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UNDERGROUND INJECTION CONTROL
DRAFT
CLASS III AREA PERMIT

Area Permit No. SD31231-00000

Class III Injection Well Area Permit
Dewey Burdock Uranium In-Situ Recovery Project
Custer and Fall River Counties, South Dakota

Issued To

Powertech (USA) Inc.
5575 DTC Parkway, Suite 140,
Greenwood Village, Colorado 80111

PART I. EFFECT OF PERMIT

Under the authority of the Safe Drinking Water Act and Underground Injection Control (UIC) Program regulations of the U. S. Environmental Protection Agency 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 Area Permit,

Powertech (USA) Inc.
5575 DTC Parkway, Suite 140,
Greenwood Village, Colorado 80111

is hereby referred to as the "Permittee."

Because this permit authorizes more than one injection well, it is an Area Permit and subject to the requirements found at 40 CFR § 144.33. The Permittee is allowed to engage in underground injection in accordance with the conditions of this Area Permit. The Permittee shall not construct, operate, maintain, convert, plug, abandon or conduct any other 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 141 or may otherwise adversely affect the health of persons. Any underground injection activity not authorized by this Permit, or by rule, is prohibited. Issuance of 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 State or local law or regulations. 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 Safe Drinking Water Act (SDWA) or any other law governing protection of public health or the environment, for any imminent and substantial endangerment to human 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 State or local laws or regulations.

Issuance of this Area Permit authorizes the construction and operation of the Class III uranium in-situ recovery (ISR) injection wells in the wellfields listed in Table 1 within the Permit Area described below according to the conditions set in this Area Permit.

A. Class III Permit Area Boundary

The Class III injection wells shall be located within the Permit Area. As shown in Figure 1, the Class III Permit Area is located in Custer and Fall River Counties, South Dakota. The area included within the Class III Permit Boundary encompasses the portions of Sections 20, 21, 27, 28, 29, 30, 31, 32, 33, 34 and 35 of Township 6 South, Range 1 East in Custer County, South Dakota. The Permit Area also includes the portions of Sections 1, 2, 3, 4, 5, 10, 11, 12, 14 and 15 in Township 7 South, Range 1 East in Fall River, South Dakota. Figure 2a shows the Dewey Area ore zones and wellfields in Sections 29, 30, 31 and 32 of Township 6 South, Range 1 East. Figure 2b shows the Burdock Area ore zones and wellfields in Sections 34 and 35 of Township 6 South, Range 1 East and Sections 1, 2, 3, 10, 11, 12, 14 and 15 Township 7 South, Range 1 East.

B. Well Locations

This Area Permit authorizes the construction and operation of Class III injection wells in the 14 wellfields located within the Permit Area described above according to the conditions set in this Area Permit. The approximate locations of these fourteen wells fields are listed in Table 1:

Table 1. Wellfields Proposed under the Class III Area Permit

Wellfield Permit Number	Wellfield Name	Section/Township/Range
SD31231-09459	Burdock Wellfield 1	Sections 11 and 12 T7S R1E
SD31231-09460	Burdock Wellfield 2	Sections 10, 11, 14 and 15 T7S R1E
SD31231-09461	Burdock Wellfield 3	Sections 10 and 11 T7S R1E
SD31231-09462	Burdock Wellfield 4	Sections 10 and 11 T7S R1E
SD31231-09463	Burdock Wellfield 5	Sections 3 and 10 T7S R1E
SD31231-09464	Burdock Wellfield 6	Sections 1, 2, 11 and 12 T7S R1E
SD31231-09465	Burdock Wellfield 7	Sections 1 and 2 T7S R1E
SD31231-09466	Burdock Wellfield 8	Section 35 T6S R1E
SD31231-09467	Burdock Wellfield 9	Section 3 T7S R1E
SD31231-09470	Burdock Wellfield 10	Section 34 T6S R1E
SD31231-08351	Dewey Wellfield 1	Sections 29 and 32 T6S R1E
SD31231-09471	Dewey Wellfield 2	Sections 29, 30, 31, 32 and 33 T6S R1E
SD31231-09472	Dewey Wellfield 3	Sections 29, 30, 31 and 32 T6S R1E
SD31231-09473	Dewey Wellfield 4	Sections 29, 30, 31, 32 and 33 T6S R1E

Permit requirements herein are based on regulations found in 40 CFR parts 124, 144, 146, and 147, which are in effect on the Effective Date of this Permit. The UIC regulations specific to South Dakota are found at 40 CFR § 147.2100.

This Area 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 Area Permit and/or formal enforcement action.

The Area Permit will remain in effect for the life of the facility. The Director shall review this Area Permit at least once every 5 years to determine whether it should be modified, revoked and reissued, terminated, or a minor modification made as provided in §§144.39, 144.40, and 144.41. This Area Permit may be adopted, modified, revoked and reissued, or terminated if primary enforcement authority for this program is delegated to the State of South Dakota. Upon the effective date of delegation, all reports, notifications, questions and other compliance actions shall be directed to the State Program Director or designee.

Issue Date: _____

Effective Date: _____

_____

Darcy O'Connor
Assistant Regional Administrator
Office of Water Protection

*NOTE: Throughout this Permit the term "Director" refers to either the Assistant Regional Administrator for the Office of Water Protection (WP) or the Assistant Regional Administrator of Environmental Compliance, Enforcement and Justice (ECEJ).

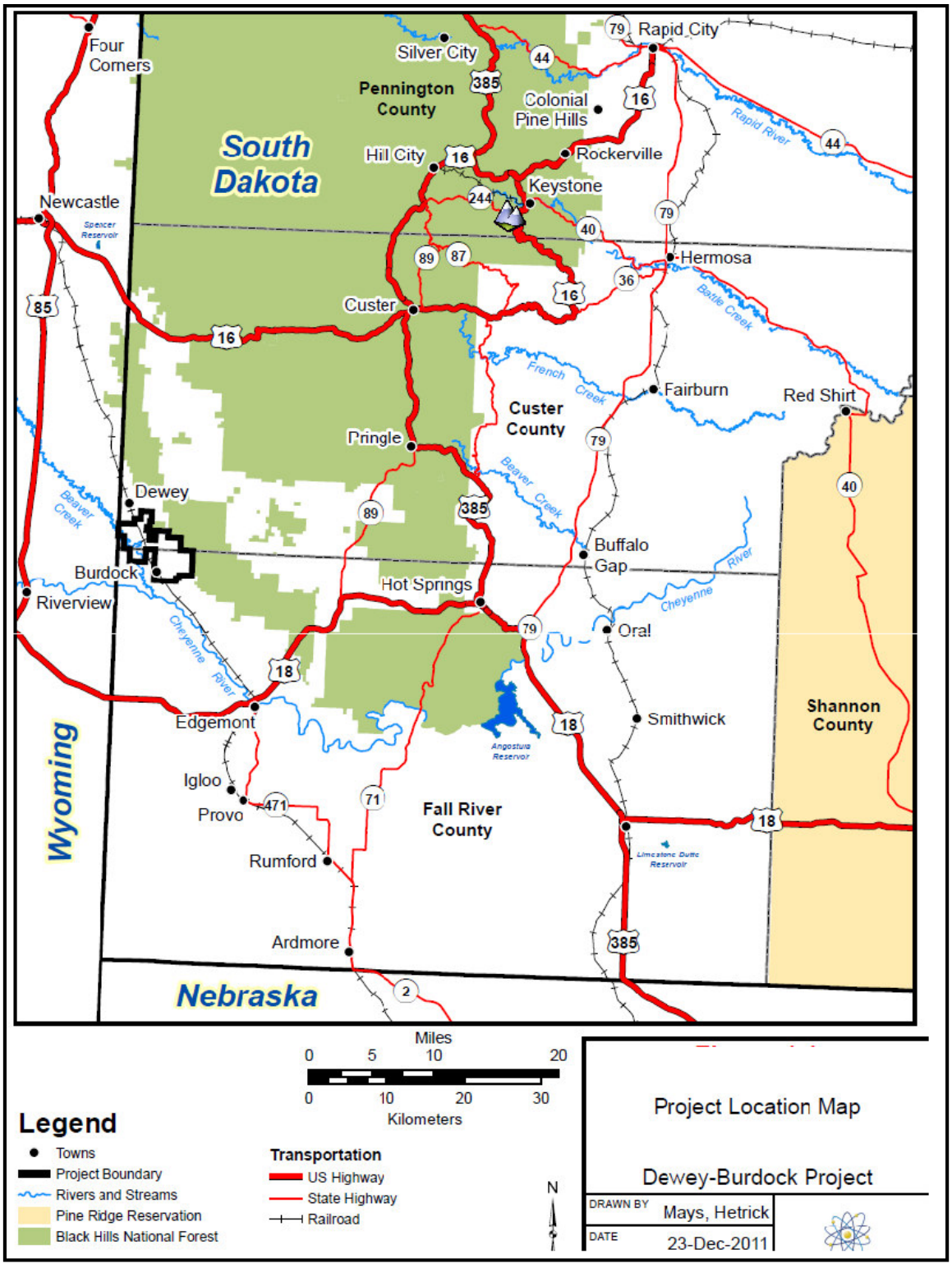


Figure 1. Dewey Burdock Project Location

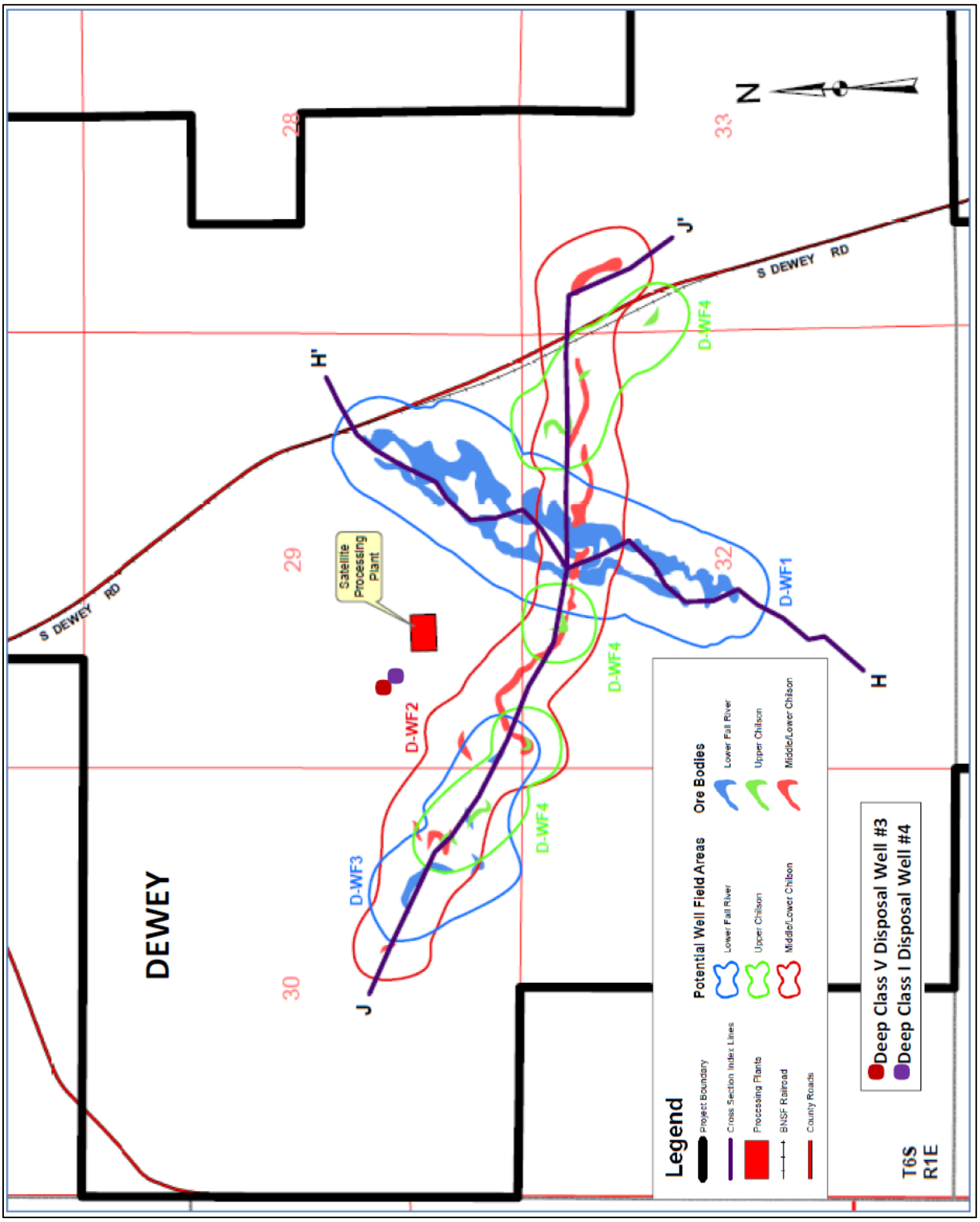


Figure 2a. Locations of the Proposed ISR Wellfields in the Dewey Area.

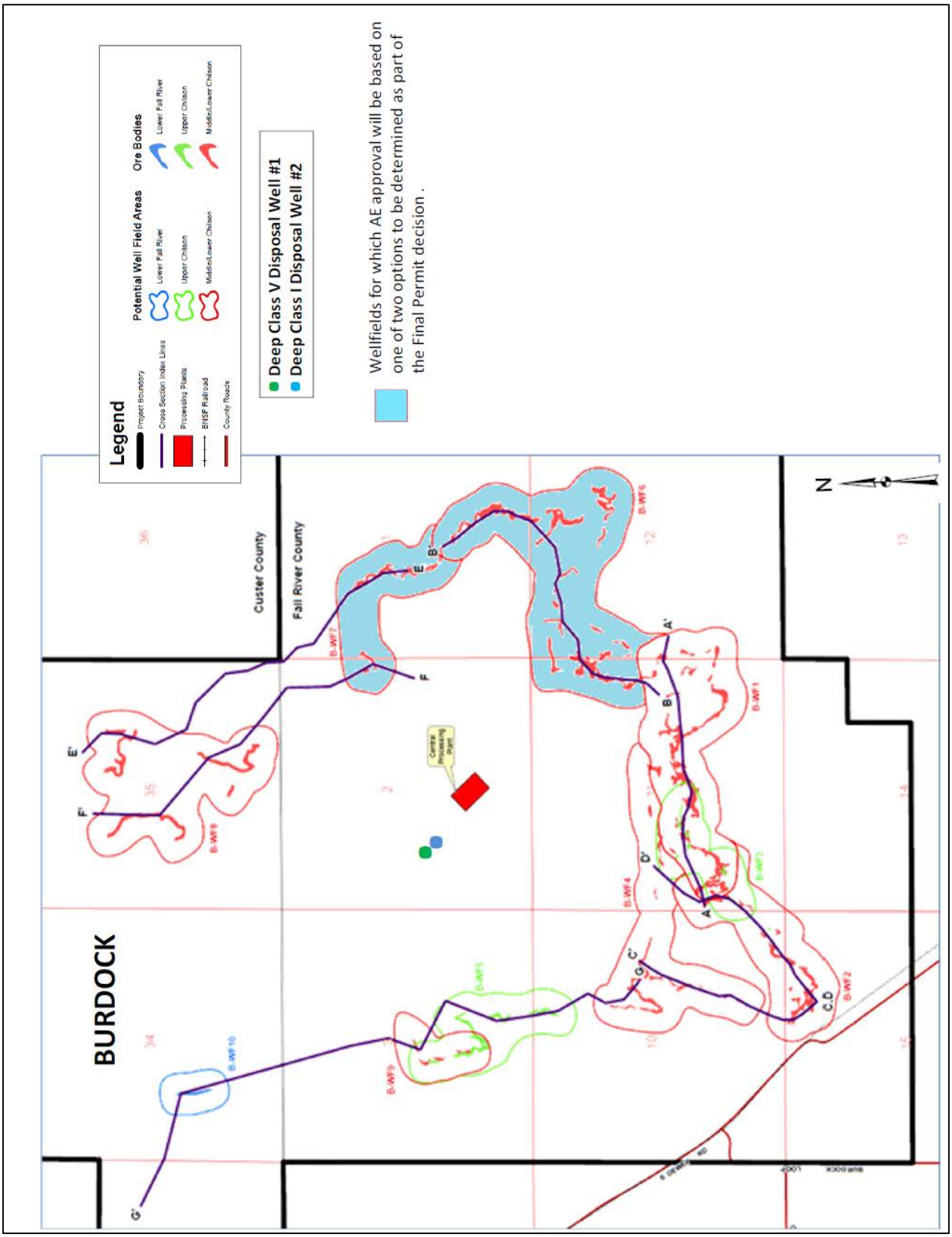


Figure 2b. Locations of the Proposed ISR Wellfields in the Burdock Area.

PART II. WELLFIELD DELINEATION AND PUMP TESTING REQUIREMENTS; AUTHORIZATION TO COMMENCE INJECTION

In order to obtain an Authorization to Commence Injection into wellfield injection wells, wellfield delineation drilling, drillhole logging and wellfield testing shall be performed as described below. A descriptive report interpreting the results of logs and tests shall be prepared by a knowledgeable log analyst and submitted to the Director as part of the Injection Authorization Data Package Report described in Section H of this Part.

A. Wellfield Location Restrictions

All wellfields and perimeter monitoring wells shall be located within the Permit Area boundary described in Part I. No wellfields shall be located within 1,600 feet of the Permit Area boundary in order to establish an operational buffer between the wellfields and the Permit Area boundary.

B. Drilling and Logging of Wellfield Delineation Drillholes and Pump Testing Wells

The Permittee shall conduct the following drilling and logging operations as described below to identify:

(1) the top and bottom depths of the upper and lower confining zones across the wellfield;
(2) the top and bottom depths of the injection interval across the wellfield;
(3) the horizontal extent of injection interval across the wellfield; and
(4) the top and bottom depths of the aquifer units overlying and immediately underlying the confining zones across the wellfield, excluding those below the Morrison Formation.

1. Wellfield Delineation Drilling

a. The Permittee shall conduct delineation drilling to delineate the vertical and horizontal extent of the ore deposits targeted for ISR operations within the wellfield and develop a more detailed conceptual hydrogeologic model for wellfield design including:
   i. the horizontal and vertical extent of the proposed injection intervals based on ore deposit locations;
   ii. the presence and thickness of overlying confining zones; and
   iii. the presence and thickness of overlying aquifer units requiring non-injection interval monitoring wells.

b. So as not to compromise the integrity of the Morrison Formation lower confining zone of the Inyan Kara Group, the only delineation drillholes required through and below the Morrison Formation are those for the two new observation wells described in Section C.2.d and Section D.4.c.ii of this Part.

c. If the lower confining zone for the target injection interval is <u>not</u> the Morrison Formation, then delineation drillholes shall penetrate below the proposed injection interval through the first underlying aquifer unit to evaluate:
   i. the thickness of the confining zone underlying the target injection interval; and
   ii. the thickness of the first underlying aquifer unit requiring non-injection interval monitoring wells.

2. Logging of Wellfield Delineation and Pump Test Well Drillholes

a. The Permittee shall log all delineation drillholes and the pump test wells drillholes to determine lithologic horizons and the extent of the ore zones within the wellfield. The list of logs is included in Table 2.
b. The Permittee shall provide this information to the Director in the form of a descriptive narrative containing detailed map or maps and cross sections. The descriptive narrative interpreting the results of logs and tests shall be prepared by a knowledgeable log analyst.
c. The Permittee shall identify in the report any injection interval perimeter monitoring wells completed in

a uranium ore body.

d. The Permittee shall submit the report to the Director as part of the Injection Authorization Data Package Report described in Section H of this Part.

Table 2. Delineation and Pump Test Well Drillhole Logging Program

TYPE OF LOG	PURPOSE	DUE DATE
Gamma Ray	To identify ore depth and thickness	Prior to setting well casing
Self Potential	To identify confining zones and aquifer units.	Prior to setting well casing
Resistivity	To identify confining zone depth and thickness	Prior to setting well casing
Physical Geologic Log	To identify lithology and stratigraphy	During drilling

e. The detailed map(s) and cross sections shall show:
   i. the ore zones color-coded to differentiate the different ore horizons within the injection interval;
   ii. the locations of proposed injection/production wells and monitoring wells color-coded to different well type and completion interval;
   iii. wellfield cross sections as described in Table 3 with ore deposits, geologic units and confining zones labeled as applicable;
   iv. new delineation drillholes labeled on a separate map and representative drillhole logs included in cross-sections;
   v. cross section locations index map; and
   vi. a potentiometric surface elevation map for each aquifer intersected by a drillhole or well.

f. If appropriate to better fit the ore zone configurations, the Permittee may propose alternate wellfield cross section configurations that are different from those described in Table 3 and shown in Appendix A figures, without modification to this Area Permit.

Table 3. Example Cross Section Locations Required for Each Wellfield

Wellfield	Number of Cross Sections
D-WF1	A minimum of 2 cross sections trending NE/SW along trend of Lower Fall River roll fronts delineating Lower Fall River ore deposits and approximately parallel to cross section H – H', as shown in Appendix A, Figure A1. A minimum of 5 cross sections intersecting the first two cross sections, also delineating Lower Fall River ore deposits. The cross sections shall clearly identify aquifer units, confining units and Lower Fall River ore deposits.
D-WF2	A minimum of 1 cross section along trend of Middle Chilson roll fronts delineating Middle Chilson ore deposits approximately parallel to cross section J – J' as shown in Appendix A, Figure A1. A minimum of 1 cross section intersecting the first cross section also delineating Middle Chilson ore deposits located in the middle of the west side of D-WF2, as shown in Appendix A, Figure A1. The cross sections shall clearly identify aquifer units, confining units and Middle Chilson ore targeted by D-WF2. Also include any intersected ore zones targeted by D-WF1, D-WF3 and D-WF4 as applicable.
D-WF3	A minimum of 1 cross section along trend of Lower Fall River roll fronts delineating Lower Fall River ore deposits, as shown in Appendix A, Figure A1. The cross section shall clearly identify aquifer units, confining units and Lower Fall River ore deposits.
D-WF4	**Western Section:** A minimum of 1 cross section trending approximately NW/SE delineating Upper Chilson ore deposits, as shown in Appendix A, Figure A2. A minimum of 3 approximately NE/SW cross sections intersecting the first cross section also delineating Upper Chilson ore deposits. The cross sections shall clearly identify aquifer units, confining units and Upper Chilson ore targeted by the western section of D-WF4. Also include any intersected ore zones targeted by D-WF3 as applicable.

D-WF4	**Middle Section**: A minimum of 1 cross section trending approximately NW/SE delineating Upper Chilson ore deposits as shown in Appendix A, Figure A2. A minimum of 1 approximately NE/SW cross section intersecting the first cross section also delineating Upper Chilson ore deposits. The cross sections shall clearly identify aquifer units, confining units and Upper Chilson ore targeted by the middle section of D-WF4. **Eastern Section:** A minimum of 1 cross section trending approximately NW/SE delineating Upper Chilson ore deposits as shown in Appendix A, Figure A2. A minimum of 2 approximately NE/SW cross sections intersecting the first cross section also delineating Upper Chilson ore deposits. The cross sections shall clearly identify aquifer units, confining units and Upper Chilson ore targeted by the eastern section of D-WF4.
B-WF1	A minimum of 1 cross section trending approximately along cross section A – A' in Figure 2b, along trend of and delineating Lower and Middle Chilson ore deposits. A minimum of 4 approximately north/south trending cross sections intersecting cross section A – A' also delineating Lower and Middle Chilson ore deposits. The cross sections shall clearly identify aquifer units, confining units and Lower and Middle Chilson ore deposits targeted by B-WF1. Also include any intersected ore zones targeted by B-WF2, B-WF3, B-WF4 and B-WF6 as applicable.
B-WF2	A minimum of 1 cross section trending approximately along cross section D – D' in Figure 2b, along the trend of and delineating Middle Chilson ore deposits. A minimum of 3 approximately NW/SE trending cross sections intersecting cross section D – D' also delineating Middle Chilson ore deposits. The cross sections shall clearly identify aquifer units, confining units and Middle Chilson ore deposits ore deposits targeted by B-WF2. Also include any intersected ore zones targeted by B-WF1, B-WF3 and B-WF4 as applicable.
B-WF3	A minimum of 1 cross section trending approximately SW/NE along the trend of the Upper Chilson roll fronts and delineating Upper Chilson ore deposits. A minimum of 2 approximately NW/SE trending cross sections intersecting the first cross section. The cross sections shall clearly identify aquifer units, confining units and Upper Chilson ore deposits targeted by B-WF3.
B-WF4	A minimum of 1 cross section trending approximately east/west as shown in Appendix A, Figure A3, delineating Middle and/or Lower Chilson ore deposits. A minimum of 5 approximately north-south trending cross sections intersecting the first cross section also delineating Middle and/or Lower Chilson ore deposits. One north-south trending cross section shall be approximately parallel to the portion of cross section C – C' in B-WF4. The cross sections shall clearly identify aquifer units, confining units and Middle and/or Lower Chilson ore deposits ore deposits targeted by B-WF4. Also include any intersected ore zones targeted by B-WF1, B-WF2 and B-WF3 as applicable.
B-WF5	A minimum of the 3 cross sections shown in Appendix A, Figure A4 delineating Upper Chilson ore deposits. The cross sections shall clearly identify aquifer units, confining units and Upper Chilson ore deposits targeted by B-WF5.
B-WF6	A minimum of the 9 cross sections in the approximate locations shown in Appendix A, Figure A5 delineating Middle and/or Lower Chilson ore deposits. The cross sections shall clearly identify aquifer units, confining units and Middle and/or Lower Chilson ore deposits ore deposits targeted by B-WF6. Also include any intersected ore zones targeted by B-WF1 and B-WF7 as applicable.
B-WF7	A minimum of the 2 cross sections shown in Appendix A, Figure A5 delineating Middle and/or Lower Chilson ore deposits. The cross sections shall clearly identify aquifer units, confining units and Middle and/or Lower Chilson ore deposits ore deposits targeted by B-WF7.
B-WF8	A minimum of the cross sections shown in Appendix A, Figure A6 delineating Middle and/or Lower Chilson ore deposits. The cross sections shall clearly identify aquifer units, confining units and Middle and/or Lower Chilson ore deposits ore deposits targeted by B-WF8.

B-WF9	A minimum of the 2 cross sections shown in Appendix A, Figure A4 delineating Middle (and Lower, if applicable) Chilson ore deposits. The cross sections shall clearly identify aquifer units, confining units and Middle (and Lower, if applicable) Chilson ore deposits targeted by B-WF9. Also include any intersected ore zones targeted by B-WF5 as applicable.
B-WF10	A minimum of the 2 cross sections shown in Appendix A, Figure A7 delineating Lower Fall River ore deposits. The cross sections shall clearly identify aquifer units, confining units and Lower Fall River ore deposits ore deposits targeted by B-WF10.

3. Plugging and Abandonment of Wellfield Delineation Drillholes

After drilling and logging, all delineation holes that are not used for injection, production or monitoring well construction shall be plugged and abandoned in a manner that ensures the integrity of all intersected confining zones remains intact. The integrity of intersected confining zones shall be demonstrated by the results of the wellfield pump test required under Part II, Section F.

C. Wellfield Pump Test Design and Pump Test Well Installation

1. The Permittee shall design a pump test program for each wellfield to evaluate the hydrogeology and to assess the ability to operate the wellfield and control injection interval fluids.
2. Based on the results of delineation drilling, the Permittee shall complete the following wellfield development steps and document each step in the Injection Authorization Data Package Report described in Section H of this Part:
   a. Identify each production and injection well location and screened interval.
   b. Identify known or suspected locations of exploration drillholes within the wellfield area and adapt pump test design to detect evidence of inter-aquifer communication at the drillhole locations.
   c. Design the monitoring well system as required under Part II, Section D below based on production and injection well locations and the refined conceptual geology and hydrogeology provided by the results of wellfield delineation drilling.
   d. Install observation wells below the Morrison Formation lower confining zone as described in Table 4. The purpose of the observation wells below the Morrison Formation is to verify that drillholes penetrating the Morrison confining zone have been properly plugged and do not compromise the integrity of the Morrison Formation lower confining zone.
   e. Identify all monitoring well locations and screened intervals.
   f. Install all wellfield perimeter monitoring wells.
   g. Install all pumping and observation wells to be used during pump testing.
   h. Plug and abandon all water supply wells within ¼ mile of the perimeter monitoring well ring or incorporate them into the monitoring system for the wellfield pump test to determine if they have potential to be impacted by ISR operations or to impact ISR operations.

