UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
UNDERGROUND INJECTION CONTROL PROGRAM

DRAFT AREA PERMIT
CO52409-00000

Town of Castle Rock Utilities Department Project
Class V Aquifer Storage and Recovery Wells
Douglas County, Colorado

Issued To

Town of Castle Rock Utilities Department
175 Kellogg Court
Castle Rock, Colorado 80109

TABLE OF CONTENTS

PART I. AUTHORIZATION TO CONSTRUCT AND OPERATE

Under the authority of the Safe Drinking Water Act (SDWA) and Underground Injection Control (UIC) Program regulations of the U. S. Environmental Protection Agency (EPA) codified at Title 40 of the Code of Federal Regulations (40 CFR) parts 2, 124, 144, 146, and 147, and according to the terms of this permit (Permit),

Town of Castle Rock Utilities Department
175 Kellogg Court
Castle Rock, Colorado 80109

hereinafter referred to as the "Permittee," is authorized to construct and to operate Class V Aquifer Storage and Recovery (ASR) injection wells according to the terms and conditions of this Permit underlying the portion of the Town of Castle Rock Utilities Department District located in Douglas County, Colorado.

Currently only wells CR-223 and CR-224 are authorized for construction within the service field area.

- ***CR–223 Well***
  1462 feet from the north line and 2559 feet from the east line
  SW ¼ NE ¼, Section 34, Township 7 South, Range 67 West
  Douglas County, Colorado

- ***CR–224 Well***
  1488 feet from the north line and 2458 feet from the east line
  SW ¼ NE ¼, Section 34, Township 7 South, Range 67 West
  Douglas County, Colorado

The wells are located wholly within the service area permit boundary as shown in Figure 1 with the legal description identified in Table 1:

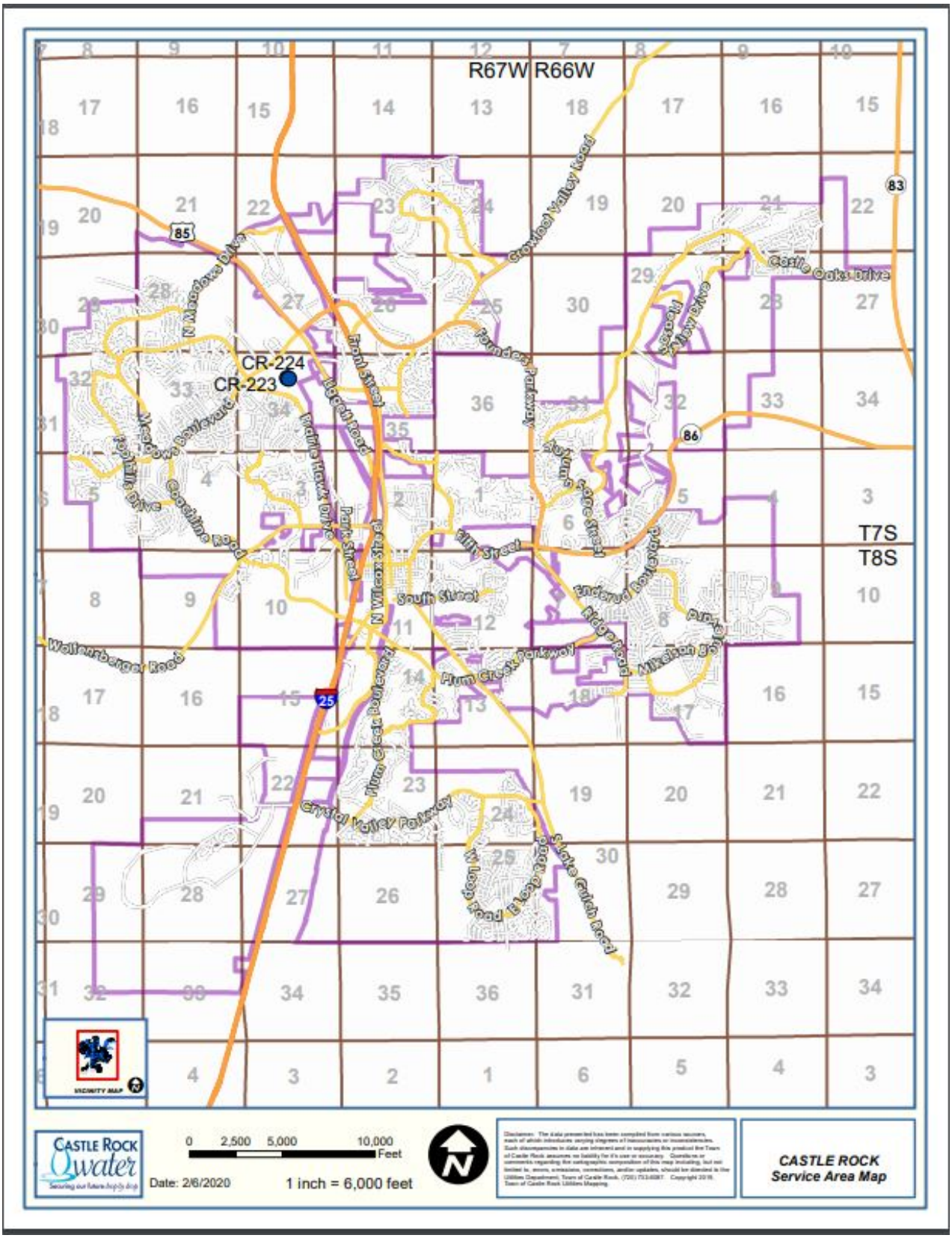

Figure 1. Town of Castle Rock Water Service Area

TOWNSHIP 7 SOUTH, RANGE 67 W, SECTION 21 SW/4 OF SW/4	TOWNSHIP 8 SOUTH, RANGE 67 W, SECTION 9
Township 7 South, Range 67 W, Section 22 SW/3 of SW/4, E/2 of SW/4, SE/4	Township 8 South, Range 67 W, Section 10
Township 7 South, Range 67 W, Section 23 NE/4, SE/4, SW/4, SW/4 of NW/4, SE/4 of NW/4	Township 8 South, Range 67 W, Section 11
Township 7 South, Range 67 W, Section 24 NW/4 of NW/4, S/2 of NW/4, SW4, SE4	Township 8 South, Range 67 W, Section 12
Township 7 South, Range 67 W, Section 25	Township 8 South, Range 67 W, Section 13
Township 7 South, Range 67 W, Section 26	Township 8 South, Range 67 W, Section 14
Township 7 South, Range 67 W, Section 27	Township 8 South, Range 67 W, Section 15
Township 7 South, Range 67 W, Section 28	Township 8 South, Range 67 W, Section 16
Township 7 South, Range 67 W, Section 29 SE/4, SE/4 of SW/4	Township 8 South, Range 67 W, Section 21
Township 7 South, Range 67 W, Section 32 E/2, E/2 of NW/4, E/2 of SW/4	Township 8 South, Range 67 W, Section 22
Township 7 South, Range 67 W, Section 33	Township 8 South, Range 67 W, Section 23
Township 7 South, Range 67 W, Section 34	Township 8 South, Range 67 W, Section 24
Township 7 South, Range 67 W, Section 35	Township 8 South, Range 67 W, Section 25
Township 7 South, Range 67 W, Section 36	Township 8 South, Range 67 W, Section 26
Township 7 South, Range 66 W, Section 19 S/2	Township 8 South, Range 67 W, Section 27
Township 7 South, Range 66 W, Section 20 S/2	Township 8 South, Range 67 W, Section 28
Township 7 South, Range 66 W, Section 21 S/2	Township 8 South, Range 67 W, Section 29 E/2
Township 7 South, Range 66 W, Section 22 SW/4 of NW/4, W/2 of SW/4	Township 8 South, Range 67 W, Section 32 NE/4

Township 7 South, Range 66 W, Section 27 N/2 of NW/4	Township 8 South, Range 67 W, Section 33 N/2
Township 7 South, Range 66 W, Section 28 W/2, N/2 of SE/4	Township 8 South, Range 66 W, Section 4 W/2
Township 7 South, Range 66 W, Section 29	Township 8 South, Range 66 W, Section 5
Township 7 South, Range 66 W, Section 30	Township 8 South, Range 66 W, Section 6
Township 7 South, Range 66 W, Section 31	Township 8 South, Range 66 W, Section 7
Township 7 South, Range 66 W, Section 32	Township 8 South, Range 66 W, Section 8
Township 7 South, Range 66 W, Section 33 W/2	Township 8 South, Range 66 W, Section 9 W/2, W/2 of SE/4
Township 8 South, Range 67 W, Section 1	Township 8 South, Range 66 W, Section 17
Township 8 South, Range 67 W, Section 2	Township 8 South, Range 66 W, Section 18
Township 8 South, Range 67 W, Section 3	Township 8 South, Range 66 W, Section 19 W/4 of SW/4, W/8 of NW/4
Township 8 South, Range 67 W, Section 4	Township 8 South, Range 66 W, Section 30 W/2, SW/4 of SE/4
Township 8 South, Range 67 W, Section 5 E/2, E/2 of NW/4	

Table 1. Legal Description of the Permittee Service Area

This Permit is based on representations made by the applicant and on other information contained in the administrative record. Misrepresentation of information or failure to fully disclose all relevant information may be cause for termination, revocation and reissuance, or modification of this Permit and/or formal enforcement action. It is the Permittee's responsibility to read and understand all provisions of this Permit.

Where a state or tribe is not authorized to administer the UIC program under the SDWA, the EPA regulates underground injection of fluids into wells so that injection does not endanger Underground Sources of Drinking Water (USDWs). The EPA UIC permit conditions are based on authorities set forth at 40 CFR parts 144 to 147 and address potential impacts to USDWs. Under 40 CFR part 144, subpart D, certain conditions apply to all UIC permits and may be incorporated either expressly or by reference. Regulations specific to injection wells in Colorado are found at 40 CFR §§ 147.301 and 147.305. The Permittee shall not construct, operate, maintain, convert, plug, abandon, or conduct any other injection activity in a manner that allows the movement of a fluid containing any contaminant into USDWs, except as authorized by 40 CFR part 146.

The Permittee is authorized to engage in underground injection in accordance with the conditions of this Permit. Any underground injection activity not authorized by this Permit or by rule is prohibited.

Compliance with the terms of this Permit does not constitute a defense to any enforcement action brought under the provisions of Section 1431 of the SDWA or any other law governing protection of public health or the environment, nor does it serve as a shield to the Permittee's independent obligation to comply with all UIC regulations. Nothing in this Permit relieves the Permittee of any duties under applicable regulations.

This Permit is issued for three (3) years from the Final Permit Date, until it expires under the terms of the Permit, or unless modified, revoked and reissued, or terminated under 40 CFR §§ 124.5, 144.12, 144.39, 144.40 or 144.41.

Issue Date: **DRAFT** Effective Date **DRAFT**

DRAFT

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Sarah Bahrman, Chief*
Safe Drinking Water Branch

* Throughout this Permit the term “Director” refers to the Safe Drinking Water Branch Chief or the Water Enforcement Branch Chief.

PART II. SPECIFIC PERMIT CONDITIONS

Section A. LIST OF WELLS (LW)

Injection wells regulated by the EPA and subject to the terms and conditions of this Permit are listed below:

- ***CR–223 Well***
  Permit No. CO52409-10716
  1462 feet from the north line and 2559 feet from the east line
  SW ¼ NE ¼, Section 34, Township 7 South, Range 67 West
  Douglas County, Colorado

- ***CR–224 Well***
  Permit No. CO52409-10717
  1488 feet from the north line and 2458 feet from the east line
  SW ¼ NE ¼, Section 34, Township 7 South, Range 67 West
  Douglas County, Colorado

The EPA Region 8 will maintain a LW that are added to this Permit. This list will be available to the Permittee and the public upon request. Injection wells regulated by the EPA and subject to the terms and conditions of this Permit are listed in the LW with the EPA Permit No. CO52409 and are assigned a unique well identification number by the EPA.

Section B. WELL CONSTRUCTION REQUIREMENTS

The Permittee shall not convert recovery wells to injection wells or commence injection into wells until the Permittee has been approved to do so in accordance with the following procedures:

1. Requesting Authorization of Additional Injection Wells

Prior to converting any additional existing drinking water supply (i.e., recovery) wells to injection wells, the Permittee shall submit the following materials to the Director:

(a) a cover letter requesting authorization to convert the well referencing Area UIC Permit CO52409-00000 and the name and Colorado Division of Water Resources Permit number for the well;
(b) a completed EPA 7520-6 (Class V) injection well application form with the applicable attachments;
(c) evidence and/or written statement that water feed lines have been installed to the requested well(s);
(d) a laboratory analysis, of formation water drawn from the subject well(s) proposed to be added, using APPENDIX G Parameters or a statement that the water sample will be obtained during well construction and submitted in accordance with APPENDIX A;
(e) a topographic map extending to at least ¼ mile radius Area of Review (AOR) for the well;
(f) a wellbore diagram;
(g) pump rate test data results;
(h) a listing of all wells penetrating the confining zone within the ¼ mile AOR, and cementing records and/or cement bond logs for all wells not previously submitted and evaluated by the EPA (for both injection and AOR wells); and
(i) a well location plat map for the requested injection well.

2. Authorization to Construct Additional Injection Wells

Once the EPA has confirmed that the proposed well meets the Permit conditions, the Director will authorize construction by email or other written communication to the Permittee.

3. Casing and Cement

Casing and Cement requirements are specified in APPENDIX A.

4. Sampling and Monitoring Devices

The Permittee shall install and maintain in good operating condition:

(a) a pressure actuated shut-off device attached to the injection flow line set to shut-off the injection pump when or before the Maximum Allowable Injection Pressure (MAIP) is reached at the wellhead;

(b) one-half (1/2) inch female iron pipe fitting, isolated by shut-off valves and located at the wellhead at a conveniently accessible location, for the attachment of a pressure gauge capable of monitoring pressures ranging from normal operating pressures up to the MAIP described in Part II, Section C.4 on:

(i). the wellhead casing; and

(ii). the injection tubing string(s);

(c) a sampling port such that samples shall be collected at a location that ensures they are representative of the injected fluid. For example, a fluid sampling point between the pump house or storage tanks and the injection well, isolated by shut-off valves, for sampling the injected fluid;

(d) a flow meter capable of recording instantaneous flow rate and cumulative volume attached to the injection line; and continuous recording devices to monitor injection pressure, flow rate, and volume.

5. Pre-Injection Logs and Tests

Well logging and testing requirements prior to receiving authorization to inject are found in APPENDIX B. Well logs and tests shall be performed according to current EPA-approved procedures, or alternate procedures approved by the Director. The Director may stipulate specific test methods and criteria best suited for a specific well construction and injection operation. Limited injection is permissible prior to receiving authorization to inject only for the purposes of conducting the initial well logs and tests required in APPENDIX B.

6. Postponement of Construction or Conversion to Injection Wells

(a) For the two (i.e., CR-223 and CR-224) wells to be initially converted, the Permit shall expire if well construction has not begun within two years of the Effective Date of the Permit.

(b) The Permittee may request a one-time extension of the permit expiration date, not to exceed two additional years, which must be made prior to expiration of the Permit. Notification shall be in writing and state the reasons for the delay, provide an estimated completion date, and list additional wells within the AOR that were not included in the initial permit application. For those newly completed AOR wells that penetrate the upper confining zone, a well construction diagram, cement records and/or cement bond logs are also required.

Once the Permit has expired under this part, the Permittee will need to reapply for a UIC permit and restart the complete permit process, including opportunity for public comment, before injection can occur.

(c) For wells that have begun construction or have been converted injection, if authorization to inject has not been provided within two years of spud date or the Effective Date of the Permit, respectively, the Permittee is subject to the conditions found in Part II, Section F.5. *Wells Not Actively Injecting* or may elect to convert the well to a non-UIC well found in Part III, Section B.2 *Conversion to Non-UIC Well*.

Section C. WELL OPERATION

1. Outermost Casing Injection Prohibition

Injection between the outermost casing protecting USDWs and the well bore is prohibited.

2. Requirements Prior to Receiving Authorization to Inject

Well injection may commence only after all well construction and pre-injection requirements have been met and a written authorization to commence injection has been obtained from the Director.

