Monitoring and Operational Guidance Handbook for Colorado Public Water Systems Utilizing Hand-Pumped Wells Which Do Not Provide Continuous Disinfection

Colorado Department of Public Health and Environment
Water Quality Control Division
Colorado Safe Drinking Water Program

This operational handbook has been developed to assist public water systems that utilize hand-pumped wells in complying with the applicable regulations in Regulation 11 of the Colorado Primary Drinking Water Regulations, 5 CCR 1002-11 ("Regulation 11").

COLORADO
Department of Public Health & Environment

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1 INTRODUCTION

Hand-pumped wells are typically shallow wells that do not have a means for providing continuous disinfection of the well water. Hand-pumped wells are utilized by small, transient non-community public water systems such as campgrounds. Historically, transient, non-community water systems have had a microbiological sampling/testing frequency of once per quarter, during the period of time that the water system is open to the public. Department water quality records document microbiological maximum contaminant level (MCL) violations at many hand-pumped well systems, indicating that the improved procedures provided by this handbook are necessary to protect the health of consumers. This handbook was prepared based upon the current requirements in the state statute and regulations.

On March 10, 2015, the Water Quality Control Commission adopted revisions to Regulation 11 of the Colorado *Primary Drinking Water Regulations*, 5 CCR 1002-11 ("Regulation 11"). This included the addition of the Groundwater Rule: Hand-Pumped Wells in section 11.12 of Regulation 11. The purpose of this handbook is to provide a reference for public water systems that utilize hand-pumped wells and identifies:

- An overview of the Groundwater Rule: Hand-Pumped Wells section of Regulation 11
- An overview of the Seasonal Systems portion of the Revised Total Coliform Rule
- Department policy regarding applicability to seasonally operated hand-pumped well systems
- Regulatory requirements
- Recommended best practices

2 OVERVIEW OF HAND-PUMPED WELLS REGULATION AND SEASONALSYSTEM PORTION OF THE REVISED TOTAL COLIFORM RULE

The Groundwater Rule: Hand-Pumped Wells regulations have special provisions including the following:

- Limits the use of hand-pumped wells to transient non-community groundwater systems.
- Requires suppliers of water to operate and maintain hand-pumped wells in accordance with Department-approved hand-pumped well monitoring and operational criteria (Appendix A)
- Requires the supplier to distribute special public notice including the statement:
    - "This hand pump serves unchlorinated well water. For more information, please contact [phone number of public water system owner, operator, or designee of the public water system]"
- For seasonally operated hand-pumped wells, the supplier must disinfect the well no earlier than 30 days prior to opening.
    - Year-round hand-pumped wells must disinfect during the busiest month.
- Upon receiving a total coliform sample that is positive for *e.coli* or a repeat sample positive for total coliform, the supplier must:
    - Close the hand-pumped well until a sample is absent of bacteria

- Disinfect the hand-pumped well before resuming operation.

The Revised Total Coliform Rule, provided in section 11.16 of Regulation 11, becomes effective April 1, 2016, and includes:

- A definition for a seasonal system public water system
- A NEW requirement that seasonal systems must complete department-approved start-up procedures each season.
- A NEW requirement that suppliers of water operating seasonal systems must certify that department-approved start-up procedures were completed.

Since many of the hand-pumps being operated within Colorado are seasonal, the department has modified this handbook in order to accommodate both the requirements of section 11.12 and section 11.16 of Regulation 11 for hand-pumped wells.

3 DEPARTMENT POLICY

The department has developed this handbook for use by seasonal systems that utilize hand-pumped wells. If a seasonal water system does not utilize hand-pumped wells, the pertinent requirements applicable to such systems are included in the document, "Revised Total Coliform Rule Start-up Procedures for Seasonal Systems Handbook." This guidance is available online at: https://www.colorado.gov/cdphe/wq-guidance.

4 REGULATORY REQUIREMENTS

This section identifies the regulatory requirements identified in Regulation 11, Sections 11.12 and 11.16(5) that are specific to Hand-Pumped Wells and Hand-Pumped Seasonal Systems.

4.1 Seasonal Hand-Pumped Well Systems

Seasonal hand-pumped well systems are required to disinfect all hand-pumped wells no earlier than 30 days prior to opening. These systems are also required to collect one sample from the hand-pump well and have it analyzed for total coliform prior to serving water to the public. In addition, seasonal systems are required to conduct routine drinking water quality monitoring. The department provides monitoring schedules that clearly identify all of the monitoring requirements. The monitoring schedules are updated weekly and available online at www.wqcdcompliance.com/schedules.