Table 4. Observation Wells for Monitoring the Integrity of the Morrison Formation Lower Confining Zone

Drillholes Penetrating the Morrison Lower Confining Zone within a Wellfield	Location	Wellfield ID	Observation Well Location	Construction of New Well Required?
ELT 14	SESE Section 30 T6S R1E	Dewey WF2	Hydro ID 693 NENW Section 29 T6S R1E	No
DB08-32-11	NENW Section 29 T6S R1E	Dewey WF2		
TRM 38	SENW Section 35 T6S R1E	Burdock WF8	Within Burdock Wellfield 8 between drillholes TRM 38 and DRJ 90.	Yes
DRJ 90	SEE Section 35 T6S R1E T6S R1E	Burdock WF8 Approximately at aquifer exemption boundary		
DB08-1-7	SE Section 2 T7S R1E	Approximately at aquifer exemption boundary of Burdock WF6	Monitor Hydro ID 703 during WF6 pump test, if possible.	No
FBR 31	SESE Section 2 T7S R1E	Burdock WF6 Between aquifer exemption boundary and perimeter monitoring well ring	Between drillholes FBR 31 and DB07-11-31 so it can be used for Burdock WF1 and WF6 pump tests.	Yes
DB07-11-31	NESE Section 11 T7S R1E	Inside Burdock WF1		
DB07-11-18	NESW Section 11 T7S R1E	Inside Burdock WF1	Hydro ID 690 NESW Section 11 T7S R1E	No
DB07-11-16C	NESW Section 11 T7S R1E	Inside Burdock WF1		
RONA 81	SW Section 11 T7S R1E	Inside Burdock WF1		

D. Design and Construction of Wellfield Monitoring Well System

1. Where injection is into an aquifer which contains water with less than 10,000 mg/l Total Dissolved Solids (TDS), monitoring wells shall be completed into the injection interval and into any underground sources of drinking water above the injection interval.
2. Because cementing records for the wellfield injection/production wells shall be used to demonstrate the absence of significant fluid movement to fulfill the external mechanical integrity demonstration requirement as described under Part VII, Section D, the monitoring program shall be designed to verify the absence of significant fluid movement through the confining zones per 40 CFR § 146.8(c)(4).
3. The monitoring wells shall be located in such a fashion as to detect any vertical or horizontal excursion of injection fluids, process by-products, or formation fluids outside the injection interval or wellfield.
4. The wellfield monitoring well system shall include:
   a. **Wellfield perimeter monitoring well ring:** Monitoring wells shall be completed in the injection interval around the wellfield. These wells shall be located as specified in Table 5.

b. **Overlying monitoring wells:** Overlying monitoring wells shall be completed in all aquifers units overlying the injection interval. These wells shall be located as specified in Table 5.

c. **Underlying monitoring wells:**
   i. If the lower confining zone of the injection interval is not the Morrison Formation, then monitoring wells shall be completed in the first underlying aquifer unit. These wells shall be located as specified in Table 5.
   ii. If the lower confining zone is the Morrison Formation then at least one pump test observation well shall be completed in the Unkpapa aquifer below the Morrison Formation near any exploration drillholes penetrating the Morrison Formation to verify that drillholes penetrating the Morrison Formation have not compromised the integrity of the Morrison Formation confining zone. Table 4 lists where the Unkpapa observation wells shall be located.

d. **Monitoring wells surrounding possible breaches in confining zones:** if wellfield pump test results indicate a possible breach in a confining unit that cannot be located for corrective action, or corrective action does not completely repair the confining zone breach, then the monitoring well system shall be designed to verify that wellfield injection interval fluids will remain within the approved injection interval per 40 CFR § 144.55(b)(4).

e. **Down-gradient Compliance Boundary Wells:** As required for Post-Restoration Monitoring discussed under Part IV.

f. **Mechanical integrity testing of monitoring wells:** Because the injection interval monitoring wells and any monitoring wells in the first aquifer underlying the injection interval penetrate the injection interval, the Permittee shall demonstrate external mechanical integrity for these wells according to Part VII, Section D to verify these wells do not create pathways through the injection interval confining zones for injection interval fluids to move out of the injection interval. The Permittee shall plug and abandon any monitoring well for which mechanical integrity cannot be demonstrated. The plugging and abandonment procedures shall be conducted according to the requirements under Part XI.

5. Injection Zone Core Sample Collection from Monitoring Wells Located Down-gradient of Wellfields

a. The Permittee shall collect a minimum of two (2) cores per wellfield through the proposed injection interval while drilling the down-gradient perimeter monitoring wells ring wells or the Down-gradient Compliance Boundary Wells.

b. Core shall be recovered and preserved in a manner to prevent further oxidation so as to be representative of in-situ geochemical conditions for use in columns tests as part of Post-Restoration Monitoring to verify that no ISR contaminants will cross the down-gradient aquifer exemption boundary.

Table 5. Monitoring Well Location Requirements

Type of Monitoring Well	Location Requirements
Injection interval wellfield perimeter monitoring well ring	1) No farther than 400 feet from the outermost wellfield well. 2) Maximum spacing of either 400 feet or spacing that will ensure no greater than a 70 degree angle between adjacent perimeter monitor wells and the nearest wellfield well.
Overlying monitoring wells	1) Monitoring wells completed in first aquifer unit overlying the injection interval: a density of at least one monitoring well per 4 acres of well field area. 2) Monitoring wells completed in subsequent aquifer units overlying the injection interval: a density of at least one well per 8 acres of wellfield area.
Underlying monitoring wells	A density of one well per 4 acres of wellfield area except for aquifers below the Morrison Formation lower confining zone.
Unkpapa Formation observation wells	Unkpapa Formation observation wells are specified in Table 4. Monitoring of Unkpapa Formation observation wells is required only during the wellfield pump tests in order to evaluate the integrity of the Morrison Formation lower confining zone.

E. Formation Testing

1. The Permittee shall conduct the formation testing as required in this Section. Table 6 provides a summary of the required testing.

Table 6. Formation Testing Program

Type of Test	Purpose	Timing
Water level measurements in all pump test wells	• To determine potentiometric surfaces of the injection interval and monitored non-injection interval aquifers. • To identify any potential areas of leakage across confining zones due to improperly plugged boreholes or wells, improperly completed wells or naturally occurring features such as fractures.	• After construction of all wellfield pump test wells is completed • The static potentiometric surface for each aquifer has stabilized from well development activities, and • Prior to initiation of pump testing activities.
Water sample collection and analysis for all pump test wells	• To identify any potential areas of leakage across confining zones due to improperly plugged boreholes or wells or naturally occurring features such as fractures. • To begin establishing baseline water quality in non-injection interval monitoring wells and Down-gradient Compliance Boundary Wells for the Post-Restoration Monitoring Plan required under Part IV of this Area Permit.	Prior to initiation of pump testing activities
Wellfield pump test	• To demonstrate that control of injectate and injection interval formation fluids is able to be maintained throughout the ISR process and groundwater restoration. • To establish that the production and injection wells are hydraulically connected to the injection interval perimeter monitoring wells. • To evaluate whether the production and injection wells are hydraulically isolated from non-injection interval monitoring wells. • To identify any potential areas of leakage across confining zones due to improperly plugged boreholes or wells, improperly completed wells or naturally occurring features such as fractures.	Prior to receiving written Authorization to Commence Injection from the Director

2. The Permittee shall follow these procedures while conducting the formation testing described in Table 6:
   a. Determination of Aquifer Potentiometric Surfaces
      i. Once the potentiometric surface has stabilized within each aquifer after well development, static potentiometric surface water levels shall be measured in every well in every aquifer unit in the wellfield, including injection, production and monitoring wells.
      ii. Based on these data points, the Permittee shall provide pre-pump test potentiometric surface elevation maps for the injection interval and each non-injection interval aquifer being monitored in order to identify drawdown resulting from the wellfield pump test.
      iii. These water levels shall be considered in the determination of the baseline water levels to be used to evaluate the presence of a wellfield cone of depression signifying hydraulic control of wellfield

groundwater during the wellfield pump test and to identify breaches in confining zones for non-injection interval monitoring wells.

iv. Once the potentiometric surface has stabilized within each aquifer after the pump test, static potentiometric water levels shall be measured in every well in every aquifer unit in the wellfield, including injection, production and monitoring wells, prior to the initiation of injection into the wellfield to determine if there have been any changes in water levels not attributable to changes in barometric pressure.

b. Sampling and Analysis of Injection Interval and Non-injection Interval Monitoring Wells

i. After the construction and development of the wellfield perimeter monitoring wells (and Down-gradient Compliance Boundary Wells) completed within the injection interval and the monitoring wells completed in aquifers above and below (where applicable) the injection interval, the Permittee shall collect groundwater samples from each well according to the following procedures:

A) The Permittee shall use the *Standard Operating Procedure for Low-Stress (Low Flow) / Minimal Drawdown Ground-Water Sample Collection* and measure the field parameters listed in Table 7 at the surface as fluid is pumped out of the well to determine when collection of a representative sample is possible.

B) The Permittee shall collect a sample only after the field parameters meet the stabilization criteria in Table 7, indicating that the water quality indicator parameters have stabilized.

C) If stabilization is not occurring and the procedure has been strictly followed, then sample collection can take place once three (minimum) to six (maximum) casing volumes have been removed.

D) The Permittee shall include stabilization information in the Injection Authorization Data Package Report described in Section H of this Part.[1]

Table 7. Field Parameters to be Monitored and Stabilization Criteria to Meet before Sample Collection

Parameter	Stabilization Criteria
pH	± 0.1 pH units
Specific conductance	± 3% μS/cm
Oxidation-reduction potential	± 10 millivolts
Turbidity	± 10 % NTUs when turbidity is greater than 10 NTUs
Dissolved oxygen	± 0.3 milligrams per liter

ii. After following the procedures in Part II, Section E.2.b.i above, the Permittee shall collect and handle groundwater samples according to the requirements found in 40 CFR part 136 Table II – *Required Containers, Preservation Techniques, and Holding Times*.

iii. The samples shall be analyzed for the baseline water quality parameters listed in Table 8 using the analytical methods shown. Equivalent analytical methods may be used after prior approval by the Director.

[1] The EPA recommends capturing and storing the groundwater pumped from each perimeter monitoring well (except for any completed in an ore deposit) to use as the injectate for the Step Rate Tests described in Part II, Section J.

Table 8. Baseline Water Quality Parameter List

Test Analyte/Parameter[2]	Units	Analytical Method
Physical Properties		
pH[3]	pH Units	A4500-H B
Total Dissolved Solids (TDS)	mg/L	A2540C
Specific Conductance[3]	µmhos/cm	A2510B or E120.1
Common Elements and Ions		
Total alkalinity (as Ca CO_3)	mg/L	A2320B
Bicarbonate Alkalinity (as Ca CO_3)	mg/L	A2320B (as HCO_3)
Calcium	mg/L	E200.7
Carbonate Alkalinity (as Ca CO_3)	mg/L	A2320B
Chloride, Cl	mg/L	A4500-Cl B; E300.0
Magnesium, Mg	mg/L	E200.7
Nitrate, NO_3^- (as Nitrogen)	mg/L	E300.0
Potassium, K	mg/L	E200.7
Silica, Si	mg/L	E200.7
Sodium, Na	mg/L	E200.7
Sulfate, SO_4	mg/L	A4500-SO_4 E; E300.0
Total Metals		
Aluminum, Al	mg/L	E200.7, E200.8, E200.9
Antimony, Sb	mg/L	E200.8,E 200.9
Arsenic, As	mg/L	E200.8
Barium, Ba	mg/L	E200.8
Beryllium, Be	mg/L	E200.7, E200.8,E 200.9
Boron, B	mg/L	E200.7
Cadmium, Cd	mg/L	E200.8
Chromium, Cr	mg/L	E200.8
Copper, Cu	mg/L	E200.8
Fluoride, F	mg/L	E300.0
Iron, Fe	mg/L	E200.7
Lead, Pb	mg/L	E200.8
Manganese, Mn	mg/L	E200.8
Mercury, Hg	mg/L	E200.8
Molybdenum, Mo	mg/L	E200.8
Nickel, Ni	mg/L	E200.8
Selenium, Se	mg/L	E200.8
Silver, Ag	mg/L	E200.8, A3114 B
Strontium, Sr	mg/L	E272.1, E272.2,E 200.7
Thallium, Tl	mg/L	E200.8, E200.9
Thorium, Th	mg/L	E200.8
Uranium, U	mg/L	E200.7, E200.8
Vanadium, V	mg/L	E200.7, E200.8
Zinc, Zn	mg/L	E200.8
Radiological Parameters		
Gross Alpha	pCi/L	E900.0
Gross Beta	pCi/L	E900.0
Gross Gamma	pCi/L	E901.1

Lead 210	pCi/L	E905.0 Mod.
Polonium 210	pCi/L	RMO-3008
Radium, Ra-226	pCi/L	E903.0
Thorium 230	pCi/L	EPA 910, ATSM D3972-90M

[2]Laboratory analysis only, except where indicated.
[3]Field and Laboratory

F. Wellfield Pump Test Requirements

1. The Permittee shall monitor the following wells during the pump test to evaluate the hydrogeology and assess the ability to operate the wellfield and control injection interval fluids:
   a. The wells being pumped,
   b. Monitoring wells within the injection interval,
   c. Injection interval perimeter monitoring wells,
   d. Monitoring wells in the immediately overlying non-injection interval aquifer unit,
   e. Monitoring wells in each subsequently overlying non-injection interval aquifer unit,
   f. Monitoring wells in the alluvium, if present,
   g. Monitoring wells in the immediately underlying non-injection interval aquifer unit,
   h. Any additional wells installed for investigating other hydrogeologic features,
   i. Any other wells within ¼ mile of the wellfield perimeter monitoring well ring, and
   j. Any other wells determined to be necessary by the Director or the Permittee.

2. During each pump test the Permittee shall measure and record the following parameters:
   a. instantaneous (gallons per minute) and totalized flow (gallons),
   b. periodic pressure transducer measurements (pounds per square inch),
   c. periodic manual water level depth measurements (inches or tenths of feet and feet),
   d. barometric pressure (millibars) (unless using a gauge transducer that is vented to the atmosphere), and
   e. time (scaled as appropriate).

3. The Permittee shall conduct the wellfield pump tests with sufficient iterations and using pumping wells in as many locations within the wellfield as necessary to create drawdown in each injection interval perimeter monitoring well.

4. If any injection interval perimeter monitoring well does not show any water level drawdown (decrease in water level not due to barometric pressure fluctuation), the Permittee shall recomplete or replace the well and verify that the recompleted or new well is in hydraulic communication with the wellfield injection interval.

5. The wellfield pump test for Burdock Wellfield 10 shall be designed in such a manner as to provide data in order to evaluate the impacts from Triangle Pit water on the operation and groundwater restoration of Burdock Wellfield 10.

G. Additional Requirements to Obtain Authorization to Inject for Burdock Wellfields 6, 7 and 8

1. Because the Chilson Sandstone down-gradient from Burdock Wellfields 6, 7 and 8 has been oxidized by native groundwater, the Permittee shall evaluate the capacity of the down-gradient Chilson Sandstone to remove residual contamination from restored wellfield groundwater as it travels down-gradient toward the aquifer exemption boundary.

2. To fulfill this requirement the Permittee shall:
   a. Collect a minimum of two (2) cores per wellfield through the proposed injection interval while drilling

the down-gradient perimeter monitoring wells ring wells or the Down-gradient Compliance Boundary Wells.

b. Core shall be recovered and preserved in a manner to prevent further oxidation so as to be representative of in-situ geochemical conditions.
c. Compile vertical composite samples from single cores and conduct at least two laboratory bench-scale column tests per wellfield on the composite samples. The two column tests shall be conducted using the following leachates:
    i. One column test shall be conducted using unrestored wellfield groundwater taken from a wellfield in which uranium recovery has been completed, but before groundwater restoration has begun, and
    ii. The second column test shall be conducted using restored wellfield groundwater.
d. The column testing fluids shall be analyzed for the analytes in Table 8 before and after recovery from the column so that changes in analyzed constituent concentrations may be determined.
e. After the tests in Part II, Sections G.1.c.i and G.1.c.ii have been completed, a second round of tests shall be run on these same columns using groundwater collected from up-gradient perimeter monitoring wells to determine if any constituents adsorbed or precipitated on the column matrix during the Part II, Sections G.1.c.i and G.1.c.ii column tests are released into solution by the up-gradient groundwater leachate. The up-gradient groundwater samples shall be analyzed for constituents in Table 8 before and after recovery from the column test to determine if there is a statistically significant increase in analyzed constituent concentrations after leaching through the column.
f. If the Part II, Sections G.1.c.i and G.1.c.ii column test leachates do not demonstrate an adequate decrease in ISR contaminant concentrations after passing through the columns or the up-gradient perimeter monitoring well groundwater tests show an increase in contaminant levels after passing through the columns, then the Permittee shall submit a groundwater treatment plan to the Director describing measures for preventing ISR contaminants from crossing the down-gradient aquifer exemption boundary. The plan may include geochemical modeling results demonstrating that no ISR contaminants will cross the down-gradient aquifer exemption boundary. The geochemical model should be calibrated with laboratory and/or field data.

3. If, during the wellfield pump tests using a pumping rate simulating production and restoration in Burdock Wellfields 6, 7 or 8, the Chilson aquifer potentiometric surface is drawn down to the point where the proposed injection interval becomes less than fully saturated, the Permittee shall develop a 3-D unsaturated groundwater flow model for the area where less than fully saturated conditions are anticipated.
    a. The model shall be calibrated to site-specific hydrologic conditions and verified by use of wellfield-specific pump test data.
    b. The model shall assess the ability to maintain hydraulic control in the partially saturated injection interval and demonstrate the ability to detect and reverse excursions in the partially saturated injection interval and in the first overlying non-injection interval aquifer.
    c. The model shall incorporate the effects of concurrent production and restoration activities in other Burdock wellfields on the Chilson aquifer potentiometric surface in the areas where partially saturated injection intervals are anticipated.
4. The results from the additional requirements for Burdock Wellfield 8 shall be included in the Injection Authorization Data Package Report for each of these respective wellfields.
5. If the aquifer exemption for Burdock Wellfields 6 and 7 has not been approved upon issuance of this Final Area Permit, the results from these additional requirements for Burdock Wellfield 6 and 7 shall be submitted to the Director as part of the aquifer exemption request.
6. After review of groundwater flow model results, if the Director determines that additional hydrologic testing using pumping and injection is required to verify the groundwater flow model, the Director may issue a limited authorization to inject in order to allow reinjection of groundwater pumped from the field test site pumping well(s) for the purposes of hydrologic testing only.

7. The Director will issue a limited authorization to inject into Burdock Wellfields 6 and 7 only after the aquifer exemption for those two wellfields has been approved according to Section I.3 of this Part.

H. Injection Authorization Data Package Reports

1. An Injection Authorization Data Package Report shall be prepared for each wellfield and submitted to the EPA UIC Program Director for review in order to obtain written Limited Authorization to Inject for each wellfield.
2. Each Injection Authorization Data Package Report shall contain a description of all logging and testing procedures required under Part II, Sections B through F (Sections B through G for Burdock Wellfields 6, 7 and 8) and the results of such logs and tests. In summary, each Injection Authorization Data Package Report shall contain the following:
   a. A descriptive report interpreting the results of logs and tests prepared by a knowledgeable log analyst.
   b. A description of the proposed wellfield, including a map delineating the ore zones, color-coded to differentiate each ore level within the wellfield injection interval.
   c. Map(s) showing the proposed production and injection well patterns and locations of all monitoring wells.
   d. Map showing all plugged and abandoned exploration drillholes within the wellfield perimeter monitoring ring. Identify any exploration drillholes that had to be replugged.
   e. Copies of any new or historic drillhole logs annotated to indicate presence of fault, fracture or joint for any drillholes located inside the perimeter monitoring wells ring.
   f. Map showing all plugged and abandoned wellfield delineation drillholes within the wellfield perimeter monitoring ring.
   g. Wellfield geologic cross section location map and geologic cross sections showing:
      i. the top and bottom depths of the upper and lower confining zones across the wellfield;
      ii. the top and bottom depths of the injection interval across the wellfield; and
      iii. the top and bottom depths of the aquifer units overlying and immediately underlying the confining zones across the wellfield, excluding those below the Morrison Formation.
   h. Isopach maps showing the thickness of the injection interval and the first confining zones overlying and underlying the wellfield injection interval.
   i. Descriptions of wellfield monitoring wells, including screened intervals, that will be used to demonstrate control of injectate and injection interval formation fluids throughout the ISR process and groundwater restoration.
   j. Description of well construction activities, including well completion reports and mechanical integrity test dates and results. Include the locations and plugging reports for any wells that had to be plugged and abandoned because mechanical integrity could not be demonstrated.
   k. The results from the formation testing required under Section E of this Part.
   l. Discussion of how pump testing was performed. Include results and conclusions. Include pump testing raw data, drawdown match curves, potentiometric surface maps, water level graphs, drawdown maps and, when appropriate, directional transmissivity data and graphs.
   m. Water level drawdown data demonstrating that each well in the injection interval perimeter monitoring well ring and the down-gradient compliance boundary is in communication with the wellfield injection and production wells.
   n. The report For Burdock Wellfield 10 shall include an analysis of impacts from Triangle Pit water on the operation and groundwater restoration of Burdock Wellfield 10.
   o. Estimation of wellfield maximum injection pressure calculated using the equation in Part V, Section F of this Permit and results from wellfield delineation drilling and logging for the purpose of selecting well casing and piping that meet requirements under Part V, Sections E.2.c and E.3.c.

p. The results of the evaluation of all nearby water supply wells with the potential to be impacted by ISR operations or the potential to interfere with ISR operations and the plan for replacing all wells removed from service.
q. A corrective action plan (as required under Part III) identifying areas where breaches in the overlying or underlying confining zones were detected and describing mitigation measures to prevent the migration of injectate and formation fluids out of the ore zone through identified breaches.
r. A description of any wellfield operational controls designed to contain injectate and injection interval fluids within the injection interval to address breaches in confining zones that cannot be precisely located or for which other types of corrective action cannot be performed successfully and operational controls are the method of corrective action. Include a narrative demonstration that the number and placement of non-injection interval monitoring wells are capable of detecting any loss of hydraulic control in that area per 40 CFR § 144.55(b)(4).
s. Schedule for completing mechanical integrity tests, preparing well completion reports and submitting financial responsibility for all injection and production wells prior to bringing the wells online.
t. Groundwater quality data for wellfield and injection interval perimeter monitoring ring wells. Identify any injection interval perimeter monitoring ring wells located in an ore deposit.
u. Proposed source of fluid that will be injected during the Step Rate Test described in Part II, Section J.1 below.

I. Evaluation of the Injection Authorization Data Package Reports for Authorization to Commence Injection

1. Information to Submit to the Director to Obtain a Limited Authorization to Inject for Testing Purposes

a. In order for the Director to issue a Limited Authorization to Inject only for the purpose of injection to conduct a Step Rate Test for a wellfield, the Injection Authorization Data Package Reports shall demonstrate the following:
    i. All requirements under Part II, Section B through F (and Section G, if applicable) have been met;
    ii. Hydraulic connection between the production and injection wells and all injection interval perimeter monitoring wells and down-gradient compliance wells;
    iii. The overlying and underlying confining zones provide vertical confinement of the injection interval;
    iv. Calculation of the hydraulic conductivity, storativity, and transmissivity of the injection interval aquifer unit;
    v. Evaluation of anisotropy within the injection interval aquifer unit has been conducted;
    vi. Corrective action has been performed to the extent that hydraulic control of injection interval fluids will be maintained during ISR activities until the completion of groundwater restoration;
    vii. The number and location of monitoring wells meet permit requirements, provide indication of hydraulic control of injection interval fluids and will detect potential excursions;
    viii. Wellfield injection and production wells have mechanical integrity, as required under Part VII, Section B.2; and
    ix. Analytical results for the proposed injectate to be used for the Step Rate Test for all constituents listed in Table 8.
b. If:
    i. well pump test results indicate the presence of a breach in confinement that the Permittee cannot precisely locate in order to perform corrective action or cannot eliminate through the application of best available technology; and
    ii. the Permittee proposes operational controls and monitoring as the corrective action plan, the Director may require the Permittee to perform groundwater modeling or additional pump testing to demonstrate that the wellfield design and monitoring systems are sufficient to control and detect any potential excursions before issuing any Authorization to Inject.

2. Limited Authorization to Inject

a. The Limited Authorization to Inject document will include specification of the approved fluid that will be injected during the Step Rate Test described in Part II, Section J.1.

b. No injection into Burdock Wellfields 6 and 7 will be authorized until after the Aquifer Exemption of Inyan Kara groundwater in that area has been approved by the Director.

3. Information to Submit to the Director to Obtain Approval of the Proposed Exemption of Inyan Kara Aquifers within the Proposed Aquifer Exemption Boundary around Burdock Wellfields 6 and 7

If the Permittee has not demonstrated to the Director that Well 16 located in NWSE Section 1 T7S R1E has been plugged and abandoned before issuance of the Final Class III Area Permit, the Permittee shall submit the following information to the Director for proposing exemption of the Inyan Kara aquifer within the proposed exemption boundary:

a. Injection Authorization Data Package Reports including all the information under Part II, Sections B through G and Section I. This information will serve as additional analysis of the amenability of the injection interval to the in-situ method for uranium recovery as required under § 144.7(c)(1).

b. A demonstration that Well 16 located in NWSE Section 1 T7S R1E has been plugged and abandoned.

4. Information to Submit to the Director to Obtain Authorization to Commence Injection

a. Pond Design Criteria and Cumulative Effects Analysis of Wellfield Operations

Before the Director will issue written Authorization to Commence Injection, the Permittee must submit information to the Region 8 Air Program for the EPA to determine the applicability of the 40 CFR Part 61 Subpart W regulations, and if necessary, receive construction approval from the EPA.

b. Step Rate Tests Results

i. After obtaining the Limited Authorization to Inject for a wellfield, the Permittee shall inject only for the purpose of conducting the Step Rate Tests indicated in Table 9.

ii. The Permittee shall provide information to the Director for evaluation as required under Part II, Section J. Possible locations for conducting Step Rate Tests are shown in Figures 3 and 4.

Table 9. Step Rate Tests to be Performed to Determine Fracture Gradient for the Determination of MAIP

Area	Injection Interval Formation	Test Well Location
Dewey Area	Lower Fall River	Perimeter monitoring well ring for Dewey Wellfield 1 outside of the perimeter monitoring wells rings for Dewey Wellfields 2 and 4
Dewey Area	Lower or Middle Chilson Sandstone	Perimeter monitoring well ring for Dewey Wellfield 2 outside of the perimeter monitoring wells rings for Dewey Wellfields 1 and 4
Burdock Area	Lower or Middle Chilson Sandstone	Perimeter monitoring well ring for Burdock Wellfield 1 outside of the perimeter monitoring wells rings for Burdock Wellfields 2, 3, 4 and 6

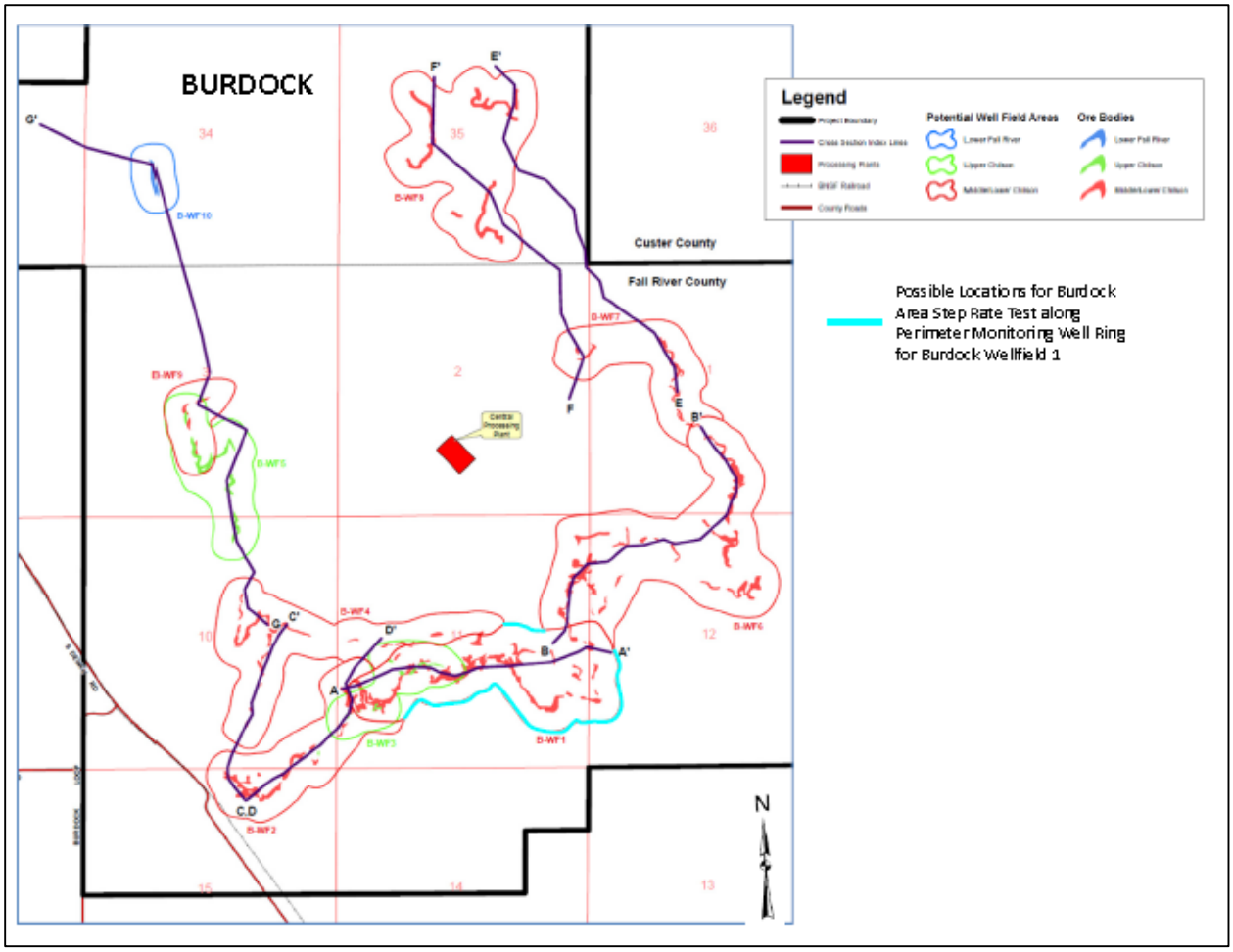


Figure 3. Possible Locations for Step Rate Test in Burdock Area.

