CIRCULAR DEQ-10

STANDARDS FOR THE DEVELOPMENT OF SPRINGS FOR PUBLIC WATER SYSTEMS

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Springs occur where the natural flow of ground water rises to the surface. There are two basic requirements for developing a spring as a source of water: (1) selection of a spring with enough capacity to provide the required quantity and quality of water throughout the year; and (2) protection of the water from contamination. Development of the spring depends on the geological formations and hydrological characteristics of the water-bearing formation. The general geologic formations for each type of aquifer and spring are shown in Figure 1. The flow from a spring may vary considerably with changes in the water table or artesian pressure. Some springs are very susceptible to contamination. Before developing a spring for a water supply, the owner should determine the nature of the water and the risk of contamination.

The design report, plans, and specifications for any spring source must be prepared and designed by a professional engineer licensed or otherwise authorized to practice engineering in Montana pursuant to Title 37, chapter 67, MCA.

Full-time microbial treatment is required for a spring source and must provide 4-log virus inactivation and/or removal. Spring sources determined to be under the direct influence of surface water must also meet the requirements of the Surface Water Treatment Rule. A deviation from the microbial treatment requirement may be granted by MDEQ in accordance with the procedures in Department Circular DEQ-1, Section 1.7, if the applicant shows that: (1) there are no existing or approved sources of viral contamination within the 200-day time-of-travel zone of influence for the spring source; and (2) new sources of contamination will not be introduced in the 200-day time-of-travel zone of influence. Additionally, a deviation requires that the applicant show the spring source was not vulnerable to significant sources of bacteriological contamination.

There are several types of springs. Gravity springs discharge from unconfined aquifers, which are water-bearing aquifers that rest on an impervious stratum and outcrop to the surface. Artesian springs discharge from confined aquifers, which are aquifers that have both an upper and lower layer of impermeable material that forms a barrier against contaminants. Seepage springs are where water flows or seeps out of sand, gravel, or other porous material.

When a spring is chosen for a water supply, the owner must determine that the water quality is acceptable, the quantity of water available is adequate to meet the needs of the water system, and the spring is protected from contamination. Seepage springs are very susceptible to contamination and should not be used as a water source. The quantity of water available from a spring can vary significantly due to changes in ground water storage. Depending on the type of spring, changes in ground water storage can come from seasonal variations, such as dry periods and withdrawals of nearby wells.

Steps must be taken to prevent contamination of the spring during construction of the improvements necessary to supply the source water. If the spring is artesian, a vertical well is drilled or collection pipe is installed into the aquifer, either directly at the spring or near the spring. Water rises in the well or collects in the pipe due to the pressure of the artesian spring, so, unlike ground water wells, a pump may not be needed to raise the water in the well or fill the collection pipe. However, pumps may be used to deliver the water to the storage tank or distribution system. If the spring is gravity driven, then a horizontal well (similar to an infiltration gallery) or collection pipe is constructed to collect the spring water before it exits at the surface. Since water from a gravity spring outcrops to the surface by gravity, pumps may only be needed to feed the water to a storage tank or distribution system.

Springs are susceptible to contamination by surface water and must be protected from surface runoff. Contamination sources include livestock, wildlife, crop fields, forestry activities, wastewater treatment

systems, and fuel tanks located upgradient from the spring outlet. Changes in color, taste, odor, or flow rate indicate possible contamination by surface water. To protect the springs, the following steps must be taken:

1. divert all surface water away from the spring and protect the spring from flooding by constructing a surface diversion ditch or berm upgradient of the spring to divert surface runoff away from the spring;

2. fence the area at least 100 feet in all directions around the spring to prevent contamination by animals and people who are unaware of the spring's location;

3. provide access to the spring box for maintenance, but install locks to prevent unauthorized entrance to the tank;

4. avoid vehicle traffic and storage of chemicals and fuels upgradient of the spring outlet; and

5. monitor the quality of the water regularly by checking for contamination. A noticeable increase in turbidity or change in flow after storms is an indication that surface runoff is reaching the spring and possibly contaminating the water;

The features of a spring box must include:

1. a watertight basin intercepting the source which extends to bedrock or a system of collection pipes and a storage tank;

2. the spring box must protect against entrance of surface water, debris, and animals or humans. The spring box must be equipped with an access hatch that will allow for cleaning and maintenance.
    - The access hatch must be elevated at least 24 inches above the sod.
    - The access hatch must be fitted with a solid watertight cover, which overlaps a framed opening and extends down around the frame at least two inches. The frame must be at least four inches high. The hatch must be hinged on one side and must have a locking device;

3. provisions for cleaning out and draining the spring box;

4. provisions for venting. The vent must open downward with the opening at least 24 inches above the roof of the spring box or sod and be covered with 24-mesh non-corrodible screen.

5. provisions for overflow.
    - The overflow must discharge at an elevation between 12 and 24 inches above the ground surface and discharge over a drainage inlet structure or splash plate.
    - The overflow must be constructed in such a way as to prevent ponding of water near the spring box.
    - The overflow must be screened with 4-mesh or smaller screen. A flapper gate or duckbill valve should also be installed on the discharge end of the overflow pipe;

6. a connection to the distribution system or backup supply; and

7. when more than one spring is piped to a common storage tank, each spring development needs valves and piping that can be isolated from the rest of the system.

The spring box is usually made of reinforced concrete. The spring box cover must be watertight to prevent undesirable water from entering. An overflow is needed to ensure that water pressure does not build up and damage the spring box. Spring boxes should have a drain to turn out the water in case the source water quality degrades. The end of the drain must have a screen to prevent entrance of animals. The intake to the water system from the tank and spring box must be located at least six inches above the bottom and screened to minimize the amount of sludge that is drawn into the intake from the chamber. If the spring box also functions as a storage tank or is connected to a storage tank, the storage tank must meet the requirements for cisterns or storage tanks in Department Circular DEQ-1 or Department Circular DEQ-16.