4.2 Hand-Pumped Well Monitoring and Operational Criteria

Per Regulations 11, Section 11.12, suppliers that use hand-pumped wells must comply with monitoring and operational criteria that are specific to hand-pumped well systems including:

- All required pre-approved procedures detailed in the Monitoring, Operational, and Start-up Procedures for Systems Utilizing Hand-Pumped Wells found in Appendix A.

- Effective April 1, 2016, all suppliers of water that operate a seasonal system must complete department-approved start-up procedures prior to supplying water to the public each season. Approved start-up procedures for hand-pumped systems are included in Appendix A.

- In addition, by the 10th of the month following the month that the seasonal system began supplying water to the public, the supplier must submit certification that the start-up procedures were completed. The certification can be found in Appendix B.

To comply with the requirement to utilize monitoring and operational criteria and to complete start-up procedures, all suppliers of water operating seasonal hand-pumped well system(s) have the following options:

Option 1: Use pre-approved start-up procedures (Appendix A).

Option 2: Submit monitoring and operational criteria and start-up procedures for department approval.

The start-up procedures, sampling techniques, and record-keeping practices will be reviewed during the supplier's sanitary survey.

4.3 Special Public Notice

Due to the fact that hand-pumped wells supply water that is not continuously disinfected, suppliers of water that utilize these wells must post special public notice near the hand-pumped well. The public notice must include the following language:

- "This hand pump serves unchlorinated well water. For more information, please contact [phone number of public water system owner, operator, or designee of the public water system]"

5 RECOMMENDED BEST PRACTICES

The following best practices are recommended but **not** specifically required by Regulation 11.

5.1 Operational

The department recommends the following best practices for routine operations at hand-pumped well systems:

- Follow procedures for operating hand-pumped wells in Appendix A.

- Prior to the supplier's scheduled opening date, perform start-up procedures and the required total coliform sampling in accordance with Appendix A with ample time to correct any sanitary defects that may be identified.
    - Failing to adequately complete start-up procedures that includes obtaining a sample free from total coliform and correcting any sanitary defects that may be identified during start-up, results in a violation of Regulation 11.
- Create a list of helpful contacts, such as the:
    - department's 24-hour Environmental Release/Incident Reporting line: (877) 518-5608
    - department's Total Coliform Positive Reporting line: (303) 692- 3308
    - staff and emergency contacts
    - local contractors

5.2 Disinfection

Develop a standard operating procedure for disinfecting your hand-pump. Starting with industry publications is appropriate, but having a customized procedure for the required disinfection practice will ensure consistent operation.

6 OTHER HELPFUL RESOURCES

- AWWA Standard for Disinfecting Water Mains, ANSI/AWWA C651-14, American Water Works Association
- AWWA Standard for Disinfection of Water Storage Facilities, ANSI/AWWA C652-92 and C652-02, American Water Works Association
- AWWA Standard for Welded Steel Tanks for Water Storage, ANSI/AWWA D100-96, American Water Works Association
- AWWA Standard for Factory Coated Bolted Steel Tanks for Water Storage, ANSI/AWWA D103-97, American Water Works Association
- AWWA Standard for Disinfection of Wells, ANSI/AWWA C654-03, American Water Works Association
- Regulation 11 of the Colorado Primary Drinking Water Regulations, 5 CCR 1002-11, https://www.colorado.gov/pacific/cdphe/water-quality-control-commission-regulations

7 FREQUENTLY ASKED QUESTIONS

Q1: What if my system is seasonal but I don't shut down the hand-pump during the off season?

A: Regardless of whether the hand pump is shut down, the seasonal supplier of water must follow the start-up procedures in Appendix A or submit procedures to the department for approval.

Q2: How do seasonal populations and special events effect my population?

A: Seasonal populations are counted as part of the average daily population both for existing public water systems and for when determining whether a new water system is public or not. For special events, the number of people who have access to the water, per day, would be considered transients when determining your average daily population both for existing public water systems and for when determining whether a new water system is public or not.

Q3: What if I start up mid-month?

A: You must provide certification in writing (department's portal, fax, US mail, etc.) to the department by the 10th day of the following month, notifying the department that you followed the approved start-up procedures prior to serving water to the public.