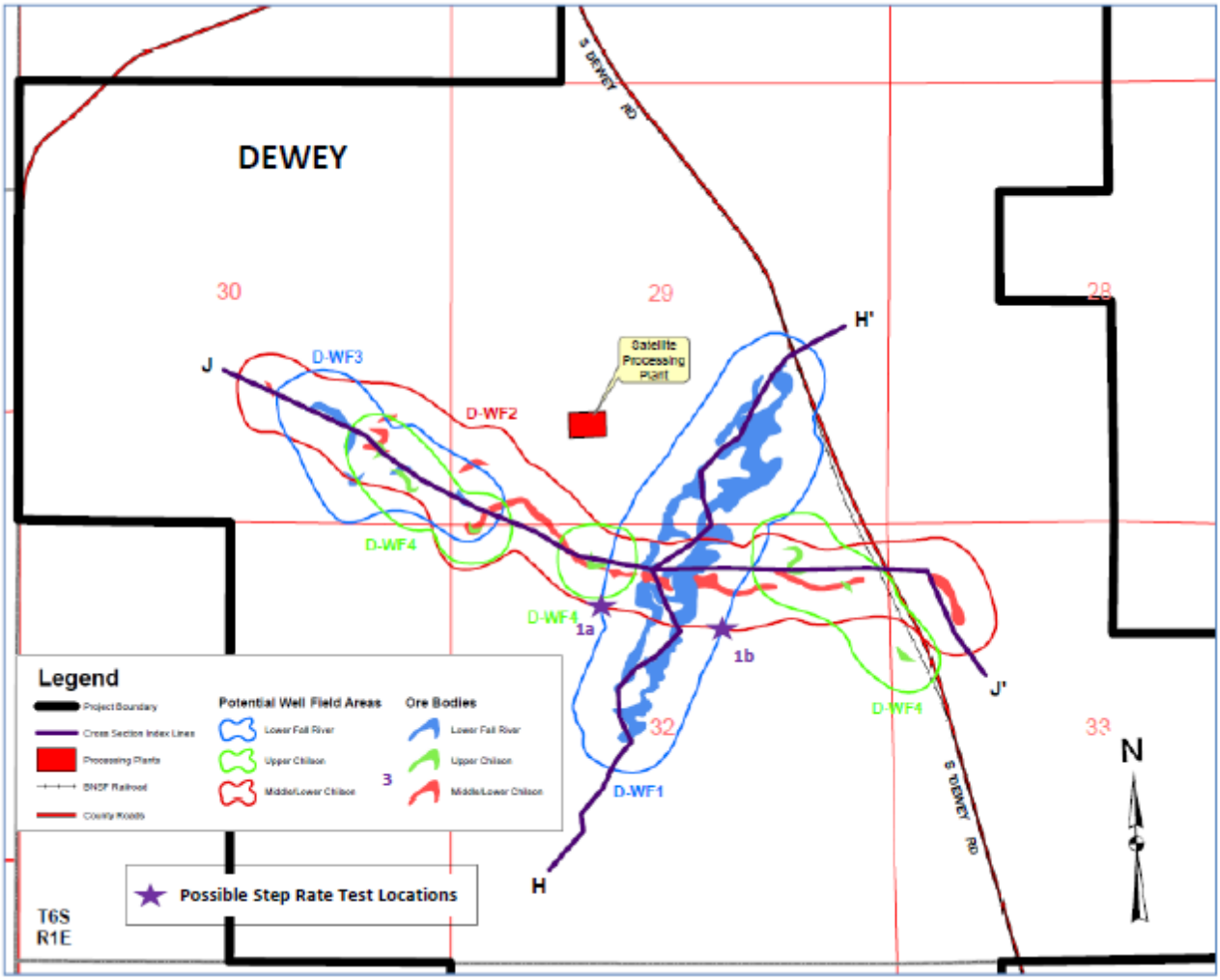


Figure 4. Possible Locations for Step Rate Test in Dewey Area.

J. Step Rate Test and Determination of Fracture Gradient

1. Fracture Pressure Determination

a. The Permittee shall run an injection Step Rate Test at a perimeter monitoring well ring well at the locations indicated in Table 9 to determine the site-specific pressure at which fractures form in the injection interval at each testing location.

b. During the Step Rate Test the Permittee shall monitor pressure within the injection interval, as well as surface injection pressure.

c. The Step Rate Test results shall be submitted to the Director for evaluation.

2. Fracture Gradient Calculation

After the site-specific fracture pressure for the injection interval has been determined based on the Step Rate Test results. The fracture gradient shall be calculated according to the following formula:

$$fg=FP/d$$

FP = fracture pressure measured in the injection interval (based on Step Rate Test)

fg = fracture gradient (calculated value)

d = depth to pressure sensor in injection interval

3. Loss in Pressure due to Friction

a. There may be a pressure loss due to friction between the injectate and the injection tubing.
b. During the Step Rate Test, if the pressure measured at the injection interval sensor is less than the pressure measured at the surface gauge plus the pressure from the weight of the injectate in the injection tubing, this is the pressure loss due to friction.
c. This pressure loss at the injection interval fracture pressure may be calculated and added back into the MAIP calculated under Part VIII, Section E.1.

K. Plugging and Abandonment of Wellfield Wells

If evaluation of the Injection Authorization Data Package Reports indicate the hydrogeologic conditions are not conducive to the in-situ recovery of uranium, the EPA will not issue authorization to commence injection and the Permittee shall plug and abandon all wellfield wells according to the requirements under Part XI of this Area Permit.

PART III. CORRECTIVE ACTION

Corrective action requirements are as follows.

A. Water Supply Wells near Wellfields

1. All water supply wells within ¼ mile of the wellfield shall either be plugged and abandoned or monitored during the wellfield pump test to determine if they have potential to be impacted by ISR operations or to impact ISR operations.
2. If wellfield pump test results demonstrate that a water supply well causes no breach in a confining zone, the Permittee may continue to use the well for monitoring.
3. The Permittee shall notify the well owner in writing prior to removing any well from private use and work with the well owner to determine whether a replacement well or alternate water supply is more appropriate.

B. Wellfield Delineation Drilling and Pump Testing

If the more detailed hydrogeologic evaluation during the delineation drilling or wellfield-scale pump testing prior to the development of each wellfield indicates a breach in a confining zone that could serve as a potential pathway for groundwater movement through an unplugged or improperly plugged drillhole, a well or a natural geologic structure:

1. The Permittee shall attempt to determine the location of the feature causing the breach using best available technology and best professional practices.
2. If the feature can be located and is man-made, then corrective action shall be performed to repair the breach in confinement.
3. If the feature is a naturally occurring geologic structure or if the feature cannot be located precisely enough to conduct corrective action or cannot be repaired, then wellfield operational controls shall be designed to contain injection interval fluids to the injection interval.
4. When features causing a breach cannot be precisely located or corrective action cannot be successfully performed and operational controls are the method of corrective action, the Permittee shall demonstrate that the number and placement of non-injection interval monitoring wells are capable of detecting any loss of hydraulic control in that area per 40 CFR § 144.55(b)(4).
5. Demonstration of the effectiveness of the monitoring system may include additional pump testing or groundwater modeling as determined by the Director after the evaluation of the wellfield Injection Authorization Data Package Report.

C. Documentation of Corrective Action

1. The Permittee shall document all corrective action activities performed according to the requirements under Part III Sections A and B and include the information in the Injection Authorization Data Package Report for each wellfield as described in Part II, Section H.
2. The Injection Authorization Data Package Report shall also include a description of corrective action implementation and completion status.

PART IV. DOWN-GRADIENT COMPLIANCE BOUNDARY BASELINE MONITORING AND POST-RESTORATION MONITORING PLAN

A. Down-gradient Compliance Boundary Post-Restoration Monitoring Plan

1. Prior to wellfield operation, the Permittee shall prepare a Down-gradient Compliance Boundary Post-Restoration Monitoring Plan which includes a proposed location for a Down-gradient Compliance Boundary to verify that no contaminants will cross the down-gradient aquifer exemption boundary at each wellfield after wellfield restoration has been completed.
2. The Plan shall also include a **Baseline Monitoring Plan** for determining the final baseline value for each water quality constituent in Table 8 for each Down-gradient Compliance Boundary Well.
3. The Permittee shall submit each wellfield Down-gradient Compliance Boundary Post-Restoration Monitoring Plan to the Director for review and approval.
4. The Director may require modification of the approved Down-gradient Compliance Boundary Post-Restoration Monitoring Plan upon determination that modification is required for the protection of USDWs without modification to this Area Permit under 40 CFR § 144.39.

B. The Post-Restoration Monitoring Plan Shall Meet the Following Requirements:

1. The Permittee shall determine the locations for the Down-gradient Compliance Boundary Wells and install them at the time of wellfield construction.
2. The Permittee shall determine the locations for the Down-gradient Compliance Boundary Wells according to the criteria in Appendix B of this Area Permit. The proposed Down-gradient Compliance Boundary may be located anywhere between the down-gradient portion of the wellfield perimeter monitoring well ring and the down-gradient wellfield boundary.
3. The Permittee shall ensure that the Down-gradient Compliance Boundary extends far enough at each end to capture all restored wellfield groundwater flowing down-gradient as illustrated in Appendix B Figure B2. If the Down-gradient Compliance Boundary Wells are pumped, a map similar to Figure B2 is sufficient to demonstrate this requirement. If the Permittee elects not to pump the wells, a groundwater flow model that accounts for dispersion of restored wellfield groundwater as it flows down-gradient shall be used to demonstrate this requirement.
4. The distance between the Down-gradient Compliance Boundary Monitoring Wells shall be set to ensure no greater than a 70 degree angle between adjacent Down-gradient Compliance Boundary Monitoring Wells and the nearest mutual point on the wellfield boundary as shown in Appendix B Figure B3.
5. The Permittee shall provide wellfield pump testing water level monitoring information demonstrating that the Down-gradient Compliance Boundary Wells are in hydraulic communication with the wellfield injection interval.
6. The Permittee shall calculate the average linear velocity of groundwater flow and travel time of groundwater located at each down-gradient wellfield boundary well to reach the each Down-gradient Compliance Boundary well under natural flow conditions or Down-gradient Compliance Boundary well pumping conditions, depending on which option the Permittee selects.
7. The Post-Restoration Monitoring Plan shall include a work plan for the laboratory testing discussed under Section D of this Part.

8. At the onset of the Post-Restoration Monitoring period, injection of conservative tracers (in addition to chloride) may be used to "tag" the groundwater at the down-gradient wellfield edges to assist in the tracking the arrival of the restored wellfield groundwater at the post-restoration Down-gradient Compliance Boundary wells.
9. The Permittee shall use chloride as a tracer, and may elect to inject additional tracers, to determine when restored wellfield groundwater has arrived at the Down-gradient Compliance Boundary. The EPA will not consider constituents used as tracers to be ISR contaminants. Authorization to inject the tracers will be included in the Director's approval of the Post-Restoration Monitoring Plan.
10. The Permittee shall also evaluate the potential impacts of groundwater located upgradient of the restored wellfield to mobilize ISR contaminants precipitated or adsorbed onto injection interval aquifer matrix down-gradient of the restored wellfield. The purpose of this evaluation is to ensure that no rebound of contaminant concentrations occurs once the upgradient groundwater passes through the portion of the injection zone aquifer located down-gradient of the restored wellfield where ISR contaminants may have been precipitated or adsorbed onto the injection zone aquifer matrix. To comply with this requirements, the Permittee shall identify a minimum of three wellfield upgradient boundary wells at locations that ensure the capture zones for the Down-gradient Compliance Boundary wells (whether these wells are monitored under pumped or natural groundwater flow conditions) will include upgradient groundwater passing through restored wellfield areas. The three wellfield upgradient boundary wells shall also be widely distributed across the wellfield. See Appendix B, Figure B for additional explanation of wellfield upgradient boundary well requirements.
11. At the onset of the Post-Restoration Monitoring period, the Permittee shall inject conservative tracers at a minimum of three upgradient wellfield boundary wells that will be used to evaluate the impacts of upgradient groundwater flow upon the restored wellfield groundwater in order to "tag" the arrival of the upgradient groundwater at the Down-gradient Compliance Boundary.
12. The Permittee shall include an explanation of where the tracers will be injected and how the tracers will be used to identify the arrival of restored wellfield groundwater and up-gradient groundwater at the Down-gradient Compliance Boundary Wells.
13. Under conditions of natural groundwater flow, Post-Restoration Monitoring shall consist of analysis of Down-gradient Compliance Boundary Well groundwater samples collected from each well every six (6) months for a minimum duration of two (2) years past the travel time for the restored wellfield groundwater to reach the Down-gradient Compliance Boundary as indicated by the presence of the tracer.
14. Alternatively, the Permittee may pump the Down-gradient Compliance Boundary Wells to decrease the travel time for the wellfield groundwater and upgradient groundwater to reach the Down-gradient Compliance Boundary. In that case, the Permittee shall determine a sampling frequency that will provide statistically independent groundwater samples. That frequency may increase near the calculated time of arrival of restored wellfield at the Down-gradient Compliance Boundary and again at the calculated time of arrival of upgradient groundwater at the Down-gradient Compliance Boundary.
15. Groundwater samples shall be collected from each pumped Down-gradient Compliance Boundary Well for a minimum duration of one (1) year past the arrival of the upgradient groundwater at the Down-gradient Compliance Boundary as indicated by the presence of the tracer.
16. The groundwater pumped from the Down-gradient Compliance Boundary Wells may be reinjected at the up-gradient perimeter monitoring well ring wells. Authorization to reinject the groundwater pumped from the Down-gradient Compliance Boundary Wells will be included in the Director's approval of the Post-Restoration Monitoring Plan if pumping of Down-gradient Compliance Boundary Wells is proposed.
17. If the Permittee elects to stop pumping the Down-gradient Compliance Boundary Wells after the arrival of the upgradient groundwater tracer(s) at the Down-gradient Compliance Boundary, then Post-Restoration Monitoring shall consist of the collection of groundwater samples from each Down-gradient Compliance Boundary Well every six months for a minimum duration of two (2) years after pumping ceases in the Down-gradient Compliance Boundary Wells.

18. The Permittee shall continue the Post-Restoration Monitoring until the data show that the analytical results from the four (4) most recent consecutive sampling events indicate no statistically significant increasing trend for all baseline constituent concentrations.

C. Determination of Baseline Constituent Concentrations to be used as Permit Limits for Post-Restoration Monitoring Wells

1. The Permittee shall collect quarterly groundwater samples from each Down-gradient Compliance Boundary Well and analyze the samples for the baseline water quality parameters listed in Table 8. The quarterly groundwater samples shall be collected according to the requirements under Part II, Section E.2.b. Quarterly groundwater samples shall be collected beginning just after the completion of well development to remove residual particulate material from drilling and construction.
2. The samples shall be analyzed using the methods shown in Table 8. Equivalent analytical methods may be used after prior approval by the Director.
3. The Permittee shall include any analytical results available for the Down-gradient Compliance Boundary Wells at the time the Post-Restoration Monitoring Plan is submitted.
4. After receiving analytical results from the last sample set collected before injection begins in the wellfield, the Permittee shall determine and propose **initial baseline values** for each constituent listed in Table 8 using analytical results from Down-gradient Compliance Boundary Wells.
5. The Permittee shall conduct a statistical trend analysis with a 95 % confidence interval on the analytical results from each Down-gradient Compliance Boundary Well for each baseline constituent listed in Table 8 to determine if there are any upward or downward trends in concentrations. The Permittee shall use *STATISTICAL ANALYSIS OF GROUNDWATER MONITORING DATA AT RCRA FACILITIES UNIFIED GUIDANCE MARCH 2009 EPA 530/R-09-007 (The Unified Guidance)* for selecting and implementing the statistical method for trend analysis.
6. If the trend analysis indicates any baseline constituent concentration initially decreased over time due to impacts of well construction, the baseline concentration for that constituent shall be determined from the constituent concentration values after the concentration levels stabilized.
7. Initial baseline values may apply to all Down-gradient Compliance Boundary Wells, or, if there is spatial variation of baseline constituent concentrations among Down-gradient Compliance Boundary Wells, initial baseline values may be applied to a subset of wells or on a well-by-well basis. The Permittee shall clearly identify which initial baseline concentration values apply to each Down-gradient Compliance Boundary Well.
8. Uranium roll front deposits may extend beyond wellfield boundaries possibly intersecting the Down-gradient Compliance Boundary. The Permittee shall identify any Down-gradient Compliance Boundary Wells located in a uranium ore body. A Down-gradient Compliance Boundary Well located in a uranium ore body could have different baseline water quality concentrations from the other Down-gradient Compliance Boundary Wells. If the baseline constituent concentrations are higher at a Down-gradient Compliance Boundary Well completed in an ore deposit location, the Permittee shall propose baseline permit limits specific for that well. Higher concentration values for constituents at Down-gradient Compliance Boundary Wells located in a uranium ore deposit shall not be used in the determination of initial baseline concentrations of other Down-gradient Compliance Boundary Wells.
9. The Permittee shall propose a statistical design for groundwater data analysis as part of the Baseline Monitoring Program to evaluate analytical results from the Down-gradient Compliance Boundary Wells. The Baseline Monitoring Program shall be designed according to the recommendations in *The Unified Guidance* using statistical methods described in that document. The purpose of the Baseline Monitoring Program is to evaluate quarterly analytical results from the Down-gradient Compliance Boundary Wells after wellfield injection begins to determine if any baseline constituent concentration increase represents a statistically significant increase above the initial baseline concentration established for each baseline constituent under 4 above. The Baseline Monitoring Program for constituents with consistent non-detect concentration values shall be similar to Detection Monitoring discussed in Part II of *The Unified Guidance*. The Baseline

Monitoring Program for constituents with initial baseline values above the non-detect value shall be similar to Chapter 7, *Strategies for Compliance/Assessment and Corrective Action* in *The Unified Guidance*.

10. In order for the Post-Restoration Monitoring Program to have adequate statistical power to detect true concentration increases above baseline permit limits and to minimize the chance of a false positive during the Baseline Monitoring Program, initial baseline values shall be updated according to Section 5.3 in *The Unified Guidance* for constituents with initial baseline concentration values above non-detect.
11. As part of the Baseline Monitoring Program the Permittee shall select statistical methods from *The Unified Guidance* to be used in evaluating groundwater monitoring data for each baseline constituent listed in Table 8 to determine if analytical results for a baseline constituent can be used to update the initial baseline concentration for that constituent according to Section 5.3 in *The Unified Guidance* for constituents with initial baseline concentration values above non-detect.
12. The Permittee shall follow the procedures discussed in Part IV of *The Unified Guidance* regarding Compliance/Assessment Monitoring to determine if a statistically significant analyte concentration increase has occurred during Baseline Monitoring that would indicate an analytical result should not be used in the determination of final baseline concentration permit limits.
13. If a statistically significant concentration increase is observed for a baseline constituent during baseline monitoring, the Permittee may use retesting to confirm that the statistically significant concentration increase actually occurred. Retesting strategies shall be proposed and conducted as discussed in *The Unified Guidance* in Chapters 19 and 20.
14. The proposed initial baseline values for each baseline constituent listed in Table 8 and the proposed statistical design for the Baseline Monitoring Program shall be submitted to the Director for review and approval as soon as possible after initial baseline values have been determined in order to obtain approval from the Director before the first quarterly sampling date under the Baseline Monitoring Program.
15. After injection begins in the wellfield, additional quarterly samples shall continue to be collected from the Down-gradient Compliance Boundary Wells and analyzed for the baseline water quality parameters in Table 8 under a Baseline Monitoring Program.
16. The Baseline Monitoring Program for the Down-gradient Compliance Boundary Wells shall be in effect through the end of wellfield restoration.
17. The Director may require modification of the approved Baseline Monitoring Program upon determination that modification is required for the protection of USDWs without modification to this Area Permit under 40 CFR § 144.39.
18. During the course of the Baseline Monitoring Program, if a trend analysis interval or other statistical test identifies a baseline constituent concentration increase due to impact from an excursion (analytical results show elevated levels of excursion indicators: chloride, specific conductance or alkalinity, but no elevated concentrations of total metals) or lixiviant flare (analytical results show elevated levels of excursion indicators: chloride, specific conductance or alkalinity and elevated concentrations of total metals), the concentrations of constituents measured during the excursion or after the lixiviant flare has affected the well shall not be used in the determination of final baseline concentrations. Quarterly monitoring shall continue, but the concentration values shall not be used to update initial baseline or be used in the determination of final baseline until a statistical test indicates the concentrations have decreased back to a level that is not a statistically significant increase over initial baseline or updated initial baseline.
19. If a Down-gradient Compliance Boundary Well is located in the flare zone, the aquifer geochemical absorption or reductive capacity may not be great enough to enable the restored wellfield groundwater to meet baseline permit limits at that particular Down-gradient Compliance Boundary Well. If the Permittee decides to use a Down-gradient Compliance Boundary Well that is located within the flare zone, a statistical analysis shall demonstrate that the groundwater at any lixiviant-impacted Down-gradient Compliance Boundary Well is no longer affected by the lixiviant before Post-Restoration monitoring begins. Alternatively, as soon as the flare zone has impacted a Down-gradient Compliance Boundary Well, the Permittee may construct a replacement Down-gradient Compliance Boundary Well located down-gradient

from the flare zone boundary and immediately begin baseline monitoring at the new Down-gradient Compliance Boundary Well. The analytical results from the new well shall be compared with those of the old well before it was impacted by the flare zone to determine if baseline concentrations from the new well are statistically similar to those of the original well. If so, then the analytical results from the original well may be used in determining final baseline at the replacement Down-gradient Compliance Boundary Well.

20. The Permittee shall demonstrate that the groundwater at any Down-gradient Compliance Boundary Well located in a flare zone or impacted by an excursion is no longer affected by the excursion or lixiviant flare before Post-Restoration monitoring begins.
21. Upon initiation of the wellfield restoration stability monitoring, the Permittee shall conduct a statistical trend analysis with a 95 % confidence interval on each baseline constituent listed in Table 8 to determine if there are any upward or downward trends in concentrations. The Permittee shall use *The Unified Guidance* for selecting and implementing the statistical method for trend analysis.
22. The Permittee shall determine and propose final baseline concentrations that will serve as permit limits for the Down-gradient Compliance Boundary Wells during Post-Restoration Monitoring. A final baseline value may apply to all Down-gradient Compliance Boundary Wells, or, if there is spatial variation of baseline constituent concentrations among Down-gradient Compliance Boundary Wells, final baseline values may be applied to a subset of wells or on a well-by-well basis. The Permittee shall clearly identify for which well or wells each final baseline concentration value applies.
23. After the final baseline concentrations have been determined, the Permittee shall submit the proposed final baseline concentrations and statistical analyses conducted separately for each baseline constituent in each Down-gradient Compliance Boundary Well to the Director for approval. Upon approval by the Director, baseline concentrations will become the permit limits for the Down-gradient Compliance Boundary Wells during Post-Restoration Monitoring.
24. Any statistical method used shall comply with the following performance standards, as appropriate:
    a. The statistical method used to evaluate groundwater monitoring data shall be appropriate for the distribution of each baseline constituent in Table 8. If the distribution of the baseline constituent is shown by the Permittee to be inappropriate for a normal theory test, then the data should be transformed or a distribution-free theory test should be used. If the distributions for the baseline constituents differ, more than one statistical method may be needed.
    b. Once baseline monitoring begins, if an individual monitoring well comparison statistical test procedure is used to compare an individual well concentration with a baseline constituent concentration permit limit, the test shall be done at a Type I error level no less than 0.01 for each testing period. If a multiple comparisons procedure is used, the Type I experiment-wise error rate for each testing period shall be no less than 0.05; however, the Type I error of no less than 0.01 for individual well comparisons must be maintained. (This performance standard does not apply to tolerance intervals, prediction intervals or control charts.)
    c. If a control chart method is used to evaluate groundwater monitoring data, the specific type of control chart and its associated parameter values shall be proposed by the Permittee for approval by the Director after determination that the control chart statistical method is protective of human health and the environment.
    d. If a tolerance interval or a prediction interval is used to evaluate groundwater monitoring data, the levels of confidence and, for tolerance intervals, the percentage of the population that the interval must contain, shall be proposed by the Permittee for approval by the Director after determination that the tolerance interval or a prediction interval is protective of USDWs. These parameters will be determined after considering the number of samples in the background data base, the data distribution, and the range of the concentration values for each baseline constituent.
    e. The statistical method shall account for data below the limit of detection with one or more statistical procedures in *The Unified Guidance* that are protective of USDWs. Any practical quantification limit (pql) approved by the Director that is used in the statistical method shall be the lowest concentration level

that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions that are available to the Permittee.

f. If necessary, the statistical method shall include procedures to control or correct for seasonal and spatial variability as well as temporal correlation in the data.

D. Laboratory Column Testing to Verify Attenuation Capability of Down-gradient Injection Zone Aquifer

1. Once wellfield restoration has been completed in a wellfield and restored wellfield groundwater is available for use in the following laboratory tests, the Permittee shall use the injection zone core samples collected as required under Part II, Section D.5 to conduct columns tests according to the following specifications:
   a. Compile vertical composite samples from single cores and conduct at least two laboratory bench-scale column tests per wellfield on the composite samples.
   b. The two column tests shall be conducted using the following leachates:
      i. One column test shall be conducted using unrestored wellfield groundwater taken from a wellfield in which uranium recovery has been initiated, but before groundwater restoration has begun, and
      ii. The second column test shall be conducted using restored wellfield groundwater.
   c. The column testing fluids shall be analyzed for the analytes in Table 8 before and after recovery from the column so that changes in analyzed constituent concentrations may be determined.
   d. After the tests in Part IV, Sections D.1.b.i and D.1.b.ii have been completed, a second round of tests shall be run on these same columns using groundwater collected from up-gradient perimeter monitoring wells to determine if any constituents adsorbed or precipitated on the column matrix during the Part IV, Sections D.1.b.i and D.1.b.ii column tests are released into solution by the up-gradient groundwater leachate. The up-gradient groundwater samples shall be analyzed for constituents in Table 8 before and after recovery from the column test to determine if there is a statistically significant increase in analyzed constituent concentrations after leaching through the column.
   e. If the Part IV, Sections D.1.b.i and D.1.b.ii column test leachates show an insufficient decrease in ISR contaminant concentrations after passing through the columns or the up-gradient perimeter monitoring well groundwater tests show an increase in contaminant levels after passing through the columns, then the Permittee shall submit a groundwater treatment plan to the Director for approval describing measures for preventing ISR contaminants from crossing the down-gradient aquifer exemption boundary. The plan shall include geochemical modeling results demonstrating that no ISR contaminants will cross the down-gradient aquifer exemption boundary. The geochemical model shall be calibrated with laboratory and/or field data.

PART V. WELL CONSTRUCTION REQUIREMENTS

The following requirements represent the approved minimum construction standards for well casing and cement for injection and production wells.

A. Approved Well Construction Plan

Details of the approved well construction plan required by 40 CFR § 144.52(a)(1) are incorporated into this Permit in the following sections and Figures 5 through 9.

B. Requirements for Changes to Approved Well Construction Plan

1. Changes in construction plans during construction may be approved by the Administrator as minor modifications under 40 CFR § 144.41.
2. No such changes may be physically incorporated into construction of the well prior to approval of the modification by the Director in accordance with 40 CFR § 144.52(a)(1).
3. After initial well construction is complete, any subsequent changes in well construction will require a major modification of this Area Permit according to 40 CFR § 144.39 and § 124.5.

