November 21, 2025

David Albright
Manager, Groundwater Protection Section
United States Environmental Protection Agency Region IX
75 Hawthorne Street
San Francisco, CA 94105-3901

Re: Response to Request for Additional Information, Project Plans and Risk-Based AoR,
Carbon TerraVault Holdings LLC (CTV) VI Project
Underground Injection Control (UIC) Permit Application
Class VI Pre-Construction Permit Application No. R9UIC-CA6-FY24-2.1 to 2.7

Dear Mr. Albright:

Carbon TerraVault Holdings LLC (CTV) has prepared this response to the U.S. Environmental Protection Agency Region IX ("EPA") CTV VI Class VI Permit Application request for additional information dated August 21, 2025 and October 27, 2025. Responses to each EPA comment are attached to this letter. The following permit application components have also been revised in response to EPA comments:

- Attachment A: Narrative Report
- Attachment B: Area of Review (AoR) and Corrective Action Plan
- Attachment C: Testing and Monitoring Plan
- Attachment E: Post-Injection Site Care Plan
- Attachment F: Emergency and Remedial Response Plan
- Attachment G1-G7: Injector Construction and Plugging Plans
- Attachment H: Financial Responsibility Demonstration
- Attachment I: Pre-Operational Testing Plan
- Appendix 9: Risk-Based AoR Delineation
- Appendix 10: Quality Assurance and Surveillance Plan

In addition, Attachment J: Stimulation Plan was created in response to operating procedures, question #1, which requests a draft stimulation plan. Wellbore diagrams, and CalGEM well history reports for the two wells within the AoR have also been included in this submission.

Updated versions of each report and a copy of this letter have been uploaded to the GSDT, and are also submitted via email.

Sincerely,

CARBON TERRAVAULT HOLDINGS LLC

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Faisal Latif
Storage Development Manager

Section	Q #	Questions/Requests for CTV	Text Section Updated	CTV Response
Operating Procedures	1	1. To avoid the need for a permit modification if stimulation were to become necessary in the future, EPA requests that CTV prepare a draft stimulation plan. The plan should describe: a. How the stimulation fluids are to be used, including any additives (e.g., corrosion inhibitors, clay inhibitors, biocides, complexing agents, or surfactants) or diverting agents; and b. Step-by-step procedures that would be employed during stimulation	Attachment J; Attachment A, Section 5.1	New **Attachment J: Stimulation Plan** has been added to the submission, as requested. **Attachment A, Section 5.1** has been updated to refer to **Attachment J: Stimulation Plan**.

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Corrective Action Plan	2	The information provided on the corrective action wells within the AoR is sufficient at this time, however, EPA could request additional information, such as an aerial or ground survey, if deemed necessary further in the review process.	None	Acknowledged.
	3	If any modifications to the modeling inputs are needed based on pre-operational testing (e.g., porosity, permeability, geochemistry), CTV must demonstrate to EPA that no additional wells are present in the revised AoR. If the AoR is adjusted and new wells are identified, these will be evaluated for corrective action.	None	Acknowledged.
	4	To address concerns about corrosion, please modify the Corrective Action Plan to refer to engineered Class G cement or incorporate additives to the Class G cement in plugs that may be exposed to CO_2.	Attachment B, Section 5.2	In portions of the wells that will be exposed to the injection zone or CO_2, additives will be incorporated into the cement blend to prevent corrosion and ensure containment of CO_2 within the reservoir. **Attachment B, Section 5.2** has been updated to reference cement additives.