Appendix A: Monitoring, Operational, and Start-up Procedures for Systems Utilizing Hand-Pumped Wells

Monitoring, Operational, and Start-up Procedures for Water Systems Utilizing Hand-Pumped Wells

Periodic evaluation of water sources, proper sampling and testing, and frequent inspections of hand-pumped wells, along with appropriate corrective actions, are required to assure the long-term quality and safety of drinking water. All Regulation 100 Operator duties must be performed by the Operator-in-Responsible Charge (ORC) or by a person trained by and under the supervision of the ORC. To avoid failure to monitor violations the department should be notified whenever a public water system is temporarily or permanently closed. For all suppliers using hand-pumped wells, the supplier must operate and maintain hand-pumped wells in accordance with the criteria below. In addition, for seasonal systems, use of the start-up procedures listed below, as well as documenting start-up activities on the corresponding Seasonal *Start-up Log* (attached to these procedures) constitutes use of a pre-approved procedure in accordance with Regulation 11, section 11.16(5)(b).

The hand-pumped well monitoring, operating, maintenance criteria along with pre-approved start-up procedures are as follows.

1. **Microbiological and Nitrate/Nitrite Sampling and Testing:** Microbiological samples must be analyzed by a department certified laboratory and all routine and repeat sample results must be submitted to the department in accordance with Regulation 11. Repeat monitoring, fecal coliform/E.coli testing, analytical requirements, and response to violations shall be in accordance with Regulation 11. For water systems that operate more than one hand-pumped well, each well must be individually monitored and treated according to the criteria in this handbook.
    a. **Routine Sampling:**
        i. For seasonal operations, at least one routine sample must be taken prior to opening (pre-opening sample) for the season. The sample must be taken after completion of the start-up procedures. When results show an absence of bacteria the well may be opened for public use.
            1. The first monthly routine sample must be taken within the calendar month the system opens for the season and no more than 7 days after seasonal operation begins. For example, if a campground opens on June 1st the first monthly routine sample must be taken before June 8th.
            2. Subsequent monthly samples may be taken on any day of the month.
        ii. All hand-pumped wells must be sampled at least monthly while in operation.
        iii. Any time during the operational season that a supplier raises or lowers the pump stand for maintenance, the hand-pumped well must be disinfected and flushed in accordance with section 4 below and a monthly routine microbiological sample must be collected. If the sample shows an absence of bacteria the well may be opened for public use.
            1. If any routine sample is total coliform positive, 3 repeat samples must be taken in accordance with item c “Response to Positive Microbial result” below.
    b. **Sample Collection Procedure:**

i. Flush the hand-pumped well by pumping for approximately five minutes.
    1. After completion of the start-up procedures, test the water for chlorine residual and ensure that the residual is less than 0.1 mg/L.
ii. Avoid sample contamination by adhering to the following:
    1. The sampling bottle must be kept unopened until the moment just prior to the bottle being filled.
    2. During sampling, do not touch the threads on the cap, the inside of the cap or the neck of the bottle. Do not touch the inside of the bottle.
    3. Do not place the cap on the ground while taking sample.
iii. Important: Do not rinse the bottle before collecting the sample! Normally, sodium thiosulfate is added to the bottle to neutralize residual chlorine in the water sample.
iv. Hold the bottle near its base, fill the bottle ~4/5 full, and replace the cap immediately. **Do not overfill!**
v. Complete the chain of custody form and return the form and sample to the laboratory.