Figure 5. Well Construction Design

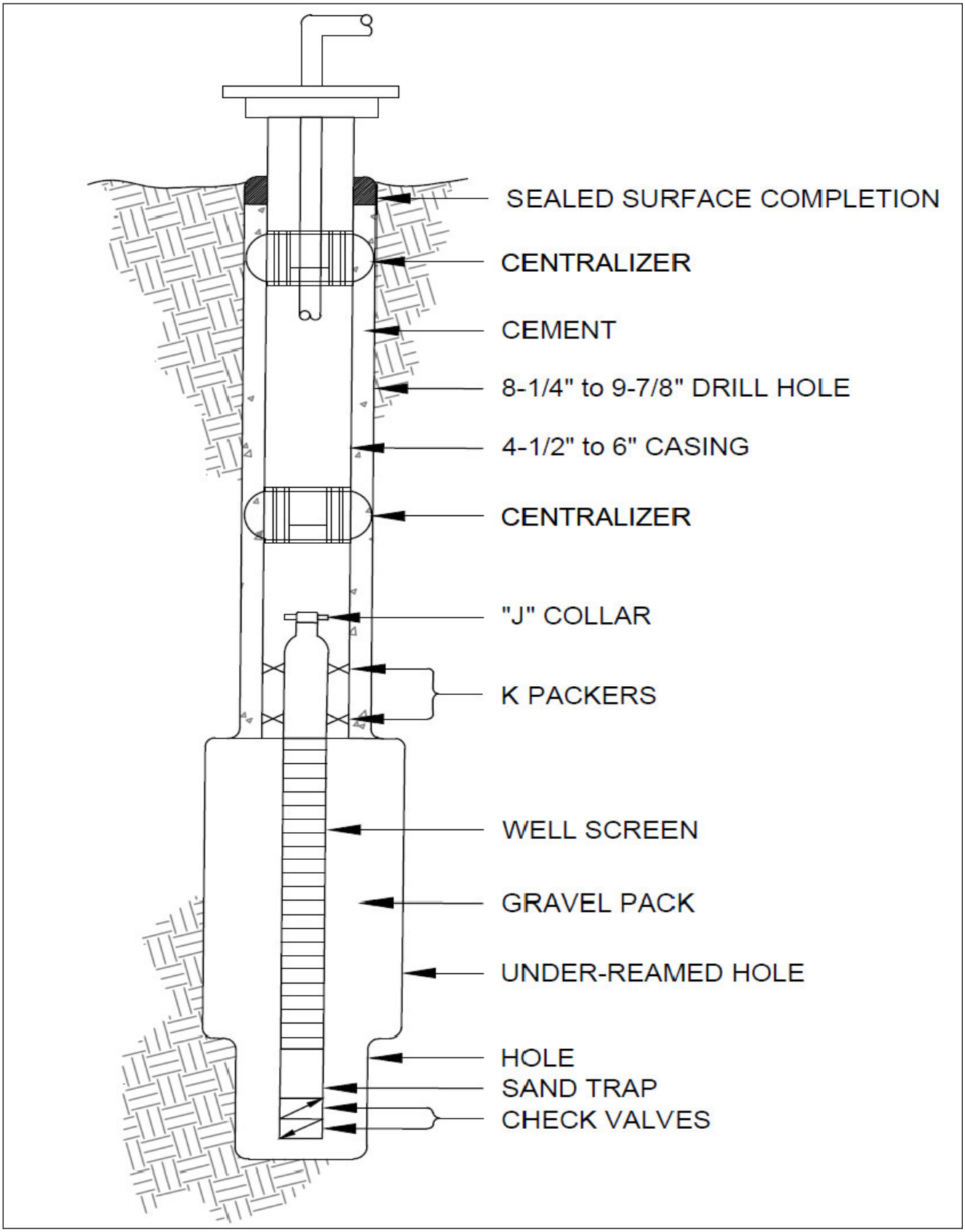


Figure 6. Injection Wellhead Design

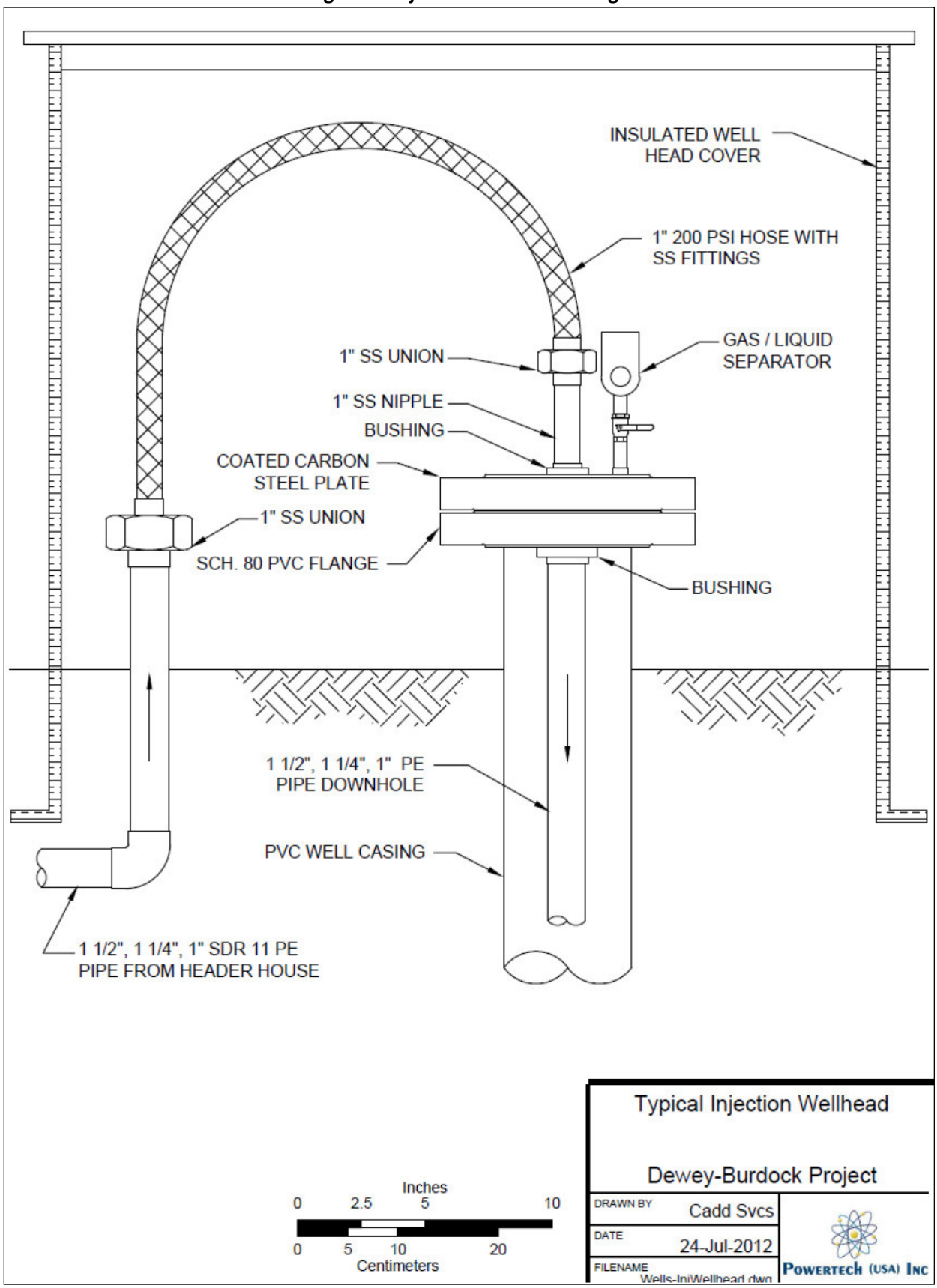
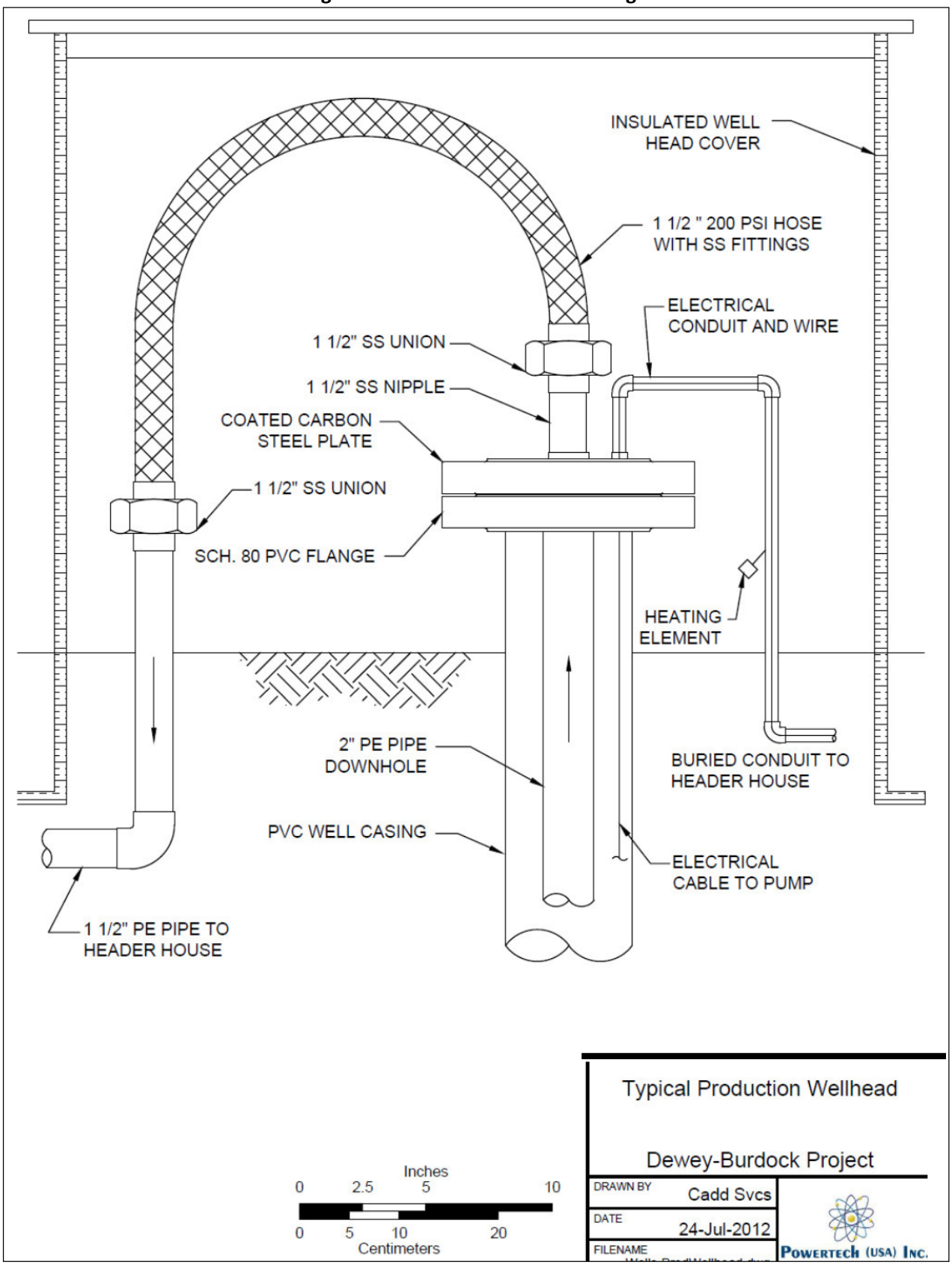


Figure 7. Production Wellhead Design



C. Well Logging

1. The logs listed in Table 10 shall be conducted during or after the drilling of all wellfield injection and production wells. A descriptive report interpreting the results of such logs shall be prepared by a knowledgeable log analyst and submitted to the Director as part of the well construction report required in Section G of this Part.
2. Deviation checks shall be conducted on all holes where pilot holes and reaming are used, unless the hole will be cased and cemented by circulating cement to the surface. Where deviation checks are necessary they shall be conducted to assure that vertical avenues for fluid migration in the form of diverging holes are not created during drillings.
3. The Permittee shall ensure the log requirements are performed on each injection and production well within the time frames specified in Table 10. Well logs shall be performed according to current EPA-approved procedures, where applicable.

Table 10. Well Drillhole Logging Program

TYPE OF LOG	PURPOSE	DUE DATE
Physical Geologic Log	To identify lithology and stratigraphy	During drilling
Gamma Ray	To identify ore depth and thickness	Prior to reaming hole to set casing
Self Potential	To identify depth and thickness of confining zones and aquifer units.	Prior to reaming hole to set casing
Resistivity	To identify depth and thickness of confining zones and aquifer units.	Prior to reaming hole to set casing

D. Well Construction Procedures

1. In order to provide an adequate annular seal, the drillhole diameter shall be at least 2 inches larger than the outside diameter of the well casing.
2. A continuous string of joined casing shall be placed into the reamed borehole.
3. Casing centralizers shall be installed as needed, a minimum of two, along the casing string to ensure that annulus space surrounding the casing is consistent.
4. When designing and installing injection, production and monitoring wells, the Permittee shall adhere to the requirements of ASTM F480 and manufacturer's criteria to ensure that the installation does not exceed the well casing hydraulic collapse resistance.

E. Well Casing and Cement

1. General Requirements

a. All injection, production and monitoring wells shall be cased and cemented to prevent the migration of fluids into or between underground sources of drinking water.
b. When a well intersects alluvium at the ground surface, surface casing shall be set 50 feet below the base of the alluvium and cemented to the surface.
c. The well casing and cement used in the construction of each injection and production well shall be designed for the life expectancy of the well.
d. The well casing, injection pipe and cement shall be chemically compatible with the injectate and formation fluids.
e. The piping connecting the wellfield injection and production wells to the header houses shall have a pressure rating greater than the highest maximum injection pressure within the wellfield.
f. Remedial cementing may be required if well cement is shown to be inadequate as a demonstration of external mechanical integrity as discussed in Part VII, Section D.

2. Well Casing Requirements

Injection and production well casing shall:

a. Meet or exceed the specifications of ASTM Standard F480 and NSF Standard 14 for thermoplastic pipe;
b. Have a Standard Dimension Ratio no greater than SDR 17;
c. Have a pressure rating that exceeds the highest maximum allowable injection pressure for the wellfield and
d. Casing joints shall be joined using methods recommended by the casing manufacturer to ensure a water tight seal between joints. The details of the joining methods shall be included in the well completion report.

Table 11. Well Casing Dimensions for SDR 17

Proposed Casing Pipe Diameter (inches)	Minimum Casing Pipe Wall Thickness (inches)	Minimum drillhole Diameter (inches)
4.5	0.265	6.5
6.0	0.353	8.0

3. Injection Piping Requirements

The injection or production pipe shall:

a. meet or exceed the specifications of ASTM Standard D2239 and NSF Standard 14 for polyethylene pipe,
b. have no greater than SDR 11, and
c. have a pressure rating that exceeds the highest maximum allowable injection pressure for the wellfield.

Table 12. Injection/Production Pipe Dimensions for SDR 11

Proposed Injection/Production Pipe Diameter (inches)	Minimum Casing Pipe Wall Thickness (inches)
1.0	0.09
1.5	0.136

4. Well Cementing Requirements

a. The Permittee shall isolate all USDWs by placing cement between the outermost casing and the well bore from top of well to top of well screen.
b. The Permittee shall use cement:
    i. Of a quantity and quality to withstand the maximum operating pressure; and
    ii. Which is resistant to deterioration from formation and injection fluids; and
    iii. In a quantity no less than 120% of the calculated volume necessary to fill the borehole-casing annulus from the top of the injection interval to the ground surface.
c. With the casing in place, a cement/bentonite grout shall be pumped under pressure into the casing allowing the grout to circulate out the bottom of the casing and back up the casing annulus to the ground surface.
d. The volume of grout necessary to cement the annulus shall be calculated from the bore hole diameter, the outer diameter of the casing, and the depth from the ground surface to the top of injection interval with a minimum of 20% additional allowance to achieve grout returning to surface.
e. Grout remaining inside the well casing shall be displaced by water to minimize the column of the grout plug remaining inside the casing. A bottom hole grout plug shall remain inside casing at completion.
f. The casing and grout then shall be allowed to set undisturbed for a minimum of 24 hours. When the grout has set, if the annular seal observed from ground surface has settled below ground surface, additional grout shall be placed into the annular space to bring the grout seal to ground surface and allowed to set for an additional 24 hours.

5. Well Screen Intervals

a. After the 24-hour (minimum) grout setup period, well construction shall be completed by drilling through the grout plug and through the target completion zone to the specified total well depth.
b. The open borehole shall then be under-reamed to a larger diameter.
c. Injection intervals and well screen intervals shall be authorized only within the vertical interval of the aquifer exemption.
d. Screened injection intervals shall be determined based on results of wellfield delineation drilling and logging and well borehole logging to determine the ore zone interval.
e. Information about the well screen interval shall be included in the well completion report.

F. Calculation of Fracture Pressure

1. The fracture pressure shall be calculated for each well using the depth to the top of the wellfield injection interval as determined from the well logging results required under Section B of this Part.
2. The calculated fracture pressure for each injection and production well shall be included in the well construction report required under Section G of this Part.
3. The fracture pressure shall be calculated according to the following formula:

$$FP = [fg - (0.433 * sg)] * d$$

FP = formation fracture pressure
fg = fracture gradient (determined from nearest Step Rate Test under Part II, Section J.2)
sg = specific gravity = 1.009 (based on maximum estimated TDS of injectate = 12,000 mg/L)
d = depth to top of well screen

G. Well Construction Report

1. After well construction is completed, the Permittee shall prepare a well construction report to submit to the Director as required in Part IX, Section F.4.
2. The well construction information shall be submitted for each well in electronic format containing the data fields from EPA 7520-9 *Completion Form for Injection Wells* and a narrative description of the procedure for the cementing of well casing, logs and tests performed as required under Section C of this Part. EPA form 7520-9 found at http://water.epa.gov/type/groundwater/uic/reportingforms.cfm.
3. The well construction report shall document the adequacy of casing and cementing to prevent USDW contamination through vertical movement of fluids through the well annulus.
4. The report shall contain information as to how the Permittee met the cementing requirements in Part V, Section E.4.
5. Remedial cementing may be required if documentation of cementing requirements are inadequate as a demonstration of external mechanical integrity.
6. The well construction report shall also contain the manufacturer-specified maximum operating pressure for all components of the injection or production well.

H. Postponement of Construction

1. The Permittee shall begin construction of at least one of the proposed wellfields within one year of the Effective Date of the Permit.
2. This Permit will expire if the Permittee has not commenced construction of at least one of the originally proposed wellfields within one year of the Effective Date of the Permit, unless the Permittee has requested an extension from the Director prior to expiration and the Director approves the extension in writing.
3. The Permittee shall request an extension of construction from the Director in writing and shall state the reasons for the delay and provide an estimated construction date.
4. Once this Permit has expired under this part, the complete permit process including opportunity for public comment is required before the Permit can be reissued.

I. Additional Required Equipment for Manifold Monitoring

Under UIC regulation 40 CFR § 146.33(b)(6), Class III wells may be monitored on a field or project basis rather than an individual well basis by manifold monitoring. Manifold monitoring may be used in cases of facilities consisting of more than one injection well, operating with a common manifold.

1. Demonstration that Manifold Monitoring Is Equivalent to Individual Well Monitoring

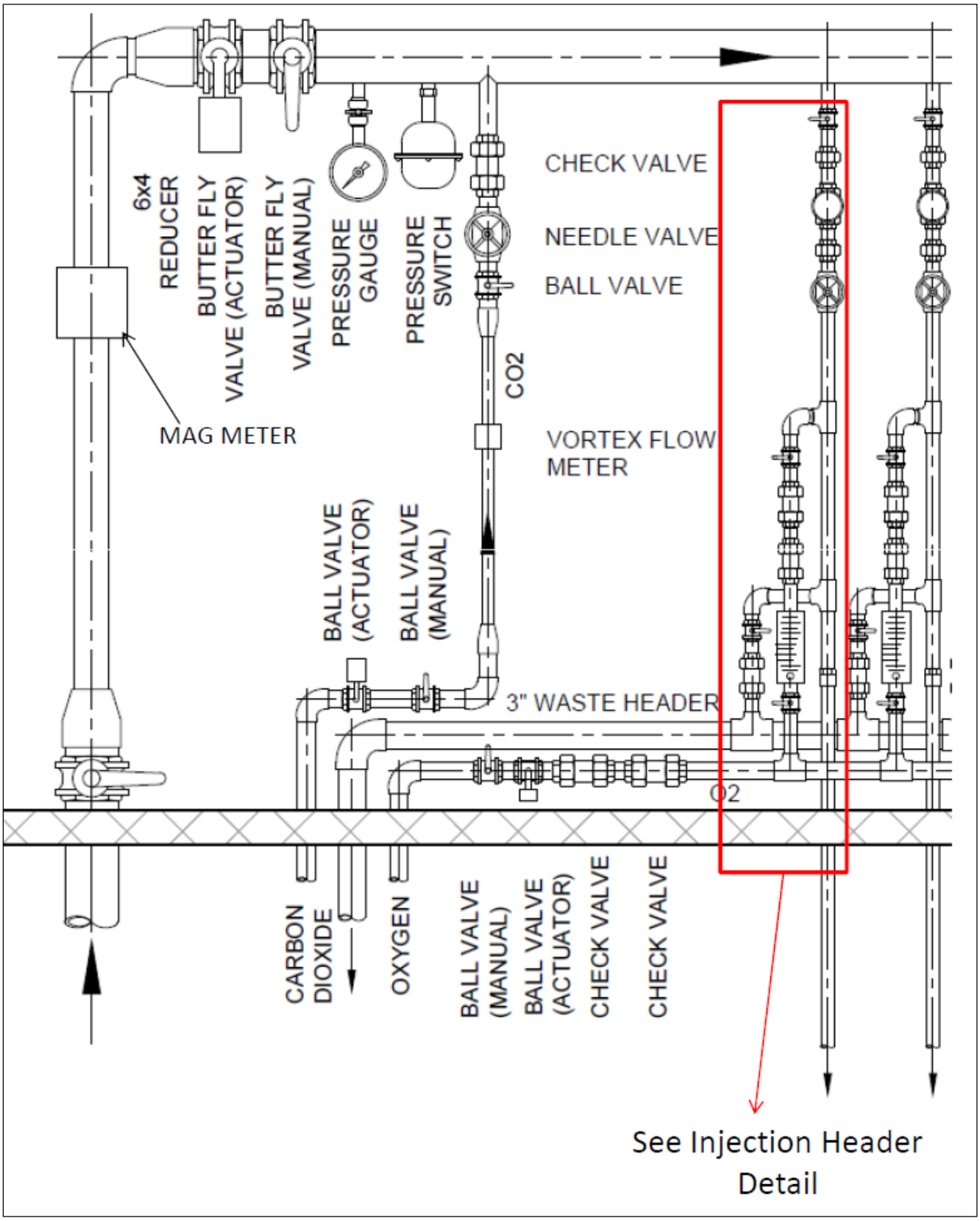
a. In order for the Permittee to use manifold monitoring rather than individual well monitoring and use the header house pressure gauge as the point of compliance for monitoring injection pressure, the Permittee shall demonstrate that manifold monitoring is comparable to individual well monitoring.
b. The Permittee shall demonstrate that the injection pressure measured at the header house pressure gauge is greater than or equal to the injection pressure measured at the wellhead of each well connected to the header house.
c. A demonstration is valid until adjustments are made to the carbon dioxide and oxygen feed lines at the header house, which are located in-line after the header house pressure gauge.
d. If, after the initial demonstration, any adjustments are made to either of these feed lines, another demonstration shall be performed.
e. A record of injection pressures measured at the header houses and at the wellheads shall be provided with the Quarterly Monitoring Report as required under Part IX, Section F.8.

2. The installation of following additional equipment is required for manifold monitoring:

At each wellfield header house the Permittee shall install and maintain in good operating condition the following sampling and monitoring devices for manifold monitoring (as shown in Figure 8):

a. a pressure gauge on the injection manifold line for continuous monitoring of injection pressure and daily recording of the injection pressure for the header house;
b. a pressure switch, as an operational control to prevent exceeding designated maximum injection pressure;
c. designated maximum injection pressure for the header house posted in a visible location near the injection manifold line pressure gauge;
d. a flow meter on the injection manifold line for continuous monitoring of injection flow rate; and
e. injection manifolds (as shown in Figures 8 and 9) equipped with:
    i. flow meters labeled with designated well identification numbers;
    ii. flow control valves to regulate the flow to each well and balance individual well patterns;
    iii. a block valve between the header and the flow meter so that the injection well may be blocked off to service the meter and the well; and
    iv. In the Burdock Central Processing Plant and the Dewey Satellite Facility:
        A) a sampling port in the injectate trunkline to collect representative samples of the injectate for each wellfield;
        B) instrumentation to continuously monitor and measure injectate and production flow rate for the daily recording of the injection and production flow rates for each wellfield; and
        C) instrumentation to continuously monitor and measure injectate and production volumes for the monthly recording of the injection and production volumes for each wellfield.

Figure 8. Injection Header Instrumentation



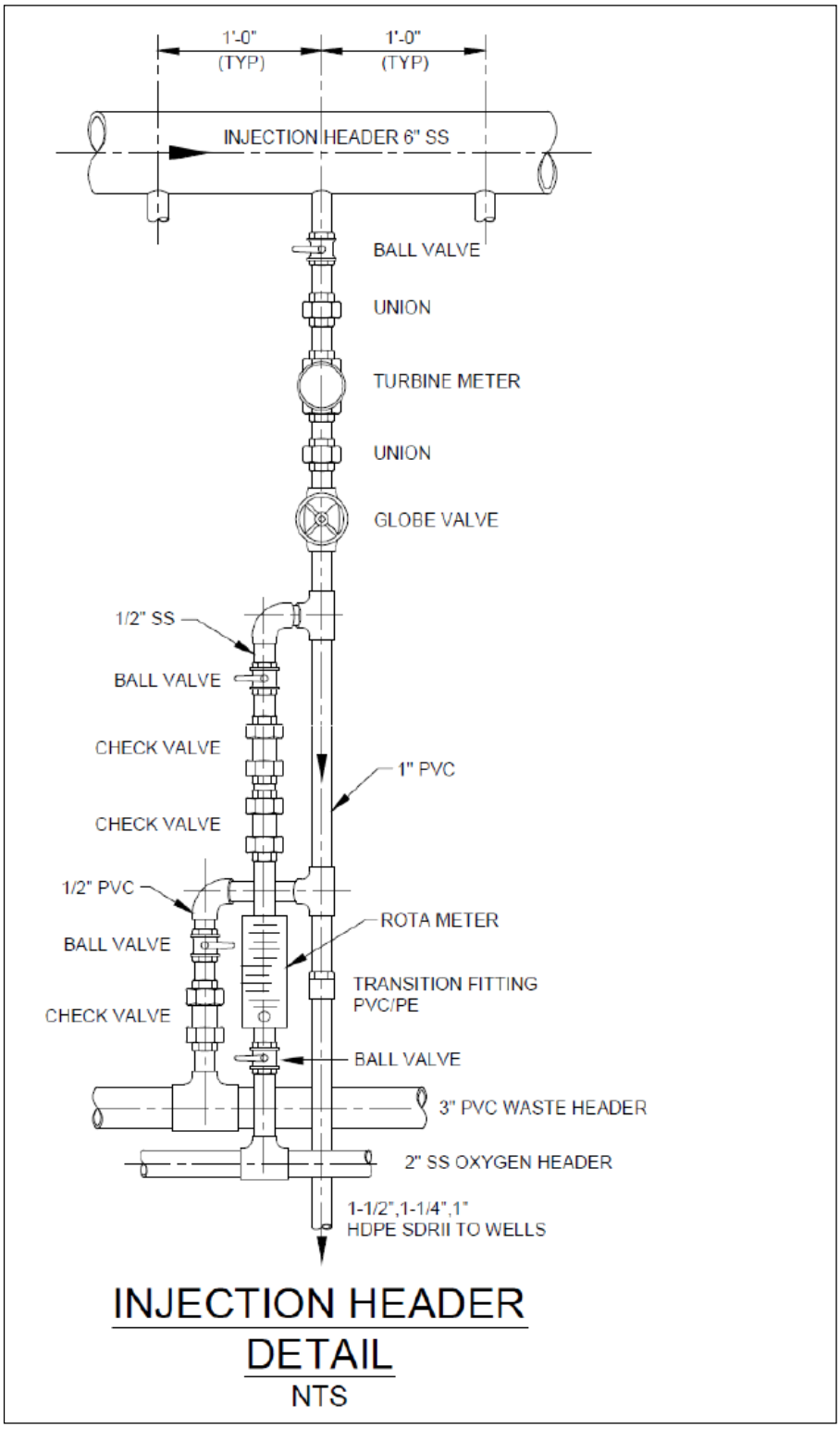
3. Wellhead and Surface Equipment

The Permittee shall install and maintain in good operating condition:

a. At each wellfield header house (as shown in Figure 9):
   i. a pressure gauge on the injection manifold line for continuous monitoring of injection pressure and daily recording of the injection pressure for the header house;
   ii. a pressure switch, as an operational control to prevent exceeding designated maximum injection pressure;
   iii. designated maximum injection pressure for the header house posted in a visible location near the injection manifold line pressure gauge;
   iv. a flow meter on the injection manifold line for continuous monitoring of injection flow rate;
   v. injection manifolds (as shown in Figure 9) equipped with:
      A) flow meters labeled with designated well identification numbers;
      B) flow control valves to regulate the flow to each well and balance individual well patterns;
      C) a block valve between the header and the flow meter so that the injection well may be blocked off to service the meter and the well.

b. In the Burdock Central Processing Plant and the Dewey Satellite Facility:
   i. a sampling port in the injectate trunkline to collect representative samples of the injectate for each wellfield;
   ii. instrumentation to continuously monitoring and measure injectate and production flow rate for the daily recording of the injection and production flow rates for each wellfield; and
   iii. instrumentation to continuously monitor and measure injectate and production volumes for the monthly recording of the injection and production volumes for each wellfield.

Figure 9. Injection Well Header Detail



J. Protective Automated Monitoring and Shut-off Devices

1. An instrumentation and control system shall be installed to monitor pressure and flow and immediately detect and correct any anomalous condition.
2. The instrumentation and control system shall meet the following requirements:
   a. Pressure and flow sensors shall be installed for the purpose of leak detection on the main trunk lines connecting the Burdock Central Processing Plant and the Dewey Satellite Facility to the wellfields.
   b. Injection pressures and flow shall be monitored through automated control and data recording systems that will include alarms and automatic controls to detect and control a potential release.
   c. Measurements shall be collected and transmitted to both the Burdock Central Processing Plant and the Dewey Satellite Facility control systems.
   d. Alarms shall be installed to provide immediate warning to operators should pressures or flows fluctuate outside of normal operating ranges to enable a timely response and implementation of appropriate corrective action.
   e. Both external and internal shutdown controls shall be installed at each header house to provide for operator safety and spill control. The external and internal shutdown controls shall be designed for automatic and remote shutdown of each header house. In the event of an automatic header house shutdown, an alarm will occur and the flows of all injection and production wells in that header house will be automatically stopped. The alarm will activate a blinking light on the outside of the header house and will cause an alarm signal to be sent to the Burdock Central Processing Plant and the Dewey Satellite Facility control rooms.
   f. A control valve that will close when power is turned off or lost as a result of power failure shall be used on the injection header to stop the flow to all injection wells.
   g. A pressure switch will be installed on each injection header to ensure that fluid pressure does not exceed the maximum designated injection pressure for the injection wells served by that header house. If the injection pressure reaches the maximum set value in the pressure switch, an automatic header house shutdown will occur.

Part VI. WORKOVERS AND ALTERATION

A. Requirements for Workovers and Alterations

1. Workovers and Alterations shall meet all conditions of the Permit.
2. Prior to beginning any addition or physical alteration to an injection well's casing or cement, the Permittee shall give advance notice to the Director.
3. Additionally, the Director's written approval must be obtained if the addition or physical alteration to the injection well modifies the approved well construction plan.
4. The Permittee shall record all changes to well construction on a Well Rework Record (EPA Form 7520-12) found at http://water.epa.gov/type/groundwater/uic/reportingforms.cfm, and shall provide this and any other record of well workover, logging, or test data to EPA in the next Quarterly Monitoring Report.
5. If the activities were conducted within 45 days of the next Quarterly Monitoring Report, then the information shall be submitted with the next Quarterly Monitoring Report.

B. Demonstration of Well Mechanical Integrity after Well Workover or Alteration

1. Following the completion of any well workover or alteration which affects the integrity of the casing or cement, the Permittee shall submit to the Director a successful demonstration of internal mechanical integrity according to Part VII, Section C before recommencing injection activities into the well.
2. Injection operations shall not be resumed until the Permittee has successfully demonstrated the well has mechanical integrity.

3. Documentation of mechanical integrity test results shall be included in the next Quarterly Monitoring Report, or if the Permittee would like to recommence injection into the well sooner, the documentation of mechanical integrity test results may be submitted immediately to the Director.
4. If the workover is being conducted because of mechanical integrity loss, the Permittee shall not resume injection until the Director has provided written approval.
5. If a mechanical integrity cannot be successfully demonstrated following a workover, the well shall be plugged and abandoned according to the approved plugging and abandonment plan in Part XI, Section C.

PART VII. MECHANICAL INTEGRITY

A. Definition of Mechanical Integrity

An injection well has mechanical integrity if:

1. There is no significant leak in the casing, tubing or packer; and
2. There is no significant fluid movement into an underground source of drinking water through vertical channels adjacent to the injection well bore.

B. Requirement to Demonstrate and Maintain Mechanical Integrity

1. The Permittee is required to ensure each injection well and production well maintains mechanical integrity at all times. Injection into a well that lack mechanical integrity is prohibited.
2. Before the Authorization to Commence Injection is issued by the Director for each well, the Permittee shall demonstrate that each wellfield injection and production well has mechanical integrity according to 40 CFR § 146.8.
3. The Permittee shall ensure the mechanical integrity tests in Table 13 are performed within the time frames specified. The internal mechanical integrity test shall be performed according to the requirements in Part VII, Section C. The external mechanical integrity shall be demonstrated according to Part VII, Section D.
4. The Director, by written notice, may require the Permittee to comply with a schedule describing when mechanical integrity demonstrations shall be made.

Table 13. Well Testing Program

TYPE OF TEST	PURPOSE	DUE DATE
Pressure-Packer Test	To assess Internal Mechanical Integrity	Before Authorization to Commence Injection is issued for the well and periodically thereafter according to Part VII, Section G.
Well cementing records	To assess External Mechanical Integrity	At the completion of well construction

C. Internal Mechanical Integrity Test

1. Prior to initiation of injection activities in a wellfield, all injection, production, and monitoring wells shall be field tested to demonstrate the mechanical integrity of the well casing.
2. The mechanical integrity of the well casing shall be demonstrated using a pressure-packer test.
3. If the testing pressure drops less than 10 percent during the 10-minute test, the well casing has demonstrated acceptable mechanical integrity.

4. The Permittee shall conduct the pressure-packer test procedure as follows:
   a. Seal bottom of the casing with a plug, downhole inflatable packer, or other suitable device.
   b. Fill the casing with water.
   c. Seal the top of the casing with a threaded cap, mechanical seal or downhole inflatable packer.

d. Apply an induced pressure on the water column within the well casing using water or air.
e. Monitor induced pressure with a calibrated pressure gauge.
f. Increase induced pressure to 125% of the maximum operating pressure of the well field or 125% of the maximum operating pressure rating of the well casing, whichever pressure value is lower.

