable to MDEQ may be selected.

8.1 WATER MAIN DESIGN

8.1.1 Pressure

All water mains, including those not designed to provide fire protection, must be sized after a hydraulic analysis based on flow demands and pressure requirements. The system must be designed to maintain a minimum normal working pressure of 35 psi. Maximum normal working pressure should be approximately 60 to 80 psi. Minimum pressure under all conditions of flow (e.g. fire flows) must be 20 psi. Minimum required pressures must be based on those occurring at ground level at the highest building sites or fire hydrant served by the proposed water mains excluding service line head losses.

8.1.2 Diameter

The mains must be sized to handle design flows.

8.1.3 Hydrants

Water mains not designed to carry fire-flows may not have standard size fire hydrants connected to them.

8.1.4 Dead ends

Dead ends must be minimized by looping of all mains whenever practical.

8.2 VALVES

Sufficient valves must be provided on water mains so that inconvenience and sanitary hazards will be minimized during repairs.

8.3 INSTALLATION OF MAINS

8.3.1 Standards

Specifications must incorporate the provisions of the AWWA standards and manufacturer's recommended installation procedures.

8.3.2 Cover

All water mains must be covered with sufficient earth or other insulation to prevent freezing.

8.3.3 Pressure and leakage testing

The installed pipe must be pressure tested and leakage tested as required by MDEQ.

8.3.4 Disinfection

All new, cleaned or repaired water mains must be disinfected, flushed and microbiologically tested in accordance with AWWA Standard C651.

8.4 SEPARATION OF WATER MAINS AND SEWERS

8.4.1 Parallel installation

~~Water mains must be laid at least 10 feet horizontally from any existing or proposed gravity sewer, septic tank, or subsoil treatment system.. The distance must be measured edge to edge.~~

Water mains must be laid at least 10 feet horizontally from any existing or proposed gravity sanitary or storm sewer, septic tank, or subsoil treatment system. The distance must be measured edge to edge. If the minimum horizontal separation as described above cannot be obtained, the design engineer shall clearly identify the locations of sub-minimum separation on the plans and shall comply with the following requirements:

- a. Minimum separation must be three (3) feet, measured edge to edge.
- b. Sewer pipe must have minimum nominal 20-foot lengths.
- c. The sewer must pass low pressure air testing in accordance with UniBell Recommended Practice UNI-B-6-98, the Montana Public Works Standard Specifications, or equivalent.
- d. Sewer services utilizing in-line fittings and extending to at least property lines must be installed and tested within 10 feet of the encroachment. Saddles are not acceptable.

8.4.2 Crossings

~~Water mains crossing sewers must be laid to provide a minimum distance of 18 inches between the outside of the water main and the outside of the sewer. This must be the case where the water main is either above or below the sewer. At crossings, one full length of water pipe must be located so both joints will be as far from the sewer as possible. Special structural support for the water and sewer pipes may be required.~~

Water mains crossing gravity sanitary or storm sewers must be laid with a minimum vertical separation distance of 18 inches between the outside of the water main and the outside of the sewer. This must be the case where the water main is either above or below the sewer. The crossing must be arranged so that the sewer joints will be equidistant and as far as possible from the water main joints. Where a water main crosses under a sewer, adequate structural support must be provided for the sewer to maintain line and grade and to prevent damage to the water main. If the proper vertical separation as described above cannot be obtained, the design engineer shall clearly identify the locations of sub-minimum separation on the plans and shall comply with the following:

- a. Vertical separation at crossings between water and sewer mains must be at least six (6) inches.
- b. A secondary means of protection, such as sleeving either the water or the sewer main or providing flowable fill at the crossing, must be provided, clearly specified, and identified on the plans.
- c. Sewer pipe must have minimum nominal 20-foot lengths.
- d. At crossings, one standard length of new pipe must be centered at approximately a 90 degree angle in respect to the existing pipe.
- e. The sewer must pass low pressure air testing in accordance with UniBell Recommended Practice UNI-B-6-98, the Montana Public Works Standard Specifications, or equivalent.
- f. Sewer services utilizing in-line fittings and extending to at least property lines must be installed and tested within 10 feet of the crossing. Saddles are not acceptable.
- g. If the minimum separation is not viable, the water line must be relocated, and vertical separation at crossings between water and sewer mains must be at least 18 inches.