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Carbon Dioxide Stream Analysis	5	Please add H_2O as a CO_2 stream analyte on Table C-1 to provide information about the potential presence of free-phase water.	Attachment C, Table C-1	**Attachment C, Table C-1** has been updated, as requested.
	6	Tables 7.2-1 and 7.2-2 of Section 7 of the Narrative indicate that sulfur trioxide (SO_3) may be a constituent of the CO_2 stream. Please update Table C-1 of the T&M Plan with an appropriate analytical or alternative method for measuring SO_3 if it is determined to be a constituent of the final CO_2 stream.	Attachment C, Table C-1	**Attachment C, Table C-1** was updated to include total sulfur in addition to the sulfur species hydrogen sulfide and sulfur dioxide. The CO_2 stream analytical laboratory (Airborne) does not have the capability to perform a specialized analysis for sulfur trioxide, as it is an uncommon analyte. The concentration of sulfur trioxide in the injectate is expected to be insignificant, less than 0.01% by mass, as noted in Attachment A, Table 7.2-1.
	7	Please clarify the types of CO_2 stream changes (including the threshold changes in physical/chemical characteristics) that would warrant a change in the proposed permit application (e.g., well material selection, sampling frequency, etc.). Please specify what the specific changes would be.	Attachment B, Section 3.12; Table 3.6, Table 3.7	New **Section 3.12** has been added to **Attachment B** to discuss the proposed CO_2 Stream. Additionally, new **Tables 3.6** and **3.7** have been added to **Attachment B** to reference the modeled injectate compositions, and to clarify the CO_2 stream limits that would warrant a change in the proposed permit application.
	8	CTV will need to update Table C-1 of the T&M Plan and Table 4 of the QASP once the specific CO_2 sources are identified.	None	Acknowledged.
Continuous Recording of Operational Parameters	9	Please describe the device CTV will use to measure annular fluid level in Section 3.4 (Page 4) and/or Table C-2. If this information is not currently available, it should be provided in the as-built schematics.	None	A fit for purpose commercial solution for annular pressure maintenance is not readily available. CTV has completed a scoping and process flow design for an annular pressure maintenance system and is currently working Frontend Engineering and Design. The system is an array of surface pumps, control/relief valves and tanks designed to continuously monitor and maintain positive pressure on the annulus.
	10	Please describe in Section 7.2 the steps CTV would take to identify and investigate any unexpected pressure deviations, or reference that CTV would implement the procedures described under “Injection well or monitoring equipment failure” in the E&RR Plan.	Attachment C, Section 6.2	CTV believes this question is intended for **Section 6.2** **Attachment C, Section 6.2** has been updated with the recommended language.
	11	Please indicate what threshold change will trigger the SCADA alarm system described on page C-4.	Attachment C, Section 3.4	**Attachment C, Section 3.4** has been updated with the following: Any decrease in pressure below 100 psi or annular fluid level will be identified with the supervisory control and data acquisition (SCADA) alarming system.
	12	Please propose the use of monitoring equipment for annular fluid volume that records more frequently than once per day.	None	A fit for purpose commercial solution for annular fluid volume is not readily available. CTV has completed scoping and process flow design for an annular pressure and volume maintenance system and is currently working Front end Engineering and Design. The system is an array of surface pumps, control/relief valves and tanks designed to continuously monitor and maintain positive pressure on the annulus.
Corrosion Monitoring	13	Please address the inconsistencies between the materials described in the corrosion monitoring plan and on the construction diagrams for each injection well in Appendix 5. For example, please modify the coupons on Table C-3 of the T&M Plan to include K-55 coupons to be consistent with the long string casing materials as described in Attachment G.	None	There are no long string materials that include K-55 material in **Table C-3**. K-55 carbon steel is only included in the surface casing, which will not encounter CO_2.