5. A well must maintain at least 90 percent of this pressure for a minimum of 10 minutes to pass the test.
6. If there are obvious leaks, or the pressure drops by more than 10 percent during the 10-minute period, the Permittee shall check and/or reset the seals and fittings on the packer system and conduct another test.

D. Demonstration of External Mechanical Integrity

1. The well construction report shall include detailed cementing records documenting that the requirements under Part V, Section E were met to demonstrate the absence of significant fluid movement through the well casing-borehole annulus.
2. Because this Area Permit is allowing cementing records to demonstrate external mechanical integrity, the monitoring program requirements in Part IX shall be designed to verify the absence of significant fluid movement outside the injection interval through confining zones as required under 40 CFR § 146.8(c)(4).
3. The Director may require the Permittee to conduct remedial cementing between the well casing and the borehole wall if the well construction report cannot verify that the requirements under Part V, Section E were met.

E. Reporting Results of Initial Mechanical Integrity Demonstrations

The results of initial mechanical integrity tests shall be submitted to the Director as required in Part IX, Section F.6.

F. Requirement to Plug and Abandon any Injection, Production or Monitoring Well for which Mechanical Integrity Cannot Be Demonstrated

1. If mechanical integrity cannot be demonstrated for any injection, production, or monitoring well after workovers and corrective actions have been performed, the Permittee shall plug and abandon those wells according to the requirements under Part XI.
2. The Permittee shall include these activities in the report on initial mechanical integrity demonstrations.

G. Ongoing Demonstration of Mechanical Integrity

1. After initial demonstration of mechanical integrity required in Part VII, Section B.2, the Permittee shall demonstrate internal mechanical integrity within five (5) years of the last successful mechanical integrity test even if the well is not active.
2. Results of mechanical integrity tests shall be submitted to the Director with the next scheduled Quarterly Monitoring Report, unless the mechanical integrity test occurred within 45 days before the due date of the Quarterly Monitoring Report. In that case, the mechanical integrity test results shall be submitted with the following Quarterly Monitoring Report.
3. Failing to provide the EPA with a successful demonstration of mechanical integrity in a timely manner will be a violation of this permit.
4. **Ongoing Demonstration of Internal Mechanical Integrity**
   a. After the initial demonstration of internal mechanical integrity, all injection and production wells shall be field tested to demonstrate ongoing mechanical integrity of the well casing.
   b. The procedure and criteria for demonstrating internal mechanical integrity are found in Part VII, Section C.4.
5. **Demonstration of External Mechanical Integrity**
   Because the well cementing record in the well construction report must be used to demonstrate external mechanical integrity as required under Part VII, Section D, no repeat test is required.
6. **Demonstration of Mechanical Integrity after Well Workovers**

In addition to these regularly scheduled demonstrations of mechanical integrity, the Permittee shall demonstrate internal mechanical integrity following any workover that affects the integrity of the casing or cement of any injection or production wells within a wellfield as required under Part VI, Section B.

7. Additional or Alternative Mechanical Integrity Tests

The Director may require additional or alternative tests if the results presented by the Permittee are not satisfactory to the Director for demonstrating there is no movement of fluid into or between USDWs resulting from injection activity.

H. Notification Prior to Testing

Except for the initial mechanical integrity test required before injection or production well operation, the Permittee shall notify the Director at least seven calendar days prior to any regularly scheduled mechanical integrity test. When the mechanical integrity test is conducted after well construction, well conversion, or a well rework, any prior notice is sufficient. The Director may allow a shorter notification period if it would be sufficient to enable EPA to witness the mechanical integrity test. Notification may be in the form of a yearly or quarterly schedule of planned mechanical integrity tests, or it may be on an individual basis.

I. Loss of Mechanical Integrity

1. If an active well fails to demonstrate mechanical integrity during a test, or a loss of mechanical integrity becomes evident during operation (such as increase in flow rate measured at injection well header or water flowing at the surface, etc.), the Permittee shall notify the Director within 24 hours (see Part XII, Section D.11.e of this Permit), and the well shall be shut-in within 48 hours unless the Director requires immediate shut-in.
2. Upon discovering that an active well fails to demonstrate mechanical integrity during a test, or a loss of mechanical integrity becomes evident during operation, as soon as practically possible, the Permittee shall collect water level measurements from the nearest monitoring wells in overlying aquifers and compare them to the previously collected water level data. If an increase in water level is observed, then the Permittee shall collect fluid samples from the nearest monitoring wells in overlying aquifers, analyze the samples for excursion parameters and compare the data to previous analyses for these wells. If an excursion is indicated, then the Permittee shall follow the requirements under Part IX, Section C.3.
3. Within five days of when the loss of mechanical integrity became evident, the Permittee shall submit a follow-up written report that documents test results, repairs undertaken or a proposed remedial action plan and the results of the recent monitoring well data required under 2 above that are available at the time of the five-day report.
4. Injection operations shall not be resumed until after the Permittee has:
    i. has successfully repaired the well,
    ii. demonstrated the well has mechanical integrity,
    iii. demonstrated that any excursion resulting from the mechanical integrity loss has been remediated, and
    iv. received written approval to resume injection from the Director.

PART VIII. WELL OPERATION

The Permittee shall adhere to the following requirements prior to and during injection and production well operation.

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

B. The migration of ISR contaminants across the aquifer exemption boundary into USDWs is prohibited.

C. Requirements Prior to Commencing Injection in a Wellfield

1. General Requirements

The Permittee shall not commence injection until:

a. Well construction is complete;
b. The well construction report is complete;
c. The Permittee has submitted the Injection Authorization Data Package Report described in Part II, Section H;
d. Initial demonstration of mechanical integrity pursuant to 40 CFR §1 46.8 and Part VII, Section B.2 has been successful and documented; and
e. The Director has issued the written Authorization to Commence Injection.

2. Confirmation of Aquifer Baseline Potentiometric Surface

a. After the construction of all wellfield injection, production and monitoring wells is completed and the static potentiometric surface for each aquifer has stabilized from well development activities and the wellfield pump tests, the static potentiometric water levels shall be measured in every well in the monitoring system prior to the initiation of injection into the wellfield to determine the degree to which the injection interval potentiometric surface recovered after the wellfield pump tests.
b. At that time the baseline static potentiometric surface for each aquifer shall be established, along with a range of water level variance to be expected due to barometric pressure change, for comparison against operational water level measurements.

D. Injection Interval

1. Injection is authorized only within the approved vertical interval of the Inyan Kara aquifers.
2. Injection intervals and well screen intervals will be authorized only within the exempted portion of the Inyan Kara aquifer.
3. Well screen injection intervals shall be determined based on results of wellfield delineation drilling and logging and injection and production well logging to determine the ore zone interval.

E. Injection Pressure Limitation

1. The Maximum Allowable Injection Pressure (MAIP) Based on Calculated Fracture Pressure

The MAIP measured at each header house pressure gauge shall not exceed 90% of the injection formation fracture pressure calculated for each well as required under Part V, Section F. The MAIP at each header house shall be set at 90% of the lowest fracture pressure of all the wells connected to the header house so as to assure that the pressure in the injection interval during injection does not initiate new fractures or propagate existing fractures within the injection interval. In no case shall injection pressure initiate fractures in the confining zone or cause the migration of injectate or formation fluids into an underground source of drinking water. Any exceedance of MAIP is a violation of this permit and may result in an enforcement action.

2. Alternative MAIP Set at Well Casing or Injection Pipe Operating Pressure

The Permittee has the option to use well casing pipe or injection pipe within the well casing that has a pressure rating below the MAIP set at 90% of the calculated fracture pressure based on the depth to the top of the injection interval. In those cases, the MAIP shall be set at the well casing or injection pipe operating pressure.

3. The permit limit MAIP shall be no greater than the lowest value of the following:

a. The lowest value of MAIP for all injection wells connected to the header house based on 90% of the calculated fracture pressure under Part V, Section F.
b. The manufacturer-specified maximum operating pressure for the well casing.
c. The manufacturer-specified maximum operating pressure of the injection pipe.
d. The manufacturer-specified maximum operating pressure of the casing and injection pipe fittings.

4. **The well construction report shall contain the manufacturer-specified maximum operating pressure for all components of the injection or production well as required under Part V, Section G.6.**

5. **MAIP Compliance Point**
   a. The Permittee shall use a pressure gauge located either at each wellhead or at the injection manifold at each header house as the compliance point at which the MAIP is demonstrated not to exceed the permit limit set according to Section E.3 of this Part.
   b. The Permittee may use pressure gauges at the injection manifold only after verification that the header house pressure gauge is greater than or equal to the injection pressure measured at the wellhead of each injection well connected to the header house as described under the following section.
   c. The Permittee shall conduct an initial injection pressure calibration check to be performed as each header house is brought online. The initial injection pressure calibration check shall involve measuring the injection pressure at each wellhead to verify that it is not greater than the injection pressure measured at the pressure gauge on the header house injection line. If the injection pressure at any injection wellhead is greater than the pressure measured at the header house injection line pressure gauge, the pressure to the individual injection well shall be adjusted so that the injection pressure at the injection wellhead is equal to or less than the injection pressure measured at the header house injection trunkline pressure gauge.

F. Hydraulic Control of Wellfield

1. The Permittee shall maintain hydraulic control of each wellfield from the initiation of injection through the end of groundwater restoration.
2. In each ISR wellfield, the production wells shall pump a larger volume of fluids out of the wellfield than the injection wells are injecting so as to maintain a hydraulic gradient directed inward toward the wellfield.
3. During post-ISR restoration, pumping wells shall extract a greater volume of groundwater than the injection wells are pumping into the wellfield to maintain the inward hydraulic gradient.
4. **Hydraulic Control of Wellfield during ISR Operation**
   a. During uranium recovery, the groundwater removal rate in each wellfield shall exceed the lixiviant injection rate, creating a cone of depression within each wellfield.
   b. This condition shall be verified by:
      i. monitoring water levels in the injection interval perimeter monitoring wells that are consistently below the baseline water levels established under Section C.2 of this Part;
      ii. continuous monitoring of injection and production flow rate and volume and
      iii. daily recording of flow rate of injection and production fluids for each wellfield.
5. **Hydraulic Control of Wellfield during Groundwater Restoration**
   a. The Permittee shall maintain hydraulic control of each wellfield until groundwater restoration has been completed through intermittent or continuous pumping of groundwater from the wellfield.
   b. Hydraulic control shall be verified by monitoring water levels in the injection interval perimeter monitoring wells that are consistently below the baseline water levels established under Section C.2 of this Part.
   c. The Permittee shall monitor the water levels in the wellfield perimeter monitoring well ring in accordance with the requirements in Part IX, Section B.1.e, Table 14.D and Part IX, Section C.
6. **Notification of Completion of Groundwater Restoration**
   a. The Permittee shall notify EPA in the next Quarterly Monitoring Report once groundwater restoration is completed for a wellfield.
   b. At that time the requirement to maintain hydraulic wellfield control for the wellfield is no longer applicable.

c. However, the monitoring requirement for measuring water levels in all perimeter wellfield monitoring wells shall be continued in order to verify the return of the natural groundwater gradient in the wellfield area.
d. Monitoring the water levels in the non-injection interval monitoring wells in overlying aquifer units shall be conducted as required in Part IX, Section C until the Permittee is able to demonstrate the natural groundwater gradient is restored in the wellfield.

G. Injection Flow Rate and Injectate Volume

Because of the net extraction of groundwater within the wellfield during injection activities, there is no injection volume limit requirement in this Area Permit.

H. Injection Fluid Limitation

1. During the ISR process, the injection fluid is limited to ISR lixiviant consisting of wellfield groundwater with carbon dioxide and oxygen added.
2. During the groundwater restoration phase, the injectate will be limited to permeate from reverse osmosis (RO) treatment of groundwater extracted from the post-ISR wellfields or clean makeup water from the Madison Limestone.
3. If the Permittee determines that injection is required for groundwater restoration either within the wellfield or outside the wellfield due to an excursion or to inject a groundwater tracer, the Permittee shall submit an authorization by rule proposal to the Director.
4. If the Permittee elects to pump groundwater from the down-gradient compliance boundary wells and decides to reinjection the pumped groundwater into another location within the exempted portion of the Inyan Kara aquifers, the Permittee shall submit an authorization by rule proposal to the Director.

I. Tubing-Casing Annulus

There are no permit requirements under this section for the annulus between the well casing and the injection tubing.

PART IX. MONITORING, RECORDING AND REPORTING OF RESULTS

A. General Monitoring Requirements

1. Because this Area Permit allows cementing records to be used to demonstrate the absence of significant fluid movement to fulfill the external mechanical integrity demonstration requirement as described under Part VII, Section D, the monitoring program required under Section B of this Part shall be designed to verify the absence of significant fluid movement through the confining zones per 40 CFR § 146.8(c)(4).
2. Monitoring observations, measurements, fluid samples, etc. taken for the purpose of complying with these requirements shall be representative of the activity or condition being monitored.
3. Fluid samples collected for the purpose of compliance with the conditions of this Area Permit shall be tracked and controlled using a Chain of Custody to verify the analytical results are applicable to the identified fluid sample.
4. To ensure that groundwater samples are representative of ambient groundwater conditions surrounding the well, groundwater samples shall be collected according to the procedures in Part II, Section E.2.b.
5. Fluid samples collected for the purpose of compliance with this Area Permit shall be handled according to the requirements found in 40 CFR part 136 Table II – *Required Containers, Preservation Techniques, and Holding Times*.
6. Operating parameters shall be observed and recorded under normal operating conditions, and all parameters shall be observed simultaneously to provide a clear depiction of well operation.
7. All monitoring equipment to be installed, maintained and used according to manufacturer's directions and any applicable operating manuals.

8. Any equipment calibration shall be conducted as specified by the manufacturer at the frequency specified by the manufacturer. Documentation of calibration shall include the name of the person performing the calibration and the date of calibration.
9. Required monitoring including type, intervals, and frequency shall be sufficient to yield data which are representative of the monitored activity including when appropriate, continuous monitoring.
10. Pressures are to be measured in pounds per square inch (psi).
11. Fluid volumes are to be measured in gallons.
12. Fluid rates are to be measured in gallons per minute (gpm).

B. Monitoring Parameters, Frequency, Records and Reports

Monitoring parameters and frequency are specified in Section 1 below.

1. Monitoring Parameters and Frequency

a. Monitoring information is to be collected, recorded and reported for all parameters at the frequency indicated, even during periods when the well is not operating.
b. Injection pressure shall be continuously monitored at the pressure gauges installed on each header house injection manifold and manually recorded at least daily for each header house.
c. The injection and production flow rates shall be continuously monitored for each wellfield and shall be recorded daily from monitoring devices at the Burdock Central Processing Plant and the Dewey Satellite Facility.
d. Monthly injection and production volumes shall be continuously monitored and recorded for each wellfield from monitoring performed at the Burdock Central Processing Plant and the Dewey Satellite Facility.
e. Parameters shall be monitored and recorded as indicated in Table 14.
f. Monitoring information and results shall be included in the Quarterly Monitoring Report.
g. Representative samples of the injectate for each wellfield shall be collected and analyzed monthly for the analytes listed in Table 15.
h. The analytical methods included in Table 15 shall be used for injectate sample analysis. Equivalent methods may be used after prior approval by the Director.

2. Determining Baseline Water Quality for Non-injection Interval Monitoring Wells

The Permittee shall determine baseline water quality permit limits for non-injection interval monitoring wells according to the requirements under Section 11.3 *Establishment of Commission-Approved Background Water Quality* in the NRC Source Material License.

3. Down-gradient Compliance Boundary Baseline Monitoring

Baseline groundwater characterization sampling shall be performed quarterly on Down-gradient Compliance Boundary wells as designated in the approved wellfield Post-Restoration Monitoring Plan beginning after well development through the end of wellfield restoration. Groundwater samples shall be collected according to the procedures in Part II, Section E.2.b. The samples shall be analyzed for the baseline water quality parameters listed in Table 8 using the analytical methods shown. Equivalent analytical methods may be used after prior approval by the Director.

Table 14. Monitoring Parameters and Frequency

A. CONTINUOUSLY	
MONITOR	Injection Pressure (psig) at each header house
	Injection Rate (gpm) for each wellfield at injection trunkline at the Burdock Central Processing Plant or the Dewey Satellite Facility Production rate (gpm) for each wellfield at production trunkline at the Burdock Central Processing Plant or the Dewey Satellite Facility
	Injection volume (gallons) for each wellfield at injection trunkline at the Burdock Central Processing Plant or the Dewey Satellite Facility Production volume (gallons) for each wellfield at production trunkline at the Burdock Central Processing Plant or the Dewey Satellite Facility

B. DAILY	
OBSERVE AND RECORD	Injection Pressure (psig) at each header house Injection Flow Rate for each wellfield Production Flow Rate for each wellfield

C. WEEKLY EXCURSION MONITORING OF WELLS WHEN EXCURSION IS CONFIRMED	
OBSERVE AND RECORD	Wellfield perimeter monitoring well water levels for impacted wells and the two adjacent non-impacted wells Impacted wellfield non-injection interval monitoring well water levels
ANALYZE	Water samples from wellfield perimeter monitoring well for chloride, total alkalinity, and specific conductance values Water samples from impacted wellfield non-injection interval monitoring wells for baseline constituents in Table 8 Water samples from adjacent unimpacted wellfield non-injection interval monitoring wells for baseline constituents in Table 8 when excursion indicator or baseline constituent concentrations are increasing or when excursion has not been remediated after 60 days. New down-gradient excursion monitoring wells during an excursion or when impacted by a remnant excursion plume.
REPORT	Next scheduled Quarterly Report

D. 14 DAY INTERVAL EXCURSION MONITORING DURING ISR OPERATION	
OBSERVE AND RECORD	Wellfield perimeter monitoring well water levels Wellfield non-injection interval monitoring well water levels
ANALYZE	Water samples from each well listed above for chloride, total alkalinity, and specific conductance values
REPORT	Next scheduled Quarterly Report

E. MONTHLY	
RECORD	Monthly Average, Maximum, and Minimum values for Injection Pressure (psig)
	Maximum, minimum and average values for Daily Injection Rate (gpm) for each wellfield
	Maximum, minimum and average values for Daily Production Rate (gpm) for each wellfield
	Injected volume for that month (gallons) for each wellfield
	Produced volume for that month (gallons) for each wellfield
ANALYZE	Injectate flowing to each wellfield for parameters in Table 15
REPORT	Next scheduled Quarterly Report

F. 60 DAY INTERVAL EXCURSION MONITORING DURING GROUNDWATER RESTORATION AND STABILITY MONITORING	
OBSERVE AND RECORD	Wellfield perimeter monitoring well water levels Wellfield non-injection interval monitoring well water levels
ANALYZE	Water samples from each well listed above for chloride, total alkalinity, and specific conductance values
REPORT	Next scheduled Quarterly Report

G. 60 DAY INTERVAL POST-RESTORATION GROUNDWATER MONITORING	
OBSERVE AND RECORD	Wellfield perimeter monitoring well water levels Wellfield non-injection interval monitoring well water levels
ANALYZE	Water samples from each wellfield non-injection interval monitoring well for baseline water quality parameters listed in Table 8.
REPORT	Next scheduled Quarterly Report

H. QUARTERLY	
ANALYZE	Samples from operational monitoring stock wells within permit area for chloride, total alkalinity, and specific conductance Samples from the operational monitoring wells listed in Table 16 for baseline parameters (Table 8) Samples from down-gradient wellfield perimeter monitoring well ring wells, Non-injection Interval Monitoring wells and Down-gradient Compliance Boundary Determination Wells from well installation through wellfield restoration for baseline water quality parameters (Table 8)
REPORT	Monthly Average, Maximum, and Minimum values for Daily Injection Pressure (psig)
	Monthly Average, Maximum, and Minimum values for Daily Injection Rate (gpm)
	Monthly Average, Maximum, and Minimum values for Daily Production Rate (gpm)
	14 day interval excursion monitoring results during ISR operation
	Injection volume for each wellfield for each month during the quarter (gallons)
	Production volume for each wellfield for each month during the quarter (gallons)
	Monthly Results of injectate fluid analysis in units listed in Table 15
	Summary of detectable seismic events occurring within a fifty (50) mile radius of the Area Permit boundary.
	Well construction reports and initial mechanical integrity test results for new injection, production and monitoring wells
	Initial header house injection pressure verification reports
	60 day interval excursion monitoring results during groundwater restoration and stability monitoring
	60 day interval post-restoration groundwater monitoring results
	Six month interval post-restoration groundwater monitoring results, when applicable.
	Quarterly sampling results from Operational Monitoring Wells
	Annual Operational Groundwater Monitoring sample results from domestic wells, when applicable.
	Weekly excursion monitoring of wells when excursion is confirmed

I. SIX MONTH INTERVAL POST-RESTORATION GROUNDWATER MONITORING	
ANALYZE	Groundwater samples from the Down-gradient Compliance Boundary wells for baseline water quality parameters (Table 8)
REPORT	Include analytical results in next scheduled Quarterly Report after analytical results are received from laboratory.

J. ANNUALLY	
ANALYZE	Groundwater samples from the domestic wells within 1.2 miles of the project boundary for baseline water quality parameters (Table 8)
REPORT	Include analytical results in next scheduled Quarterly Report after analytical results are received from laboratory.

K. 24-HOUR REPORTING	
REPORT	Upon discovery that an active well fails to demonstrate mechanical integrity during a test, or a loss of mechanical integrity becomes evident during operation as described under Part VII, Section I.
	Injection pressure measured above the MAIP for a header house.
	If a remnant excursion plume has impacted a new downgradient excursion monitoring well as described in Part IX, Section C.4.b.ii.G.
	If any detectible seismic event is reported within two miles of the permit boundary.
	If a statistically significant increase in the concentration of an ISR contaminant is confirmed in a Down-Gradient Compliance Boundary Well as described in Part IX, Section E.12.
	If any ISR contaminant crosses the aquifer exemption boundary in a concentration above the baseline permit limits as described in Part IX, Section E.14. System failures.
	Upon discovery of any other noncompliance as described in Part XII, Section D.11.j.

Table 15. Injection Fluid Characterization Parameters

Analyte	Reporting Units	Analytical Methods
Physical Properties		
pH	pH units	A4500-H B
Total Dissolved Solids	mg/L	A2540 C
Specific conductance	μmhos/cm	A2510B or E120.1
Commons Elements and Ions		
Alkalinity (as $CaCO_3$)	mg/L	A2320 B
Chloride	mg/L	A4500-Cl B; E300.0
Sulfate	mg/L	A4500-SO4 E; E300.0
Metals-Dissolved		
Arsenic	mg/L	E200.8
Iron	mg/L	E200.7
Lead	mg/L	E200.8
Manganese	mg/L	E200.8
Selenium	mg/L	E200.8
Strontium	mg/L	E200.8
Uranium	mg/L	E200.7; E200.8
Vanadium	mg/L	E200.7; E200.8

Radionuclides		
Gross Alpha	pCi/L	E900.0
Gross Beta	pCi/L	E900.0
Radium -226	pCi/L	E903.0

4. Operational Groundwater Monitoring

a. Domestic Wells

i. During operations, the Permittee shall monitor all down-gradient domestic wells within the Area of Review, unless the well owners do not consent to sampling or the condition of the wells renders a well unsuitable for sampling.

ii. Wells to be monitored under this requirement are shown in Figure 10.

iii. Samples shall be collected quarterly and analyzed for the baseline water quality parameters listed in Table 8.

b. Stock Wells

i. During the design of each wellfield, all stock wells within ¼ mile of the perimeter monitoring well ring shall be evaluated for the potential to be adversely affected by ISR operations or to adversely affect ISR operations.

ii. During operation, the Permittee shall monitor all stock wells located within the project boundary (Figure 11) that were not plugged and abandoned due to impact on ISR operations.

iii. Samples shall be collected quarterly and analyzed for water level and the three excursion indicators: chloride, total alkalinity, and specific conductance.

c. Monitoring Wells

The Permittee shall monitor wells located hydrologically up-gradient and down-gradient of ISR operations as part of the operational groundwater monitoring program.

Monitoring wells included in the operational monitoring program shall include wells completed in the alluvium, Fall River, Chilson, and Unkpapa aquifers.

The proposed wells indicated in Table 16 (Well ID is TBD) and in Figures 12 and 13 shall be installed before the first wellfield pump test is conducted in the Burdock Area.

The monitoring wells shall be monitored quarterly and analyzed for the baseline water quality parameters listed in Table 8.

d. The operational monitoring well locations are shown in Figures 10 through 14 and are listed in Table 16.

Figure 10. Domestic Wells
Figure 11. Stock Wells
Figure 12. Fall River Monitoring wells
Figure 13. Chilson Monitoring wells
Figure 14. Unkpapa and Alluvial Monitoring wells

Table 16. Monitoring Wells Included in Operational Monitoring Program

Well ID	Qrt- Qrt	Section	Township	Range	Relative Position
Alluvium					
676	SESW	34	6S	1E	Burdock/Down-gradient of land application
677	SWSW	4	7S	1E	Dewey/Down-gradient near Beaver Creek
678	SWNE	9	7S	1E	Down-gradient of Site Boundary
679	NWSE	27	6S	1E	Burdock/Up-gradient
707	SWNE	34	6S	1E	Burdock/Down-gradient of Triangle Pit
708	SESW	3	7S	1E	Burdock/Down-gradient of land application
709	SENW	15	7S	1E	Burdock/Down-gradient of wellfields
DC-1	NWSW	30	6S	1E	Dewey/Up-gradient
DC-2	SESW	30	6S	1E	Dewey/Down-gradient of land application
DC-3	NWNE	31	6S	1E	Dewey/Down-gradient of wellfield
DC-2	NWNW	32	6S	1E	Dewey/Down-gradient of wellfield
Fall River					
631	SWSW	23	6S	1E	North of Site Boundary/Up-gradient
681	NENW	32	6S	1E	Dewey/Production Zone
688	NESW	11	7S	1E	Burdock/Overlying Production Zone
694	NWNW	15	7S	1E	Burdock/Down-gradient
695	SESE	32	6S	1E	Dewey/Down-gradient

698	NESW	2	7S	1E	Burdock/Down-gradient
706	NENE	21	6S	1E	North of Project Site/Up-gradient
TBD	SWNE	34	6S	1E	Burdock/Down-gradient of Triangle Pit
TBD	NWSE	2	7S	1E	Burdock/Down-gradient of Darrow Pit
Chilson					
43	SWSE	34	6S	1E	Burdock/Down-gradient of Triangle Pit
680	NESW	11	7S	1E	Burdock/Production Zone
689	NENW	32	6S	1E	Dewey/Production Zone
696	NWNW	15	7S	1E	Burdock/Down-gradient
697	SESE	32	6S	1E	Dewey/Down-gradient
705	NENE	21	6S	1E	North of Project Site/Up-gradient
3026	SESE	1	7S	1E	Burdock/Up-gradient
TBD	SWSE	2	7S	1E	Burdock/Down-gradient of Darrow Pit
Unkpapa					
690	NESW	11	7S	1E	Burdock/Underlying Production Zone
693	NENW	32	6S	1E	Dewey /Underlying Production Zone
703	SWSE	1	7S	1E	Burdock/At Up-gradient Edge of Wellfield

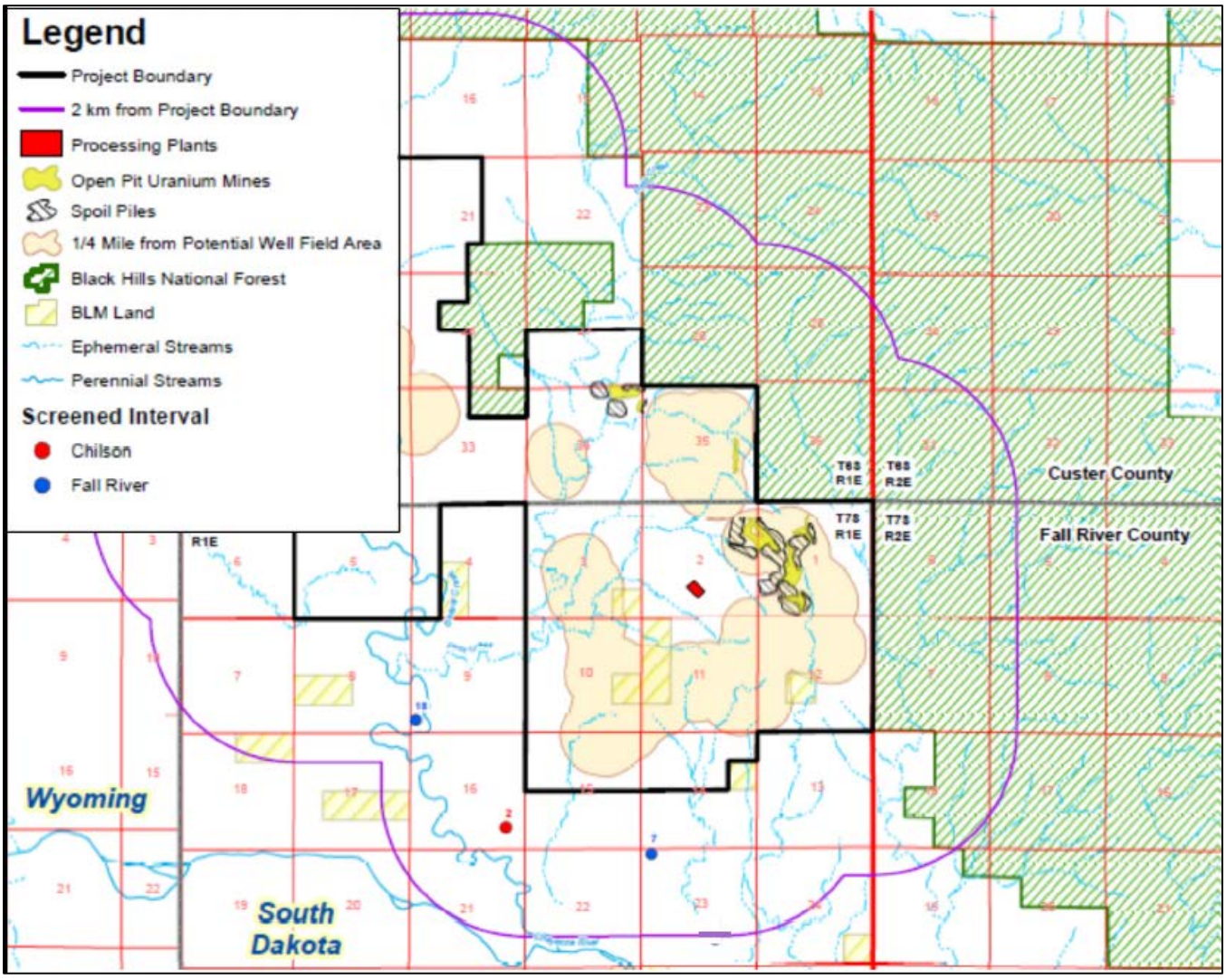


Figure 10. Operational Monitoring Wells – Three Domestic Wells: Hydro IDs 2, 7 and 18