In order to obtain written authorization to inject, the following must be satisfied:

(a) The Permittee has:

(i). submitted a cover letter referencing Area UIC Permit CO52409-00000, the well name and Colorado Division of Water Resources Permit number of the constructed injection well;

(ii). submitted to the Director a notice of completion of construction and a completed EPA Form 7520-18 and required attachments. The Permittee shall also provide a revised well diagram and a description of the modification to the well construction;

(iii). conducted all applicable logging and testing requirements found in APPENDIX B and submitted required records to the Director. The logging and testing requirements include demonstration of mechanical integrity, in accordance with the conditions found in Part II, Section D of this permit; and

(iv). satisfied requirements for corrective action in APPENDIX F, if applicable.

(b) The Director has received and reviewed the documentation associated with the requirements in Paragraph 2(a) of this section and finds it is in compliance with the conditions of the Permit.

(c) The Director has inspected the injection well and finds it is in compliance with the conditions of the Permit. If the Permittee has not received notice from the Director of his or her intent to inspect the injection well within 13 days of the date of the notice in Paragraph 2(a)(i) above, then prior inspection is waived.

3. Injection Zone and Fluid Movement

Injection zone means "a geological formation, group of formations, or part of a formation receiving fluids through a well."

Injection and perforations are permitted only within the approved injection zone specified in APPENDIX C. Injected fluids shall remain within the injection zone. If monitoring indicates the movement of fluids from the injection zone, the Permittee shall notify the Director within twenty-four (24) hours and submit a written report that documents circumstances that resulted in movement of fluids beyond the injection zone.

4. Injection Pressure Limitation

(a) Injection pressure at the wellhead shall not initiate new fractures or propagate existing fractures in the confining or injection zones. In no case shall injection pressure cause the movement of injectate or formation fluids outside of the specified injection zone.

(b) Injection pressure shall not exceed the MAIP identified in APPENDIX C.

5. Injection Volume Limitation

Injection volume is limited to the total volume specified in APPENDIX C.

6. Injection Fluid Limitation

Injected fluids are limited to fluids from those public water systems sampled and submitted as part of the application. Sources of treated drinking water to be injected shall be obtained from Alluvium, Dawson, Denver, and Arapahoe Aquifers.

The injectate will be treated to drinking water standards at the Plum Creek Water Purification Facility (PCWPF).

New water sources and/or the use of alternate treatment facilities may be added to the list of allowed injection fluid water sources in accordance with the procedures presented in Part II. Section C.7, *Addition of a New Water Source*, and in accordance with the procedures in 40 CFR § 144.41. The Permittee must obtain prior written approval from the Director before injecting fluids from a new source.

7. Addition of a New Water Source

It is anticipated that new raw water sources and other public water systems may be included in the future as part of this ASR project. Water from additional raw water sources, public water systems and/or water treatment plants not approved under Part II. Section C.6 would be considered new sources.

(a) Requirements for the addition of a new water source are as follows:
   (i). Prior to the introduction of a new water source (e.g. additional raw water source, different public water system or treatment plant within that system), the Permittee shall provide notification to the Director;
   (ii). The notification shall identify the new water source, describe the treatment process with a written narrative and diagram(s), and include a representative sample analysis of the new injection fluid collected using the baseline constituent list provided in APPENDIX G;
   (iii). The EPA will require the performance of additional tests, including testing in accordance with APPENDIX H, following review of the submittal; and
   (iv). The EPA may require the performance of additional tests, including testing in accordance with APPENDIX I, following review of the submittal;

(b) The EPA will review the submission to ensure it meets permit conditions. Any additional authorizations to inject a new water source will be in the form of an email or other written communication to the Permittee; and

(c) The Permittee shall perform monitoring in accordance with APPENDIX D.

8. Alteration, Workover, and Well Stimulation

Alterations and workovers shall meet all conditions of the Permit. Alterations and workovers include any activity that physically changes the well construction or injection formation.

Prior to beginning any addition or physical alteration to an injection well's construction or injection formation, the Permittee shall give advanced notice to the Director. Additionally, the Director's written

approval must be obtained if the addition or physical alteration to the injection well modifies the approved well construction. Substantial alterations or additions may be cause for modification to the Permit and may include additional testing or monitoring requirements.

The Permittee shall record all alterations and workovers on a Well Rework Record (EPA Form 7520-19) and submit a revised well construction diagram when the well construction has been modified. The Permittee shall provide this and any other record of well workover or test data to the EPA within sixty (60) days of completion of the activity.

The Permittee shall complete any activity which affects the tubing or casing and provide demonstration of internal (Part I) MI within ninety (90) days of beginning the activity. If the Permittee is unable to complete work within the specified time period, the Permittee shall propose an alternative schedule and obtain Director's written approval. Injection operations shall not resume until the well has successfully demonstrated mechanical integrity. If the well lost mechanical integrity, the Permittee must receive written approval from the Director to recommence injection.

9. Well Logging and Testing

Well logging and testing requirements are found in APPENDIX B. The Permittee shall ensure the log and test requirements are performed within the time frames specified in APPENDIX B. Well logs and tests shall be performed according to current EPA-approved procedures. The Director may stipulate specific test methods and criteria best suited for a specific well construction and injection operation.

10. Exceedances of Permit Limits

If exceedance(s) of a permit limit listed in the APPENDIX G is observed in the injectate and/or recovered water during normal operations, the Permittee shall resample the fluid source within 14 days. Should a second exceedance be observed, the applicant must shut in the well until the problem is resolved to the Director' s satisfaction.

11. Reopening Permit for Modification or Revocation and Reissuance

(a) If concentrations of the nitrosamine, N-nitrosodimethylamine (NDMA), in two consecutive quarterly (i.e., every 90 day, as required in APPENDIX D) samples of injectate and/or recovered water exceed seven (7) nanograms per liter (ng/L) (i.e., the Integrated Risk Information System (IRIS) based value for 10^{-5} increased cancer risk), the Permittee shall commence monthly monitoring and agrees that the Director may open the Permit for modification or revocation and reissuance.

(b) If exceedance(s) as described above in Part II Section C.10 is observed, the Permittee agrees that the Director may open the Permit for modification or revocation and reissuance.

Section D. MECHANICAL INTEGRITY

1. Requirement to Maintain Mechanical Integrity

The Permittee is required to ensure the injection well maintains mechanical integrity (MI) at all times. Injecting into a well that lacks MI is prohibited.

An injection well has MI if:

(a) there is no significant leak in the casing, tubing, or packer (internal Part I); and

(b) there is no significant fluid movement into a USDW through vertical channels adjacent to the injection well bore (external Part II).

2. *Demonstration of Mechanical Integrity*

The conditions under which the Permittee shall conduct the MI testing (MIT) are as follows and detailed in APPENDIX B:

(a) Prior to receiving authorization to inject, as specified in APPENDIX B, the Permittee shall demonstrate internal Part I MI. Well-specific conditions dictate the methods and the frequency for demonstrating MI. The due date for completing the test is specified in APPENDIX B. The method that shall be used to demonstrate Part I MI is as follows:

Internal MI may be demonstrated by performing a baseline annulus pressure test. An annulus may be created for testing purposes only by placing a temporary packer (e.g. inflatable packer) in the upper portion of the well. This test may be performed only once unless required because of a workover or by the Director. Internal (Part I) MI should be run with a pressure difference between the annulus and the injection tubing of at least 100 psig or an alternate value required by the Director. If the MAIP for any wells approved under this Permit exceeds 200 psig, then the Director may require a new pressure difference. If there is a pressure change of 10 percent or more from the initial test pressure during the 30 minute duration, the well has failed to demonstrate mechanical integrity and should be shut-in until it is repaired or plugged. A pressure change of 10 percent or more is considered significant. If there is no significant pressure change in 30 minutes from the time that the pressure source is disconnected from the annulus, the test may be completed as passed.

(b) Part II MI shall be demonstrated by providing a cement record or cement bond log (CBL).

(c) The Director may require additional or alternative tests if the results presented by the operator are not satisfactory to the Director to demonstrate there is no movement of fluid into or between USDWs resulting from the injection activity.

Results of any MIT required by this Permit shall be submitted to the Director as soon as possible but no later than thirty (30) calendar days after the test is complete.

3. Mechanical Integrity Test Methods and Criteria

EPA approved methods shall be used to demonstrate MI. These methods may be found in documents available from the EPA at https://www.epa.gov/uic/underground-injection-control-epa-region-8-co-mt-nd-sd-ut-and-wy#guidance:

- *"Ground Water Section Guidance No. 34: Cement Bond Logging Techniques and Interpretation"*
- *"Ground Water Section Guidance No. 39: Pressure Testing Injection Wells for Part I (Internal) Mechanical Integrity"*
- *"Temperature Logging for Mechanical Integrity"*

Current versions of these documents will also be available from the EPA upon request. The Director may stipulate specific test methods and criteria best suited for a specific well construction and injection operation.

4. Notification Prior to Testing

The Permittee shall notify the Director at least thirty (30) calendar days prior to any MIT. The Director may allow a shorter notification period if it would be sufficient to enable the EPA to witness the MIT or the EPA declines to witness the test. Notification may be in the form of a yearly or quarterly schedule of planned MITs, or it may be on an individual basis.

5. Loss of Mechanical Integrity

If the well fails to demonstrate MI during a test or a loss of MI becomes evident during operation (i.e. water flowing at the surface, etc.), the Permittee shall notify the Director within twenty-four (24) hours (see Part III, Section D.11(e) of this Permit), cease injection and shut-in the well within forty-eight (48) hours unless the Director requires immediate shut-in.

Within five (5) calendar days, the Permittee shall submit a follow-up written report that documents circumstances that resulted in the MI loss and how it was addressed. If the MI loss has not been resolved, the Permittee shall provide a report with the proposed plan and schedule to reestablish MI. A demonstration of MI shall be reestablished within ninety (90) calendar days of any loss of MI unless written approval of an alternate time period has been given by the Director.

Injection operations shall not resume until after the MI loss has been resolved, the well has demonstrated MI pursuant to 40 CFR § 146.8, and the Director has provided written approval to resume injection.

Section E. MONITORING, RECORDKEEPING, AND REPORTING OF RESULTS

1. *Monitoring Parameters and Frequency*

Monitoring parameters are specified in APPENDIX D. The listed parameters are to be monitored, recorded and reported at the frequency indicated in APPENDIX D, even when the well is not operating. In the event the well has not injected or is no longer injecting, the monitoring report will reflect its status. Sampling data shall be submitted if the well has injected any time during the reporting period.

Records of monitoring information shall include:

(a) the date, exact place, and time of the observation, sampling, or measurements;
(b) the individual(s) who performed the observation, sampling, or measurements;
(c) the date(s) of analyses and individuals who performed the analyses;
(d) the analytical technique or method used; and
(e) the results of such analyses.

2. *Monitoring Methods*

Observations, measurements, and samples taken for the purpose of monitoring shall be representative of the monitored activity and include:

(a) Methods used to monitor the nature of the injected fluids must comply with analytical methods cited and described in 40 CFR § 136.3 or by other methods that have been approved in writing by the Director.
(b) Injection rate, injected/recovered volume, cumulative injected/recovered volume, and wellhead pressure observed and recorded at the wellhead. All parameters shall be observed simultaneously to provide a clear depiction of well operation;
(c) Pressures are to be measured in pounds per square inch (psig).
(d) Fluid volumes are to be measured in standard oil field barrels (bbl) or thousands of cubic feet (MCF).
(e) Injection rates are to be measured in barrels per day (bbl/day) or thousands of cubic feet per day (MCF/day).

3. *Records Retention*

The Permittee shall retain records of all monitoring information, including the following:

(a) Calibration and maintenance records and all original recordings for continuous monitoring

instrumentation, copies of all reports required by this Permit, and records of all data used to complete the application for this Permit, for a period of at least (3) years from the date of the sample, measurement, report, or application. This period may be extended any time prior to its expiration by request of the Director.

(b) Nature and composition of all injected fluids until three (3) years after the completion of any plugging and abandonment (P&A) procedures specified under 40 CFR § 144.52(a)(6). The Permittee shall continue to retain the records after the three-year (3) retention period unless the Permittee delivers the records to the Regional Administrator, or his/her authorized representative, or obtains written approval from the Regional Administrator, or his/her authorized representative, to discard the records.

4. Annual Reports

Regardless of whether the well is operating, the Permittee shall submit an Annual Report to the Director that:

(a) summarizes the results of the monitoring required in Part II, Sections D and E and APPENDIX D;
(b) includes a summary of any major changes in characteristics or sources of injected fluid. The report of fluids injected during the year must identify each new fluid source by water treatment plant and identify each well name and location, and the field name or facility name; and
(c) includes any additional wells within the area of review that have not previously been submitted. For those wells that penetrate the injection zone, a well construction diagram, cement records and cement bond log are also required.

The first Annual Report shall cover the period from the effective date of the Permit through December 31 of that year. Subsequent Annual Reports shall cover the period from January 1 through December 31 of the reporting year. Annual Reports shall be submitted by February 15 of the year following data collection. EPA Form 7520-8 or 7520-11 may be used or adapted to submit the Annual Report, however, the monitoring requirements specified in this Permit are mandatory even if the EPA form indicates otherwise. An electronic form may also be obtained from the EPA to satisfy reporting requirements.

Section F. PLUGGING AND ABANDONMENT

1. Notification of Well Abandonment

The Permittee shall notify the Director in writing at least thirty (30) days prior to plugging and abandoning an injection well.

2. Well Plugging Requirements

Prior to abandonment, the injection well shall be plugged with cement in a manner which isolates the injection zone and will not allow the movement of fluids outside of the injection zone(s). Additional federal, state or local laws or regulations may also apply.

3. Approval of Plugging and Abandonment (P&A) Plan

The Permittee shall submit a proposed P&A Plan to the Director for approval that meets the requirements in APPENDIX E at least sixty (60) days prior to plugging and abandoning the injection well(s) covered under this area permit. .

4. Plugging and Abandonment Report

Within sixty (60) days after plugging a well, the Permittee shall submit a report (EPA Form 7520-19) to the Director or his/her authorized representative. The plugging report shall be certified as accurate by the person who performed the plugging operation. Such report shall consist of a statement that the well was plugged in accordance with current regulations.

5. Wells Not Actively Injecting

After any period of two (2) years during which there is no injection, the Permittee shall plug and abandon the well in accordance with the requirements in this Section and APPENDIX E of this Permit unless the Permittee:

(a) provides written notice to the Director or his/her authorized representative, prior to the two-year (2) period;

(b) describes actions or procedures, satisfactory to the Director or his/her authorized representative, that the Permittee will take to ensure that the well will not endanger USDWs during the period of temporary abandonment. These actions and procedures shall include compliance with the technical requirements applicable to active injection wells, unless waived by the Director or his/her authorized representative; and

(c) receives written notice by the Director or his/her authorized representative to temporarily waive plugging and abandonment requirements.

The Permittee of a well that has been temporarily abandoned shall notify the Director prior to resuming operation of the well.

PART III. CONDITIONS APPLICABLE TO ALL PERMITS

Section A. 40 CFR 144.12 REQUIREMENTS

Injection wells authorized under this Permit shall comply with the requirements of 40 CFR § 144.12.

1. Prohibition of movement of fluids into an underground source of drinking water

No owner or operator shall construct, operate, maintain, convert, plug, abandon, or conduct any other injection activity in a manner that allows the movement of fluid containing any contaminant into underground sources of drinking water, if the presence of that contaminant may cause a violation of any primary drinking water regulation under 40 CFR part 142 or may otherwise adversely affect the health of persons.

2. Identification of a Violation, 40 CFR l 44.l 2(c)

If at any time the Director learns that a Class V well may cause a violation, the Director may

(a) order the Permittee to take such actions (including, where required, closure of the injection well) as may be necessary to prevent the violation or
(b) take enforcement action.

3. Adversely Affect Human Health, 40 CFR 144.12(d)

Whenever the Director learns that a Class V well may be adversely affecting the health of persons, he or she may prescribe such actions as may be necessary to prevent the adverse effect, including any actions prescribed in Part III. Section A.2

Section B. CHANGES TO PERMIT CONDITIONS

1. Modification, Revocation and Reissuance, or Termination

The Director may, for cause, modify, revoke and reissue, or terminate this Permit in accordance with 40 CFR §§ 124.5, 144.12, 144.39, 144.40, and 144.41. The filing of a request for modification, revocation and reissuance, termination, or the notification of planned changes or anticipated noncompliance on the part of the Permittee does not stay the applicability or enforceability of any condition of this Permit.