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Corrosion Monitoring (cont.)	14	Please submit a demonstration that must include, at a minimum, corrosion modeling over the timescale of the project in addition to the provision of site-specific information required by 40 CFR 146.82. The corrosion modeling must consider the site-specific chemistry, including the CO_2 stream and formation fluids, as well as consider possible stress cases in addition to normal operations and any other relevant factors.	None	CTV is performing the corrosion modeling and results will be incorporated into attachments G1 through G7 once complete.
	15	If the corrosion rate is greater than 0.3 mil/year, CTV will consult with EPA. In addition, a casing inspection log may be run to assess the thickness and quality of the casing if the corrosion rate exceeds 0.3 mil/year.	Attachment C, Section 4.3	Acknowledged. The corrosion rate limits were updated in **Attachment C, Section 4.3.**
	16	The corrosion coupon materials will need to be incorporated into the final T&M Plan.	None	Acknowledged.
Above Confining Zone Monitoring	17	Spatial coverage is lacking in the northwest and southeast portions of the AoR. Please describe how the proposed monitoring well locations would detect any CO_2 leakage above the confining zone in the northwestern and southeastern portions of the AoR, or otherwise if additional monitoring wells are required for adequate spatial coverage.	None	A dynamic model that includes the Zilch and Kreyenhagen formations was developed to show how the proposed monitoring well locations are capable of detecting leakage above the confining zone in the northwestern and southeastern portions of the AoR. **RTC Figure 1** located at the bottom of this matrix displays a hypothetical leakage location (pseudo leakage source location) southeast of the plume boundary. A conservative hypothetical leak of 0.1% of the total storage volume was simulated from the injection zone into the Zilch over a period of 40 years. **RTC Figure 2** illustrates the leakage rate versus time, and **RTC Figure 3** displays the recorded pressure increase within the Zilch at the existing monitoring wells. **RTC Figure 4** displays the pressure increase radius (4 psi limit) from the pseudo leakage location at one year within the Zilch formation. Lastly, **RTC Figure 5** overlays the pressure radius (26,300 feet) to the existing monitoring well locations to illustrate the total spatial area covered by the monitoring well locations. These results indicate that the existing monitoring well locations are adequate in detecting a minor leakage of fluid and resulting pressure change above the confining zone, within, and beyond the AoR. Identifying a pressure change within the Zilch is the optimal approach for detecting a leakage of water or CO_2 above the Confining Zone. Direct detection of CO_2 would necessitate a virtually infinite array of monitoring wells, as hypothetical leakage pathways could occur at any arbitrary location.
	18	CTV's application narrative describes the Zilch Formation as a pressure dissipation zone (which reflects the California Air Resources Board CCS Protocol's definition of a dissipation interval, which is "a stratigraphic interval with hydrogeologic properties sufficient to attenuate pressure created by [carbon dioxide] or formation fluid migration along an unidentified leakage pathway through the confining system"), EPA does not expect migration of CO_2 to the Zilch or an increase in pressure due to injection operations. Any fluid migration from the injection zone to the Zilch Formation would be unauthorized and should not be referred to as a pressure dissipation zone.	Throughout the Application	All instances where "dissipation zone" was used in reference to the Zilch formation have been updated to Monitoring Zone. CTV does not expect migration of CO_2 to the Zilch or an increase in pressure due to injection operations.