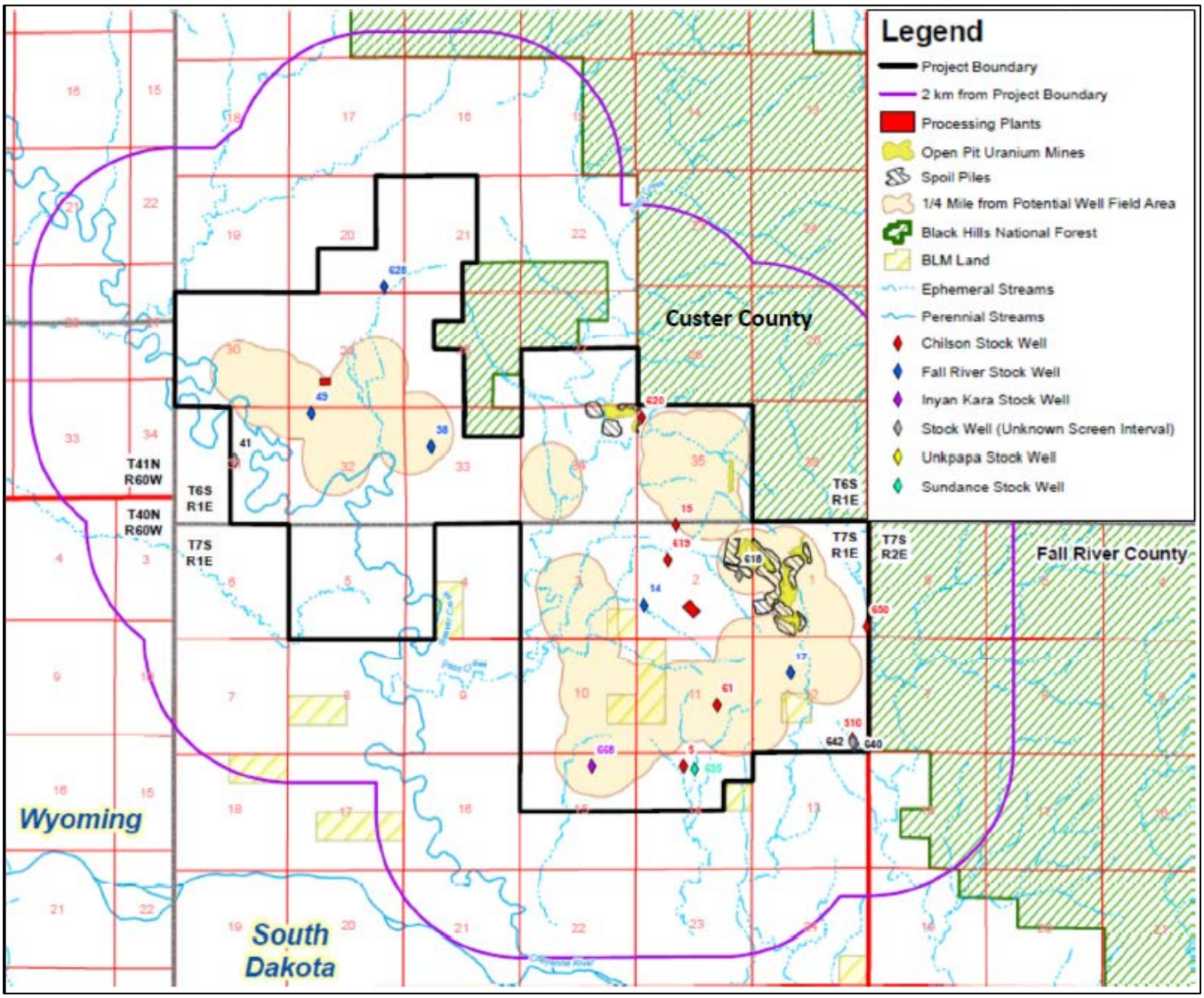


Figure 11. Operational Monitoring Wells - Stock Wells

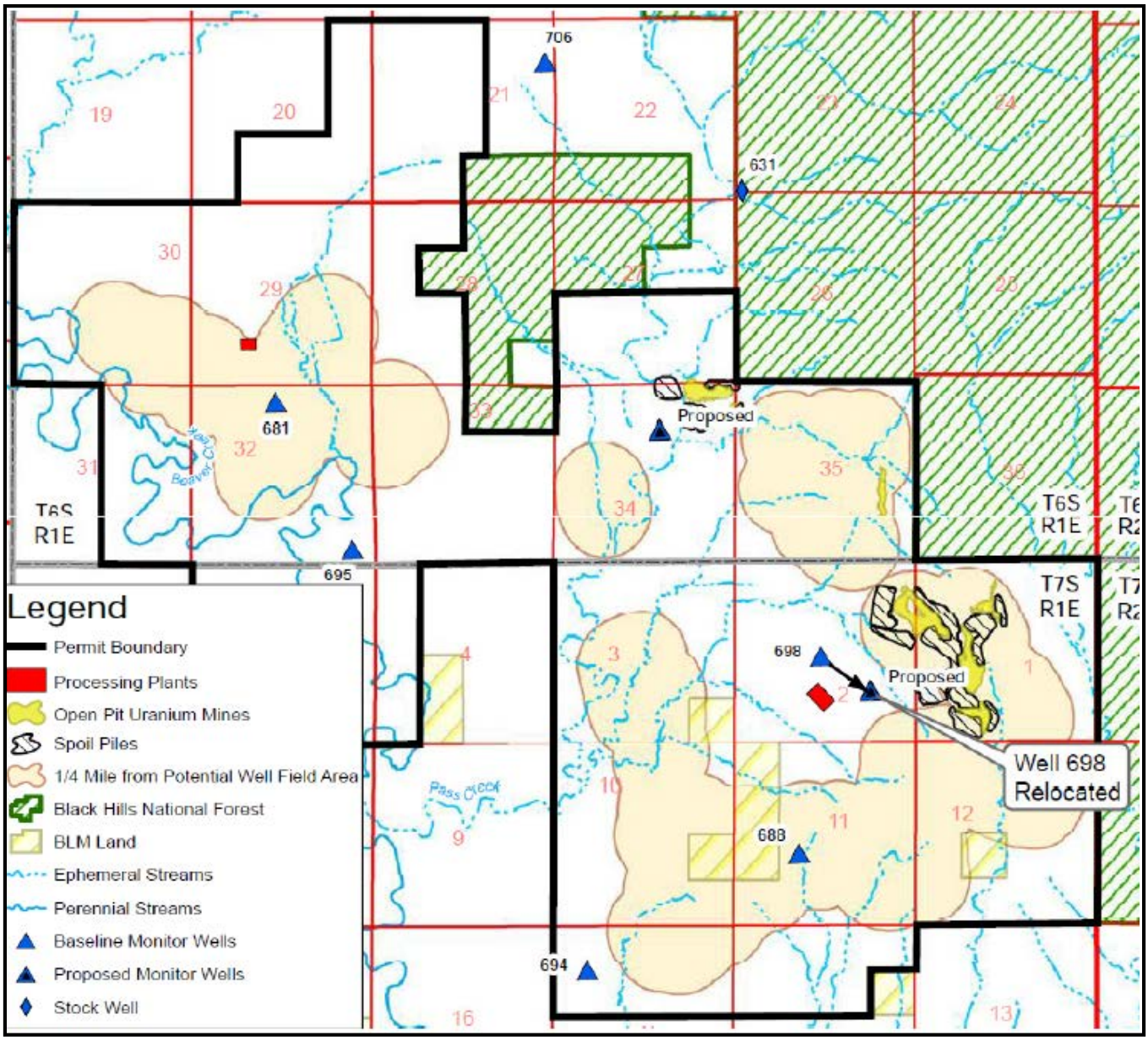


Figure 12. Fall River Operational Monitoring Wells

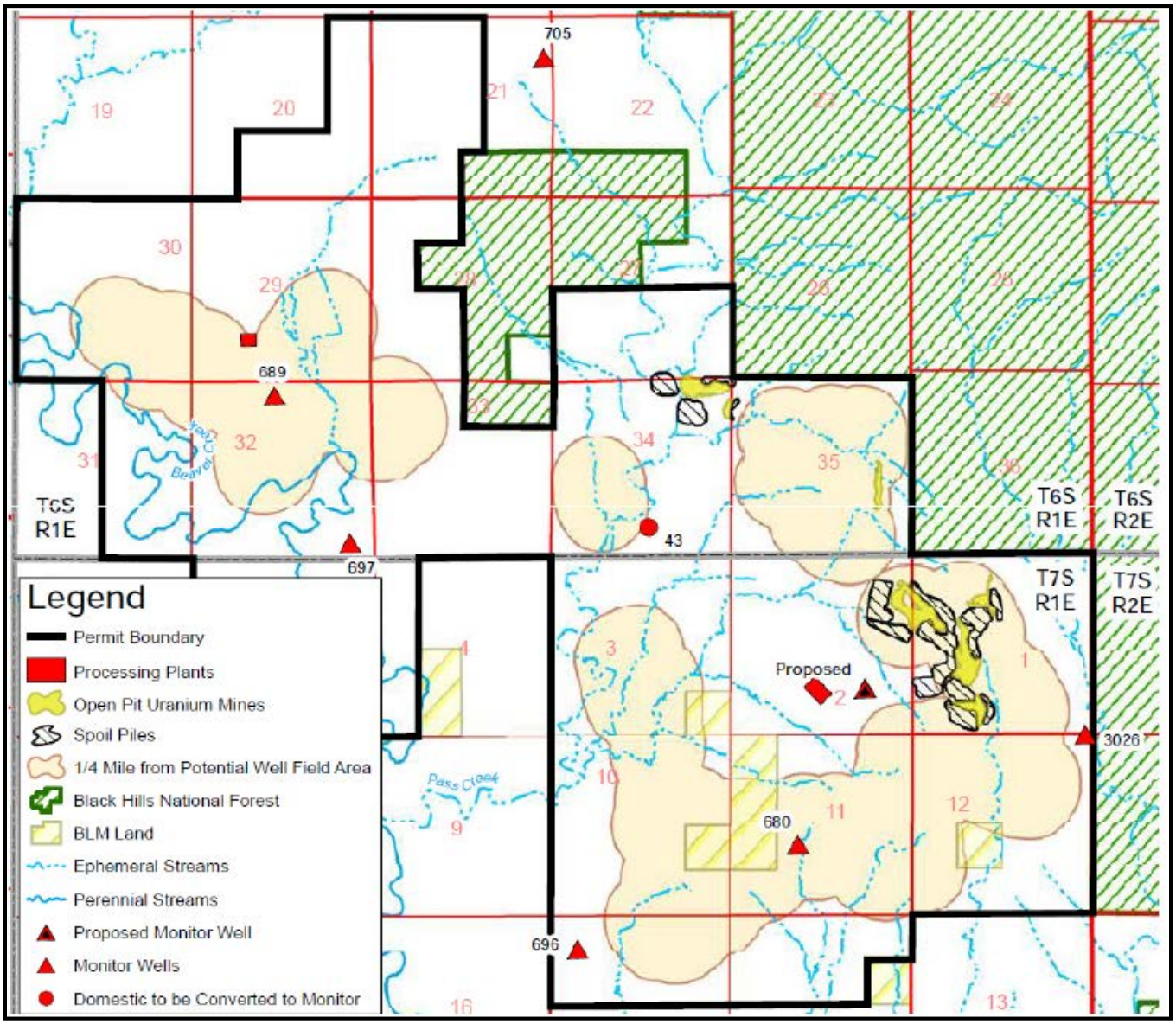


Figure 13. Chilson Operational Monitoring Wells

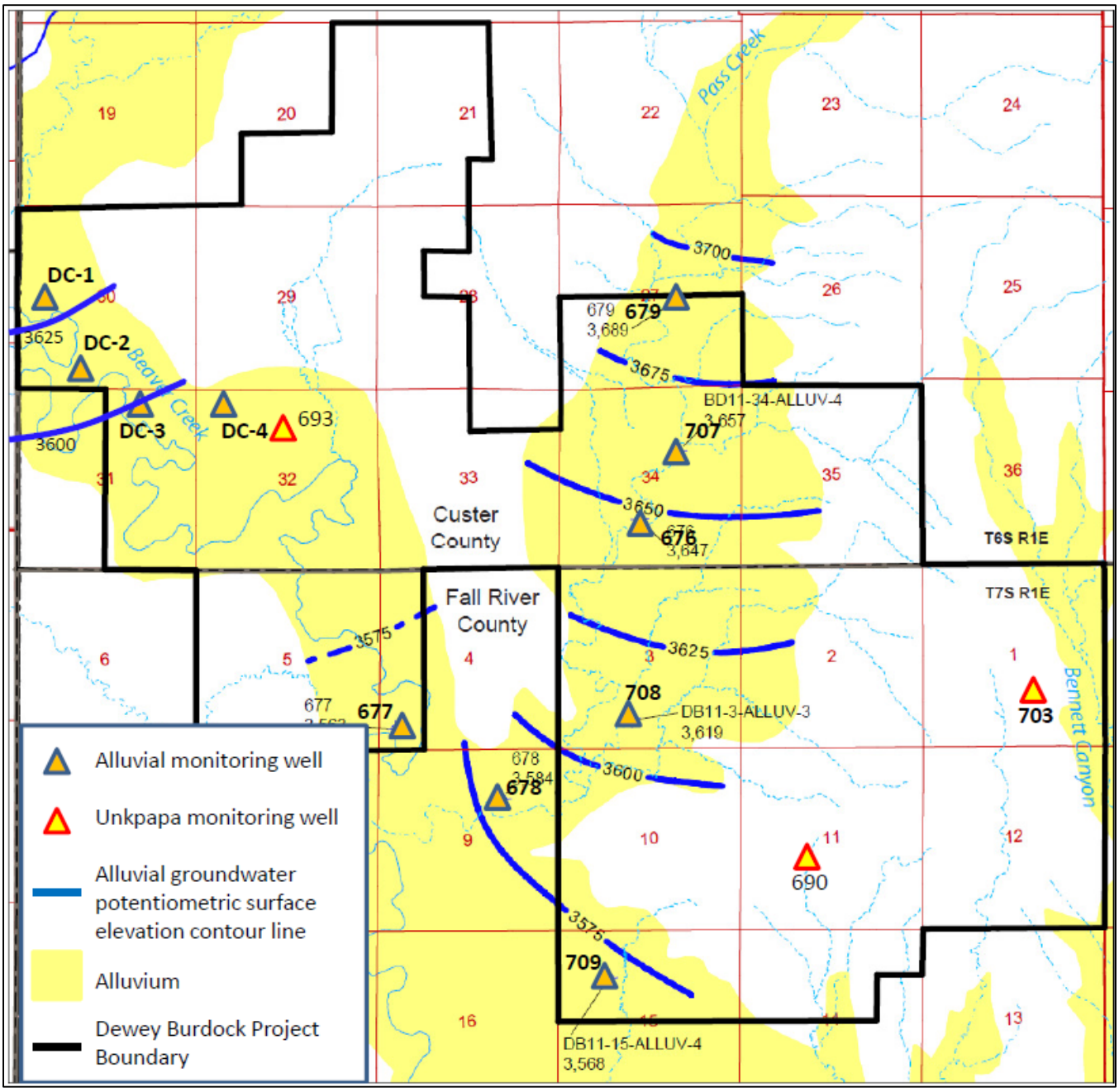


Figure 14. Unkpapa and Alluvial Operational Monitoring Wells

5. Monitoring Records Must Include:

a. Chain of Custody for fluids samples
b. The date, exact place, and time of sampling or measurements;
c. The individual(s) who performed the sampling or measurements;
d. The date(s) analyses were performed;
e. The individual(s) who performed the analyses;
f. The analytical techniques or methods used; and
g. The results of such analyses.

C. Excursion Monitoring

1. During ISR Operations

a. Groundwater Level Measurements: Monitoring for excursions during ISR operations shall consist of measuring water levels in injection interval wellfield perimeter monitoring well and non-injection interval monitoring wells twice a month and no more than 14 days apart in any given month.

b. Groundwater Sampling and Analysis: Groundwater samples shall be collected from injection interval wellfield perimeter monitoring well and non-injection interval monitoring wells and analyzed for chloride, total alkalinity and specific conductance twice a month and no more than 14 days apart in any given month.

2. During Groundwater Restoration and Stability Monitoring

a. Groundwater Level Measurements: Monitoring for excursions during ISR operations shall consist of measuring water levels in injection interval wellfield perimeter monitoring well and non-injection interval monitoring wells every 60 days**.**

b. Groundwater Sampling and Analysis: Groundwater samples shall be collected from injection interval wellfield perimeter monitoring well and non-injection interval monitoring wells and analyzed for the excursion parameters: chloride, total alkalinity and specific conductance every 60 days.

3. During a Confirmed Excursion Event

a. Groundwater Level Measurements: Monitoring during a confirmed excursion event shall consist of measuring the water levels every seven (7) days in injection interval wellfield perimeter monitoring wells and non-injection interval monitoring wells impacted by the excursion.

b. Groundwater Sampling and Analysis: Groundwater samples shall be collected every seven (7) days from all impacted wellfield monitoring wells and analyzed for the excursion parameters: chloride, total alkalinity and specific conductance.

c. Monitoring Nearest Unimpacted Wellfield Perimeter Monitoring Wells: For injection zone excursions impacting wellfield perimeter monitoring wells, the nearest injection interval wellfield perimeter monitoring wells on each side of the impacted well(s) that have not been impacted by the excursion shall also be monitored weekly according to **a** and **b** above to verify that the excursion plume is not expanding.

d. Criteria for Expanding Excursion Plume: If groundwater samples from any of the nearest unimpacted wellfield perimeter monitoring wells begin to show concentrations of any two excursion indicator parameters exceed their respective Upper Control Limit (UCL), as established under the NRC License, or any one excursion indicator parameter exceeds its UCL by 20 percent, the excursion criterion is exceeded.

e. Verification Actions for Expanding Excursion Plume:

i. A verification sample shall be taken from the newly impacted well(s) within 48 hours after results of the first analyses are received.

ii. If the verification sample confirms that the excursion criterion is exceeded, the well shall be placed on excursion status and the excursion is considered to be an expanding plume. The Permittee shall begin additional monitoring of an expanding excursion plume as required under Section 4 below.

iii. If the verification sample does not confirm that the excursion criterion is exceeded, a third sample shall be taken within 48 hours after the results of the verification sample are received. If the third sample shows that the excursion criterion is exceeded, the well shall be placed on excursion status and the excursion is considered to be an expanding plume.

iv. If the third sample does not show that the excursion criterion is exceeded, the first sample shall be considered an error. Routine weekly excursion monitoring shall continue but the well is not placed on excursion status and the excursion is not considered to be an expanding excursion plume.

f. For Excursions Detected in Non-Injection Interval Monitoring Wells:

i. Once a non-injection interval monitoring well has been verified to be on excursion, in addition to the monitoring required under **3a** and **3b** above, the Permittee shall collect groundwater samples every seven (7) days from the impacted well(s) and analyze the samples for the baseline parameters in Table 8.

ii. The Permittee shall restore a non-injection zone aquifer impacted by an excursion of injection zone fluids back to baseline concentrations determined under Part IX, Section B.2.

iii. Monitoring of baseline constituents shall continue until three (3) consecutive samples show concentrations of excursion indicators and any elevated baseline constituents are below baseline standards.

iii. If the analytical results from four (4) consecutive weekly samples show increasing concentrations of any excursion parameter or baseline constituent, the Permittee shall begin sampling the nearest unimpacted non-injection interval monitoring wells in the impacted aquifer every seven (7) days and analyze the samples for the baseline constituents in Table 8, or

iv. If the excursion has not been remediated in 60 days, the Permittee shall begin sampling the nearest unimpacted non-injection interval monitoring wells in the impacted aquifer every seven (7) days and analyze the samples for the baseline constituents in Table 8.

v. If sampling of the nearest unimpacted wells is required under **iii** or **iv** and there are no non-injection interval monitoring wells located down-gradient from the impacted well(s), then the Permittee shall install additional monitoring wells down-gradient from the impacted well according to the requirements in Section **4** below.

vi. If the Permittee decides to pump the affected well for purposes of groundwater remediation, pumping shall occur only at a very low pumping rate to be low enough to result in less than one (1) foot of drawdown in the aquifer potentiometric surface at the well being pumped.

vii. If upon pumping the impacted non-injection zone well, the contaminant concentrations begin to increase, the Permittee shall cease pumping immediately. All the wells near the impacted monitoring well, including the impacted monitoring well, shall be tested for mechanical integrity.

viii. Groundwater pumped from the Inyan Kara aquifers may be disposed of in the deep injection wells after treatment to remove radioactive constituents to below radioactive waste permit limits.

4. Additional Monitoring of an Expanding Excursion Plume

a. In the case of an expanding excursion plume, the Director will require the installation of a minimum of three additional monitoring wells down-gradient of the excursion plume leading edge to verify the excursion plume does not have the potential to cross the aquifer exemption boundary.

b. The installation and monitoring of these new down-gradient excursion monitoring wells shall meet the following requirements:

i. New Down-gradient Excursion Monitoring Well Installation Requirements

A) The Permittee shall construct a groundwater flow model simulating the excursion to identify the maximum distance the expanding plume could have travelled down-gradient from the perimeter monitoring well ring.

B) The Permittee shall install a line of no less than three down-gradient monitoring wells in an area where groundwater has not been impacted by excursion indicators at some distance down-gradient from the leading edge of the excursion plume as determined by the groundwater flow model.

C) The distance between the down-gradient monitoring wells shall be set to ensure no greater than a 70 degree angle between adjacent down-gradient monitor wells and the nearest mutual point on the leading edge of the excursion plume as determined by the groundwater flow model.

ii. New Down-gradient Excursion Monitoring Well Monitoring Requirements

A) The Permittee shall monitor the new down-gradient excursion monitoring wells according to **3a** and **3b** above.

B) If the excursion plume is detected at the down-gradient monitoring wells according to the criteria in **3d** above, the Permittee shall install a new line of no less than three monitoring wells meeting the requirements in **4a** also to be located further down-gradient from the leading edge of the excursion plume in an area where groundwater has not been impacted by excursion indicators.

C) The Permittee shall begin analyzing groundwater samples from impacted wellfield perimeter monitoring well ring wells for baseline constituents in Table 8.

D) Monitoring every seven (7) days of additional down-gradient monitoring wells under this section shall continue until the excursion has been fully remediated.

E) After remediation of the excursion plume, additional down-gradient monitoring wells shall be monitored according to the frequencies in **C.1** and **C.2** above for specific conductance measured in the field until post-restoration monitoring has been completed.

F) If specific conductance increases by 20% from the measurements initially measured in the well(s) after excursion remediation, then the Permittee shall collect verification groundwater samples from the impacted well and analyze them for excursion parameters according to procedures under **3e** above to determine if a remnant excursion plume has impacted the well(s).

G) If a remnant excursion plume has impacted the well(s), the Permittee shall immediately begin pumping the impacted well(s) to recover the remnant excursion and notify the Director within 24 hours according to Part XII, Section D.11.e. Although a remnant excursion plume is not a violation of this Area Permit unless it crosses the aquifer exemption boundary, the Permittee shall follow the requirements for the five (5) day follow up written report.

H) If a remnant excursion plume has impacted the well(s), the Permittee shall monitor the well(s) impacted by the remnant excursion plume by collecting groundwater samples every seven (7) days and analyzing the samples for the baseline constituents in Table 8.

I) Monitoring of baseline constituents shall continue until three (3) consecutive samples show concentrations of excursion indicators and any elevated baseline constituents are below baseline standards.

D. Seismic Activity Monitoring

The U.S. Geological Survey (USGS) Earthquake Hazards Program operates an email notification service which reports real-time earthquake events for any area specified by the user. The Permittee shall subscribe to this service, known as the Earthquake Notification Service (ENS) and check daily for notification emails from the service. Details for the ENS can be found at:

https://sslearthquake.usgs.gov/ens/

and a subscription can be initiated at:

https://sslearthquake.usgs.gov/ens/register

The Permittee shall notify the EPA within twenty-four (24) hours of any detectible seismic event reported within two miles of the permit boundary according to Part XII, Section D.11.e of this permit. If any seismic event of magnitude 4.0 or greater is reported within two miles of the permit boundary, the Permittee shall immediately cease injection. The EPA will determine if any structural testing of the facility infrastructure is required before

injection resumes. Injection shall not resume until the Permittee has obtained approval to recommence injection from EPA.

The Permittee shall record any seismic event occurring within fifty miles of the permit boundary and report such events to EPA on a quarterly basis.

E. Post-Restoration Groundwater Monitoring Requirements

After NRC approval that groundwater restoration has been successfully completed for a wellfield, the requirement to maintain and demonstrate hydraulic control of the groundwater within the wellfield, as required under Part VIII, Section F, is no longer applicable. At that time the natural groundwater gradient will begin to be re-established within the wellfield.

1. The Permittee shall demonstrate that no ISR contaminants will cross the aquifer exemption boundary into the down-gradient USDW by fulfilling the Post-Restoration Groundwater Monitoring requirements listed in Part IX, Section E.
2. The Permittee shall continue to measure water levels in the wellfield perimeter monitoring wells every 60 days during post-restoration groundwater monitoring as required during groundwater restoration and stability monitoring. Groundwater levels in a representative number of wellfield wells shall also be monitored every 60 days to provide information on the injection interval potentiometric surface within the wellfield. The purpose of this monitoring is to demonstrate the return of the natural groundwater gradient in and around the wellfield area. Pre-operational injection interval potentiometric surface elevations do not have to be achieved for this demonstration, but a down-gradient groundwater flow pattern should be reestablished.
3. The Permittee shall also continue to measure the water levels in overlying non-injection interval monitoring wells every 60 days until it can be demonstrated that the down-gradient groundwater flow pattern in the injection interval has been reestablished.
4. The Permittee shall also continue to collect groundwater samples every 6 months from overlying and underlying (if applicable) non-injection interval monitoring wells and analyze them for the baseline water quality parameters in Table 8 which have baseline concentrations above the non-detect value in the restored injection interval. The non-injection interval analytical results shall meet the baseline standards established under Section B.2 of this Part.
5. After approval by the Director, the baseline concentrations established according to Part IV, Section C shall serve as permit limits for Down-gradient Compliance Boundary Wells in order to demonstrate that no ISR contaminants shall cross the aquifer exemption boundary into the down-gradient USDW.
6. Post-restoration monitoring shall be conducted according to the approved Post-Restoration Monitoring Plan described in Part IV.
7. If pumping of the Down-gradient Compliance Boundary Wells is part of the Post-Restoration Monitoring Plan, no pumping shall begin until final baseline permit limits have been established for each baseline constituent listed in Table 8 at each Down-gradient Compliance Boundary Well.
8. The Permittee shall continue the post-restoration monitoring until the data show that the analytical results from the four (4) most recent consecutive sampling events indicate no statistically significant increasing trend for all baseline constituents.
9. If the monitoring results demonstrate that baseline permit limits are met at the Down-gradient Compliance Boundary at the end of the Post-Restoration Monitoring period, this demonstration will suffice to meet the requirement for the demonstration that no ISR contaminants have crossed the aquifer exemption boundary into the USDW.
10. If the analytical results from any Down-gradient Compliance Boundary Well show a concentration increase for any baseline constituent above the baseline permit limit, the Permittee shall use a statistical test to compare that concentration value to the existing baseline groundwater quality data to determine if there is any statistical evidence of an increase (increase or decrease in the case of pH) over the baseline permit limit.

11. Once statistical analyses has indicated that an SSI has occurred, a verification sample shall be taken from that well within 48 hours after results of the first analyses are received. If the verification sample confirms that an SSI has occurred the well the Permittee shall comply with requirements 12 and 13 of this Section. If the verification sample does not confirm that an SSI has occurred, a third sample shall be taken within 48 hours after the results of the verification sample are received. If the third sample shows that an SSI has occurred, the Permittee shall comply with requirements 12 and 13 of this Section. If the third sample does not confirm an SSI has occurred, the first sample shall be considered an error.
12. If a statistically significant increase (SSI) is confirmed, the Permittee shall notify the Director within 24 hours per the requirement under Part XII, Section D.11.e indicating the baseline constituent(s) that triggered the SSI, the wellfield at which the SSI occurred and the Down-gradient Compliance Boundary Well at which the SSI was detected.
13. If the results from the retesting strategy under 11 above show that an SSI has occurred in the concentration of a baseline constituent at a Down-gradient Compliance Boundary Well, the Permittee shall install at least one new Down-gradient Compliance Boundary Well and continue Post-Restoration Monitoring at the new well using the baseline permit limits of the nearest original Down-gradient Compliance Boundary Wells. More than one new Down-gradient Compliance Boundary Well may need to be installed to meet the requirement for Down-gradient Compliance Boundary Well spacing under Part IV, Section B.4.
    a. Within 30 days from confirmation of the SSI, the Permittee shall submit an aquifer remediation plan for the Director's approval showing how aquifer clean-up and monitoring will be conducted and how the Permittee will ensure that no further migration of ISR contaminants will occur across the aquifer exemption boundary will be accomplished.
    b. If this requirement is triggered, the Permittee shall also submit a written monitoring plan to the Director describing:
        i. the installation of the new Down-gradient Compliance Boundary Wells
        ii. mitigation activities to prevent baseline constituent concentrations above permit limits from reaching the new Down-gradient Compliance Boundary Wells; and
        iii. the use of a tracer to determine when groundwater from the previously impacted Down-gradient Compliance Boundary Wells reaches the new Down-gradient Compliance Boundary. The Director will issue written approval of the plan which will include authorization to inject the tracer.
    c. The Permittee shall continue post-restoration monitoring at the new Down-gradient Compliance Boundary for a minimum of two (2) years past the calculated travel time for groundwater from the previous Down-gradient Compliance Boundary to reach the new Down-gradient Compliance Boundary as indicated by the presence of the tracer. The analytical results from the last two (2) years of post-restoration monitoring shall show that the most recent four (4) consecutive samples from all new Down-gradient Compliance Boundary Wells indicate no statistically significant increasing trend for all baseline water quality constituents that would lead to an exceedance above the permit limit.
    d. Alternatively, the Permittee may pump the new Down-gradient Compliance Boundary Wells to decrease the travel time for the groundwater at the previous Down-gradient Compliance Boundary Wells to reach the new Down-gradient Compliance Boundary. In that case, the collection of groundwater samples from each new Down-gradient Compliance Boundary Well shall be conducted every three (3) months for a minimum duration of one (1) year past the arrival of calculated travel time for groundwater from the previous Down-gradient Compliance Boundary to reach the new Down-gradient Compliance Boundary as indicated by the presence of the tracer. The groundwater pumped from the Down-gradient Compliance Boundary Wells may be reinjected at the up-gradient perimeter monitoring well ring wells. Authorization to reinject the groundwater pumped from the new Down-gradient Compliance Boundary Wells will be included in the Director's approval of the monitoring plan described under **13a** and **b** above, if pumping of Down-gradient Compliance Boundary Wells is proposed.