8.4.3 Force mains

There must be at least a 10 foot horizontal separation between water mains and sanitary sewer force mains and there must be an 18 inch vertical separation at crossings.

8.5 CROSS CONNECTIONS AND INTERCONNECTIONS

8.5.1 Cross connections

There may not be any unprotected cross-connections between the distribution system and any pipes, pumps, hydrants or tanks whereby unsafe water or other contaminating materials may be discharged or drawn into the system. Cross-connections must be eliminated in conformance with Title 17, Chapter 38, Sub-Chapter 3, ARM, for public systems.

8.6 WATER SERVICES AND PLUMBING

8.6.1 Plumbing

Water services and plumbing must conform to the Uniform Plumbing Code as amended by ARM 8.70.302.

8.6.2 Booster pumps

Individual home booster pumps may not be considered or required for any individual residential service from the water supply mains unless specifically approved by the Department. Where permitted for multi story public building services, booster pumps must be designed in accordance with DEQ-1 Sections 6.4 through 6.4.4.

8.7 WATER MAIN ABANDONMENT

Mains must be abandoned in a manner to prevent cross connections and must be entirely or partially removed to prevent future connection to the abandoned main.

APPENDIX A

A.1 General

In addition to the information required in the circular, information on management, operation, maintenance, and financing of the system must be submitted. The purpose of this information is to allow evaluation of a new system for proper system management, operation and maintenance (O&M), and financial planning that provides ~~long-term~~long-term stability of the new system. The 1996 Safe Drinking Water Act provides for State development of strategies to ensure the managerial, technical, and financial capacity for new non-transient non-community water systems.

Capacity terms are defined as follows based on definitions in Title 36, Chapter 23, Sub-Chapter 1, ARM:

Managerial capability (capacity) means the management structure of the water system, including, but not limited to, ownership accountability, staffing, and organization.

Technical capability (capacity) means the physical infrastructure of the water system, including but not limited to the source water adequacy, infrastructure adequacy, and technical knowledge based on information provided.

Financial capability (capacity) means the financial resources of the water system, including but not limited to the revenue sufficiency, credit worthiness, and fiscal controls.

The Department is granted the authority in 75-6-103(2)(f), MCA, to ensure financial viability of proposed public water supply systems (and public sewage systems) as necessary to ensure the capability of the system to meet the requirements of Title 75, Chapter 6, Part 1, MCA.

A separate application form with appropriate guidance is available from the Department to assist in providing information. All new non-transient non-community public water supplies and existing systems making modifications must submit a capacity development inventory and self-assessment form.

A.2 Managerial Capacity

Provide the following information:

1. Name, address, and telephone number of the owner(s). If ownership is to change in the near future, provide a projected time line for change of ownership.
2. Administrative and management organizational charts define the functions and responsibilities of the organization and each administrative/managerial position. For example, if the organization has a secretary, provide a brief description of the secretary's responsibilities.
3. Plans for staffing the system with a certified operator and back-up operator. Provide the name of the operator if an operator has been selected. An operator should be available to operate the system even if the system has not yet become public. If the system is to be operated under contracted services, provide a copy of the contract.
4. A system or plan for maintaining records, plans and specifications for construction, as-built drawings, O&M manuals, and compliance information. Preferably, office space should be dedicated for storing all information that is readily accessible by the operator, manager(s), and owner(s) of the system.
5. Copies of the by-laws, articles of incorporation, or similar documents that provide information on meetings, dissemination of information to system users, voting, and other pertinent information regarding the system.

The managerial plan must allow for:

- a. efficient operation of the system.
- b. adequate control of and accountability for the system by the owner(s), manager(s), and operator(s).
- c. adequate resources and accountability for regulatory compliance by the owner(s), manager(s) and operator(s).
- d. dissemination of appropriate information to all customers and the regulatory agencies.