2. Conversion to Non-UIC Well

The Director may allow conversion of the well to a non-UIC well. Conversion may not proceed until the Permittee receives written approval from the Director, at which time this permit will expire due to the end of operating life of the facility. Once expired under this part, the Permittee will need to reapply for a UIC permit and restart the complete permit process, including opportunity for public comment, before injection can occur.

Conditions of such conversion shall include approval of the proposed well rework, demonstration of mechanical integrity, and documentation that the well is authorized by another regulatory agency.

3. Transfer of Permit

Under 40 CFR § 144.38, this Permit may be transferred by the Permittee to a new owner or operator only if:

(a) the Permit has been modified or revoked and reissued (under 40 CFR § 144.39(b)(2)), or a minor modification made (under 40 CFR § 144.41(d)), to identify the new permittee and incorporate such other requirements as may be necessary under the SDWA, or

(b) the Permittee provides written notification (EPA Form 7520-7) to the Director at least thirty (30) days in advance of the proposed transfer date and submits a written agreement between the existing and proposed new permittees containing a specific date for transfer or permit responsibility, coverage, and liability between them. If the Director does not notify the Permittee and the proposed new permittee of his or her intent to modify or revoke and reissue, or modify, the transfer is effective on the date specified in the written agreement. A modification under this paragraph may also be a minor modification under 40 CFR § 144.41.

4. Permittee Change of Address

Upon the Permittee's change of address, or whenever the operator changes the address where monitoring records are kept, the Permittee must provide written notice to the Director within thirty (30) days.

Section C. SEVERABILITY

The provisions of this Permit are severable, and if any provision of this Permit or the application of any provision of this Permit to any circumstance is held invalid, the application of such provision to other circumstances, and the remainder of this Permit shall not be affected thereby. Additionally, in a permit modification, only those conditions to be modified shall be reopened. All other aspects of the existing permit shall remain in effect for the duration of the permit.

Section D. CONFIDENTIALITY

In accordance with 40 CFR part 2 and 40 CFR § 144.5, information submitted to the EPA pursuant to these regulations may be claimed as confidential by the submitter. Any such claim must be asserted at the time of submission by stamping the words "confidential business information" on each page containing such information. If no claim is made at the time of submission, the EPA may make the information available to

the public without further notice. If a claim is asserted, the information will be treated in accordance with the procedures in 40 CFR part 2 (Public Information). Claims of confidentiality for the following information will be denied:

- the name and address of the Permittee; and
- information which deals with the existence, absence or level of contaminants in drinking water.

Section E. ADDITIONAL PERMIT REQUIREMENTS

1. Duty to Comply

The Permittee must comply with all conditions of this Permit. Any permit noncompliance constitutes a violation of the SDWA and is grounds for enforcement action; for permit termination, revocation and reissuance, or modification; or for denial of a permit renewal application; except that the Permittee need not comply with the provisions of this Permit to the extent and for the duration as such noncompliance is authorized in an emergency permit under 40 CFR § 144.34. All violations of the SDWA may subject the Permittee to penalties and/or criminal prosecution as specified in Section 1423 of the SDWA.

2. Need to Halt or Reduce Activity Not a Defense

The Permittee shall not use as a defense in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this Permit.

3. Duty to Mitigate

The Permittee shall take all reasonable steps to minimize or correct any adverse impact on the environment resulting from noncompliance with this Permit.

4. Proper Operation and Maintenance

The Permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances), which are installed or used by the Permittee to achieve compliance with the conditions of this Permit. Proper operation and maintenance include effective performance, adequate funding, adequate operator staffing and training, and adequate laboratory and process controls, including appropriate quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems only when necessary to achieve compliance with the conditions of this Permit.

5. Permit Actions

This Permit may be modified, revoked and reissued or terminated for cause. The filing of a request by the Permittee for a permit modification, revocation and reissuance, or termination, or a notification of planned changes or anticipated noncompliance, does not stay any permit condition.

6. Property and Private Rights; Other Laws

This Permit does not convey property rights of any sort or any exclusive privilege; nor does it authorize any injury to persons or property, any invasion of other private rights, or any infringement of any other federal, state or local law or regulations.

7. Duty to Provide Information

The Permittee shall furnish to the Director, within a time specified, any information which the Director may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit, or to determine compliance with this permit. The Permittee shall also furnish to the Director, upon request, copies of records required to be kept by this Permit.

8. Inspection and Entry

The Permittee shall allow the Director, or an authorized representative, upon the presentation of credentials and other documents as may be required by law, to:

(a) enter upon the Permittee's premises where a regulated facility or activity is located or conducted, or where records must be kept under the conditions of this Permit;

(b) have access to and copy, at reasonable times, any records that must be kept under the conditions of this Permit;

(c) inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this Permit; and

(d) sample or monitor at reasonable times, for the purposes of assuring permit compliance or as otherwise authorized by the SDWA, any substances or parameters at any location.

9. Signatory Requirements

All applications, reports or other information submitted to the Regional Administrator or his/her authorized representative shall be signed and certified according to 40 CFR § 144.32. This section explains the requirements for persons duly authorized to sign documents and provides wording for required certification.

10. Continuation of Expiring Permits

(a) Duty to Reapply
If the Permittee wishes to continue an activity regulated by this Permit after the expiration date of this Permit, the Permittee must submit a complete application for a new permit at least 180 days before this Permit expires.

(b) Permit Extension
The conditions of an expired permit continue in force in accordance with 5 U.S.C. 558(c) until the effective date of a new permit, if:
(i). the Permittee has submitted a timely application which is a complete application for a new permit; and
(ii). the Director, through no fault of the Permittee, does not issue a new permit with an effective date on or before the expiration date of the previous permit.

(c) Enforcement
When the Permittee is not in compliance with the conditions of the expiring or expired permit, the Regional Administrator or his/her authorized representative may choose to do any or all of the following:
(i). Initiate enforcement action based upon the permit which has been continued.
(ii). Issue a notice of intent to deny the new permit. If the permit is denied, the owner or operator would then be required to cease the activities authorized by the continued permit or be subject to enforcement action for operating without a permit.
(iii). Issue a new permit under 40 CFR part 124 with appropriate conditions.
(iv). Take other actions authorized by these regulations.

11. Reporting Requirements

Copies of all reports and notifications required by this Permit shall be signed and certified in accordance with the requirements under Part III, E.9 of this Permit and shall be submitted to the EPA:

UIC Enforcement, Mail Code: 8ENF-WSD
U.S. Environmental Protection Agency
1595 Wynkoop Street
Denver, Colorado 80202-1129

All correspondence should reference the well name and location and include the EPA Permit number.

(a) *Monitoring Reports.* Monitoring results shall be reported at the intervals specified elsewhere in this Permit.
(b) *Planned changes.* The Permittee shall give notice to the Director as soon as possible of any planned changes, physical alterations or additions to the permitted well, and prior to commencing such changes.
(c) *Anticipated noncompliance.* The Permittee shall give advance notice to the Director of any planned changes in the permitted facility or activity which may result in noncompliance with Permit requirements.
(d) *Compliance schedules.* Reports of compliance or noncompliance with, or any progress reports on, interim and final requirements contained in any compliance schedule of this Permit shall be submitted no later than thirty (30) calendar days following each schedule date.
(e) *Twenty-four-hour reporting.* The Permittee shall report to the Director any noncompliance which may endanger human health or the environment, including:
    (i). any monitoring or other information, which indicates that any contaminant may cause an endangerment to a USDW; or
    (ii). any noncompliance with a permit condition or malfunction of the injection system which may cause fluid migration into or between USDWs.

Information shall be provided, either directly or by leaving a message, within twenty-four (24) hours from the time the Permittee becomes aware of the circumstances by telephoning (800) 227-8917 and requesting EPA Region 8 UIC Program SDWA Enforcement Supervisor, or by contacting the EPA Region 8 Emergency Operations Center at (303) 293-1788.

In addition, a follow up written report shall be provided to the Director within five (5) calendar days of the time the Permittee becomes aware of the circumstances. The written submission shall contain a description of the noncompliance and its cause, the period of noncompliance including exact dates and times, and if the noncompliance has not been corrected the anticipated time it is expected to continue; and the steps taken or planned to reduce, eliminate, and prevent recurrence of the noncompliance.

(f) *Other Noncompliance.* The Permittee shall report all instances of noncompliance not reported under Paragraphs 11(a), 11(b), 11(d), or 11(e) of this Section at the time the monitoring reports are submitted. The reports shall contain the information listed in Paragraph 11(e) of this Section.
(g) *Other information.* Where the Permittee becomes aware that it failed to submit any relevant facts in a permit application or submitted incorrect information in a permit application or in any report to the Director, the Permittee shall submit such facts or information to the Director within thirty (30) days of discovery of failure.
(h) *Oil Spill and Chemical Release Reporting.* The Permittee shall comply with all reporting requirements related to the occurrence of oil spills and chemical releases by contacting the National Response Center (NRC) at (800) 424-8802 or NRC@uscg.mil.

APPENDIX A - WELL CONSTRUCTION REQUIREMENTS

These requirements represent the approved minimum construction standards for the CR-223 and CR-224 wells and all new well casing and cement well head configurations, and injection tubing. Deviation from the approved construction standards without prior approval from the Director is prohibited. Requirements for obtaining samples during or prior to well construction are described below. A description for the construction of the CR-223 and CR-224 wells are provided below.

Casing and Cement

The well or wells shall be cased and cemented to prevent the movement of fluids into or between USDWs and shall be in accordance with 40 CFR §147.305 and the Colorado Office of the State Engineer's Water Well Construction Rules. The Permittee must meet all applicable requirements in these Colorado Rules including Rule 10 entitled "Minimum Construction Standards for Water Wells." This Rule is designed to ensure that "…construction prevents harm to public health, will not impair water quality or cause contamination of shared groundwater resources, and will ensure the safety of groundwater resources for Colorado's existing and future populations." Rule 10 requirements include:

(a) Rule 10.1: "General - To assist in the orderly development of the groundwater resources of Colorado, to ensure the protection of the public health, and to prevent degradation of the groundwater resource, all wells constructed to withdraw or inject water must be constructed, maintained, or repaired in such a manner that will:
    (i). maintain existing natural protection against contamination of aquifers;
    (ii). prevent the entry of contaminants through the borehole;
    (iii). limit groundwater production to one aquifer unless otherwise permitted by the State Engineer; and
    (iv). prevent the intermingling of groundwater from different sources through the borehole."
(b) Rule 10.5: "Grout and Grout Placement – All wells must be grouted to prevent contaminants from entering the borehole, to separate groundwater in different aquifers, and to seal off water bearing zones known or suspected to contain contaminants".

These Rules can be found at: Code of Colorado Regulations, Secretary of State, State of Colorado, Department of Natural Resources, Division of Water Resources, Rules and Regulations for Water Well Construction, Pump Installation, Cistern Installation, and Monitoring and Observation Hole/Well Construction, 2 CCR 402-2, Rule 10 Minimum Construction Standards for Water Wells.

Collection of Water Samples

Upon request water quality samples for new well requests will be collected during well construction in accordance with Part II.B.1.d. A representative water sample from each discrete injection zone(s) shall be analyzed. After a minimum of three successive pore volumes, a representative sample shall be determined by stabilized specific conductivity.

The analysis shall be submitted to the Director within sixty (60) calendar days of completion of the logging or testing activity and shall include a report describing the methods used during logging or testing and an interpretation of the log or test results.

CR-223 and CR-224 Well Construction

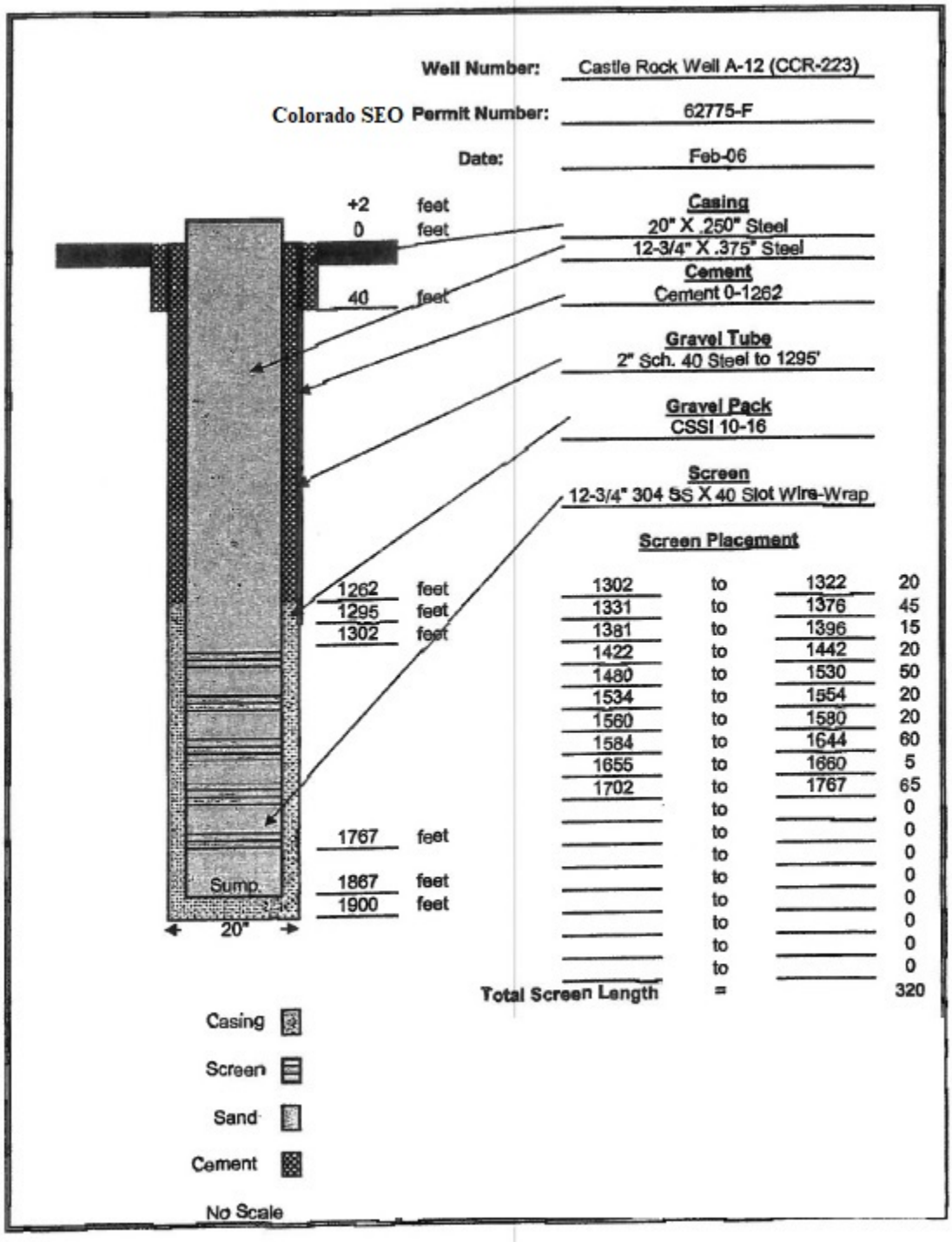
CR-223 Injection Well – into the Arapahoe Aquifer
EPA UIC Permit Number CO52409-10716
1462 feet from the north line and 2559 feet from the east line
SW ¼ NE ¼, Section 34, Township 7 South, Range 67 West
Douglas County, Colorado

Casing Type	Hole Size, inch (in)	Steel Casing Size, in.	Casing Interval, ft.	Cemented Interval, ft.	Screen interval, feet
Conductor	unknown	20	0 - 2	0 - 2	
Surface	36	24	0 - 40	0 - 40	
Longstring	20	12.75	0 - 1262	0 - 1262	
Gravel Pack	20		1262 - 1900		1302 - 1767
Steel Plate			0 – 1302 and 1767 - 1867		

No well stimulation program is proposed during well completion. In the event the Permittee wishes to conduct well stimulation, the Permittee shall follow the requirements in Part II, Section B.8. *Alteration, Workover, and Well Stimulation*.