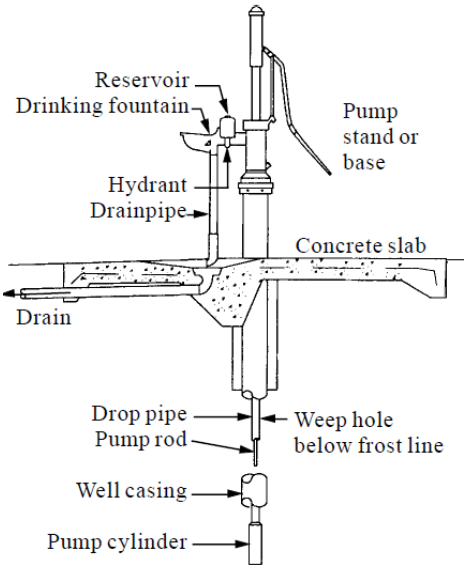
c. **Response to Positive Microbiological Result:**
i. If any routine microbiological sample is total coliform positive, but not fecal coliform or E.coli positive, collect 3 repeat samples from each hand-pumped well that tested positive. The first sample should be collected as soon as possible, but no later than 24 hours after receiving notice of a positive result. The remaining samples must be collected on the same day unless the Department allows the remaining samples to be collected over a three-day period. If the repeat samples show an absence of bacteria, the hand-pumped well may remain open or be opened for public use. If any of the repeat samples are total coliform or *E. coli* positive, the well must be taken out of service by removing the pump handle to prevent public access as soon as possible, but no later than 24 hours after receiving notice of a repeat sample positive result. If any repeat samples are total coliform or *E. coli* positive, the well must be disinfected and retested according to 'iv' below. If any of the repeat samples taken due to a positive **monthly** sample are E.coli positive, take samples according to 'iii' below.
ii. If any routine microbiological sample result is fecal coliform or E.coli positive, collect three repeat samples from each well that tested positive as soon as possible, but no later than 24 hours after receiving notice of a positive result. The well must be taken out of service by removing the pump handle to prevent public access as soon as possible, but no later than 24 hours after receiving notice of a fecal coliform or E.coli positive routine microbiological result. The well must be disinfected and retested according to 'iv' below. If any of the repeat samples taken due to a positive **monthly** sample are E.coli positive take samples according to 'iii' below.
iii. If any repeat microbiological sample taken as a result of a positive monthly routine sample is E.coli positive, take 3 confirmation samples from each well that tested positive unless the Department requires immediate corrective action. If no immediate corrective action is

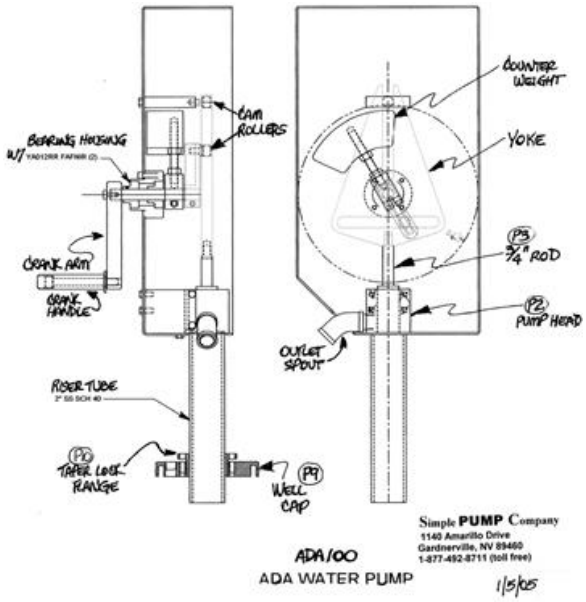
required, the three confirmation samples must be collected within 24 hours after receiving notice of the repeat E.coli positive sample. If any of the confirmation samples are E.coli positive corrective action will be required by the department.

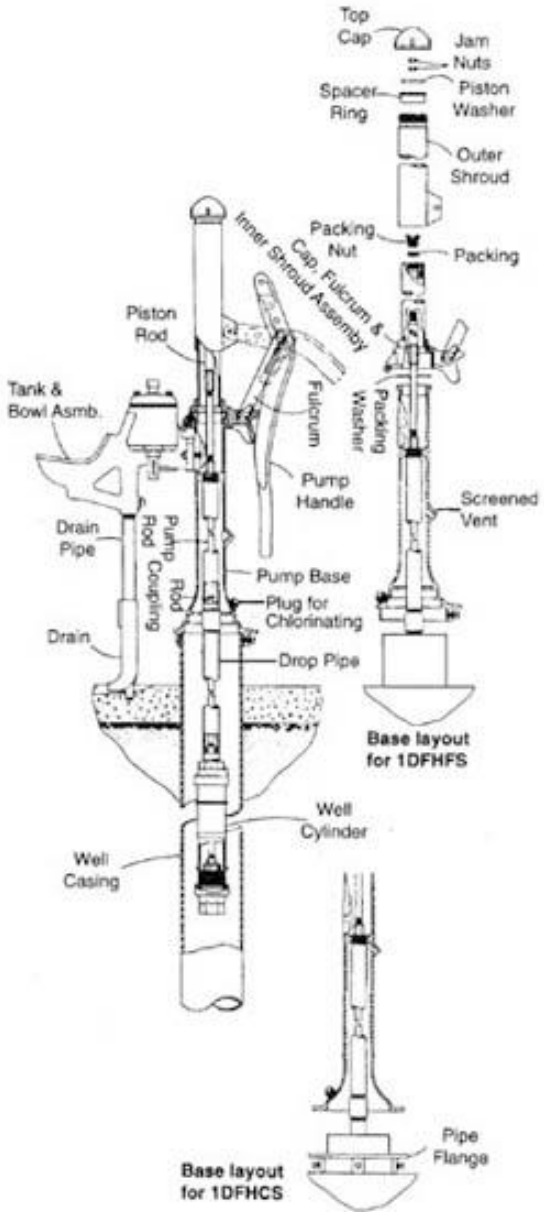
iv. After any fecal coliform/*E. coli* positive routine sample or total coliform or *E. coli* positive repeat sample, all hand-pumped wells that tested positive must be disinfected, flushed and re-tested prior to opening to the public. The well must be disinfected and flushed in accordance with section 4 below. After disinfection and flushing take at least one microbiological sample and remove the pump handle until the result(s) are received. If all microbiological samples taken after disinfection and flushing are absent of bacteria, the well may be opened for public use. If any microbiological sample is total coliform positive, keep the well closed and request a sanitary survey. Issues identified during the Sanitary Survey must be corrected. Once corrected, or if no issues are identified, disinfect and flush the well, then take one microbiological sample. If the microbiological sample is absent of bacteria, the well may be opened for public use.