A.3 Technical, Operational, and Maintenance Capacity

Provide the following information in the form of an O&M manual that will be available to the operator, owner(s), and manager(s):

1. An explanation of startup and normal operation procedures. Startup should address operation of the system throughout system build out if applicable (i.e., a subdivision will experience varying demands as the subdivision develops and builds out).
2. Will any equipment be leased or rented? Are easement or lease agreements necessary for any portion of the system? If applicable, provide pertinent information (i.e., a copy of the easement or lease agreement). Are changes in local zoning necessary to protect the proposed source(s)?
3. Record keeping method and system for reporting to the Department.
4. Sampling and analyses program to demonstrate compliance with drinking water standards (Title 17, Chapter 38, Sub-Chapter 2, ARM) for all sources, entry points, treatment, and distribution systems.
5. Staffing and training requirements to operate the system to maintain compliance with drinking water standards (Title 17, Chapter 38, Sub-Chapter 2, ARM).
6. Documentation of a safety program.
7. Documentation of an emergency notification system in case of an emergency.
8. Manufacturers' manuals for all equipment and contact names for service. A routine maintenance program and maintenance schedules must also be included. Forms for recording routine maintenance checks per manufacturers' guidelines should be provided, including frequency of maintenance and anticipated replacement dates for major equipment.

Items 1 through 5 must be submitted in the form of an O&M manual prior to approval of the system.

A letter from the applicant must be provided prior to the system being used stating that the system (or portion of the system that has been completed to date) was constructed per the approved plans and specifications.

As-builts for the system (or portion of the system that has been completed to date) must be provided within 90 days after the system has become operational. The as-builts must include an O&M manual addressing items 1 through 9 and that contains manufacturers' manuals and other pertinent information to complete the O&M manual.

The system must be operated in a manner to:

- a. maintain compliance with drinking water standards (Title 17, Chapter 38, Sub-Chapter 2, ARM),
- b. allow effective operation of the system in accordance with the approved plans and specifications,
- c. supply adequate water, both quantity and quality, and
- d. be consistent with operating conditions presented in the engineer's report,

A.4 Financial Capacity

The following financial information must be submitted prior to receiving approval of the system:

1. The financial information in Table A-1 must be completed for a 5-year period.
2. O&M rates and capital improvement/replacement rates must be developed and based on information in Table A-1. Will a reserve fund be established to address future replacement of equipment?
3. Customers should be metered. If customers are metered, demonstrate rates account for metering (cost of meters, cost of operator to read/maintain meters, how rates correspond to meter readings).
4. Connection/system development fee and basis for fee, if applicable.
5. Does the owner(s) or responsible entity have access to financial capital?

The financial plan must demonstrate:

- a. revenues match or exceed expenses, and
- b. the 5-year cash flow presented in Table A-1 is sufficient to properly operate the system,

TABLE A-1 SYSTEM BUDGET

Applicant: _____

Completed by: _____

Date: _____

5 Year Projections	Year 1 Projected	Year 2 Projected	Year 3 Projected	Year 4 Projected	Year 5 Projected
Enter Year:					
1. Beginning Cash on Hand					
2. Cash Receipts:					
a. Total Revenues					
b. Connection Fees					
c. Interest and Dividend Income					
d. Other Income					
e. Total Cash Revenues (2a thru 2d)					
f. Transfers in/Additional Rev Needed					
g. Loans, Grants or other Cash Injection					
h. other - please specify					
3. Total Cash Receipts (2e thru 2h)					
4. Total Cash Available (1 + 3)					
5. Operating Expenses					
a. Salaries and wages					
b. Employee Pensions and Benefits					
c. Purchased Water					
d. Purchased Power					
e. Fuel for Power Production					
f. Chemicals					
g. Materials and Supplies					
h. Contractual Services - Engineering					
i. Contractual Services - Other					
j. Rental of Equipment/Real Property					
k. Transportation Expenses					
l. Laboratory					
m. Insurance					
n. Regulatory Commission Expenses					
o. Advertising					
p. Miscellaneous					
q. Total Cash O & M Expenses (5a + 5p)					
r. Replacement Expenditures					
s. Total O M & R Expenditures (5q + 5r)					
t. Loan Principal/Capital Lease Payments					
u. Loan Interest Payments					
v. Transfers Out					
w. Capital Purchases (specify)					
x. Other					
6. Total Cash Paid out (5s thru 5x)					
7. Ending Cash Position (4 - 6)					
8. Number of Customer Accounts					