INJECTION WELL CONSTRUCTION DIAGRAM

CR-223 Injection Well for the Arapahoe Formation



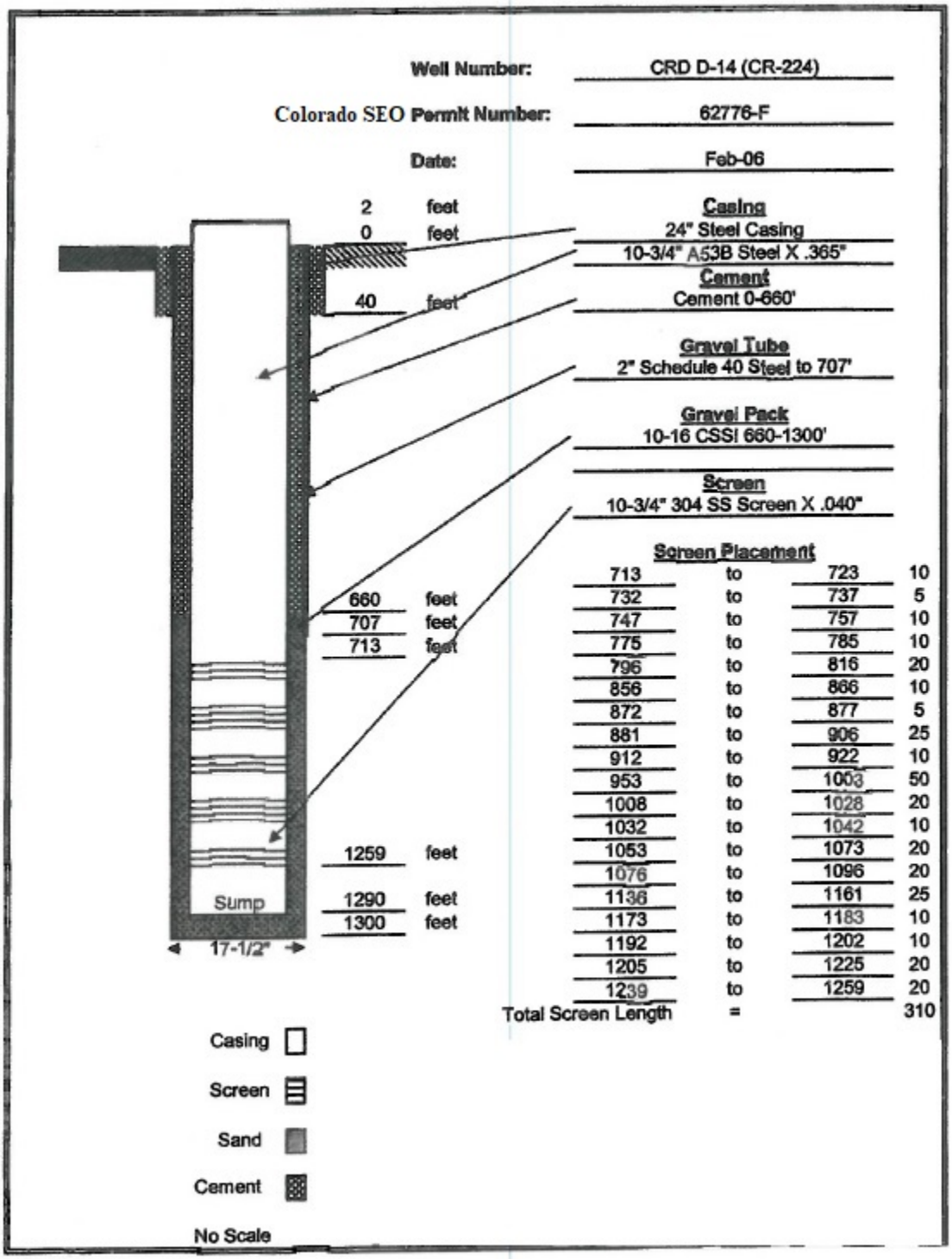
CR-224 Injection Well – into the Denver Aquifer
Permit No. CO52409-10717
1488 feet from the north line and 2458 feet from the east line
SW ¼ NE ¼, Section 34, Township 7 South, Range 67 West
Douglas County, Colorado

Casing Type	Hole Size, inch (in)	Steel Casing Size, in.	Casing Interval, ft.	Cemented Interval, ft.	Screen interval, feet
Conductor	unknown		0 - 2	0 - 2	
Surface	36	24	0 - 40	0 - 40	
Longstring	17.5	10.75	0 - 660	0 - 660	
Gravel Pack	20		660 - 1300		713 - 1259
Steel Plate		10.75	0 – 713 and 1259 - 1290		

No well stimulation program is proposed during well completion. In the event the Permittee wishes to conduct well stimulation, the Permittee shall follow the requirements in Part II, Section B.8. *Alteration, Workover, and Well Stimulation*.

INJECTION WELL CONSTRUCTION DIAGRAM

CR-224 Injection Well Denver Formation



APPENDIX B - LOGGING AND TESTING REQUIREMENTS

Well logging and tests shall be performed according to the EPA approved procedures. It is the responsibility of the Permittee to obtain and use these procedures prior to conducting any well logging or test required as a condition of this Permit. These procedures can be found at https://www.epa.gov/uic/underground-injection-control-epa-region-8-co-mt-nd-sd-ut-and-wy#guidance.

Well logs and test results shall be submitted to the Director within sixty (60) calendar days of completion of the logging or testing activity and shall include a report describing the methods used during logging or testing and an interpretation of the log or test results. When applicable, the report shall include a descriptive report prepared by a knowledgeable log analyst, interpreting the results of that portion of those logs and tests which specifically relate to: (1) a USDW and the confining zone adjacent to it, and (2) the injection zone and adjacent formations.

LOGS AND TESTS

TYPE OF LOG OR TEST	DATE DUE
Annulus Pressure Test Part II Section D.2.a	Prior to receiving authorization to inject. -CR-223 well -CR-224 well -new wells
Baseline Water Analysis For the constituents found in APPENDIX G for new water sources proposed for injection (Part II Section C.7) and when wells are added to the Permit (Part II Section B.1(d))	Collect a representative fluid sample of proposed new injectate (treated water source) near the injection point and prior to receiving authorization to inject. Prior to receiving authorization to inject, collect a representative fluid sample of the formation water from the proposed new well(s)or a statement that the water sample will be obtained during well construction and submitted in accordance with APPENDIX A;
Pipe analysis log or Caliper Log to check the condition of the casing of an existing well to be converted to an ASR well (40 CFR § 147.305(a) in Part II Section C.1)	Prior to receiving authorization to inject. Run during well conversion activities. -CR-223 well -CR-224 well -new well
Cement Records and/or Cement Bond Logs (for Injection and AOR wells) not previously evaluated for Part II MI Demonstration (Part II Section E.2(b))	Prior to receiving an authorization to inject: -CR-223 well -CR-224 well - when requesting authorization of additional wells, - when requesting an extension to construct a well, if not previously provided.
Bench Scale Water Chemistry follow procedures in Appendices H (Part II Sections B and D.7 (a)(iii))	Perform tests following Authorization to Inject: -new water source -new well

Pilot Cycle Tests Follow procedures in Appendix I Analyze for constituents found in APPENDIX J (Part II Sections B and D.7 (a)(iii))	Perform tests following Authorization to Inject: -new well -new water source (upon request from the Director only)

APPENDIX C - OPERATING REQUIREMENTS

INJECTION ZONE:
Injection is permitted only within the approved injection zone listed below.

APPROVED INJECTION ZONE (GL, ft.)

WELL NAME	FORMATION NAME OR STRATIGRAPHIC UNIT	TOP (FT.) *	BOTTOM (FT.) *
CR-223	**ARAPAHOE**	**1284**	**1770**
CR-224	**DENVER**	**628**	**1283**

*estimated top and bottom depths of formations

MAXIMUM INJECTION VOLUME:

There is no limitation on the fluid volume permitted to be injected into this well at this time. In no case shall injection pressure exceed the MAIP.

MAXIMUM INJECTION PRESSURE:

Maximum Allowable Injection Pressure (MAIP) as measured at the surface shall not exceed the pressure(s) listed below:

Well Name: CR-223, CR-224 and all added wells

Maximum Allowable Inject Pressure: 133 psig or an alternate approved pressure by the Director.

APPENDIX D - MONITORING, AND REPORTING PARAMETERS

This is a listing of the parameters required to be observed, recorded, and reported. Refer to the Part II, Section D and F of the Permit, for detailed requirements for observing, recording, and reporting of these parameters once baseline samples have been taken for constituents in APPENDIX G. All water quality samples shall be taken from a sampling port location that ensures the samples are representative of the injected/recovered water.

EPA Form 7520-8 or 7520-11 may be used or adapted to submit the Annual Report, however, the monitoring requirements specified in this Permit are mandatory even if EPA Form 7520-11 indicates otherwise. An electronic form may also be obtained from the EPA to satisfy reporting requirements.

OBSERVE WEEKLY AND RECORD MONTHLY	
	Cumulative Fluid Volume Injected (since injection began) (bbls)
	Cumulative Fluid Volume Recovered (since injection began) (bbls)
	Injection Pressure (measured at the injection or pump house) versus Wellhead Injection Pressure
	Injection Rate (bbls/day) Note: measured near the point of injection
	Injection Volume (bbl)
	Injection and Recovery Volume (bbl)
	Recovery Rate (bbls/day) Note: measured near the point of injection
	Wellhead Injection Pressure (psig)

*Note: Injection pressure is the pressure which is exerted at the pump house or location where fluids or storage tanks when they stored prior to reaching the well. Wellhead injection pressure is the pressure exerted on the wellhead to place fluids in the subsurface.

QUARTERLY SAMPLING & ANALYSIS	
ARSENIC EVALUATIONS	Obtain and analyze injectate and recovered water (from both the Denver and Arapahoe Formations) for arsenic on a quarterly (i.e., every 90 days) basis for the duration of this Permit. This analysis may be coordinated with other sampling requirements. The Director may change the sampling frequency following the review of the quarterly (i.e., every 90 days) analysis through written correspondence.
NDMA EVALUATIONS	Obtain and analyze injectate and recovered water (from both the Denver and Arapahoe Formations) for NDMA on a quarterly (i.e., every 90 days) basis for the duration of this Permit. This analysis may be coordinated with other sampling requirements.
NEW WATER SOURCE	Obtain and analyze a new water source using the APPENDIX G constituent to obtain a baseline water sample.

	Obtain and analyze individual samples of the injectate and recovered water on a quarterly (i.e., every 90 days) basis using the constituent list in APPENDIX J. The Director may change the sampling frequency following the review of the quarterly (i.e., every 90 days) analysis.
NEW WELL	Obtain and analyze the recovered water from the new well (Denver and/or Arapahoe Formations) on a quarterly (i.e., every 90 days) basis using the constituent list in APPENDIX J. The Director may change the sampling frequency following the review of the quarterly (i.e., every 90 days) analysis.

ANNUAL SAMPLING & ANALYSIS	
INJECTATE	Obtain and analyze injectate (Denver and Arapahoe formations) on an annual basis using the parameter list in APPENDIX J.
NDMA ANALYSIS FOR INJECTATE SAMPLE	Obtain an injectate sample from the tap at the wellhead and analyze injectate for NDMA on an annual basis during the month where flows from surface water sources are at their maximum level. The peak month shall be determined by evaluating three years of monthly recovery rates at the supplying water systems.
RECOVERED WATER	Obtain and analyze recovered water (Denver and Arapahoe formations) on an annual basis using the parameter list in APPENDIX J.

QUARTERLY REPORTING	
CUMULATIVE FLUID VOLUME	Monthly cumulative injected and recovered fluid volume to date.. (bbls)
INJECTION FLOW RATE	Monthly average, maximum, minimum values for injection flow rate measured near the wellhead. (bbl/day)
INJECTION PRESSURE (measured from the Pump House)	Monthly average, maximum, minimum values for injection pressure measured at the pump house. (psig)
INJECTION VOLUME	Monthly average, maximum, minimum values for injection volume measured near the wellhead. (bbls)
RECOVERY VOLUME	Monthly average, maximum, minimum values for recovery volume measured near the wellhead. (bbls)
SAMPLING RESULTS	The results of any quarterly (i.e., every 90 days) sampling analysis obtained for the injectate and/or recovered waters, including for arsenic and NDMA, elevated constituents from new wells or water sources, and any other constituents required by the Director*.
WELLHEAD	Monthly average, maximum, minimum values for injection

PRESSURE (measured near the wellhead)	pressure measured near the wellhead. (psig)

ANNUAL REPORTING	
FLUID ANALYSIS	Written results of annual injected fluid analysis.
IDENTIFICATION OF ALL SOURCES	Sources of all fluids injected during the year, including any wellfield and formation, noting any major changes in characteristics of injected fluid.

In addition to these items, additional logging and testing results may be required periodically. For a list of those items and their due dates, please refer to APPENDIX B – LOGGING AND TESTING REQUIREMENTS.

APPENDIX E - PLUGGING AND ABANDONMENT (P&A) REQUIREMENTS

All wells shall be plugged with cement in a manner which isolates the injection zone and will not allow the movement of fluids either into or between USDWs in accordance with 40 CFR § 146.10. Additional federal, state or local law or regulations may also apply.

APPENDIX F - CORRECTIVE ACTION PLAN

No corrective action is required at this time as the EPA's evaluation did not identify migration pathways within the area of review.

APPENDIX G - ASR BASELINE CONSTITUENT LIST

APPENDIX G contains a list of constituents to be analyzed for baseline evaluations, and the permit limit for each contaminant. Injection activities will not be authorized if a contaminant exceeds a permit limit. This list shall also be used to analyze the injectate whenever a new water source is added and/or to analyze the formation water whenever a new well is authorized under this Permit. All analytical testing must be done in a state-certified laboratory.

AQUIFER STORAGE AND RECOVERY PROJECTS
List of constituents to be analyzed for baseline evaluations:

General

PARAMETER NAME	REGULATORY LIMIT (MG/L) OR SPECIFIED UNIT	STANDARD TYPE	ANALYTICAL METHODS
pH	6.5 – 8.5	secondary	150.1
Electricity Conductivity			SM 2510B, 120.1
Total Dissolved Solids	500	secondary	
Total Organic Carbon			
Alkalinity, Total	mg/L as $CaCO_3$	0.006	

Metals

Parameter Name	Regulatory Limit (mg/L) or Specified Unit	Standard Type	Analytical Methods
Aluminum	200 ug/l		
Antimony	0.006	MCL	EPA 200.8, 200.9
Arsenic	0.01	MCL	EPA 200.7, 200.8, 200.9
Barium	2	MCL	EPA 200.7, 200.8
Beryllium	0.004	MCL	EPA 200.7, 200.8, 200.9
Boron	6	HA-Lifetime	EPA 200.7, 212.3
Cadmium	0.005	MCL	EPA 200.7, 200.8, 200.9
Calcium			
Chromium (total)	0.1	MCL	EPA 200.7, 200.8, 200.9
Copper	1.3	MCL-TT	EPA 200.7, 200.8, 200.9
Iron	5	Region 8 Permit Limit	EPA 200.7, 200.9
Lead	0.015	MCL-TT	EPA 200.8, 200.9
Manganese	0.3	HA-Lifetime	EPA 200.7, 200.8, 200.9
Magnesium			

Parameter Name	Regulatory Limit (mg/L) or Specified Unit	Standard Type	Analytical Methods
Mercury (inorganic)	0.002	MCL	EPA 245.1, 245.2, 200.8
Molybdenum	0.04	HA-Lifetime	EPA 200.7, 246.1, 246.2
Nickel	0.1	HA-Lifetime	EPA 200.7, 200.8, 200.9
Potassium			
Selenium	0.05	MCL	EPA 200.8, 200.9
Silver	0.1	HA-Lifetime	EPA 200.7, 200.8, 200.9
Sodium			
Strontium	4	HA-Lifetime	EPA 272.1, 272.2, 200.7
Thallium	0.002	MCL	EPA 200.8, 200.9
Zinc	2	HA-Lifetime	EPA 200.7, 200.8

Inorganics

Parameter Name	Regulatory Limit (mg/L) or specified unit	Standard Type	Analytical Methods
Ammonia	30 mg/L	HA-Lifetime	EPA 350.1, 350.2, 350.3
Asbestos (fibers/1>10µm in length)	7 million fibers/L	MCL	EPA 100.1,100.2
Bicarbonate			SM 2330B
Carbonate			SM 2330B
Chloride	250	secondary	
Cyanide	0. 2 mg/L	MCL	EPA 335.4
Fluoride	4 mg/L	MCL	EPA 300.0
Nitrate (as N)	10 mg/L	MCL	EPA 300.0
Nitrate-Nitrite (both as N)	10 mg/L	MCL	EPA 300.0
Nitrite (as N)	1 mg/L	MCL	EPA 300.0
Sulfate	250	secondary	