A diversion ditch around the uphill end of the spring area is needed to keep rainwater from flowing over the spring area and infiltrating the ground. An impervious barrier, such as clay or a plastic liner, over the spring area will help prevent potential contaminants from entering the collection facilities. Springs must meet the appropriate state requirements for setback distances from sanitary hazards.

Disinfection of Springs

Springs are often contaminated with bacteria during construction or maintenance. All new and repaired water systems must be properly disinfected. Disinfection procedures must be clearly specified in the design. Typical methods used for storage tank or well disinfection may be used as a guide for spring disinfection procedures. **Full-time disinfection with adequate contact time is required for spring sources receiving water from an aquifer with a water table that is within 25 feet of the ground surface. A deviation from this standard may be granted by MDEQ in accordance with the procedure in Department Circular DEQ-1, Section 1.7, if adequate source water protection can be established.**

Physical, Chemical, and Radiological Quality

1. Every new, modified, or reconditioned ground water source must be examined for applicable physical and chemical characteristics by tests of a representative sample in a laboratory certified by the Department of Public Health and Human Services, and the results submitted to MDEQ.

2. For community and nontransient noncommunity systems, sample results for the constituents of ARM 17.38.216 must be submitted to MDEQ for review and approval to demonstrate compliance with ARM Title 17, chapter 38, subchapter 2 prior to placing the spring into service.

3. For transient noncommunity systems, testing must include bacteriological, nitrate/nitrite, and total dissolved solids or conductivity at a minimum. Additional testing may be required for other parameters.

4. Field determinations of physical and chemical constituents or special sampling procedures may be required by MDEQ.

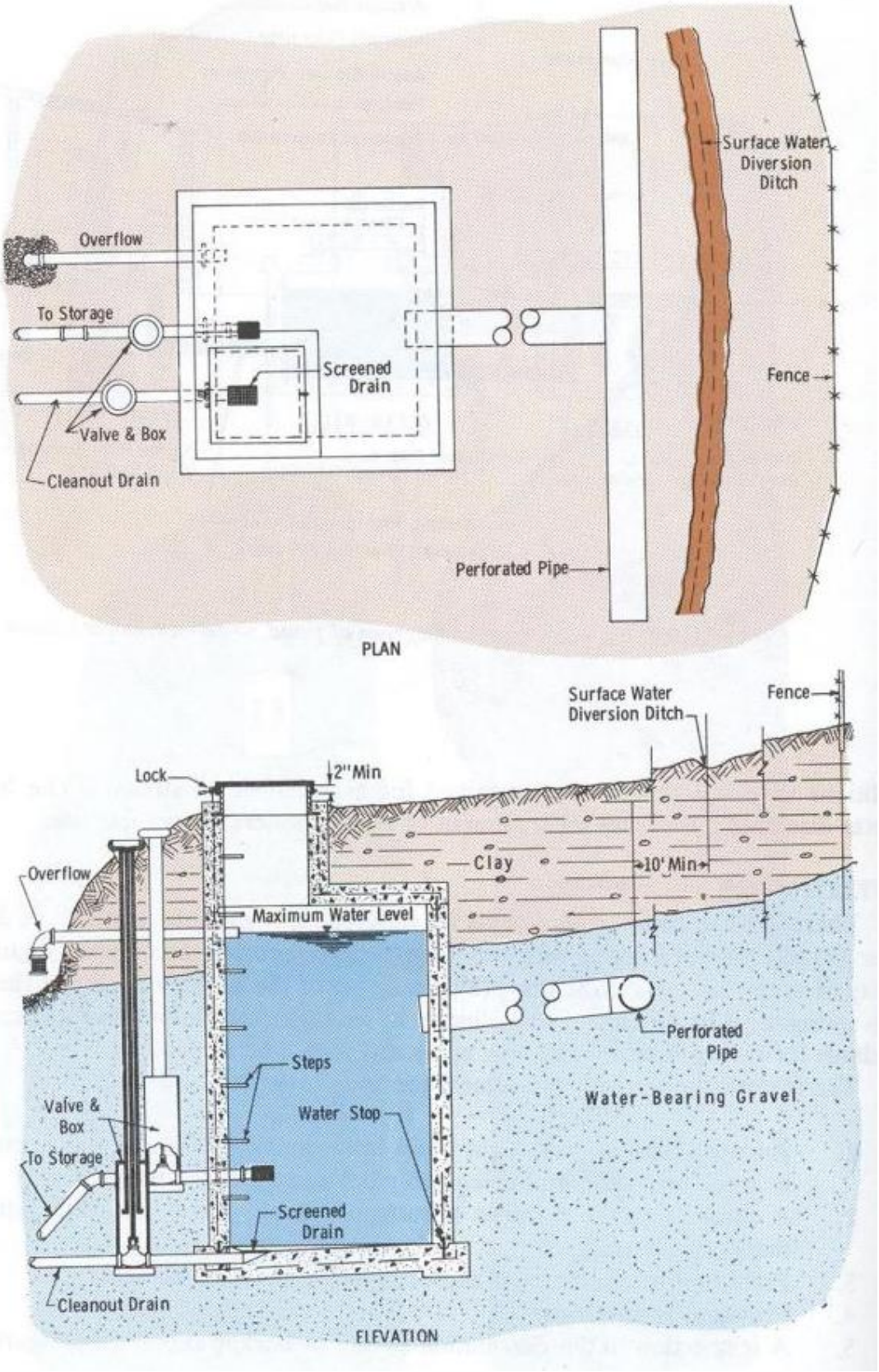

Figure 1. Spring Protection