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Above Confining Zone Monitoring (cont.)	19	Please include fluid sampling and analysis in the Zilch Formation during the injection and post-injection phases to provide earlier indication of chemical changes than would be detected via solely USDW fluid sampling.	None	As described in CTV's response to Above Confining Zone Monitoring question #17, direct detection of CO_2 or chemical changes would necessitate a virtually infinite array of monitoring wells since leakage pathways could manifest at any arbitrary location. Pressure monitoring to detect anomalous pressure changes is the optimal approach, as it enables comprehensive spatial surveillance of subsurface dynamics without the need for extensive physical well locations
	20	Please add cations of Sb to Table C-5 for consistency with the analytes for plume tracking in Table 3 of the QASP.	Attachment C, Table C-5	**Attachment C, Table C-5** has been updated as requested.
	21	Please document in the AoR reevaluation schedule (Section 6.1 of the AoR and Corrective Action Plan [Page B-12]) that updates to the T&M plan may include additional USDW monitoring wells (e.g., if pressure increases are detected in the Zilch Formation or USDW) or additional plume and pressure front monitoring.	Attachment B, Section 6.1	**Attachment B, Section 6.1** has been updated as requested.
	22	On page C-6, where CTV proposes that "Additional groundwater monitoring wells will be drilled…," please add a statement that, if CTV detects evidence of USDW endangerment, it will implement the E&RR Plan in consultation with EPA.	Attachment C, Section 5.1	**Attachment C, Section 5.1** has been updated as requested.
	23	Table E-3 of the PISC/SC Plan indicates that the minimum sampling and recording frequency for pressure gauges in the USDW monitoring wells will be 5 hours during the injection phase. However, this is not apparent in Table C-2 or C-4 in the T&M Plan. Please revise Table C-2 to clarify the minimum sampling and recording frequency for pressure in the USDW monitoring wells to be consistent with the PISC/SC Plan.	Attachment C, Table C-2	**Attachment C, Table C-2** has been updated as requested.
	24	Please elaborate in Table 7 of the QASP the specific quantitative action limits above or below baseline analysis that would constitute actionable T&M outputs.	Attachment C, Section 5.7; Appendix 10, Table 7	New **Section 5.7**, Data Interpretation, was added to **Attachment C** to define trends indicative of potential leakage adopted from Section 4.3 of the EPA Testing and Monitoring Guidance. Additionally, a note was added to **Appendix 10, Table 7** to reference this new section.
Internal Mechanical Integrity Testing	25	Table C-6 lists fluid sampling as a monitoring activity, implying it is an internal MIT testing requirement. Please remove fluid sampling from Table C-6.	Attachment C, Table C-6	Fluid sampling was removed from **Attachment C, Table C-6** as requested.
	26	Please state on page 9 that, prior to any SAPT, CTV will provide EPA notice and the opportunity to witness the test at least 30 days in advance of the test.	Attachment C, Section 7	**Attachment C, Section 7** has been updated as requested.
External Mechanical Integrity Testing	27	Please describe what external MITs CTV proposes to perform on monitoring wells.	Attachment C, Section 7.1	Temperature logging is planned to be performed as the primary MIT, using either conventional wireline logging tool or a distributed temperature sensing (DTS) fiber optic cable. A detailed description of the procedure for using DTS for a temperature log is given in **Attachment C, Section 7.3**. **Attachment C, Section 7.1** was updated as part of this response.

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Carbon Dioxide Plume and Pressure Front Tracking	28	The in-zone monitoring well locations lack adequate spatial coverage of the CO_2 plume. Please explain how CTV proposes to directly monitor the plume and pressure front in the southeastern and northwestern portions of the CO_2 plume.	None	This question is addressed in CTV's response to Above Confining Zone Monitoring question #17. Pressure evolution throughout the project AoR will be detected by the existing monitoring well locations. In addition, plume monitoring will be provided through the SASSA based monitoring discussed in CTV's response to External Mechanical Integrity Testing question #29. As mentioned in **Attachment C, Section 9.3**, the array will be setup to validate the expansion of the plume by monitoring in multiple azimuths including toward monitoring well locations.
	29	The application lacks proposed 3D seismic surveys for tracking plume development. The updated T&M Plan for CTV IV includes a Scalable, Automated, Semipermanent Seismic Array (SASSA). Could this array design be applied to CTV VI?	Attachment C, Section 9.3	New **Section 9.3** has been added to **Attachment C** to include the Scalable, Automated, Semipermanent Seismic Array (SASSA) approach as requested, and following positive testing of the technology since the initial application.
	30	The application does not include testing procedures for pulsed neutron logging. Please provide the pulsed neutron logging procedures to be used for plume monitoring.	Attachment C, Section 9.2	PNL Procedures have been added to **Attachment C, Section 9.2**.
	31	The application does not include information about the location and depth of the installed seismometers per 40 CFR 146.82(c). Please provide information about the location and depth of seismometers, once available.	Attachment C, Section 10.3	Refer to new **Section 10.3** of **Attachment C** which provides the current details of the proposed seismometer layout. The final design will be available during later project phases once the receiver layout for the indirect plume monitoring has been fully modeled and designed. Additional infilling of monitoring stations will be included as necessary to meet the stated seismicity monitoring requirements.
Surface Air and/or Soil Gas Monitoring	32	If, based on the results of planned pre-operational testing, uncertainties about the geologic setting are identified, the need for surface air and/or soil gas monitoring will be reconsidered; EPA could request surface air and/or soil gas monitoring, per 40 CFR 146.90(h).	None	Acknowledged.
Quality Assurance Procedures	33	Please include H_2O as a CO_2 stream analyte in Table 4 of the QASP (Appendix 10: Page 6) for consistency with Table 7.2-1 of the permit application narrative.	Appendix 10, Table 4	**Appendix 10, Table 4** has been updated as requested.
	34	Please add cations of Zn to Table 17 of the QASP (Appendix 10: Page 16) for consistency with the groundwater monitoring analytes in Table C-5 of the T&M Plan (Page 23).	Appendix 10, Table 17	**Appendix 10, Table 17** has been updated as requested.
	35	Please revise Table 1 of the QASP to refer to Airborne Labs International for carbon dioxide stream analysis to be consistent with Section 2.4 of the T&M Plan (Page 2).	Appendix 10, Table 1	**Appendix 10, Table 1** has been updated as requested.