Radionuclides

Parameter Name	Regulatory Limit (mg/L) or specified unit	Standard Type	Analytical Methods
Radium 226 & 228 combined	5 pCi/L	MCL	Standard Method 304
Gross alpha particle activity (excluding Ra-226, radon, and uranium)	15 pCi/L	MCL	EPA 900.0

Parameter Name	Regulatory Limit (mg/L) or specified unit	Standard Type	Analytical Methods
Uranium	0.03	MCL	EPA 908.0, 908.1

Volatile Organics using EPA Method 524.2 or 8260

Parameter Name	CAS No	Regulatory Limit (mg/L)	Standard Type
1,1,1,2-Tetrachloroethane	630-20-6	0.07	HA-Lifetime
1,1,1-Trichloroethane	71-55-6	0.2	MCL
1,1,2,2-Tetrachloroethane	79-34-5	0.04	Region 8 Permit Limit 10^{-4} Cancer Risk
1,1,2-Trichloroethane	79-00-5	0.005	MCL
1,1-Dichloroethylene	75-35-4	0.007	MCL
1,2-(cis)Dichloroethylene	156-59-2	0.07	MCL
1,2-(trans)Dichloroethylene	156-60-5	0.1	MCL
1,2,3-Trichloropropane	96-18-4	0.02	Region 8 Permit Limit
1,2,4-Trichlorobenzene	120-82-1	0.07	MCL
1,2-Dibromomethane (Ethylene Dibromide EDB)	106-93-4	0.00005	MCL
1,2-Dichlorobenzene o-	95-50-1	0.6	MCL
1,2-Dichloroethane	107-06-2	0.005	MCL
1,2-Dichloropropane	78-87-5	0.005	MCL
1,3-Dichlorobenzene m-	541-73-1	0.6	HA-Lifetime
1,4-Dichlorobenzene p-	106-46-7	0.075	MCL
2-Chlorotoluene (o-)	95-49-8	0.1	HA-Lifetime
4-Chlorotoluene (p-)	106-43-4	0.1	HA-Lifetime
Acetone	67-64-1	6	Region 8 Permit Limit
Acrylonitrile	107-13-1	0.006	Region 8 Permit Limit 10^{-4} Cancer Risk
Benzene	71-43-2	0.005	MCL
Bromobenzene	108-86-1	0.06	HA-Lifetime
Bromochloromethane	74-97-5	0.09	HA-Lifetime
Bromodichloromethane (THM)	75-27-4	0.02	Region 8 Permit Limit
Bromoform (THM)	75-25-2	0.2	Region 8 Permit Limit
Bromomethane	74-83-9	0.01	HA-Lifetime
Carbon tetrachloride	56-23-5	0.005	MCL
Chlorobenzene	108-90-7	0.1	MCL

Parameter Name	CAS No	Regulatory Limit (mg/L)	Standard Type
(Monochlorobenzene)			
Chlorodibromomethane (Dibromochloromethane) (THM)	124-48-1	0.06	HA-Lifetime
Chloroform (THM)	67-66-3	0.07	HA-Lifetime
Chloromethane	74-87-3	0.4	10-day HA for a 10 kg child
Cyanogen Chloride (testing not needed if cyanide is present in source water and alkaline chlorination is used, pH 8.5)	506-77-4	0.4	Region 8 Permit Limit
Dichlorodifluoromethane	75-71-8	1	HA-Lifetime
Dichloromethane (Methylene chloride)	75-09-2	0.005	MCL
Ethylbenzene	100-41-4	0.7	MCL
Hexachlorobutadiene	87-68-3	0.002	Region 8 Permit Limit
Hexachloroethane	67-72-1	0.001	HA-Lifetime
Isopropylbenzene (cumene)	98-82-8	0.8	Region 8 Permit Limit
Methyl Ethyl Ketone	78-93-3	4	HA-Lifetime
Naphthalene	91-20-3	0.1	HA-Lifetime
Perchloroethylene (PCE) (Tetrachloroethylene)	127-18-4	0.005	MCL
Styrene	100-42-5	0.1	MCL
Toluene	108-88-3	1	MCL
Total Trihalomethanes		0.08	MCL
Trichloroethylene (TCE)	79-01-6	0.005	MCL
Trichlorofluoromethane	75-69-4	2	HA-Lifetime
Vinyl chloride	75-01-4	0.002	MCL
Total Xylenes	1330-20-7	10	MCL

Semi-volatile Organics using EPA Method 525.2 or 8270

Parameter Name	CAS No	Regulatory Limit (mg/l) or specified unit	Standard Type
1,2,4-Trichlorobenzene	120-82-1	0.07	MCL
1,2-Dichlorobenzene	95-50-1	0.6	MCL
1,3-Dichlorobenzene	541-73-1	0.6	HAL
1,4-Dichlorobenzene	106-46-7	0.075	MCL

Parameter Name	CAS No	Regulatory Limit (mg/l) or specified unit	Standard Type
2,4,6-Trichlorophenol	88-06-2	0.002	Region 8 Permit Limit
2,4-Dichlorophenol	120-83-2	0.02	HA-Lifetime
2,4-Dinitrotoluene	121-14-2	0.005	Region 8 Permit Limit 10^{-4} Cancer Risk
2,6-Dinitrotoluene	606-20-2	0.005	Region 8 Permit Limit 10^{-4} Cancer Risk
2-Chlorophenol	95-57-8	0.04	HA-Lifetime
4-Nitrophenol	100-02-7	0.06	HA-Lifetime
Acenaphthene	83-32-9	0.4	Region 8 Permit Limit
Aldrin	309-00-2	0.0002	Region 8 Permit Limit 10^{-4} Cancer Risk
Anthracene	120-12-7	2	Region 8 Permit Limit
Benzo(a)pyrene	50-32-8	0.0002	MCL
bis(2-Ethylhexyl) phthalate	117-81-7	0.006	MCL
Butyl benzyl phthalate	85-68-7	1	Region 8 Permit Limit
Chlordane	57-74-9	0.002	MCL
Dieldrin	60-57-1	0.0002	Region 8 Permit Limit 10^{-4} Cancer Risk
Diethyl phthalate	84-66-2	6	Region 8 Permit Limit
Di-n-butyl phthalate	84-74-2	0.8	Region 8 Permit Limit
Endrin	72-20-8	0.002	MCL
Fluorene	86-73-7	0.2	Region 8 Permit Limit
Heptachlor	76-44-8	0.0004	MCL
Heptachlor epoxide	1024-57-3	0.0002	MCL
Hexachlorobenzene	118-74-1	0.001	MCL
Hexachlorobutadiene	87-68-3	0.002	Region 8 Permit Limit
Hexachlorocyclopentadiene	77-47-4	0.05	MCL
Hexachloroethane	67-72-1	0.001	HA-Lifetime
Isophorone	78-59-1	0.1	HA-Lifetime
Lindane	58-89-9	0.0002	MCL
Naphthalene	91-20-3	0.1	HA-Lifetime
Pentachlorophenol	87-86-5	0.001	MCL
Phenol	108-95-2	2	HA-Lifetime
Pyrene	129-00-0	0.2	Region 8 Permit Limit
Toxaphene	8001-35-2	0.003	MCL

Pesticides and Herbicides

Parameter Name	CAS No	Regulatory Limit (mg/L) or specified unit	Standard Type	Analytical Methods
Alachlor	15972-60-8	0.002	MCL	EPA 505, 507, 525
Aldicarb	116-06-03	0.003	MCL	EPA 531.1
Aldicarb sulfone	1646-87-4	0.002	MCL	EPA 531.1
Aldicarb sulfoxide	1646-87-3	0.004	MCL	EPA 531.1
Aldrin	309-00-2	0.0002	Region 8 Permit Limit 10^{-4} Cancer Risk	EPA 505, 508
Ametryn	834-12-8	0.06	HA-Lifetime	EPA 507
Atrazine	1912-24-9	0.003	MCL	EPA 505, 507
Bromacil	314-40-9	0.07	HA-Lifetime	EPA 507
Butylate	2008-41-5	0.4	HA-Lifetime	EPA 507
Carbaryl	63-25-2	0.08	Region 8 Permit Limit	EPA 531.1
Carbofuran	1563-66-2	0.04	MCL	EPA 531.1
Carboxin	5234-68-4	0.7	HA-Lifetime	EPA 507
Chlordane	57-74-9	0.002	MCL	EPA 505, 508, 525
Chlorothalonil	1897-45-6	0.1	Region 8 Permit Limit	EPA 508
DCPA (Dactyl)	1861-32-1	0.07	HA-Lifetime	EPA 508
Diazinon	333-41-5	0.001	HA-Lifetime	EPA 507
Dieldrin	60-57-1	0.0002	Region 8 Permit Limit 10^{-4} Cancer Risk	EPA 505, 508
Diphenamid	957-51-7	0.2	HA-Lifetime	EPA 507
Disulfoton	298-04-4	0.0007	HA-Lifetime	EPA 507
Endrin	72-20-8	0.002	MCL	EPA 505, 508, 525.1
Fenamiphos	22224-92-6	0.0007	HA-Lifetime	EPA 507
Heptachlor	76-44-8	0.0004	MCL	EPA 505, 508
Heptachlor epoxide	1024-57-3	0.0002	MCL	EPA 505, 508
Hexachlorobenzene	118-74-1	0.001	MCL	EPA 505, 508, 525.1
Hexachlorocyclopentadiene	77-47-4	0.05	MCL	EPA 505, 525.1
Hexazinone	51235-04-2	0.4	HA-Lifetime	EPA 507
Lindane	58-89-9	0.0002	MCL	EPA 505, 508
Methomyl	16752-77-5	0.2	HA-Lifetime	EPA 531.1
Methoxychlor	72-43-5	0.04	MCL	EPA 505, 508, 525
Metolachlor	51218-45-2	0.7	HA-Lifetime	EPA 507

Parameter Name	CAS No	Regulatory Limit (mg/L) or specified unit	Standard Type	Analytical Methods
Metribuzin	21087-64-9	0.07	HA-Lifetime	EPA 507
Oxamyl (Vydate)	23135-22-0	0.007	MCL	EPA 531.1
Prometon	1610-18-0	0.4	HA-Lifetime	EPA 507
Pronamide	23950-58-5	0.1	Region 8 Permit Limit 10^{-4} Cancer Risk	EPA 507
Propachlor	1918-16-7	0.1	Region 8 Permit Limit 10^{-4} Cancer Risk	EPA 508
Propazine	139-40-2	0.01	HA-Lifetime	EPA 507
Simazine	122-34-9	0.004	MCL	EPA 505, 507, 525.1
Tebuthiuron	34014-18-1	0.5	HA-Lifetime	EPA 507
Terbacil	5902-51-2	0.09	HA-Lifetime	EPA 507
Terbufos	13071-79-9	0.0004	HA-Lifetime	EPA 507
Trifluralin	1582-09-8	0.01	HA-Lifetime	EPA 508

Disinfectants and Disinfection Byproducts

Parameter Name	Regulatory Limit (mg/L) or specified unit	Standard Type	Analytical Method
Bromate	0.01	MCL	EPA 317.0, Revision 2 321.8, 326.0
Chloramine (as free chlorine)	4	MCL	
Chlorine (free chlorine, combined)	4	MCL	Standard Methods 20th edition: 4500-Cl D 4500-Cl F 4500-Cl G 4500-Cl H
Chlorine dioxide	0.8	MCL	EPA 327, Revision 1 Standard Method 20th edition: 4500-ClO_2 D 4500-CLO_2 E
Chlorite	1.0	MCL	EPA 300.0, 300.1
Total Haloacetic Acids (HAA5s) Bromoacetic acid Dibromoacetic acid	0.06	MCL	EPA 552.3

Parameter Name	Regulatory Limit (mg/L) or specified unit	Standard Type	Analytical Method
Dichloroacetic acid Monochloroacetic acid Trichloroacetic acid			
Total Trihalomethanes (TTHMs) Chloroform Bromodichloromethane Dibromocloromethane Bromoform	0.08	MCL	EPA 502.2, 524.2
N-nitroso-dimethylamine (NDMA)	NA		EPA 521
N-nitroso-diethylamine (NDEA)	NA		EPA 521
N-nitroso-di-n-butylamine (NDBA)	NA		EPA 521
N-nitroso-di-n-propylamine (NDPA)	NA		EPA 521
N-nitroso-methylethylamine (NMEA)	NA		EPA 521
N-nitroso-pyrrolidine (NPYR)	NA		EPA 521

MCL: Maximum Contaminant Level. The highest level of a contaminant that is allowed in drinking water. MCLs are set as close to the MCLG as feasible using the best available analytical and treatment technologies and taking cost into consideration. MCLs are enforceable standards.

MCLG: Maximum Contaminant Level Goal. A non-enforceable health goal which is set at a level at which no known or anticipated adverse effect on the health of persons occurs and which allows an adequate margin of safety.

TT: Treatment Technique. A required process intended to reduce the level of a contaminant in drinking water.

HA: Health Advisory. An estimate of acceptable drinking water levels for a chemical substance based on health effects information; a Health Advisory is not a legally enforceable Federal standard, but serves as technical guidance to assist Federal, State, and local officials.

HA-Lifetime: The concentration of a chemical in drinking water that is not expected to cause any adverse non-carcinogenic effects for a lifetime of exposure. The Lifetime HA is based on exposure of a 70-kg adult consuming 2 liters of water per day. The Lifetime HA for Group C carcinogens includes an adjustment for possible carcinogenicity.

Region 8 Permit Limit: Permit limit calculated by Region 8 Drinking Water Toxicologist based on human health criteria.

10^{-4} Cancer Risk: The concentration of a chemical in drinking water corresponding to an excess estimated lifetime cancer risk of 1 in 10,000

HA-Ten Day: The concentration of a chemical in drinking water that is not expected to cause any adverse non-carcinogenic effects for up to ten days of exposure for a 10 kg child consuming 1 liter per day.

APPENDIX H - BENCH SCALE WATER CHEMISTRY TEST PROCEDURES FOR NITROSAMINES

This APPENDIX provides a procedure for implementing a bench scale water chemistry test for the Permittee's ASR Project. The Bench Scale Water Chemistry test will be used to help predict any changes that may occur in the injectate chemistry over time. The procedure will be performed for The Permittee's addition of wells that are authorized under this Permit. The Director also requires that this test be performed for a new water source. This test may be performed in parallel to pilot cycle testing and operational use of the well due to the potential duration of this test.

Samples for the test shall be obtained prior to performing the Pilot Cycle Test. Testing of water chemistry shall be performed on the injectate and recovered formation water. Prior to the start of testing, a detailed sampling protocol shall be obtained from the contract laboratory. This protocol shall include a written description of sampling methods for use by field personnel and for inclusion in reporting to the Colorado State Engineers Office and the EPA. Sampling shall adhere to protocols as specified by the water quality testing laboratory for sampling methods, sample preservation, sample handling times, and chain-of-custody records.

Section A. Analysis of the Formation Water
The Permittee shall arrange for analytical data prepared by the laboratory to be submitted to them and the EPA, simultaneously.

Prior to performing the Part I MI and Pilot Cycle Test, The Permittee shall collect four samples of sufficient size to meet the requirements for testing of the formation water from each of the proposed ASR wells. These samples shall be obtained using the volatile organic carbon (VOC) collection method and stored on a shelf at the temperature recorded for the recovered water until analyzed. The VOC collection method requires field staff to fill the bottle to the maximum level and exclude all air pockets.

1. These samples shall be "spiked" by the laboratory with a quantity of 10 ng/L of N-nitrosodimethylamine NDMA and 10 ng/L of N-nitroso-di-n-butylamine (NDBA). The purpose of this shelf test is to observe how NDMA and NDBA react with the native formation water. The sample bottles should be stored in a fashion that prevents light degradation.

2. Ninety (90) days following the collection of the formation samples, one sample bottle shall be analyzed for NDMA and NDBA. This analytical process shall be repeated for the next bottles on a quarterly (i.e., every 90 days) basis. The analytical results of NDMA and NDBA concentrations shall be reported to the Director within thirty (30) days.