d. **Nitrate and Nitrite Quality:** Nitrate and Nitrite samples must be analyzed by a department certified laboratory and all routine and confirmation sample results must be submitted to the department in accordance with Regulation 11.

2. **Wellhead Inspection:** A wellhead inspection must be performed on each hand-pumped well installation before system start-up and after the system is shut-down. Year-round sites that have hand pumps must have a wellhead inspection performed at least once a year during the busiest month of operation. A wellhead inspection is simply a physical inspection of the hand pump, well seal, and surrounding well area. Minimum items to be checked on a wellhead inspection are summarized below.
    a. Drainage system should be clear of any debris and functioning properly.
    b. The sanitary well seal must be secure, in place, and watertight.
    c. Concrete slab should not be cracked and any burrows under this slab must be filled. Ensure a tight seal (no gaps) between wellhead and concrete slab.
    d. Nuts and bolts tight, gaskets intact at watertight joints.
    e. Pump stand and major components not cracked or broken.
    f. Packing nut and packing checked for wear; hole in packing nut not worn oblong; packing nut not bottomed out because packing worn out. Check condition of the upper piston guide on models with such appurtenances (e.g., 1DFHF and 1DFHC pumps).
    g. Weep hole open (verify by demonstration, visual verification is not necessary).
    h. Area around the well is clear of potential sources of contamination.
    i. Vent is properly screened with a non-corrodible 24-mesh screen.







Note: Performing a wellhead inspection in the fall after the water system has been shut-down is useful in identifying items that must be corrected before the next season. Thus, materials can be made available and on hand for installation. A wellhead inspection performed before system start-up can determine if any additional damage has occurred during the winter. **Problems noted during the wellhead inspection are considered to be sanitary defects. These defects must be corrected prior to any further public use. Correction of the sanitary defects must be noted in the O&M records.**