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Pre- and Post-Injection Pressure Differential	36	Per the requirement of 146.93(a)(2)(i), please discuss in Section 2 (page E-1) the maximum predicted injection pressure differential over the life of the project in each injection zone.	Attachment E, Section 2	CTV forecasts the potential CO_2 stored in the Injection Zone at 3.38 million metric tons (MMT) annually on average for 30 years for a total of 101.5 MMT. Based on current operation conditions, the maximum predicted injection pressure differential over the life of the project at the monitoring well locations for the Domengine, Blewett and Tracy Formations are 248 psi, 406 psi and 366 psi at the end of injection, respectively. **Figure 4.3(a)** of **Attachment B** displays the average reservoir pressure in the CO_2 plume area vs. time for the different Injection Zones. The maximum predicted injection pressure differential in the CO_2 plume area for the Domengine, Blewett and Tracy Formations are 248 psi, 355 psi and 285 psi at the end of injection, respectively. **Attachment E, Section 2** has been updated with the above information as requested.
	37	Given that it is unclear whether pressure will return to pre-injection levels, please discuss the point in time at which pressure at the injection wells is expected to decrease to pre-injection levels, and the rates at which pressure is expected to decline at the injection and monitoring wells.	None	**Attachment B, Figure 4.3(a)** displays the average reservoir pressure of the Domengine, Blewett, and Tracy Formations within the CO_2 plume area vs. time. At 100 years post injection the average reservoir pressure in the CO_2 plume area remains at 2.0%, 1.4% and 0.9% above the pre-injection levels for the Domengine, Blewett, and Tracy Formations, respectively. The post-injection reservoir pressure will not return to pre-injection levels based on material balance calculations and within the simulated timeframe.
Predicted Position of the CO_2 Plume and Associated Pressure Front at Site Closure	38	Please provide a cross-sectional view of the plume evolution to display vertical plume progression over the duration of the project.	Attachment E, Section 3	**Attachment B, Figures 4.2(a)** through **4.2(g)** have been added to **Attachment E,** as **Figures E-5(a)** through **E-5(g)**. The CO_2 plume boundary is stabilized at 20 years post injection.
Post-Injection Monitoring	39	Please correct the discrepancy in the analytical method for Hydrogen sulfide between Table E-2 and Table C-5 of the T&M Plan.	Attachment E, Table E-2; Attachment C, Table C-5	The Hydrogen Sulfide analytical method listed in **Attachment E, Table E-2** and **Attachment C, Table C-5** has been updated to ISBT 14.0 (GC/SCD). These tables are now consistent.
	40	Please expand Table E-3 to include sampling and recording frequencies for continuous monitoring in wells CTVW-M-IZ1 and CTVW-M-IZ2.	Attachment E, Table E-3	**Attachment E, Table E-3** has been updated as requested.
	41	Please edit the statement on page E-2 to say that CTV will submit the results of PISC monitoring annually, within 90 days of the anniversary date of cessation of injection, to be consistent with Section 4.3.	Attachment E, Section 4	**Attachment E, Section 4** has been updated as requested.
Site Closure Plan	42	Please correct the first sentence of Section 6 (page E-5) to state that CTV will submit a demonstration of non-endangerment of USDWs to the Director per 40 CFR 143.93(b)(2) **and** (3).	Attachment E, Section 6	**Attachment E, Section 6** has been updated as requested.
	43	Clarify how the PISC timeframe meets the 40 CFR 146.93(c)(1)(ii) requirement of the pressure decline within the injection zone, and any other zones, such that formation fluids may not be forced into any USDWs; and/or the timeframe for pressure decline to pre-injection pressures.	None	The risk-based AoR analysis (**Appendix 9**) indicates that pressure buildup will not be sufficient to impact USDWs throughout the AoR over the lifetime of the project. A top-of-injection-zone pressure increase of 350 psi was assumed, which is greater than the pressure increase expected across the AoR at all times. No changes were made based on this comment.
	44	Case C – tripling the formation permeability – must be confirmed with planned pre-operational logging and core testing.	None	Acknowledged.