Section B. Analysis of the Injectate Water
The Permittee shall arrange for analytical data prepared by the laboratory to be submitted to them and the EPA, simultaneously.

1. Collect five samples of a volume needed to meet the requirements of the injectate testing on the same day within thirty (30) days following the start of the Pilot Cycle Test. These samples shall be obtained using the VOC collection method. Analyze the first sample for NDMA and NDBA.

Store the other four samples on a shelf at formation temperatures until analyzed. The sample bottles should be stored in a dark location away from light to prevent premature breakdown.

2. Ninety (90) days following the collection of the injectate samples, one sample bottle shall be analyzed for NDMA and NDBA. Repeat this analytical process for the next sampling bottles on a quarterly (i.e., every 90 days) basis. The analytical results of NDMA and NDBA concentrations shall be reported to the Director within thirty (30) days.

APPENDIX I - ASR PILOT CYCLE TEST PROCEDURES

This APPENDIX provides procedures for pilot cycle testing of The Permittee's addition of new wells for sampling and analysis of constituents listed below and in APPENDIX J. This test may also be used when adding a new water source upon receipt of written notification from the Director. The intent of this procedure is to be responsive to conditions existing at the time of the pilot testing. For example, while this protocol defines one of the test cycles as a 7-day cycle (7 days of recharge/7 days of recovery), a change in the Permittee's supply or demand during the cycle may require a delay in operations to achieve the minimum recharge or recovery time frame. This test will be used to predict any potential impacts which could occur as a result of injection activities.

Additionally, since recovery rates vary from injection rates, as required by the State of Colorado, these time periods will not be the same. If there are significant changes between successive sampling events, it may be appropriate to increase sampling frequency and/or parameters.

Sampling shall adhere to protocols as specified by the water quality testing laboratory for sampling methods, sample preservation, sample handling times, and chain-of-custody records.

Section A. Measurements, Instrumentation and Monitoring

The following conditions will be measured and recorded in advance of and during each round of cycle testing:

1. Static water levels (between cycles)
2. Water levels while pumping
3. Water levels while injecting or specify surface, if applicable
4. Flow rate and cumulative amount pumped while recovering, by cycle and total
5. Flow rate and cumulative amount stored while injecting, by cycle and total
6. Flow rate entering and exiting the system collected at the pump house
7. Pressure data collected at the wellhead
8. Inflation pressure on flow control valve (FCV), pressure data collected from the pump or in the pipeline
9. Intermittent sampling as described in the application for measurement of total organic carbon and dissolved oxygen in injectate and recovered water
10. Start/stop times and elapsed time for cycles
11. Sampling dates and sample testing protocol

Measurements 1-10 listed above in Section A will be communicated via the Permittee's SCADA system to the control facility, where the data will be processed and archived. Measurements of wellhead pressure (item 7) will be made and recorded manually on a weekly schedule, depending on the consistency of line pressure.

The following measurements will be made and recorded after cycle testing:

1. Static water levels (between pumping periods)
2. Water levels while pumping
3. Flow rate and cumulative amount pumped while pumping and total
4. Flow rate entering and exiting the system collected at the pump house
5. Line pressure (at the wellhead)

6. Inflation pressure on FCV
7. Nitrogen tank pressure (if present)

Section B. Cycle Testing

The applicant shall obtain an injectate sample prior to starting cycle testing if there has been a change in the water chemistry from baseline sampling previously provided to the EPA. Cycle testing will consist of progressively longer periods during which water is injected, stored, and then recovered. For purposes of this permit, one cycle consists of one period of injection, followed by storage, followed by recovery.

The cycle testing will occur according to the following schedule:

Schedule for Cycle Testing				
Cycle No.	Injection Time (days)	Storage Time (days)	Recovery Time (days)	Comments
1	3	1	3	Optimization work to be performed during implementation of Cycle 1
2	7	7	7	
3	14	14	14	
4	21	21	21	
Alternate Cycle 4 (optional Cycle 4 test)	45	45 - 60	45	Alternative Cycle 4 test

1. Storage Time

The storage times presented above are the minimum durations that fluids must be maintained in storage. This time may be increased at Permittee's discretion.

2. Recovery Time

The recovery times presented above are estimates. This time shall be adjusted so that: 1) recovery continues until native source water is encountered; and 2) the volume previously injected is recovered considering recovery occurs at a higher rate than injection.

3. Additional cycles may be added as needed

(a) Analysis/or Cycle 1 for Recovered Water

Cycle 1 shall be performed to optimize the equipment for testing. Field measurements shall include temperature, pH, TDS, electrical conductivity, dissolved oxygen, oxidation-reduction potential (ORP);

(b) Analysis for Cycles 2 through 4 for Recovered Water

(i). Collect data sets during Cycles 2 through 4 and any additional cycling events at the beginning, mid-stream, and end of recovery for each cycle to monitor and record the pH, TDS, dissolved oxygen, oxidation reduction potential, and electrical conductivity;

(ii). Evaluate indicator results in item (i) above to determine the potential timeframe (or recovered water volume point) in which the transition from injectate to native Formation water can be detected based on the water chemistry of injected fluids during each cycle; and

(iii). Collect a water sample after recovering between 80% - 90% of the injected volume for Cycles 2 – 4 and analyze for APPENDIX J parameters. Collect a sample of the injectate water ("bubble fringe") prior to the transition into the native water by considering the findings in item (ii) above.

4. Final Report

(a) Prepare a summary report for each cycle for the implementation and findings observed during the implementation of the Pilot Cycle Test. Include a copy of the analytical data collected during the Pilot Cycle Test in this report. This report shall summarize the analysis and discuss the potential for future injection activities to result in changes in groundwater chemistry.

(b) All submitted laboratory data shall include the EPA' s regulatory limits (maximum contaminant levels, Region 8 limits, health advisory limits). All values which exceed the regulatory limits shall be highlighted.

(c) This report shall be submitted to the Director within thirty (30) calendar days from the completion of all test procedures and receipt of all analytical results from the last cycle conducted.

APPENDIX J - CONSTITUENT LIST FOR PILOT CYCLE TEST ANALYSIS & ONGOING MONITORING REQUIREMENTS

APPENDIX J lists the required constituents for Pilot Cycle Testing following the procedures in APPENDIX I. This constituent list shall also be used to collect water quality data for ongoing monitoring requirements presented in APPENDIX D. All analytical testing must be done in a state certified laboratory. However, other constituents may be added by written response from the Director through email or letter following the review of baseline data collected with the constituent list presented in APPENDIX G and/or if there is a need to evaluate a new constituent(s). Any new constituent added to the list of constituents in APPENDIX J shall be evaluated following the procedures in APPENDIX I and/or review of monitoring results in APPENDIX D.

Parameter Name	**Regulatory Limit (mg/L) or specified unit**	**Detection Limit (mg/L) or Specified Unit**	**Standard Type**	**Analytical Methods**
pH	6.5 - 8.5		Secondary	150.1
Specific Gravity				
Temperature				
Electricity Conductivity				M 2510B, 120.1
Total Dissolved Solids	500		Secondary	
ANIONS				
Carbonate				SM 2330B
Chloride	250		Secondary	
Nitrate (as N)	10		MCL	353.2
Nitrite (as N)	1		MCL	353.2
Nitrate-Nitrite				
Bicarbonate				SM 2330B
Sulfate	250		Secondary	
Fluoride	4		MCL	SM 4500-F C
CATIONS				
Calcium				
Magnesium				
Potassium				
Sodium				
METALS				
Antimony	0.006	0.003	MCL	200.8, 200.9
Arsenic	0.01	0.005	MCL	200.7, 200.8, 200.9
Barium	2	1	MCL	200.7, 200.8

Beryllium	0.004	0.002	MCL	200.7, 200.8, 200.9
Boron	6	0.7	HA-Lifetime	200.7, 212.3
Cadmium	0.005	0.0025	MCL	200.7, 200.8, 200.9
Chromium	0.1	0.05	MCL	200.7, 200.8, 200.9
Copper	1.3	0.65	MCL-TT	200.7, 200.8, 200.9
Total Iron	5	2.5	Region 8 Permit Limit	200.7, 200.9
Lead	0.015	0.0075	MCL-TT	200.8, 200.9
Manganese	0.3	0.4	HA-Lifetime	200.7, 200.8, 200.9
Mercury (inorganic)	0.002	0.001	MCL	245.1, 245.2, 200.8
Molybdenum	0.04	0.02	HA-Lifetime	200.7, 246.1, 246.2
Nickel	0.1	0.05	HA-Lifetime	200.7, 200.8, 200.9
Selenium	0.05	0.025	MCL	200.8, 200.9
Silver	0.1	0.05	HA-Lifetime	200.7, 200.8, 200.9
Strontium	4	2	HA-Lifetime	272.1, 272.2, 200.7
Thallium	0.002	0.001	MCL	200.8, 200.9
Zinc	2	1	HA-Lifetime	200.7, 200.8
Uranium	0.003			908.0, 908.1
Gross Alpha	15 pCi/L			900
Radium 226 & 228 combined	5 pCi/L			304
Aluminum	0.05 to 0.2		Secondary	
Total Trihalomethanes	0.08		MCL	502.2, 524.2
Turbidity	TT'			
Total Haloacetic acid (HAA5s)	0.06		MCL	552.2
Coliforms	5.0%'+			

N-nitroso-dimethylamine (NDMA)		2 ng/L		521
N-nitroso-di-n-butylamine (NDBA)		6 ng/L		521

STATEMENT OF BASIS

Town of Castle Rock Utilities Department
Douglas County, Colorado

Class V Aquifer Storage and Recovery Area Permit
CO52409-00000

CONTACT: Linda Bowling
U. S. Environmental Protection Agency
Underground Injection Control (UIC) Program, 8WD-SDU
1595 Wynkoop Street
Denver, Colorado 80202-1129
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This Statement of Basis gives the derivation of site-specific UIC permit conditions and reasons for them. Referenced sections and conditions correspond to sections and conditions in CO52409-00000 (Permit).

The U.S. Environmental Protection Agency (EPA) Underground Injection Control (UIC) program permits regulate the injection of fluids into underground injection wells, so that the injection does not endanger underground sources of drinking water (USDWs). The EPA UIC permit conditions are based upon the authorities set forth in regulatory provisions at 40 CFR parts 2, 124, 144, 146 and 147, and address potential impacts to USDWs. In accordance with 40 CFR § 144.35, issuance of this Permit does not convey any property rights of any sort or any exclusive privilege, nor authorize injury to persons or property or invasion of other private rights, or any infringement of other federal, state or local laws or regulations. Under 40 CFR § 144 Subpart D, certain conditions apply to all UIC Permits and may be incorporated either expressly or by reference. General permit conditions for which the content is mandatory and not subject to site-specific differences (40 CFR parts 144, 146 and 147) are not discussed in this document.

Upon the Effective Date when issued, the Permit authorizes the construction and operation of injection well or wells so that the injection does not endanger USDWs. The Permit is issued for a duration of three (3) years unless terminated for reasonable cause under 40 CFR § 144.40 and can be modified or revoked and reissued under 40 CFR § 144.39 or § 144.41.

The Permit will expire upon delegation of primary enforcement responsibility (primacy) for applicable portions of the UIC Program to an approved state or tribal program, unless the delegated agency has the authority and chooses to adopt and enforce this Permit as a tribal or state permit.

The Town of Castle Rock Water District is the "Permittee" or "Castle Rock Water". Castle Rock Water is municipally owned and provides three distinct water services – drinking water, wastewater and stormwater. Water service includes acquiring the sources of water and ensuring supply for customers now and in the future. Over the last decade, Castle Rock Water has provided water services to a growing community of more than 70,000 residents in 2018 and an estimated 90,000 by the year 2030. In order to ensure the Permittee continues to provide sustainable water, the Permittee has submitted an application to utilize an aquifer storage and recovery system (ASR). This system will allow the Permittee to store fresh water in the subsurface during periods of low demand and then recover the water to supply their residences during

periods of high demand. The Permittee requests to inject potable drinking water, store it, and recover the water from the Denver and Arapahoe aquifers. Injection water will be supplied from Castle Rock Water's drinking water distribution system. Sources of treated drinking water to be injected are Dawson, Denver and Arapahoe aquifers and renewable source water from the Plum Creek (alluvial wells). The injectate will be treated to drinking water standards at the Plum Creek Water Purification Facility (PCWPF).

PART I. General Information and Description of Project

Town of Castle Rock Utilities Department
175 Kellogg Court
Castle Rock, CO 80109

submitted an application for a UIC Program permit for the following area:

TOWNSHIP 7 SOUTH, RANGE 67 W, SECTION 21 SW/4 OF SW/4	TOWNSHIP 8 SOUTH, RANGE 67 W, SECTION 9
Township 7 South, Range 67 W, Section 22 SW/3 of SW/4, E/2 of SW/4, SE/4	Township 8 South, Range 67 W, Section 10
Township 7 South, Range 67 W, Section 23 NE/4, SE/4, SW/4, SW/4 of NW/4, SE/4 of NW/4	Township 8 South, Range 67 W, Section 11
Township 7 South, Range 67 W, Section 24 NW/4 of NW/4, S/2 of NW/4, SW4, SE4	Township 8 South, Range 67 W, Section 12
Township 7 South, Range 67 W, Section 25	Township 8 South, Range 67 W, Section 13
Township 7 South, Range 67 W, Section 26	Township 8 South, Range 67 W, Section 14
Township 7 South, Range 67 W, Section 27	Township 8 South, Range 67 W, Section 15
Township 7 South, Range 67 W, Section 28	Township 8 South, Range 67 W, Section 16
Township 7 South, Range 67 W, Section 29 SE/4, SE/4 of SW/4	Township 8 South, Range 67 W, Section 21
Township 7 South, Range 67 W, Section 32 E/2, E/2 of NW/4, E/2 of SW/4	Township 8 South, Range 67 W, Section 22
Township 7 South, Range 67 W, Section 33	Township 8 South, Range 67 W, Section 23
Township 7 South, Range 67 W, Section 34	Township 8 South, Range 67 W, Section 24
Township 7 South, Range 67 W, Section 35	Township 8 South, Range 67 W, Section 25
Township 7 South, Range 67 W, Section 36	Township 8 South, Range 67 W, Section 26

Township 7 South, Range 66 W, Section 19 S/2	Township 8 South, Range 67 W, Section 27
Township 7 South, Range 66 W, Section 20 S/2	Township 8 South, Range 67 W, Section 28
Township 7 South, Range 66 W, Section 21 S/2	Township 8 South, Range 67 W, Section 29 E/2
Township 7 South, Range 66 W, Section 22 SW/4 of NW/4, W/2 of SW/4	Township 8 South, Range 67 W, Section 32 NE/4
Township 7 South, Range 66 W, Section 27 N/2 of NW/4	Township 8 South, Range 67 W, Section 33 N/2
Township 7 South, Range 66 W, Section 28 W/2, N/2 of SE/4	Township 8 South, Range 66 W, Section 4 W/2
Township 7 South, Range 66 W, Section 29	Township 8 South, Range 66 W, Section 5
Township 7 South, Range 66 W, Section 30	Township 8 South, Range 66 W, Section 6
Township 7 South, Range 66 W, Section 31	Township 8 South, Range 66 W, Section 7
Township 7 South, Range 66 W, Section 32	Township 8 South, Range 66 W, Section 8
Township 7 South, Range 66 W, Section 33 W/2	Township 8 South, Range 66 W, Section 9 W/2, W/2 of SE/4
Township 8 South, Range 67 W, Section 1	Township 8 South, Range 66 W, Section 17
Township 8 South, Range 67 W, Section 2	Township 8 South, Range 66 W, Section 18
Township 8 South, Range 67 W, Section 3	Township 8 South, Range 66 W, Section 19 W/4 of SW/4, W/8 of NW/4
Township 8 South, Range 67 W, Section 4	Township 8 South, Range 66 W, Section 30 W/2, SW/4 of SE/4
Township 8 South, Range 67 W, Section 5 E/2, E/2 of NW/4	

The application, including the required information and data necessary to issue or modify a UIC permit in accordance with 40 CFR parts 2, 124, 144, 146 and 147, was reviewed and determined by the EPA to be complete.