14. If ISR contaminants cross the aquifer exemption boundary above the baseline permit limits, the Permittee shall notify the Director within 24 hours and provide the five-day written follow-up report per the requirements under Part XII, Section D.11.e.
15. The Permittee shall conduct aquifer cleanup to restore the USDW back to baseline water quality standards, design and implement a monitoring plan to verify that aquifer cleanup has restored the USDW to below the baseline permit limits and ensure that no further migration of ISR contaminants will occur across the aquifer exemption boundary.

F. Reporting Requirements

Monitoring may be reported on a project or field basis rather than individual well basis where manifold monitoring is used.

1. Reporting requirements shall, at a minimum, include:

a. Quarterly reporting to the Director on required monitoring required by this Permit;
b. Results of mechanical integrity as required under Section 5 below and any other periodic test required by the Director.

2. Following authorization to begin injection into a wellfield, the Permittee shall submit Quarterly Monitoring Reports to the Director containing the monitoring information required in Part IX, Section B whether the wellfield is operating or not.
   a. Reporting periods and due dates for Quarterly Monitoring Reports are shown in Part IX, Section F.8.
   b. An electronic format may be used to submit monitoring information using the data fields included on EPA Form 7520-8 *Injection Well Monitoring Report* found at http://water.epa.gov/type/groundwater/uic/reportingforms.cfm as a guide.
   c. However, the monitoring requirements specified in this Permit are mandatory even if EPA Form 7520-8 indicates otherwise.

3. Injection Authorization Data Package Reports

Injection Authorization Data Package Reports shall be prepared and submitted to the EPA UIC Program Director for each wellfield in order to obtain written Authorization to Commence Injection in that wellfield. These data packages may be submitted when completed and do not have to be submitted on the Quarterly Monitoring Report schedule shown below. The Injection Authorization Data Package Reports shall be signed according to Part XII, Section D.10 and certified using the paragraph included under Part XII, Section D.10(d). The information may be submitted in electronic format, but must be accompanied by a letter containing the required certification.

4. Injection, Production and Monitoring Well Completion Reports

a. After an injection, production or monitoring well has been completed, the Permittee shall submit a well completion report including the information in EPA Form 7520-9 *Completion Form for Injection Wells* with attachments.
b. The report may be in electronic format including the completion information for a number of wells. The EPA Form 7520-9 can be found at http://water.epa.gov/type/groundwater/uic/reportingforms.cfm.
c. The well construction report shall also contain the manufacturer-specified maximum operating pressure for all components of the injection or production well.
d. The cementing procedure shall be documented in detail in each well completion report.
e. Remedial cementing may be required if the Director determines the well cementing record is not adequate for demonstration of external mechanical integrity.

f. Injection well completion reports shall be submitted to the Director with the next scheduled Quarterly Monitoring Report, unless well construction was completed within 45 days of the next Quarterly Monitoring Report due date.
g. If well construction was completed within 45 days of the next Quarterly Monitoring Report due date, the well completion report shall be submitted with the following Quarterly Monitoring Report.

5. Demonstration that Manifold Monitoring of Injection Pressure is Comparable to Wellhead Monitoring

a. Demonstration shall consist of a list of injection pressures measured at each wellfield injection wellhead compared to the injection pressure measured at the pressure gauge at each header house and the time and date each injection pressure measurement was collected.
b. The Permittee shall make an effort to record the measurements at the same time from wellhead pressure gauge and the header house pressure gauge.
c. The report shall consist of
    i. injection well identification numbers,
    ii. injection pressure measured at each wellhead,
    iii. time and date of measurement,
    iv. header house identification number for the injection well,
    v. header house injection pressure measured,
    vi. time and date of measurement,
    vii. flow rate of carbon dioxide for the header house and
    viii. flow rates of oxygen for each injection well.
d. This information shall be included in the next Quarterly Report after the information is compiled.
e. After the initial demonstration for a wellfield, if adjustments are made to the oxygen flow rate or carbon dioxide flow rates, which are located in-line after the header house pressure gauge, then a new demonstration is required.

6. Initial Internal Mechanical Integrity Reports

The initial mechanical integrity test results required under Part VII, Section B.2 shall be submitted to the EPA UIC Program Director in order to obtain written Authorization to Commence Injection. The mechanical integrity test results may be submitted when completed and do not have to be submitted on the Quarterly Monitoring Report schedule shown below. The mechanical integrity test results shall be signed according to Part XII, Section D.10 and certified using the paragraph included under Part XII, Section D.10(d). The information may be submitted in electronic format, but must be accompanied by a letter containing the required certification.

7. Ongoing Demonstrations of Mechanical Integrity

The results from ongoing mechanical integrity tests shall be submitted to the Director with the next scheduled Quarterly Monitoring Report, unless the mechanical integrity test was completed within 45 days of the next Quarterly Monitoring Report due date. In that case, the information shall be submitted with the following Quarterly Monitoring Report.

8. Quarterly Monitoring Reports

a. The Permittee shall include the monitoring parameters listed under Part IX, Section B in the Quarterly Monitoring Report as specified here.
b. The Permittee shall submit the Quarterly Monitoring Reports to Director according to the schedule included in Table 17.
c. At minimum, the Permittee shall include in the Quarterly Monitoring Reports the following information:
    i. Monthly physical, chemical and other relevant analytical results of injection fluids.
    ii. Monthly average, maximum and minimum values for injection pressure, flow rate and volume.

iii. Quarterly mechanical integrity test results, a list of any wells failing mechanical integrity test and corrective actions taken, and a list of wells anticipated to undergo mechanical integrity testing during the next quarter.
iv. Operational monitoring results.
v. Excursion monitoring results.
vi. Post-restoration wellfield monitoring.
vii. Any seismic events within a 2 mile radius of the Area Permit boundary, gathered from USGS Earthquake Hazard Program website or through personal communication.
viii. Any well maintenance activities.

d. The Permittee shall sign and certify the monitoring reports according to the Draft Area Permit Part XII, Section D.10.
e. The Permittee may submit quarterly Monitoring Reports in electronic format but the electronic data must be accompanied by a letter containing the required certification.

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Director, UIC/FIFRA/OPA Technical Enforcement Programs, Mailcode: 8ENF-W-SDW
1595 Wynkoop Street
Denver, CO 80202-1129.

f. The Permittee shall include in the monitoring reports raw data and graphical analysis for the current reporting period to date.
g. The Permittee shall tabulate each calendar quarter, the maximum, minimum, and average monthly values for each continuously monitored parameter specified for the injection wells.
h. The Permittee shall include a narrative description of any deviations from permit limitations that occurred during the reporting period.
i. The Permittee shall describe any maintenance activities, mechanical integrity test activities, and other significant events that took place during the reporting period.

Table 17. Schedule for Submitting Quarterly Monitoring Reports

QUARTER	REPORTING PERIOD	REPORT DUE TO EPA
1st Quarter	January 1 – March 31	May 15
2nd Quarter	April 1 – June 30	August 15
3rd Quarter	July 1 – September 30	November 15
4th Quarter	October 1- December 31	February 15

9. Excursion Reporting

a. Initial Excursion Reporting

i. If an excursion has been confirmed, the Permittee shall notify the EPA within 24 hours per Part XII, Section D.11.e and follow up with a written report within 5 days.
   A) the Permittee shall notify the EPA within 24 hours per Part XII, Section D.11.e and follow up with a written report within 5 days.Location of excursion,
   B) Monitoring wells impacted,
   C) How the excursion was detected,
   D) Date of previous excursion monitoring activities in the area,
   E) Estimation of how far excursion plume may have traveled (include map showing estimated excursion plume), and
   F) Actions to correct the excursion.

b. 60 Day Excursion Reporting

i. Within 60 days of the excursion confirmation, the Permittee shall submit a written report describing the excursion event, corrective actions taken and the corrective action results.

ii. If monitoring wells are still on excursion status when the report is submitted, the report will also contain a schedule for submittal of future reports describing the excursion event, corrective actions taken, and results obtained.

c. Reporting an Expanding Excursion Plume

i. If an expanding excursion plume is confirmed per Part IX, Section C.3.e, the Permittee shall notify the EPA within 24 hours per Part XII, Section D.11.e and follow up with a written report within 5 days.

ii. The written report shall contain a description of the Permittee's implementation plan for compliance with the requirements under Part IX, Section C.4.

PART X. RECORDKEEPING REQUIREMENTS

A. Records of Permit Application Data

The Permittee shall keep records of all data used to complete permit applications and any supplemental information submitted under 40 CFR § 144.31 for a period of at least 3 years from the date the application is signed.

B. Records of Monitoring Data

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

1. Calibration and maintenance records and data from continuous monitoring instrumentation, copies of all reports required by this permit, for a period of at least 3 years from the date all wells have been plugged and abandoned.
2. Well completion reports.
3. The nature and composition of all injected fluids until three years after the completion of any plugging and abandonment procedures specified under § 144.52(a)(6), or under part 146 subpart G as appropriate.
4. Mechanical integrity test results, description and results of any other tests required by EPA, and any well workovers completed.
5. System failures and follow-up actions.
6. The Permittee shall also will maintain an electronic database containing well completion and mechanical integrity test records for all injection wells and provide it for EPA use upon request.
7. Records of all monitoring activities must be retained and made available for inspection. The Permittee shall notify the EPA as to the location where the records of monitoring activities are maintained and notify the EPA if this location changes.
8. At the end of the retention period, the owner or operator shall deliver the records to the EPA Regional Administrator or obtain written approval from the Regional Administrator to discard the records.

C. Retention Schedule for Well Plugging and Abandonment Reports

1. The Plugging and Abandonment Reports required under Part XI, Section D shall be retained for at least 3 years from the date of the submission unless the EPA requests an extension.
2. At the conclusion of the retention period, the reports will be delivered to the EPA upon request.

PART XI. PLUGGING AND ABANDONMENT

A. Notification of Well Abandonment, Conversion or Closure

1. Except for the plugging and abandonment of a well that cannot demonstrate mechanical integrity under Part VII and will be replaced by a newly constructed well meeting the requirements in Part V, the Permittee shall notify the Director in writing at least forty-five (45) days prior to:
   a. plugging and abandoning an injection well;
   b. converting to a non-injection well, other than a wellfield production well; and
   c. closure of the project.
2. Notification shall include demonstration that the NRC considers the wellfield groundwater to be restored before the EPA will authorize the closure of wellfield injection and production wells.
3. In accordance with 40 CFR § 146.10(a)(4), the plugging and abandonment plan required in 40 CFR §§ 144.51(o) and 144.52(a)(6) shall demonstrate adequate protection of USDWs.
4. Before approving well closure, the Director may prescribe aquifer cleanup and monitoring where he deems it necessary and feasible to ensure adequate protection of USDWs.

B. Well Plugging Requirements

1. Prior to abandonment, each Class III injection well shall be plugged with cement in a manner which prevents the movement of fluids into or between underground sources of drinking water.
2. Each well shall be plugged in accordance with the approved plugging and abandonment plan and with 40 CFR § 146.10

C. Approved Plugging and Abandonment Plan

1. Wells shall be plugged with bentonite grout if the weight of the bentonite grout column is greater than the bottom hole pressure or shall be plugged with cement grout placed from the bottom of the well or hole to within eight feet of the ground surface. Cement grout shall be placed from eight feet below ground surface to within three feet of the ground surface. The top three feet may be filled with native material. If a pipe cannot be lowered inside the well casing to place grout from the bottom to the top, the well may be plugged by making a tight connection to the top of the casing and pumping a volume of cement grout, sufficient to fill the well, under pressure into the well. Bentonite grout shall not be used if the well is being plugged by making a tight connection to the top of the casing and pumping the grout in under pressure. If it cannot be verified that a well's casing was grouted in accordance with this chapter, an effort shall be made to plug the annulus from the bottom of the annulus up to the ground surface with the same type of material or materials required for plugging inside the casing.
2. Records shall be kept of each well cemented including at a minimum the following information:
   a. well ID, total depth, and location
   b. driller, company, or person doing the cementing work
   c. total volume of grout placed down hole
   d. viscosity and density of the grout
3. The Permittee shall remove surface casing or cut off surface casing below ground and set a cement surface plug on each well plugged and abandoned.
4. Changes to the approved plugging and abandonment plan shall be approved by the Director prior to beginning plugging operations. The Director also may require revision of the approved plugging and abandonment plan at any time prior to plugging the well.

D. Plugging and Abandonment Report

1. Within 60 days after plugging a well or at the time of the next quarterly report (whichever is less) the owner or operator shall submit a report to the Director. If the quarterly report is due less than 15 days before completion of plugging, then the report shall be submitted within 60 days. In accordance with this

requirement, a Plugging and Abandonment Report (EPA Form 7520-13) shall be submitted to the Director.

2. The plugging report shall be certified as accurate by the person who performed the plugging operation. Such report shall consist of either:
   a. A statement that the well was plugged in accordance with the approved plugging and abandonment plan in Section C of this Part; or
   b. Where actual plugging differed from the approved plugging and abandonment plan, an updated version of the plan specifying the differences.
3. Documentation shall be provided to verify that the quantity of sealing material placed in the well is at least equal to the volume of the empty hole.
4. The Plugging and Abandonment Reports will be retained for at least 3 years from the date of the submission unless the EPA requests an extension. If requested, at the conclusion of the retention period, the reports will be delivered to the EPA.

PART XII. CONDITIONS APPLICABLE TO ALL PERMITS

A. CHANGES TO PERMIT CONDITIONS

1. Modification, Reissuance or Termination

The Director may, for cause or upon a request from the Permittee, modify, revoke and reissue, or terminate this Permit in accordance with 40 CFR §§ 124.5, 144.12, 144.39, and 144.40. Also, this Permit is subject to minor modification for causes as specified in 40 CFR § 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. Conversions

The Director may, for cause or upon a written request from the Permittee, allow conversion of the well from a non-injection well. Conversion may not proceed until the Permittee receives written approval from the Director. Conditions of such conversion may include but are not limited to, approval of the proposed well rework, follow up demonstration of mechanical integrity, well-specific monitoring and reporting following the conversion, and demonstration of practical use of the converted configuration.

3. Transfer of Permit

Under 40 CFR § 144.38, this Permit is transferable provided the current Permittee notifies the Director at least thirty (30) days in advance of the proposed transfer date (EPA Form 7520-7) and provides a written agreement between the existing and new Permittees containing a specific date for transfer of Permit responsibility, coverage and liability between them. The notice shall adequately demonstrate that the financial responsibility requirements of 40 CFR § 144.52(a)(7) will be met by the new Permittee. The Director may require modification or revocation and reissuance of the Permit to change the name of the Permittee and incorporate such other requirements as may be necessary under the Safe Drinking Water Act; in some cases, modification or revocation and reissuance is mandatory.

4. Permittee Change of Address

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

5. Construction Changes, Workovers, Logging and Testing Data

The Permittee shall give advance notice to the Director, and shall obtain the Director's written approval prior to any physical alterations or additions to the permitted facility. Alterations or workovers shall meet all conditions as set forth in this permit. The Permittee shall record any changes to the well construction on a

Well Rework Record (EPA Form 7520-12), and shall provide this and any other record of well workovers, logging, or test data to EPA with the next quarterly report. If the quarterly report is due within 30 of the activity, then the Permittee shall include the information in the subsequent quarterly report.

B. 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.

C. CONFIDENTIALITY

In accordance with 40 CFR part 2 and 40 CFR § 144.5, information submitted to EPA pursuant to this Permit 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, EPA may make the information available to the public without further notice. If a claim is asserted, the validity of the claim will be assessed 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.

D. GENERAL PERMIT REQUIREMENTS

1. Duty to Comply

The Permittee must comply with all conditions of this Permit. Any noncompliance constitutes a violation of the Safe Drinking Water Act (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 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. 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 Extensions. The conditions of an expired permit may 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 Director 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 Permittee 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 part 124 with appropriate conditions; or
    iv. Take other actions authorized by the UIC regulations.

d. State Continuation. An EPA issued permit does not continue in force beyond its expiration date under Federal law if at that time a State has primary enforcement authority. A State authorized to administer the UIC program may continue either EPA or State-issued permits until the effective date of the new permits, if State law allows. Otherwise, the facility or activity is operating without a permit from the time of expiration of the old permit to the effective date of the State-issued new permit.

3. Need to Halt or Reduce Activity Not a Defense

It shall not be a defense for a Permittee 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.

4. 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.

5. 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 includes effective performance, adequate funding, adequate Permittee 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.

6. 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.

7. Property Rights

This Permit does not convey any property rights of any sort, or any exclusive privilege.

8. 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. The Permittee is required to submit any information required by this Permit or by the Director to the mailing address designated in writing by the Director.

9. 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 monitoring at reasonable times, for the purpose of assuring permit compliance or as otherwise authorized by the SDWA, any substances or parameters at any location.

10. Signatory Requirements

All reports or other information requested by the Director shall be signed and certified as follows:

a. All reports required by this permit and other information requested by the Director shall be signed as follows:
   i. for a corporation—by a responsible corporate officer, such as a president, secretary treasurer, or vice president of the corporation in charge of principal business function, or any other person who performs similar policy or decision-making functions for the corporation;
   ii. for partnership or sole proprietorship—by general partner or the proprietor, respectively; or
   iii. for municipality, state, federal, or other public agency—by either a principal executive or a ranking elected official.

b. A duly authorized representative of the official designated in paragraph (a) above also may sign only if:
   i. the authorization is made in writing by a person described in paragraph (a) above;
   ii. the authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility or activity, such as the position of plant manager, operator of a well or a wellfield, superintendent, or a position of equivalent responsibility. A duly authorized representative may thus be either a named individual or any individual occupying a named position; and
   iii. the written authorization is submitted to the Director.

c. If an authorization under paragraph (b) of this section is no longer accurate because a different individual or position has responsibility for the overall operation of the facility, a new authorization satisfying the requirements of paragraph (b) of this section shall be submitted to the Director prior to or together with any reports, information or applications to be signed by an authorized representative.

d. Any person signing a document under paragraph (b) of this section shall make the following certification:

> *I certify under the penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fines and imprisonment.*

11. Reporting Requirements

Before written Authorization to Commence Injection is issued by the Director for a well, copies of all reports and notifications required by this Permit shall be signed and certified in accordance with the requirements under Part XII, D.10 of this permit and shall be submitted to the EPA at the following address:

Underground Injection Control Unit Manager, 8WP-SUI
1595 Wynkoop Street
Denver, Colorado 80202-1129

After written Authorization to Commence Injection is issued by the Director for a well, copies of all reports and notifications required by this Permit shall be signed and certified in accordance with the requirements under Part XII, D.10 of this permit and shall be submitted to the EPA at the following address:

UIC Enforcement Coordinator, 8ENF-W-SDW
1595 Wynkoop Street
Denver, Colorado 80202-1129

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

a. 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 facility, and prior to commencing such changes.
b. 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.
c. Monitoring Reports. Monitoring results shall be reported at the intervals specified in this Permit.
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 30 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 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.
f. 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 VIII UIC Program Compliance and Technical Enforcement Director, or by contacting the EPA Region VIII Emergency Operations Center at (303) 293-1788.
g. In addition, a follow up written report shall be provided to the Director within five (5) 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.
h. The written report shall also be provided to the Director in electronic format for release to the public and tribal governments on the EPA Region 8 UIC website.
i. 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**.
j. Other Noncompliance. The Permittee shall report all instances of noncompliance not reported under paragraphs Part XII, Section D.11.b, Section D.11.e or Section D.11.i at the time the monitoring reports are submitted. The reports shall contain the information listed in Part XII, Section D.11.g and be provided to the Director in electronic format as required in Part XII, Section D.11.h.
k. Other information. Where the Permittee becomes aware that it failed to submit any relevant facts in the permit application, or submitted incorrect information in a permit application or in any report to the Director, the Permittee shall promptly submit such facts or information to the Director.

PART XIII. FINANCIAL RESPONSIBILITY

A. Method of Providing Financial Responsibility

The Permittee shall maintain continuous compliance with the requirement to maintain financial responsibility and resources to close, plug, and abandon the underground injection well(s). No substitution of a demonstration of financial responsibility shall become effective until the Permittee receives written notification from the

Director that the alternative demonstration of financial responsibility is acceptable. The Director may, on a periodic basis, require the holder of a permit to revise the estimate of the resources needed to plug and abandon the well to reflect changes in such costs and may require the Permittee to provide a revised demonstration of financial responsibility.

B. Insolvency

In the event of:

1. the bankruptcy of the trustee or issuing institution of the financial mechanism; or
2. suspension or revocation of the authority of the trustee institution to act as trustee; or
3. the institution issuing the financial mechanism losing its authority to issue such an instrument,

the Permittee must notify the Director in writing, within ten (10) business days, and the Permittee must establish other financial assurance or liability coverage acceptable to the Director within sixty (60) days after any event specified in (a), (b), or (c) above.

The Permittee must also notify the Director by certified mail of the commencement of voluntary or involuntary proceedings under Title 11 (Bankruptcy), U.S. Code naming the owner or Permittee as debtor, within ten (10) business days after the commencement of the proceeding. A guarantor, if named as debtor of a corporate guarantee, must make such a notification as required under the terms of the guarantee.

C. Updated Cost Estimate and Timing for Demonstration of Financial Responsibility

An updated cost estimate shall be submitted upon the Issue Date of the Final Permit. The demonstration of financial responsibility shall be submitted to the EPA within 21 calendar days of the Effective Date of the Final Permit and before the commencement of any well construction activities.

D. This surety fulfills a portion of the decommissioning activities cited in the U.S. Nuclear Regulatory Commission Materials License SUA-1600, pursuant to Title 10 Code of Federal Regulations Part 40, Appendix A, Criterion 9.

APPENDIX A
WELLFIELD CROSS SECTIONS
Figure A1. Cross Sections through Dewey Wellfields 1, 2 and 3