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Site Closure Plan (cont.)	45	If the requested revisions to the injection and post-injection phase testing and monitoring are made, adequate data must be collected to support modeling updates and the development of a non-endangerment demonstration.	None	Acknowledged.
	46	CTV does not describe the specific activities it proposes to perform to restore the site. Please describe the site restoration activities referenced in Section 7 that CTV proposes to perform.	Attachment E, Section 7	Once the injection and monitoring wells are plugged and abandoned, casing will be cut 5 feet below ground level. A metal cap will be welded onto the top of the cut casing and stamped with the well name and API. Surface locations will then be backfilled and restored to pre-operation conditions. **Attachment E, Section 7** was updated.
	47	Please indicate in Section 7 that CTV will maintain the PISC records and site closure report for 10 years, per 40 CFR 146.93(h), and that CTV will deliver PISC records to the UIC program director.	Attachment E, Section 7	**Attachment E, Section 7** was updated as requested.
	48	Please correct the typo in the first sentence of Section 7; it should read 40 CFR 146.93(d).	Attachment E, Section 7	**Attachment E, Section 7** has been updated as requested.

Section	Q #	Questions/Requests for CTV	Text Section Updated	CTV Response
Proposed Emergency and Remedial Response Plan	49	Section 3: Potential Risk Scenarios a. Please include a table that describes the degrees of risk of emergency events and their severities (i.e., Minor, Major, and Serious) to align with the severities referenced in the Potential Response Actions.	Attachment F, Table F-1	**Attachment F, Table F-1** has been updated to align with the severities referenced in Sections 4.1 through 4.5.
	50	Section 4: Emergency Identification and Response Actions b. Please correct the typo. It should read, "The potential risk scenarios identified in Part 3…" (not "Part 2).	Attachment F, Section 4	**Attachment F, Section 4** has been updated to reference Section 3.
	51	Section 4.1: Well Integrity Failure c. Please indicate that a well integrity failure can have a severity from minor to serious. d. Please fix the typo for "preform" to "perform" under both major and minor emergencies (pages F-3 and F-4).	Attachment F, Section 4.1	**Attachment F, Section 4.1** has been updated as requested.
	52	Section 4.2: Injection Well Monitoring Equipment Failure e. Please revise the title of Section 4.2 to read "Injection Well or Monitoring Equipment Failure" to reflect the list of potential risk scenarios identified in Section 4.0.	Attachment F, Section 4.2	**Attachment F, Section 4.2** has been updated as requested.
	53	Section 4.3: Potential Brine or CO_2 Leakage to the USDW f. Please broaden the introduction to this scenario (Page F-5) to encompass any evidence of CO_2 or fluid movement out of the injection zone (i.e., not necessarily to a USDW) to address events associated with unanticipated fluid movement pathways, any potential USDW endangerment / unacceptable changes in water quality, and CO_2 leakage to the surface. This would also more directly address the identified potential risk scenarios in Section 4.0. g. Under detection methods (Page F-6), please identify specific triggers for a response (e.g., pressure gauge detection limits). Also, reference the actionable testing and monitoring outputs in Table 7 of the QASP. *h.* Please refer to shutting in the injection wells (plural) rather than "the injection well" in the response actions for this scenario, since there are multiple wells at the site, and all would need to be shut-in.	Attachment F, Section 4.3	f. The introduction of **Attachment F, Section 4.3** has been updated as requested g. Detection limits have been added to **Attachment F, Section 4.3**. Table 7 of the QASP (Appendix 10) is mentioned in the introduction of Attachment F: "The ERRP would be implemented in response to events that could be detected in the course of monitoring pursuant to **Attachment C: Testing and Monitoring Plan (Attachment C)**, including exceedances of Actionable Testing limits described in **Table 7** of **Appendix 10: Quality Assurance and Surveillance Plan (QASP) (Appendix 10)**. h. **Attachment F, Section 4.3** has been updated as requested.
	54	*Section 4.4: Natural Disaster* *i. Please indicate the severity on Page F-7 to be Minor to Catastrophic.* *j. Please move the sentence "If a natural disaster occurs that affects normal operation of the injection well, CTV will perform the following:" from the introduction on Page F-7 to immediately under "Potential Response Actions."* *k. Please refer to shutting in the injection wells (plural) rather than "the injection well" in the response actions of this scenario, since there are multiple wells at the site, and all would need to be shut-in.*	Attachment F, Section 4.4	i. The severity listed in **Attachment F, Section 4.4** has been updated to "Minor to Catastrophic" as requested. j. The referenced sentence in **Attachment F, Section 4.4** has been moved as requested. k. **Attachment F, Section 4.4** has been updated as requested.