PART II. Permit Considerations (40 CFR § 146.24)

Hydrogeologic Setting

Castle Rock Water is one of several water districts which operate in the Denver Basin. The Denver Basin, variously referred to as the Julesburg Basin, Denver-Julesburg Basin (after Julesburg, Colorado), or the D-J Basin, is a geologic structural basin centered in eastern Colorado in the United States, but extending into southeast Wyoming, western Nebraska, and western Kansas. It underlies the Denver-Aurora Metropolitan Area on the eastern side of the Rocky Mountains.

The basin consists of a large asymmetric syncline of Paleozoic, Mesozoic, and Cenozoic sedimentary rock layers, trending north to south along the east side of the Front Range from the vicinity of Pueblo northward into Wyoming. The basin is deepest near Denver, where it reaches a depth of approximately 13,000 feet (ft) (3900 meters (m)) below the surface. The basin is strongly asymmetric: the Dakota Sandstone outcrops in a "hog-back" ridge near Morrison a few miles west of Denver, reaches its maximum depth beneath Denver, then ascends very gradually to its eastern outcrop in central Kansas. The Dakota hogback exposes Dakota Sandstone overlying and protecting the Morrison Formation beneath and to the west. Between Golden and Morrison, the Dakota hogback is called Dinosaur Ridge and is the site of a dinosaur trackway and dinosaur fossils exposed in the outcrop that are part of a Colorado State Natural Area and Geological Points of Interest. The Lyons and Lykins formations outcrop in a smaller hogback. Farther west, the Fountain Formation outcrops as flatirons and forms the namesake of the Red Rocks Park and Amphitheatre. Against the eastern edge of the Rocky Mountain Front range, the Fountain Formation is in nonconformable contact with the Precambrian crystalline rock of the Idaho Springs Formation.

The basin started forming as early as 300 million years ago, during the Colorado orogeny that created the Ancestral Rockies. Rocks formed during this time include the Fountain Formation, which is most prominently visible at Red Rocks, and the Boulder Flatirons. The present basin was within the Cretaceous Interior Seaway, which deposited a thick Cretaceous section in the basin.

The basin was most likely further deepened in Paleogene time, between 66 and 45 million years ago, during the Laramie orogeny that created the modern Colorado Rockies. In particular, the uplifting of the Rockies in the Front Range caused the crust near Denver to buckle downward on the eastern side, deepening the basin. The basin later became filled with sediment eroded from the Rockies. The Front Range peaks rise approximately 22,000 ft (6600 m) from the floor of the basin under Denver.

The deep part of the basin near Denver became filled with Paleogene sandstone and conglomerate, a layer now called the Denver Formation. In the regions to the north and south of Denver, however, stream erosion removed the Paleogene layers, revealing the underlying Cretaceous Pierre Shale.

The upper formations of the Denver Basin are aquifers that serve as important sources of water supply in the region. The Denver Basin includes four aquifers of major significance. In ascending order, these are: Laramie-Fox Hills Aquifer; Arapahoe Aquifer; Denver Aquifer; and Dawson Aquifer. The Denver Basin includes four aquifers of major significance. In ascending order, the aquifers are Laramie-Fox Hills Aquifer; Arapahoe Aquifer; Denver Aquifer; and Dawson Aquifer.

TABLE 2.1A
CR-223 Geologic Setting

Well: CR-223 (Arapahoe Formation Injection Well)

Formation Name	Top (ft)*	Base (ft)*	Lithology
Upper Dawson	0	147	Sandstone, grey, with some shale, grey layers
	147	242	Shale, sandy, grey
	242	375	Sandy, grey alternating with shale grey layers
Lower Dawson	375	431	Sandstone
	431	465	Shale, sandy, grey
Denver	465	590	Sandstone, grey, alternating with shale, grey layers
	590	632	Shale, sandy, grey
	632	820	Alternating layers of sandstone, grey and shale, silty, grey
	820	888	Shale, sandy, grey
	888	1190	Alternating layers of sandstone, grey and shale, silty, grey
	1190	1217	Shale, grey
	1217	1283	Alternating layers of sandstone, grey, and shale, grey
Arapahoe	1283	1442	Sandstone, grey with rare shale, grey
	1442	1478	Very thin alternating layers of sandstone, grey and shale, silty, grey
	1478	1671	Alternating layers of sandstone, grey and shale, silty, grey
	1671	1694	Shale, grey
	1694	1770	Sandstone, grey
Laramie	1770	1900	Shale, sandy, grey

TABLE 2.1B
CR-223 Geologic Setting

Well: CR-224 (Denver Formation Injection Well)

Formation Name	Top (ft)*	Base (ft)*	Lithology
Dawson	0	146	Sandstone, grey, with some shale, grey layers
	146	206	Shale, sandy, grey
	206	380	Sandy, grey alternating with shale grey layers
	380	424	Sandstone, grey
	424	463	Shale, sandy, grey
	463	584	Sandstone, grey, alternating with shale, grey layers
	584	628	Shale, sandy, grey
Denver	628	815	Alternating layers of sandstone, grey and shale, silty, grey
	815	856	Shale, sandy, grey
	856	1107	Alternating layers of sandstone, grey and shale, silty, grey.
	1107	1135	Shale, grey
	1135	1161	Sandstone, grey
	1161	1283	Alternating layers of sandstone, grey, and shale, grey
	1283	1300	Shale, grey

Injection Zone
An injection zone is a geological formation, group of formations, or part of a formation that receives fluids through a well. The proposed injection zone(s) are listed in TABLE 2.2.

Injection will occur into an injection zone that is separated from USDWs by a confining zone which is free of known open faults or fractures within the Area of Review.

TABLE 2.2
INJECTION ZONE

Well Name	Formation Name or Stratigraphic Unit	Top (ft)*	Base (ft)*	Porosity	Exemption Status
CR-223	**Arapahoe**	**1284**	**1770**		**Not applicable**
CR-224	**Denver**	**628**	**1283**		**Not applicable**

Confining Zones
A confining zone is a geological formation, part of a formation, or a group of formations that limits fluid movement above and below the injection zone. The confining zone or zones are listed in TABLE 2.3.

TABLE 2.3A
CONFINING ZONES

Well: CR-223 (Arapahoe Formation Injection Well)

Formation Name	Top (ft)*	Base (ft)*	Lithology
Upper Confining Zone Denver Formation	1261	1284	Shale, grey
Lower Confining Zone Laramie Formation	1770	1900	Shale, grey

The upper and lower confining layers for the CR-223 well were obtained from a Geologic Log dated March 1, 2006, in the State of Colorado, Office of the State Engineer's data base. The Permittee submitted additional information to identify the Upper Confining Zone in an email dated February 27, 2020. Additional confining layers isolate the Denver Formation from the Dawson Formation. These upper confining layers are found between the depths of 1190 - 1216 ft; 1236 – 1238 ft; and 1242 – 1250 ft within the Denver Formation. Confinement and minimal injection pressures are expected to maintain injectate in the Arapahoe Aquifer injection zone.

TABLE 2.3B
CONFINING ZONES

Well: CR-224 (Denver Formation Injection Well)

Formation Name	Top (ft)*	Base (ft)*	Lithology
Upper Confining Zone Dawson Formation	584	628	Shale, grey
Lower Confining Zone Denver Formation	1283	1300	Shale, grey

Underground Sources of Drinking Water (USDWs)
Aquifers, or the portions thereof, which 1) currently supply any public water system or 2) contain a sufficient quantity of groundwater to supply a public water system and currently supply drinking water for human consumption or contain fewer than 10,000 milligrams per liter (mg/l) total dissolved solids (TDS), are considered to be USDWs. The receiving aquifers, Denver and Arapahoe are USDWs and these currently supply water for the Denver metropolitan area. Pursuant to the UIC regulations at 40 CFR Part 144.12, underground injection cannot cause movement of a contaminant into a USDW, if the presence of that contaminant may cause a violation of any primary drinking water regulation under 40 CFR Part 142 or may otherwise adversely affect the health of persons.

Other USDWs exist above and below the proposed injection zones. The proposed injection fluid is treated to drinking water standards at a drinking water supply plant. The EPA has concluded that the other USDWs at this location will not be impacted by injection activities due to the geologic isolation separating them from the injection zone for this project.

Sands and sandstone layers of the following aquifers are USDWs in the proposed area: Laramie-Fox Hills Aquifer; Arapahoe Aquifer; Denver Aquifer; and Dawson Aquifer. Compliance with permit conditions will ensure that the Denver and Arapahoe Aquifers are protected as USDWs. The USDWs are listed in TABLE 2.4A and B below.

TABLE 2.4A
UNDERGROUND SOURCES OF DRINKING WATER (USDWs)

PART I ***Well: CR-223 (Arapahoe Formation Injection Well)***

Formation Name	Top (ft)*	Base (ft)*	Lithology
Upper Dawson	0	375	Sandstone, sand, shale
Lower Dawson	375	465	Sandstone, sand, shale
Denver	465	1190	Sandstone, sand, shale
	1217	1283	Sandstone, shale
Arapahoe	1283	1770	Sandstone, sand, shale

TABLE 2.4B
UNDERGROUND SOURCES OF DRINKING WATER (USDWs)

Well: CR-224 (Denver Formation Injection Well)

Formation Name	Top (ft)*	Base (ft)*	Lithology
Dawson	0	628	Sandstone, grey, with some shale, grey layers
Denver	628	815	Alternating layers of sandstone, grey and shale, silty, grey

PART III. Well Construction (40 CFR § 146.22)

The approved well construction plan, incorporated into the Permit as APPENDIX A, will be binding on the Permittee. Modification of the approved plan during construction is allowed under 40 CFR § 144.52(a)(1) provided written approval is obtained from the Director prior to actual modification.

The wells shall be cased and cemented to prevent the movement of fluids into or between USDWs. Wells shall be constructed in accordance with 40 CFR § 147.305 and the Colorado Office of the State Engineer's Water Well Construction Rules. The Colorado Office of the State Engineer's Water Well Construction Rules may be found at:

Code of Colorado Regulations, Secretary of State, State of Colorado, Department of Natural Resources, Division of Water Resources, Rules and Regulations for Water Well Construction, Pump Installation, Cistern Installation, and Monitoring and Observation Hole/Well Construction, 2 CCR 402-2, Rule 10 Minimum Construction Standards for Water Wells.

These rules along with the requirements of 40 CFR § 147.305 have been evaluated and are expected to be protective of USDWs. The Colorado Office of the State Engineer's Water Well Construction Rules are

being used for well construction in an effort to help the Permittee and both agencies to work more efficiently when evaluating the well construction for the two approved wells (CR-223 and CR-224) and future wells.

Both CR-223 and CR-224 have operated as recovery wells and have completed Bench Scale and Pilot Cycle Testing consistent with Permit requirements. However, additional logging and testing requirements identified in APPENDIX B must be completed prior to obtaining authorization to inject.

Casing and Cement

Two wells are currently approved for construction for ASR purposes, CR-223 and CR-224. The well construction plans for all wells shall be evaluated and determined to be in conformance with standard practices and guidelines that ensure well injection does not result in the movement of fluid containing any contaminant into USDWs. Well construction details for the injection wells are shown in TABLE 3.1.

Remedial cementing may be required if the casing cement is shown to be inadequate by cement bond log or other demonstration of external (Part II) mechanical integrity.

TABLE 3.1
WELL CONSTRUCTION REQUIREMENTS FOR CR-223 & CR-224

Well Name	Casing Type	Casing Material	Hole Size (in)	Casing Size (in)	Cased Interval (ft)	Cemented Interval (ft)
CR-223	Surface	steel	36	24	0-40	0-40
	Longstring	steel	20	12.75	0-1900	0-1262
CR-224	Surface	steel	36	24	0-40	0-40
	Longstring	steel	17.5	10.75	0-1300	0-660

The well construction plan for the CR-223 and CR-224 wells was obtained from the Castle Rock Water's application. Well Construction and Test Report Form No. GWS-31 which were prepared for the State of Colorado, Office of the State Engineer, was included in the application for each well.

Sampling and Monitoring Device

To fulfill permit monitoring requirements and provide access for EPA inspections, sampling and monitoring equipment will need to be installed and maintained. Required equipment includes but is not limited to: 1) a pressure actuated shut-off device attached to the injection flow line set to shut-off the injection pump when or before the Maximum Allowable Injection Pressure (MAIP) is reached at the wellhead; 2) fittings or pressure gauges attached to the injection tubing(s); 3) a fluid sampling point between the pump house or storage tanks and the injection well, isolated by shut-off valves, for sampling the injected fluid; 4) a non-resettable flow meter that records the cumulative volume of injected fluid; and continuous recording of injection pressure, flow rate, volume, and any additional monitoring locations.

If the well construction will allow, monitoring shall also be performed at the tubing casing annulus (TCA), and surface casing-production casing (bradenhead) annulus. Injection pressure is the pressure that is measured in a pump house or alternate location whereas wellhead pressure is measured at the top of the well. Data is evaluated to determine if there may be a problem with field operations if data shows an interruption in injection activities.

All sampling and measurement taken for monitoring must be representative of the monitored activity.

PART IV. Area of Review, Corrective Action Plan (40 CFR § 144.55)

Area of Review (AOR)
Permit applicants are required to identify the location of all known wells within the AOR which penetrate the lowermost confining zone, which is intended to prevent injection fluids from migrating outside of the injection zone. Under 40 CFR § 146.6 the AOR may be a fixed radius of not less than one quarter (1/4) mile or a calculated zone of endangering influence. For area permits, a fixed width of not less than one quarter (1/4) mile for the circumscribing area may be used.

A list of wells in the AOR must be updated and reported in the Annual Report that is submitted to the EPA.

Corrective Action Plan (CAP)
For wells in the AOR which are improperly sealed, completed or abandoned, the applicant will develop a CAP consisting of the steps or modifications that are necessary to prevent movement of fluid into USDWs.

No corrective action is required at this time as the EPA's evaluation did not identify migration pathways that would impact USDWs within the AOR.

PART V. Well Operation Requirements (40 CFR § 146.23)

Mechanical Integrity (MI) (40 CFR § 146.8)
An injection well has mechanical integrity (MI) if:

1. Internal (Part I) MI: there is no significant leak in the casing, tubing, or packer; and
2. External (Part II) MI: there is no significant fluid movement into a USDW through vertical channels adjacent to the injection well bore.

The Permit requires MI to be maintained at all times. The Permittee must demonstrate MI prior to injection, as required in APPENDIX B Logging and Testing Requirements. A demonstration of well MI includes both internal (Part I) and external (Part II). The methods and frequency for demonstrating internal (Part I) and external (Part II) MI are dependent upon well conditions and are subject to change. Should well conditions change during the operating life of the well, additional requirements may be specified and will be incorporated as minor modifications to the Permit.

A successful internal Part I Mechanical Integrity Test (MIT) is required prior to receiving authorization to inject. A demonstration of internal MI is also required following any workover operation that affects the tubing, packer, or casing or after a loss of MI. In such cases, the Permittee must complete work and restore MI within ninety (90) days following the workover or within the timeframe of the approved alternative schedule. After the well has lost MI, injection may not recommence until after internal MI has been demonstrated and the Director has provided written approval.

Internal MI may be demonstrated by performing a baseline annulus pressure test. An annulus may be created for testing purposes only by placing a temporary packer (e.g. inflatable packer) in the upper portion of the well. This test may be performed only once unless required because of a workover or by the Director. Internal (Part I) MI should be run with a pressure difference between the annulus and the injection tubing of at least 100 psig or an alternate value required by the Director. If the MAIP for any wells approved under this Permit exceeds 200 psig, then the Director may require a new pressure difference. If there is a pressure change of 10 percent or more from the initial test pressure during the 30 minute duration, the well has failed

to demonstrate mechanical integrity and should be shut-in until it is repaired or plugged. A pressure change of 10 percent or more is considered significant. If there is no significant pressure change in 30 minutes from the time that the pressure source is disconnected from the annulus, the test may be completed as passed.

The tubing-casing annulus (TCA) allows the casing, tubing and packer to be pressure-tested prior to injection for mechanical integrity and will allow for detection of leaks.

External (Part II) MIT may be demonstrated by evaluation of cement records or cement bond logs (CBLs) to show that adequate cement exists to prevent significant movement of fluid out of the approved injection zone through the casing cement. Guidance on the logging and interpretation of the CBL can be found at https://www.epa.gov/uic/underground-injection-control-epa-region-8-co-mt-nd-sd-ut-and-wy#guidance.