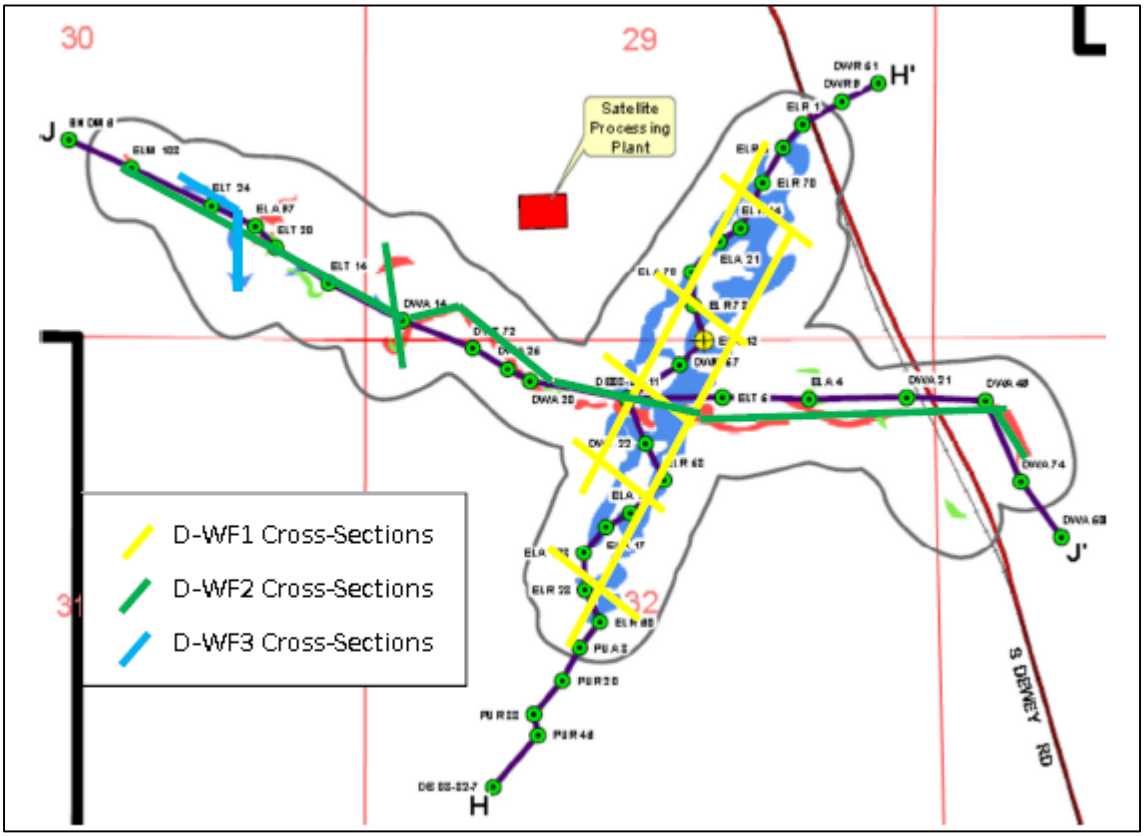


Figure A2. Cross Sections through Dewey Wellfield 4

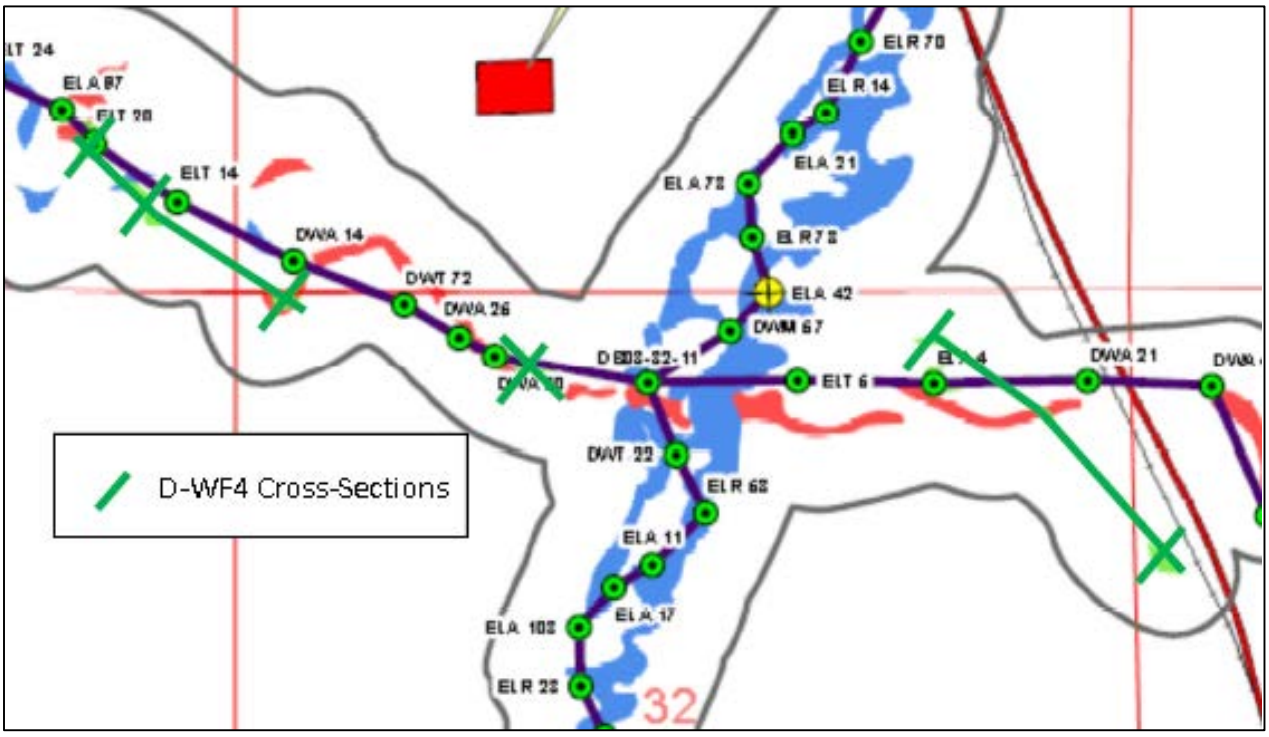


Figure A3. Cross Sections through Burdock Wellfield 4

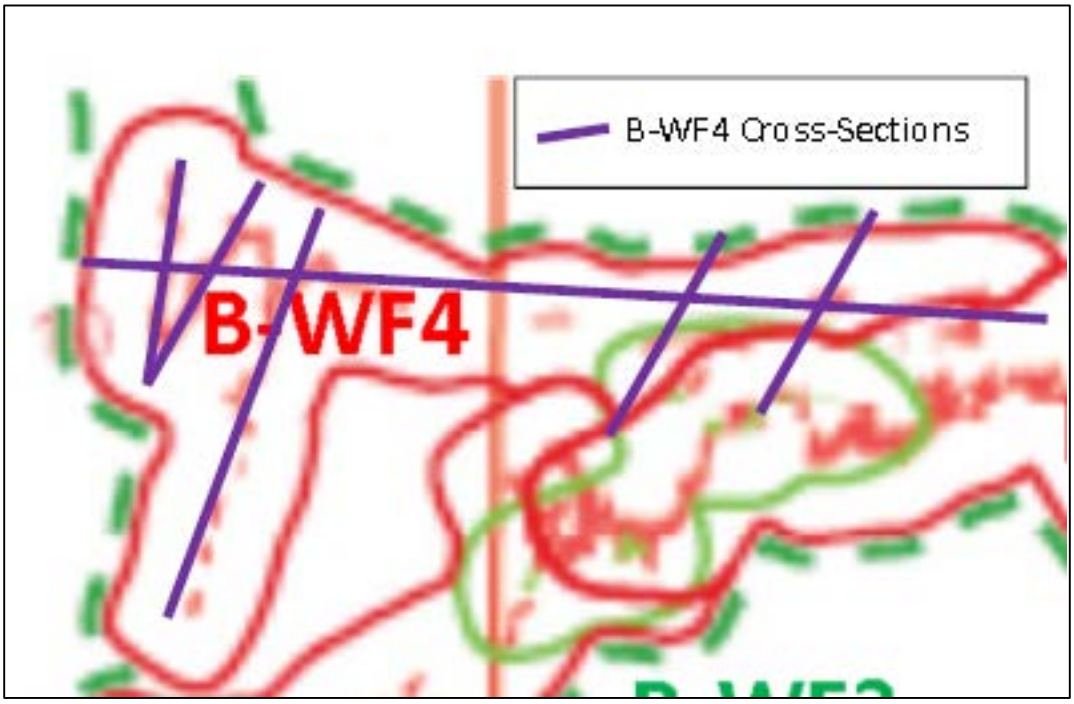


Figure A4. Cross Sections through Burdock Wellfields 5 and 9

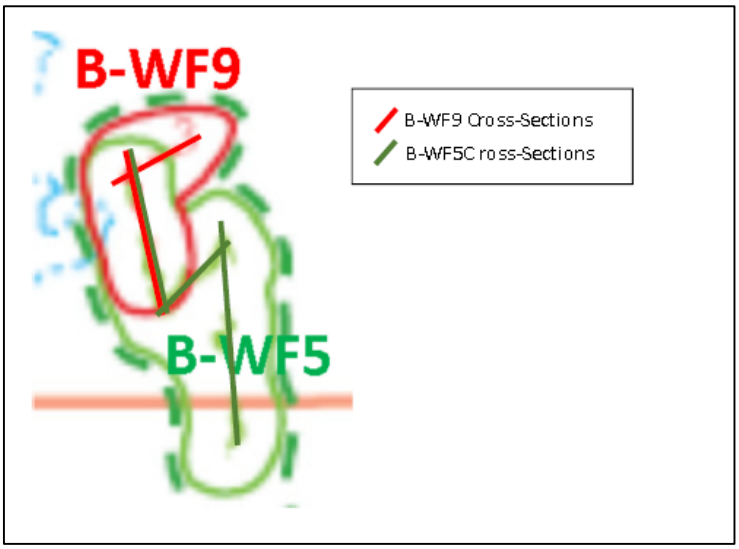


Figure A5. Cross Sections through Burdock Wellfields 6 and 7

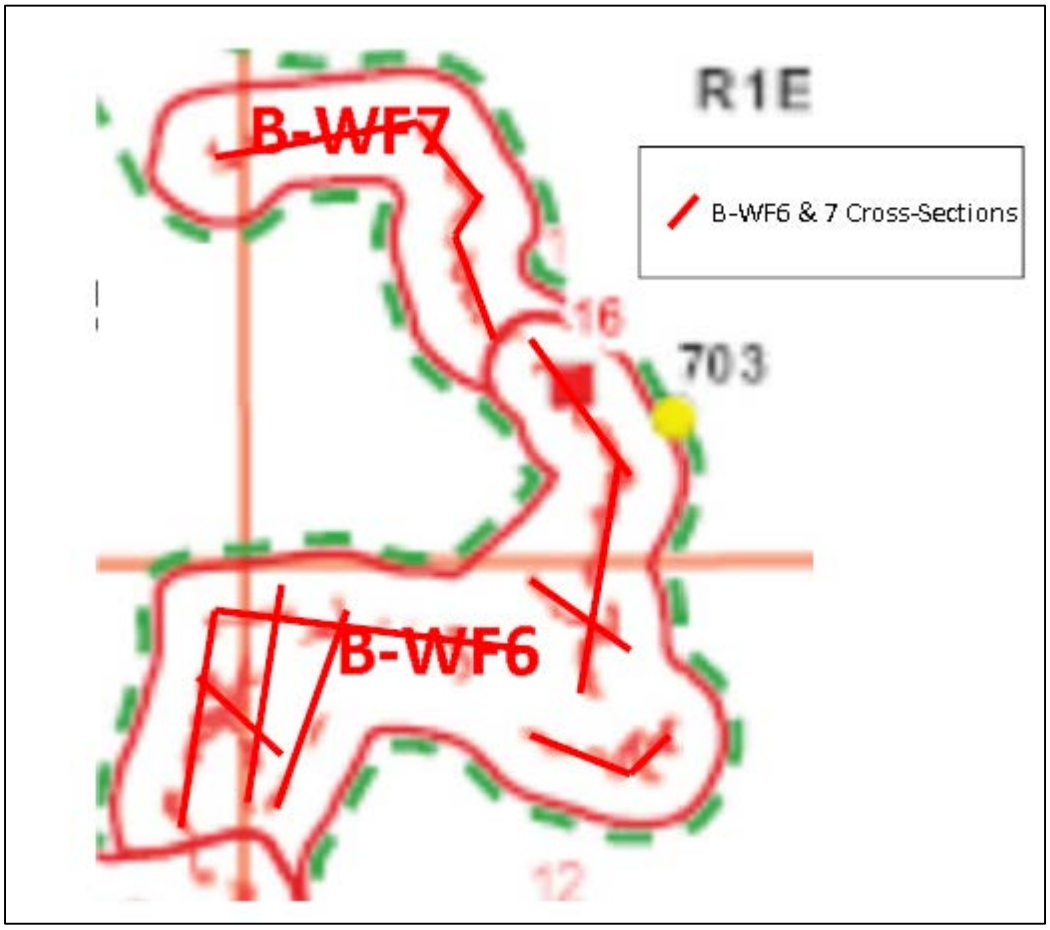


Figure A6. Cross Sections through Burdock Wellfield 8

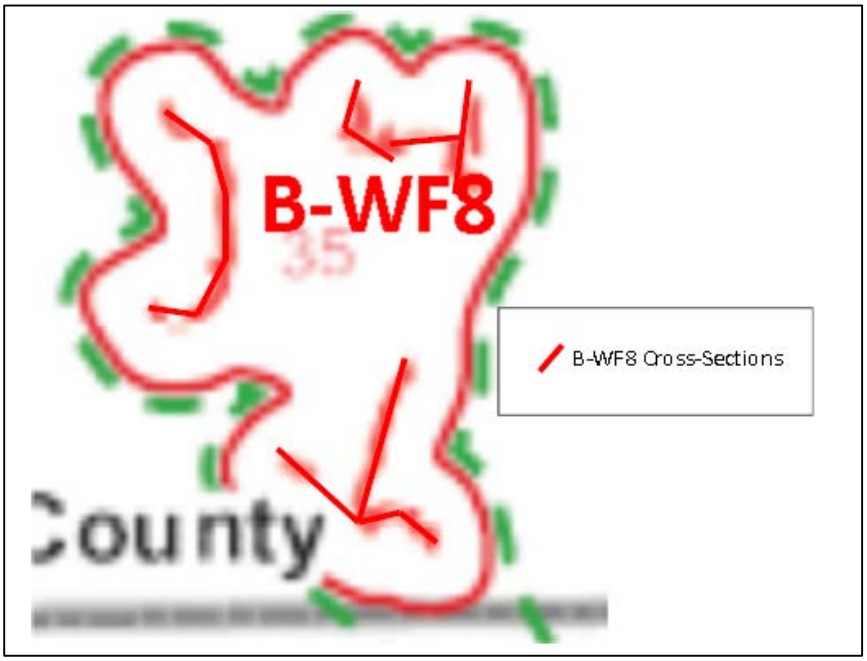
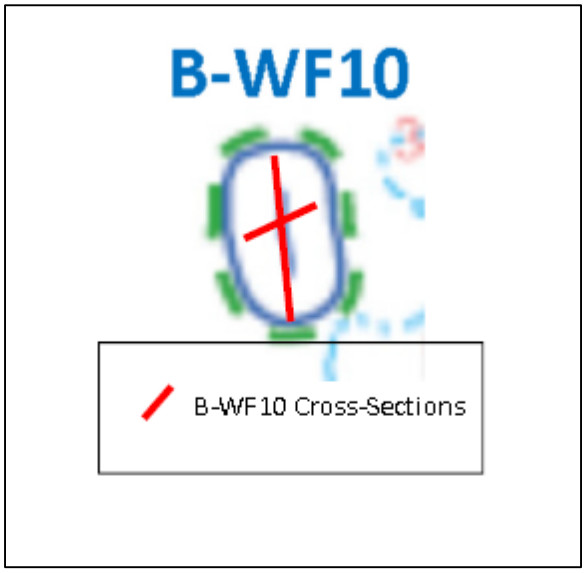


Figure A7. Cross Sections through Burdock Wellfield 10



APPENDIX B
ILLUSTRATION OF OPTIONS AND REQUIREMENTS
FOR POST-RESTORATION GROUNDWATER MONITORING
USING DEWEY WELLFIELD #1 AS THE EXAMPLE

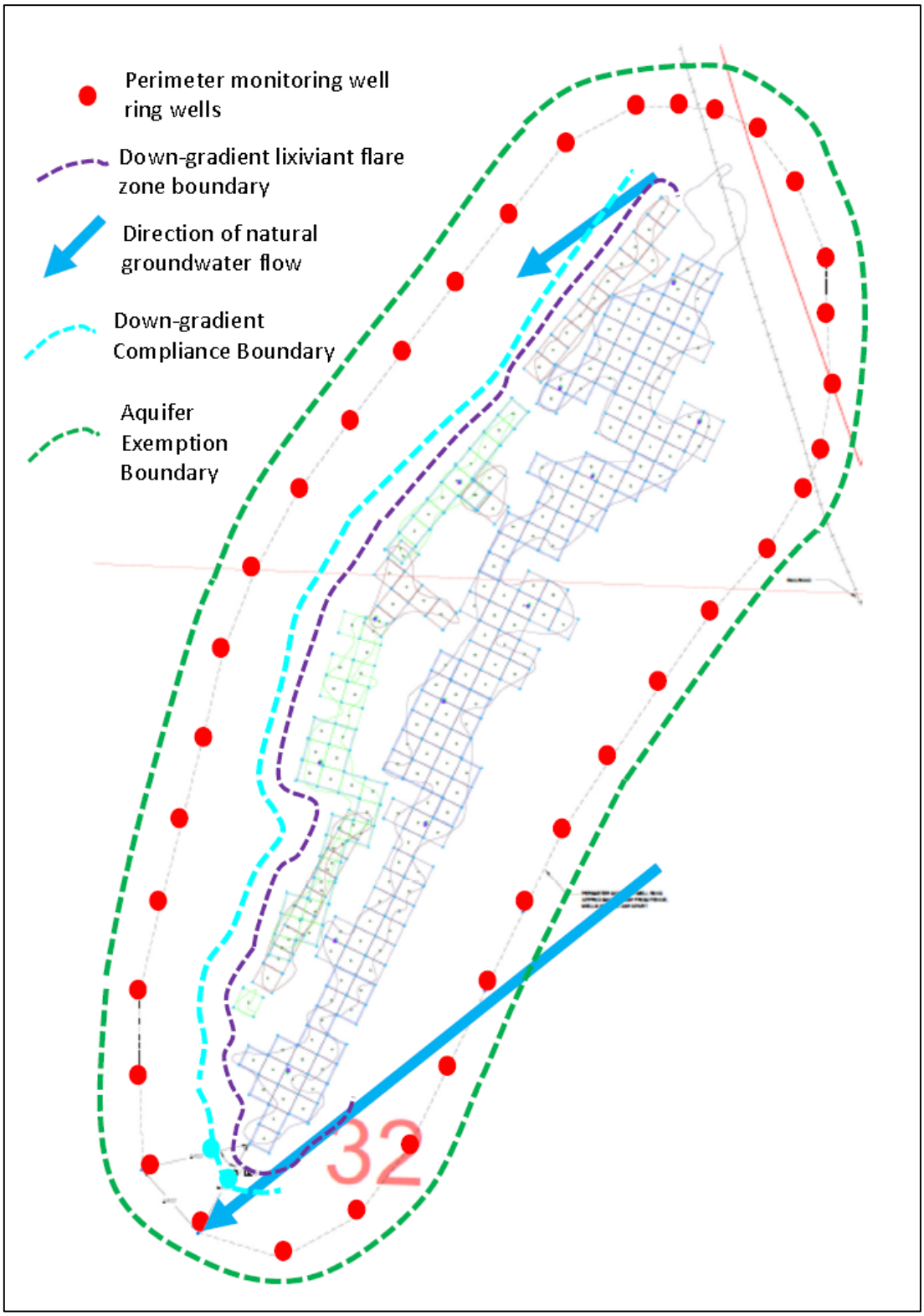


Figure B1. Example for Location of Down-gradient Compliance Boundary

Figure B1 illustrates how the Permittee shall locate the Down-gradient Compliance Boundary Wells at which baseline constituents must meet the permit limits established according to Post-Restoration Monitoring Plan described in Part IV. The Down-gradient Compliance Boundary should be located between the down-gradient portions of the perimeter monitoring well ring and the down-gradient wellfield boundary as defined by the location of the injection and production well locations. Ideally the Down-gradient Compliance Boundary wells should be located down-gradient from the lixiviant flare zone in order to allow the restored wellfield groundwater to travel through injection interval formation that remains unaltered by contact with lixiviant.

Considerations for Down-gradient Compliance Boundary Location:

1. The closer the Down-gradient Compliance Boundary is to the wellfield ore zone boundary:
    i. The shorter the time required for groundwater to flow from the restored wellfield to the Down-gradient Compliance Boundary.
    ii. The shorter the contact time for the restored wellfield groundwater to pass through unaltered injection interval formation, which should mitigate any elevated concentrations of baseline constituents.
    iii. The greater the risk that the flare zone will encroach upon the Down-gradient Compliance Boundary.
    iv. The Down-gradient Compliance Boundary is farther from the Aquifer Exemption Boundary, providing a larger buffer zone for mitigation if baseline constituents exceed the baseline permit limit at the Down-gradient Compliance Boundary.
2. Alternatively, the closer the Down-gradient Compliance Boundary is to the perimeter monitoring well ring:
    i. The longer the time required for groundwater to flow from the restored wellfield to the Down-gradient Compliance Boundary.
    ii. The longer the contact time for the restored wellfield groundwater to pass through unaltered injection interval formation, which should mitigate any elevated concentrations of baseline constituents.
    iii. The smaller the risk that the flare zone will encroach upon the Down-gradient Compliance Boundary.
    iv. The Down-gradient Compliance Boundary is closer to the Aquifer Exemption Boundary, providing a smaller buffer zone for mitigation if baseline constituents exceed the baseline permit limit at the Down-gradient Compliance Boundary.

The Permittee has the option of pumping the Down-gradient Compliance Boundary Wells, which will decrease the travel time for the restored wellfield groundwater to reach Down-gradient Compliance Boundary.

The Permittee shall ensure that the Down-gradient Compliance Boundary extends far enough so that each end of the boundary intercepts all restored wellfield groundwater flowing down-gradient as illustrated in Figures B2a and B2b. Figure B2a shows the north end of the wellfield in Figure B1; Figure B2b shows the south end of the wellfield in Figure B1. In both figures, the aqua Down-gradient Compliance Boundary extends far enough to intercept down-gradient wellfield groundwater flow. If the Down-gradient Compliance Boundary Wells are pumped, a map similar to Figure B2 is sufficient to meet this requirement. If the Permittee elects not to pump the wells, a groundwater flow model that accounts for dispersion of restored wellfield groundwater as it flows down-gradient shall be used to meet this requirement.

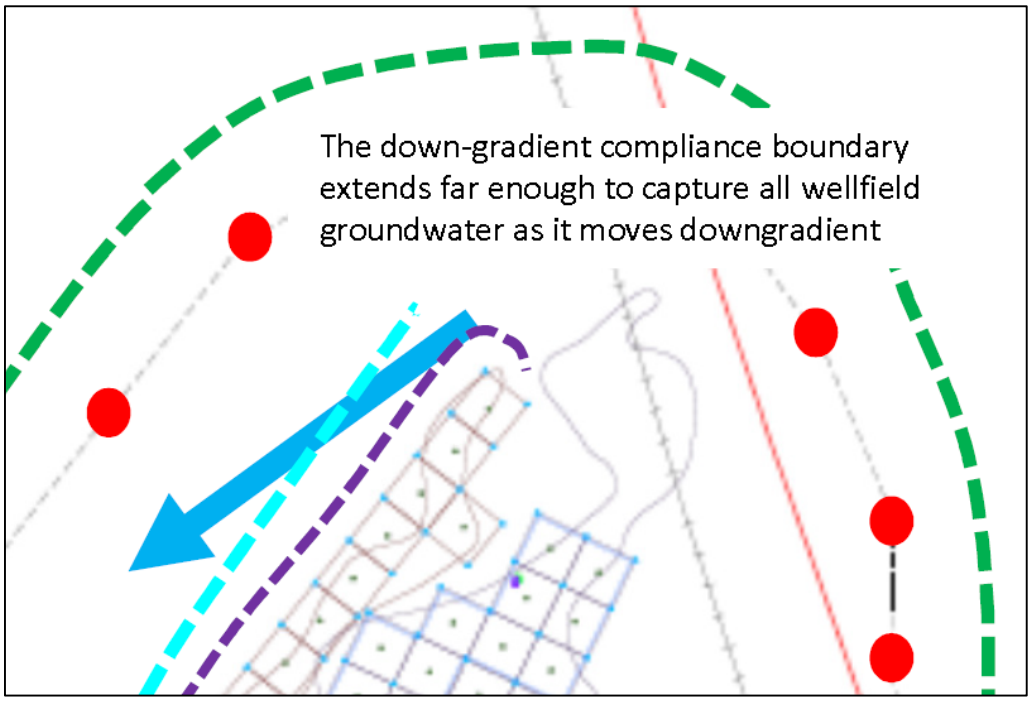


Figure B2a. The Down-gradient Compliance Boundary at the north end of the wellfield shown in Figure B1 extends far enough at each end to capture any restored groundwater flowing from the wellfield.

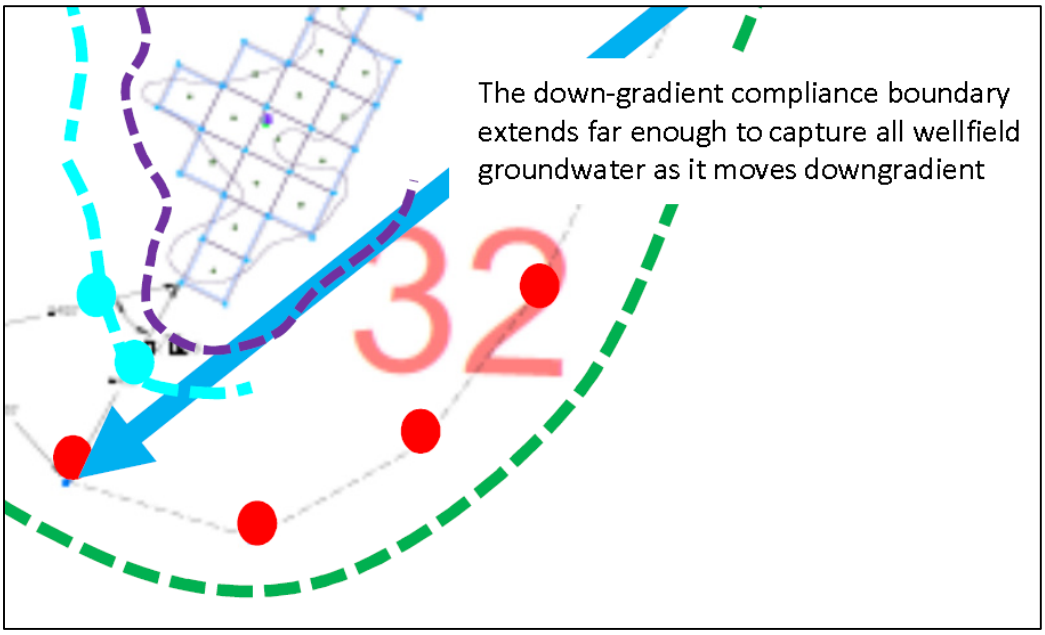


Figure B2b. The Down-gradient Compliance Boundary at the north end of the wellfield shown in Figure B1 extends far enough at each end to capture any restored groundwater flowing from the wellfield.

The distance between the Down-gradient Compliance Boundary Monitoring Wells shall be set to ensure no greater than a 70 degree angle between adjacent Down-gradient Compliance Boundary Monitoring Wells and the nearest mutual point on the wellfield boundary as shown in Figure B3.

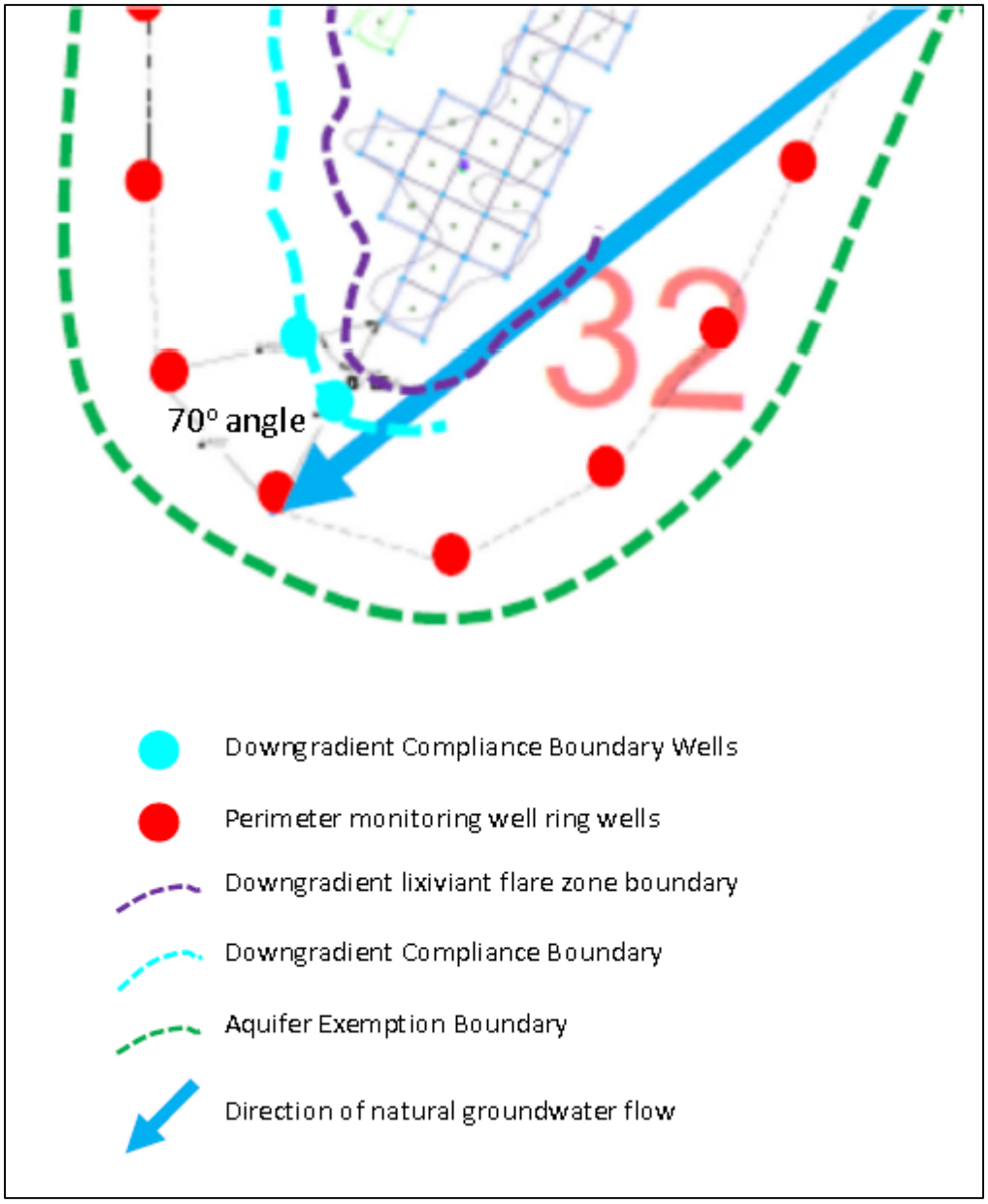


Figure B3. Down-gradient Compliance Boundary Wells Located to Form a 70 Degree Angle with Nearest Mutual Point on the Wellfield Boundary

The permit requirement at Part IV, Section B.10, requires the Permittee to evaluate the impacts of groundwater located upgradient of the restored wellfield on any ISR contaminants precipitated or adsorbed onto the injection zone aquifer matrix down-gradient of the restored wellfield. The groundwater upgradient of the restored wellfield would have a chemical composition somewhat different from that of the restored wellfield groundwater. The purpose of this monitoring is to ensure that ISR contaminants precipitated or adsorbed onto the injection zone aquifer matrix are not mobilized when the upgradient groundwater flows through the area.

The Permittee shall identify a minimum of three wellfield upgradient boundary wells at locations that ensure the capture zones for the Down-gradient Compliance Boundary wells (whether these wells are monitored under pumped or natural groundwater flow conditions) will include only upgradient groundwater that has passed through restored wellfield areas. Figure B4 shows examples of wellfield upgradient boundary wells in locations that fulfill this requirement. Note that the direction of groundwater flow, and therefore the location of the capture zones of the Down-gradient Compliance Boundary wells, are different depending on whether they are monitored under natural groundwater flow conditions or pumped conditions.

The black arrows in Figure B4 are examples of the groundwater flow paths from wellfield upgradient boundary wells to the Down-gradient Compliance Boundary under conditions of natural groundwater flow. The black arrows parallel the wide blue arrows showing the direction of natural groundwater flow in the area of Dewey wellfield 1. In contrast, the red arrows are examples of the groundwater flow paths from wellfield upgradient boundary wells to the Down-gradient Compliance Boundary under conditions of pumping the Down-gradient Compliance Boundary wells. The pumping changes the direction of groundwater flow as shown by the directions indicated by the red arrows.

The Permittee must inject a tracer into a minimum of three wellfield upgradient boundary wells located in areas such as those shown in Figure B4 and widely distributed across the wellfield. Groundwater arriving at the Down-gradient Compliance Boundary from these wells would be representative of upgradient groundwater that has flowed through the restored wellfield. When the tracer is detected at the Down-gradient Compliance Boundary and no ISR contaminants are measured above the baseline permit limits, then the EPA will be assured that the upgradient groundwater will not mobilize ISR contaminants that have been precipitated or absorbed onto the injection interval aquifer matrix downgradient of the restored wellfield and that ISR contaminants will not cross the aquifer exemption boundary in concentrations above the baseline permit limits.

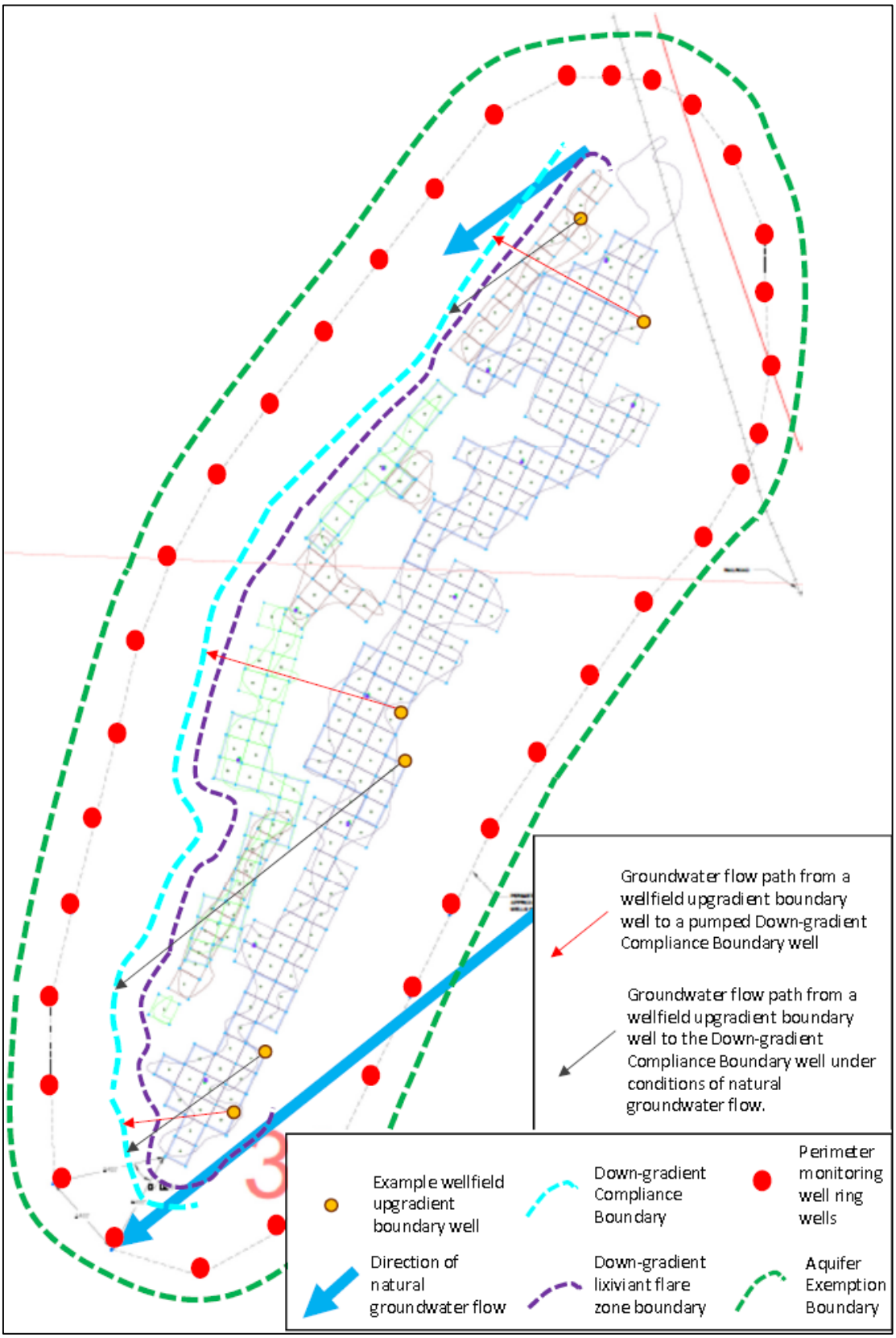


Figure B4. Examples of locations of wellfield upgradient boundary wells occurring in good locations to provide representative upgradient groundwater that has flowed through the restored wellfield and the portion of the injection zone aquifer located downgradient of the restored wellfield.