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Proposed Emergency and Remedial Response Plan (cont.)	55	Section 4.5 Induced or Natural Seismic Event l. Under Timing of event (Page F-8), please edit the sentence to read, "An induced seismic event ~~will~~ could occur when the reservoir stresses are altered, which would occur during the injection or post-injection phase" to reflect that this is a conditional statement and the stated timing of any such event. m. Please make the following revisions to the response activities in Table F-2: i) Refer to shutting in the injection wells (plural) rather than "the injection well" throughout the table since there are multiple wells at the site. ii) Edit, "Report findings to the UIC Program Director and perform corrective actions" in item # 5 under the **orange** operating state, # 11 in the **magenta**, and #9 in the **red** operating states. iii) Edit items #9 under the **magenta** and #7 of the **red** operating states to read, "If USDW contamination is detected, endangerment and/or CO_2 leaked" (so the response applies to either situation). *iv)* Add a response to the red operating state: "Assess monitoring plans and, where necessary, intensify the monitoring plan to ensure containment."	Attachment F Section 4.5 and Table F-2	l. The referenced sentence of **Attachment F, Section 4.5** has been updated as requested. m.(i) through m.(iv): **Attachment F, Table F-2** has been updated as requested.
	56	Section 8: Staff Training and Exercise Procedures a. Please describe or attach the CO_2 Facilities and Safety Trainings mentioned in this section (Page F-10).	None	The Staff Training and Exercise procedures included in the permit is a high-level framework. Details on the CO_2 Facilities and Safety Trainings will be updated during the pre-operational testing period.