3. **Hand-Pumped Well Start-up Procedures:**
    - **a.** Perform wellhead inspection (see section 2).
    - **b.** Complete necessary maintenance and repairs.
    - **c.** Install pump handle.
    - **d.** Loosen and readjust packing nuts as necessary (e.g., Monitor 1DFHC and 1DFHF pump stands). Add packing nut if necessary.
    - **e.** Flush hand-pumped well by pumping until discharge is clear of rust, sediment, etc.
    - **f.** Disinfect and flush the hand-pumped well in accordance with section 4 below, no more than 30 days prior to opening for the season.
    - **g.** Collect a microbiological sample and any required nitrate and nitrite samples prior to opening.
    - **h.** If the preopening routine sample shows an absence of bacteria, the start-up procedures may continue. If the preopening routine sample is total coliform positive, keep the pump handle off and comply with section 1c above.
    - **i.** Once the well is free of contamination, reinstall the pump handle.
    - **j.** Ensure that the public notice is posted and legible.
    - **k.** Collect the first monthly routine sample within the first seven days that the system is open for public use.
    - **l.** Maintain records to demonstrate that the start-up procedures were followed.
4. **Disinfection of the Hand-Pumped Well**: For seasonally operated hand-pumped wells, the well water, pump and piping must be disinfected within 30 days of opening for the season. Hand-pumped wells that operate year round must disinfect at least once a year during the busiest month of operation prior to monthly routine microbiological sampling. Additionally the hand-pumped well water, pump and piping must be disinfected whenever the pump stand is raised or removed for maintenance. If the pump stand is raised, disinfection must include washing (either by wiping down or by spraying with a chlorine solution) the exterior surface of the drop pipe and pump cylinder in addition to dosing the hand-pumped well and disinfecting the water, wetted casing, drop pipe and pump internals, as described below. In all other scenarios, including annual disinfection and disinfection as a response to positive microbiological samples, water systems with a hand-pumped well that allows disinfection without raising or removing the pump stand may disinfect by dosing the well and disinfecting the water, wetted casing, drop pipe and pump internals, as described in items b-f, excluding item a below.
    - **a.** *To wash the exterior when the pump stand is raised or removed* - Wash the exterior surface of the drop pipe and pump cylinder with a 100-mg/L-chlorine solution as they are lowered into the well. **NOTE: 1.5 tablespoons** of 8 ¼ percent household bleach per five gallons of water is approximately a 100-mg/L-chlorine solution. Ensure that the bleach being used has not passed its expiration date.
    - **b.** Pour chlorine solution into well (just before installing pump cylinder and drop pipe assembly if they have been removed). Chlorine solution is made by adding **1.5 tablespoons** of 8 ¼ percent household bleach per five gallons of water. Add 5 gallons of this solution into the well for each 20 feet of standing water, e.g., 15 gallons for 60 feet of standing water. Disperse chlorine evenly throughout the hand-pumped well by pouring chlorine solution through a disinfected hose or pipe that is moving up or down in the well, while the chlorine solution is added.

c. After installation of the hand pump is complete, operate the hand pump until the distinct odor of chlorine is detected in the discharge.
d. Remove the pump handle and allow the chlorine solution to remain in the well for a minimum of 6 hours.
e. Reinstall the pump handle and flush the well until the free chlorine residual is below 0.2 mg/L. Chlorine residual must be measured with an approved chlorine test kit.
f. Remove pump handle. Handle may be reinstalled for sampling purposes; however, the well must remain closed until sample results show an absence of bacteria.

5. **Well Cleaning or Flushing**: Some wells are not adequately cleaned at the low pumping rate of hand pumps. Accumulations of sediment, rust particles, etc., eventually may affect the physical quality of the well water. At some well locations, periodic cleaning of the hand-pumped well can be beneficial. The ORC should consult with facility engineers if available on specific installations for hand-pumped wells.
6. **Shut-down:**
   a. Perform wellhead inspection (see section 2)
   b. Inspect packing nut on pump stands for tightness, where applicable, so packing forms a watertight seal while the hand-pumped well is shut down for the season.
   c. Remove pump handle.
7. **Certification of Procedures Completed (Report – See Appendix B)**
   a. Complete the certification of start-up procedures and submit to the department.
8. **Start-up Log (see following page)**
   a. The appropriate start-up log is part of the pre-approved procedure and must be completed in order to verify completion of each step of the start-up procedures. Please note any sanitary deficiencies and confirm that they have been corrected.

Hand-Pumped Well - Seasonal System Start-up Log		*System Name*	
	Description	*Date Completed*	*Corrective Actions and Notes*
Wellhead Inspection	**1. Drainage System** Clear of debris and functioning properly.		
	2. Sanitary seal Secure and water-tight.		
	3. Concrete slab (if applicable) Not cracked, no animal burrows, and has a tight seal with wellhead.		
	4. Pump components Verify pump, pump stand, nuts, bolts, piston, weep hole, etc.		
	5. Area around wellhead Free from potential sources of contamination.		
Disinfection and Flushing	**6. Shock Disinfection** Disinfect well according to approved procedure.		
	7. Flushing After disinfection, flush water until chlorine is absent.		
Public Notice	**8. Public notice sign is posted near the well and legible**		
Monitor	**9. Startup Bacteria sample** Collection of a total coliform sample after disinfection and prior to opening is required: Regulation 11.16(5)(c).		
Report	**10. Start-up Certification Form (Appendix B)** Submit completed and signed certification to the Department once start-up procedures completed		
	11. Additional notes:		

Appendix B: Certification of Completion of Start-up Procedures

https://www.colorado.gov/cdphe/gwr