9. Average Annual User charge Account users:(2a/8)					
10. End of Year Reserves					
a. Debt Service Reserve					
b. Bond Retirement Reserve					
c. Capital Improvement Reserve					
d. Replacement Reserve					
e. Total Reserves (10a thru 10 d)					
11. End of Year Operating Cash (7 - 10e)					

GLOSSARY

<u>Active Storage Volume:</u>	<u>The volume of water available in a hydropneumatic pressure tank between the ON-OFF pressure settings. The effective volume is limited to approximately 25 - 30% of the total volume of the tank. More accurate percentages can be obtained from tables utilizing pump ON-OFF settings and tank pre-charge. Manufacturers' information on captive air tanks give the effective volume for different operating pressure ranges and pre-charges.</u>
<u>Accessory Building</u>	<u>A subordinate building or structure on the same lot as the main building, which is under the same ownership as the main building and which is devoted exclusively to an accessory use such as a garage, workshop, art studio, guest house or church rectory.</u>
<u>Average-Day Demand:</u>	<u>Annual water consumption divided by 365 days in a year. Average-Day Demand normally includes the following components for design of new systems. Average-Day Demand from actual use records for existing systems that provide fire Protection may also include some Fire Demands that have occurred. However, separate Fire Demand must always be added to the components listed below for new systems or to the actual average use for existing systems when designing for fire storage.</u> <ol style="list-style-type: none"><u>1. Domestic demand: Volume of water required by the average household for drinking, cooking, laundry, bathing and sanitation.</u><u>2. Commercial/Industrial: Volume of water required by users other than residential. Such as restaurants, offices, institutions, shops.</u><u>3. Irrigation Demand: Volume of water used to irrigate lawns and gardens. The total seasonal demand over 180 days is averaged for the entire year.</u>
<u>Design Pump Capacity:</u>	<u>Anticipated production rate based on pump selection from manufacturer's pump performance curves. Pump selections, within recommended efficiency ranges, are made using water system Total Dynamic Head (TDH) and desired production capacity.</u>
<u>Discharge piping:</u>	<u>Water line from the source to the pressure control assembly. Includes the piping to which the pressure control appurtenances are attached. Discharge piping would normally begin at a well pitless unit or adaptor.</u>
<u>Fire-flow Demand:</u>	<u>Volume of water required to fight structural fires, expressed as flow rate times duration. The proposed fire flows must be as recommended by the fire protection agency in which the water system is being developed, or in the absence of such a recommendation, the fire code adopted by the State of Montana. Fire flow demand must be added to the maximum day demand during the hours of peak demand when designing a system.</u>
<u>Hydraulic analysis:</u>	<u>An evaluation of the distribution system to determine if adequate pressure is maintained under all flow conditions in accordance with DEQ-1, Section 8.2.1. The analysis can be performed using a calibrated model or established empirical equations, such as Darcy-Weisbach or Hazen-Williams.</u>
<u>Maximum Day Demand:</u>	<u>The highest volume of water consumed on any day in a year.</u>
<u>Network analysis:</u>	<u>The process of analyzing water distribution systems through the use of mathematical computer models.</u>

<u>Peak Instantaneous Demand:</u>	<u>The highest flow rate on the hydrographic curve. Expressed as a volume per unit of time. Calculated from a Fixture Unit analysis per the UPC, AWWA Fixture Value Method, or by applying a peaking factor to the Average Day Demand in gallons per minute, or other means acceptable to MDEQ.</u>
<u>Service connection:</u>	<u>A line that provides water service to a single building or main building with accessory buildings and that is designed to service line specifications.</u>
<u>Storage Sizing Engineering Analysis:</u>	<u>A detailed engineering study that includes diurnally peaked water usage demands during the maximum day and subsequent and preceding days, operational storage volume requirements, reserve standby storage requirements, dead storage volume, and extended time reservoir mass flow analysis for the maximum day demand with the required fire flow, when fire protection is provided, occurring during the hours of peak demand. The required design storage volume must be determined with the largest well, largest treatment train, or the largest booster pump out of service and must include provisions for auxiliary power.</u>
<u>Water main:</u>	<u>Any line providing water to multiple service connections, any line serving a water hydrant that is designed for fire fighting purposes, or any line that is designed to water main specifications.</u>