Should the cement records or CBL analysis show inadequate external Part II MI, additional periodic tests may be required.

Injection Fluid Limitation
Injection fluids are limited to fluids from those public water systems sampled and submitted as part of the application. Sources of treated drinking water to be injected shall be obtained from Alluvium, Dawson, Denver and Arapahoe Aquifers. The injectate will be treated to drinking water standards at the Plum Creek Water Purification Facility. Injection fluid limitations are found in Part II. Section C.6 of the Permit.

Injection Pressure Limitation
40 CFR § 146.23(a)(1) requires that the injection pressure at the wellhead must not exceed a maximum calculated to ensure that the pressure during injection does not initiate new fractures or propagate existing fractures in the confining zone adjacent to the USDWs. In lieu of testing to determine the fracture pressure of the confining zone, which may be impractical, the MAIP will be set below a pressure that will not initiate new fractures or propagate existing fractures in the injection zone thereby ensuring that no injection or formation fluids will migrate out of the injection zone and into other USDWs. Based on the calculations noted below, the EPA has determined that a Part I MI test pressure of up to 200 psig can be safely conducted without causing such fracturing and that the MAIP be set at 2/3 of the Part I MI test pressure. Should the Permittee wish to inject at a higher pressure, then an additional test may be required such as a Step Rate Test. Since the Permittee anticipates injecting at pressures no higher than 125 psig, the EPA is setting the MAIP at 133 psig for the CR-223 and CR-224 wells based on the Permittee conducting a successful Part I MI test at 200 psig.

The fracture pressure of the injection zone is determined by using the depth at the top of the well screen, a conservative fracture gradient value of 0.8 psi/foot, and a specific gravity for the injected fluid of 1.0 in the formula below. As a result, the fracture pressures for the CR-223 and CR-224 wells are 475 psig and 260 psig respectively.

$$FP = [FG - (0.433 * SG)] * D$$

FP = Fracture Pressure
FG = Fracture Gradient
SG = Specific Gravity
D = Depth

Therefore, the EPA has determined that a MAIP of 133 psig is sufficiently protective of USDWs outside of the injection zone.

TABLE 5.1 provides the MAIP for the two wells which are authorized to construct for ASR purposes.

TABLE 5.1
MAXIMUM ALLOWABLE INJECTION PRESSURE (MAIP) For Authorized Wells

Formation Name or Stratigraphic Unit	Top Screen Depth (ft)	Estimated Formation FP (psi)
Arapahoe (CR-223 well)	1302	133
Denver (CR-224 well)	713	133

PART VI. Monitoring, Recordkeeping and Reporting Requirements

Injection Well Monitoring Program
At least once a year the Permittee must analyze a sample of the injected fluid for parameters specified in APPENDIX J of the Permit. This analysis must be reported to the EPA annually as part of the Annual Report to the Director. APPENDIX D contains a list of monitoring requirements.

Instantaneous injection pressure, injection flow rate, injection volume, and cumulative fluid volume must be observed on a weekly basis. A recording, at least monthly, must be made of that month's injected and recovered volume and cumulative fluid volume to date, and the maximum and average value for injection tubing pressure and rate. This information is required to be reported quarterly as part of the Annual Report to the Director.

The Permittee has submitted baseline water quality data and results from both a Pilot Cycle Test and Bench Scale Test results for the CR-223 and CR-224 wells. These well applications contained a baseline water quality analysis which showed no exceedances of those constituents on the national primary drinking water standards with maximum contaminant levels (MCLs). There was a detection of a nitrosamine known as N-Nitroso-di-n-butylamine (NDBA) during the baseline analysis. The detection of NDBA had a concentration of 2.2 nanograms per liter (ng/L). There have been no further detections of six reported nitrosamines above the reporting limit of 2 ng/L. Nitrosamines do not currently have MCLs. However, nitrosamines are organic compounds which are probable human carcinogens. There is limited data about the fate of nitrosamines in aquifers, and the monitoring required under this permit will help fill this data gap.

Monitoring requirements also include:

- APPENDIX D also requires additional sampling to be performed. EPA will evaluate the data results in an effort to safeguard USDWs in the area during injection activities.

- The Permittee has submitted Pilot Cycle Test data results collected in 2016 and 2017 which show an upward trend of detected arsenic. Concentrations for the arsenic results range between 2.6 – 6.6 ug/L for the CR-223 and ND – 2 ug/L for the CR-224 well. These concentrations are below the arsenic MCL of 10 ug/L. However, arsenic levels will be monitored quarterly or as required by the Director, if changed. Arsenic is being monitored to determine the risk to USDWs should any mobilization be occurring due to injection.

Injectate and Recovered Water

Treated injectate will be analyzed near the injection point to determine if there have been any changes in the water quality. Recovered water from both the Denver and Arapahoe Aquifers will be analyzed prior to any further treatment to determine if mobilization or any other geochemical reactions are occurring over time due to injection.

NDMA
The Permittee is treating the injectate by chloramination. N-nitroso-dimethylamine (NDMA) is the most common potential nitrosamine by-product of chloramination. Therefore, ongoing monitoring of NDMA shall be performed. NDMA samples will be collected for the injectate from the tap at the wellhead and from each injection zone through the approved injection wells on a quarterly basis. This information will be used to evaluate whether NDMA is present in the injectate, may be present in the Denver or Arapahoe aquifers, and whether it attenuates over time. A sample of the injectate from the tap at the wellhead will be obtained and analyzed for NDMA on an annual basis during the month where flows from surface water sources are at their maximum level. The peak month shall be determined by evaluating three years of monthly recovery rates at the supplying water systems. A trigger of 7 ng/L has been set for NDMA which, if exceeded, may cause the EPA to re-evaluate the permit conditions.

New Water Source
The Permittee may add new water sources beyond those listed in the Injection Fluid Limitation section presented above. Baseline Water Quality Data and Bench Scale Test results must be collected for each new water source. The Director may require a Pilot Cycle Test be performed based on a review of prior to injection information (e.g., if there are concerns that injection of the new water source could result in mobilization concerns). A new water source is defined as a new water treatment plant, new raw water source, or other public water systems. The Permittee shall follow the procedures identified Part II. Section C.7 and Appendices B, D, and H. The purpose of testing the new water source is to evaluate water quality prior to injection and to determine the potential formation of NDMA. Monitoring requirements for new water sources are included in APPENDIX D of the Permit.

New Injection Well
New injection well requests shall be submitted in accordance with Part II. Section B.1 and Appendices B, D, H and I. Well testing for injection wells will be performed to ensure that injection activities do not endanger USDWs through the introduction or mobilization of contaminants.

- APPENDIX G – ASR Baseline Constituent List

1. This APPENDIX contains a list of general constituents, anions, cations, metals, inorganics, radionuclides, volatile organic compound, semi volatile organic compounds, pesticides and herbicides, disinfectants and disinfection byproducts, and nitrosamines, and the permit limit for each contaminant.
2. This is a larger list of constituents analyzed to establish a baseline and to evaluate water quality for a new water source and/or the injection zone for a new well. This information is needed to ensure that future injection activities will not adversely impact human health and/or cause the mobilization of contaminants into a USDW.
3. Injection activities will not be authorized if a contaminant exceeds a Permit Limit.
4. Nitrosamines are included on this list of analytes. The reporting limits for nitrosamines were obtained from the Second Unregulated Contaminants Monitoring Rule for EPA Method 521. If constituents not currently listed in APPENDIX J are detected during baseline evaluations and/or exceed a Permit Limit, the Director may choose to add it to APPENDIX J.

- APPENDIX H – Bench-Scale Water Chemistry Test Procedures for Nitrosamines

The Permit requires a bench scale water chemistry test for two nitrosamines following authorization to inject by EPA. There are two main goals for this test: 1) collect formation water and spike it with NDMA and NDBA to evaluate the conditions associated with any attenuation or other reactions which may occur over time; and 2) investigate changes in water chemistry that may occur over time for the injectate as a result of water storage and recovery.

More specifically, the Permittee will collect initial source water and formation water samples for this test prior to commencing injection in order to obtain representative samples for bench-scale testing. Part A of the water chemistry bench test is expected to provide more information about the potential for NDBA and/or NDMA to attenuate in the Denver and Arapahoe aquifers. Part B of the bench test is performed to evaluate the potential for NDMA and/or NDBA formation in these aquifers over time. The EPA is requiring that NDBA and NDMA be analyzed because these two nitrosamines have been detected at ASR facilities. The Permittee shall perform this test for new well and new water source additions.

- APPENDIX I – ASR Pilot Cycle Test Procedures

A pilot cycle test is required to evaluate the potential impacts of injection for ASR on the Denver and Arapahoe aquifers. There are three main goals for these procedures: 1) investigate the well and aquifer hydraulics and behavior during repetitive storage and recovery cycles; 2) evaluate the mechanics involved in well operation, flow and water level control, and instrumentation; and 3) investigate changes in water quality chemistry that may occur from water storage and recovery. This APPENDIX does not address all the details, or all of the contingencies associated with an ASR pilot-testing plan, as many of these cannot be reliably anticipated in advance of the actual testing. Rather, it is intended to provide an overall structure for conducting the pilot studies.

The Permittee shall perform this test for both the CR-223 and CR-224 wells following authorization to inject from the EPA. The test procedure under APPENDIX I, Section B, contains the minimum timeframes associated with injection, storage and recovery of fluids that EPA Region 8 requires at all ASR facilities. Cycle 1 will be used to optimize project operations. Cycles 2 thru 4 will be performed for a longer duration of time. For Cycles 2, 3, and 4, analysis will be performed for the constituents listed in APPENDIX J to evaluate any potential for mobilization of contaminants in these aquifers. The Permittee may perform a longer test for Cycle 4 which is labeled as alternate test for this cycle.

Once the test is completed, the Permittee shall submit a report to the EPA in accordance with Part II, Section F.5 of the Permit. This information will inform the potential contamination risk, if any, to these aquifers resulting from injection activities. These tests will be required whenever a new well is added. The Director may require that a Pilot Cycle Test be performed when a new water source is added if there are concerns that injection activities may result in the mobilization of metals or a potential introduction of contaminants.

The following conditions must be measured and recorded in advance of, and during, the cycle testing:

1. Static water levels (between cycles)
2. Water levels while pumping
3. Water levels while injecting or specify surface, if applicable
4. Flow rate and cumulative amount pumped while recovering, by cycle and total

5. Flow rate and cumulative amount stored while injecting, by cycle and total
6. Flow rate entering and exiting the system
7. Pressure recorded from a gauge on the wellhead.
8. Inflation pressure on flow control valve.
9. Intermittent sampling for measurement of total organic carbon and dissolved oxygen in injectate and recovered water
10. Start/stop times and elapsed time for cycles
11. Sampling dates and sample testing protocol

- APPENDIX J – Constituent List for Pilot Cycle Test Analysis and Ongoing Monitoring Requirements

The Permittee will use this shorter parameter list to evaluate water quality for the injectate and/or recovered water required in the Pilot Cycle Test procedures in APPENDIX I and when analytical data is required for monitoring requirements provided in APPENDIX D. This list may be modified based on the initial samples collected and results of pilot cycle testing.

PART VII. Plugging and Abandonment Requirements (40 CFR § 146.10)

Plugging and Abandonment Plan

All wells shall be plugged with cement in a manner which isolates the injection zone and will not allow the movement of fluids either into or between USDWs in accordance with 40 CFR § 146.10. Additional federal, state or local law or regulations may also apply.

Wells authorized under this Permit, must be either transferred out of the program or plugged and abandoned. Castle Rock Water will notify the EPA with any plans to permanently abandon the well. The Director will review and approve any plugging and abandonment plans prior to Meridian implementing any such plans.

Within thirty (30) days after plugging the owner or operator must submit Plugging Record (EPA Form 7520-19) to the Director. The Plugging Record must be certified as accurate and complete by the person responsible for the plugging operation. The plugging and abandonment plan is described in APPENDIX E of the Permit.

PART VIII. Considerations Under Other Federal Law (40 CFR § 144.4)

The EPA will ensure that issuance of this Permit will be in compliance with the laws, regulations and orders described at 40 CFR § 144.4, including the National Historic Preservation Act, the Endangered Species Act, and Executive Order 12989 (Environmental Justice), before a final permit decision is made.

National Historic Preservation Act (NHPA)
Section 106 of the National Historic Preservation Act, 54 U.S.C. § 306108, requires federal agencies to consider the effects on historic properties of actions they authorize, fund or carry out. The EPA has determined that a decision to issue a Class V injection well permit for authorization of injection into the well constitutes an undertaking subject to the National Historic Preservation Act and its implementing regulations at 36 CFR part 800.

The Historic Preservation Plan for the Town of Castle Rock was started in 2006 and adopted by Resolution in 2007. Cultural resources in the area are:

Site Type	Principle Meridian (P.M.)	Township and Range	Section	Quarter
Prehistoric open camp	6	T7S/R66W	3	SE NE
AT&SF Railroad	6	T6S/R68W T7S/R68W T7S/R67W T8S/R68W	24 sections	Numerous
Louviers Village	6	T6S/R68W T7S/R68W	23, 4	Numerous

No planned ASR activities will affect historical properties. The wells are built, have operated for recovery, and may require workover activities that will not impact surrounding areas. All roads are in place, and injection fluid will be transported to the site via existing infrastructure. Therefore, the EPA has concluded that there will be "no adverse effect" on historic properties.

Endangered Species Act (ESA)
Section 7(a)(2) of the Endangered Species Act (ESA), 16 U.S.C. § 1536 (a)(2), requires federal agencies to ensure that actions they authorize, fund, or carry out are not likely to jeopardize the continued existence of federally-listed endangered or threatened species or result in the destruction or adverse modification of designated critical habitat of such species. The EPA has determined that a decision to issue a Class V permit for authorization of injection into the wells constitutes an action that is subject to the Endangered Species Act and its implementing regulations (50 CFR part 402).

Federally listed species of the Central and Lower Platte River Ecosystem are:

Interior least tern (Sterna antillarum)	Piping plover (Charadrius melodius circumcinctus)	Whooping crane (Grus americana)
Pallid sturgeon (Scaphirhynchus albus)	Preble's meadow jumping mouse riparian habitat	Preble's meadow jumping mouse
Ute ladies tresses orchid	Colorado Butterfly plant	

The Town of Castle Rock is part of two habitat conservation plans (HCP) that focus on the Preble's meadow jumping mouse riparian habitat. These are the Douglas County Habitat Conservation Plan and the Meadows Habitat Conservation Plan.

The Douglas County HCP conservation planning began in 1997 because of the proposed listing of the Preble's meadow jumping mouse under the ESA. Permit #TE-125749 is an Incidental Take Permit (ITP) associated with the Douglas County Habitat Conservation Plan.

The Habitat Conservation Plan for a portion of the Meadows Property, Douglas County, Colorado, was prepared December 15, 2003, and amended in 2012 and 2015. The permit number is TE-064965-0. The U.S. Fish and Wildlife Service (Service) issued a finding of no significant impact for issuance of an incidental take permit for the Preble's Meadow Jumping Mouse for a Portion of the Meadows Property Douglas County, Colorado dated February 17, 2004.

The CR-223 and CR-224 wells to be used for ASR injection are existing recovery wells. Other than minimal work over activity on the equipment inside the wells, no other alterations will be made to the site. These activities are similar to any work that would be carried out during typical well operations and therefore do not pose a threat or impact to these listed species or their habitat. Therefore, no effects are anticipated from the conversions to, and operation of, ASR wells.

Executive Order 12898

On February 11, 1994, the President issued Executive Order 12898, entitled "Federal Actions to Address Environmental Justice (EJ) in Minority Populations and Low-Income Populations." The EPA has concluded that there may be potential EJ communities proximate to the Authorized Permit Area. The primary potential human health or environmental effects to these communities associated with injection well operations would be to local aquifers that are currently being used or may be used in the future as USDWs. The EPA's UIC program authority under the Safe Drinking Water Act is designed to protect USDWs through the regulation of underground injection wells. The EPA has concluded that the specific conditions of UIC Permit CO52409-00000 will prevent contamination to USDWs, including USDWs which either are or will be used in the future by communities of EJ concern. The UIC program will be conducting enhanced public outreach to EJ communities by publishing a public notice announcement in local newspapers and holding a public hearing, if requested, or if public interest in the proposed permit is high.