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Injection Zone/ Above Zone Monitoring Wells	57	Pursuant to 146.86(b)(2), the surface casing must extend through the base of the lowermost USDW and be cemented to the surface through the use of a single or multiple strings of casing and cement. EPA is continuing to evaluate this item and may request additional information further in the review process.	None	Acknowledged.
	58	The application is missing monitoring well construction procedures and plugging procedures for the four new planned monitoring wells. This information will need to be reviewed as part of the alternative PISC timeframe evaluation. For completeness, please provide the proposed monitoring well construction procedures, including the type and placement of cement, corrosion control, how the casings near surface will be cut and capped. Additionally, describe MITs that will be performed on the in-zone monitoring wells.	None	CTV will generate the proposed construction procedure documents for the monitoring wells and will provide them once complete.
	59	Please describe how the casings will be cemented in place, including the type of cement proposed.	Attachments G1 through G7, Section 3.4	**Section 3.4** of **Attachments G1 through G7** has been updated to describe how the casings will be cemented and the type of cement to be used.
	60	Because of potential concerns about the corrosion of Class G cement in the presence of CO_2-water mixtures, please modify the well construction plan to include corrosion-resistant additives in the sections of the injection and monitoring wells that are most likely to be exposed to CO_2.	None	CTV is performing the corrosion modeling and results will be incorporated into attachments G1 through G7 once complete. The corrosion impact on the cement will be addressed in those updated documents.
	61	Once the CO_2 injectate composition is ascertained, CTV must inform EPA if the CO_2 injectate composition results in any modification to the materials described in the construction plans.	None	Acknowledged.
	62	Please describe the material proposed to be used on the conductor casing for the injection and monitoring wells.	None	Conductor casing for all injection and monitoring wells will be constructed with carbon steel, as per standard for oil and gas well construction.
	63	Please explain the significance of the green sections of the long string casings on the injection zone and above zone monitoring well schematics.	None	The annotated green sections show the planned potential perforation intervals in each respective well. Specific well perforations will be picked after the wells have been drilled and logged. These perforations will be provided in the final well completion report for each well for approval prior to start of injection.
	64	All of the injection wells are proposed to have a conductor casing to be set from 14 feet to a depth of 54 feet. Please clarify that the 14 foot depth refers to KB.	None	All new drill wells have a standardized 14 feet Kelly Bushing (KB) height, such that the start of the well is 14 feet below the KB of the drilling rig. This is a reference depth and will be finalized once the well is drilled and completed during pre-operational testing.
	65	Please include the procedure or reference applicable guidance for the SCTP in Attachment G.	None	Standard Casing Pressure Test (SCPT) and Standard Annular Pressure Test (SAPT) can be used interchangeably as a form of testing the well casing internal mechanical integrity. **Attachment C, Section 6.1** discusses the procedure for conducting an SAPT.
Monitoring Well Plugging	66	Please describe how long the cement plug intervals will be allowed to set for curing prior to emplacing the abandonment mud and next cement stage.	None	Cement plugs are cured for 24 hours prior to emplacing abandonment mud, as per standard oil and gas abandonment procedure.
	67	To address concerns about corrosion, please modify the injection and monitoring well plugging plans to refer to engineered Class G cement or incorporate additives to the Class G cement in plugs that will be exposed to CO_2.	None	CTV is performing the corrosion modeling and results will be incorporated into attachments G1 through G7 once complete. The corrosion impact on the cement will be addressed in those updated documents.

Section	Q #	Questions/Requests for CTV	Text Section Updated	CTV Response
Financial Responsibility Demonstration	68	Please revise the post-injection site care cost estimate (Table 4) to include a total of 8 pulsed neutron logs (i.e., two in each of the in-zone monitoring wells over the PISC timeframe).	None	The cost estimate already includes an assumption of an 8 well survey. See Attachment H, Table 4, Footnote C. No edits made based on this comment.
	69	Please include the cost of maintaining the seismic monitoring network that will track the plume and pressure front.	Attachment H, Table 4	Attachment H has been revised to add seismic monitoring as requested.
	70	Regarding the letter of credit, please clarify whether other liabilities (including for other CTV Class VI projects) are covered using the same line of credit and, if so, how the funds specified for Class VI financial responsibility under the letter of credit will be protected from other liabilities.	None	CTV intends to provide separate financial assurance for each CTV project.
	71	EPA requests that CTV consult the UIC Program Class VI Financial Responsibility Guidance as it develops the instruments, including: a. The recommended specifications for a letter of credit (beginning on page 31) and insurance (on page 32), and b. The recommended financial instrument language provided in Appendix B of the Guidance (on page B-2 for a LOC and page B-17 for a certificate of insurance).	None	Acknowledged. CTV will consult the UIC Program Class VI Financial Responsibility Guidance as it develops the required instruments.
	72	Potential changes to various Cost Tool inputs (e.g., the dimensions of the injection or monitoring wells, the size of the AoR based on final modeling, the total volume of CO_2 to be injected, the final approved PISC timeframe, and corrective action needs at the time the permit is issued) would affect financial responsibility needs, and therefore financial responsibility may need to be updated before a final permit decision is made.	None	Acknowledged.

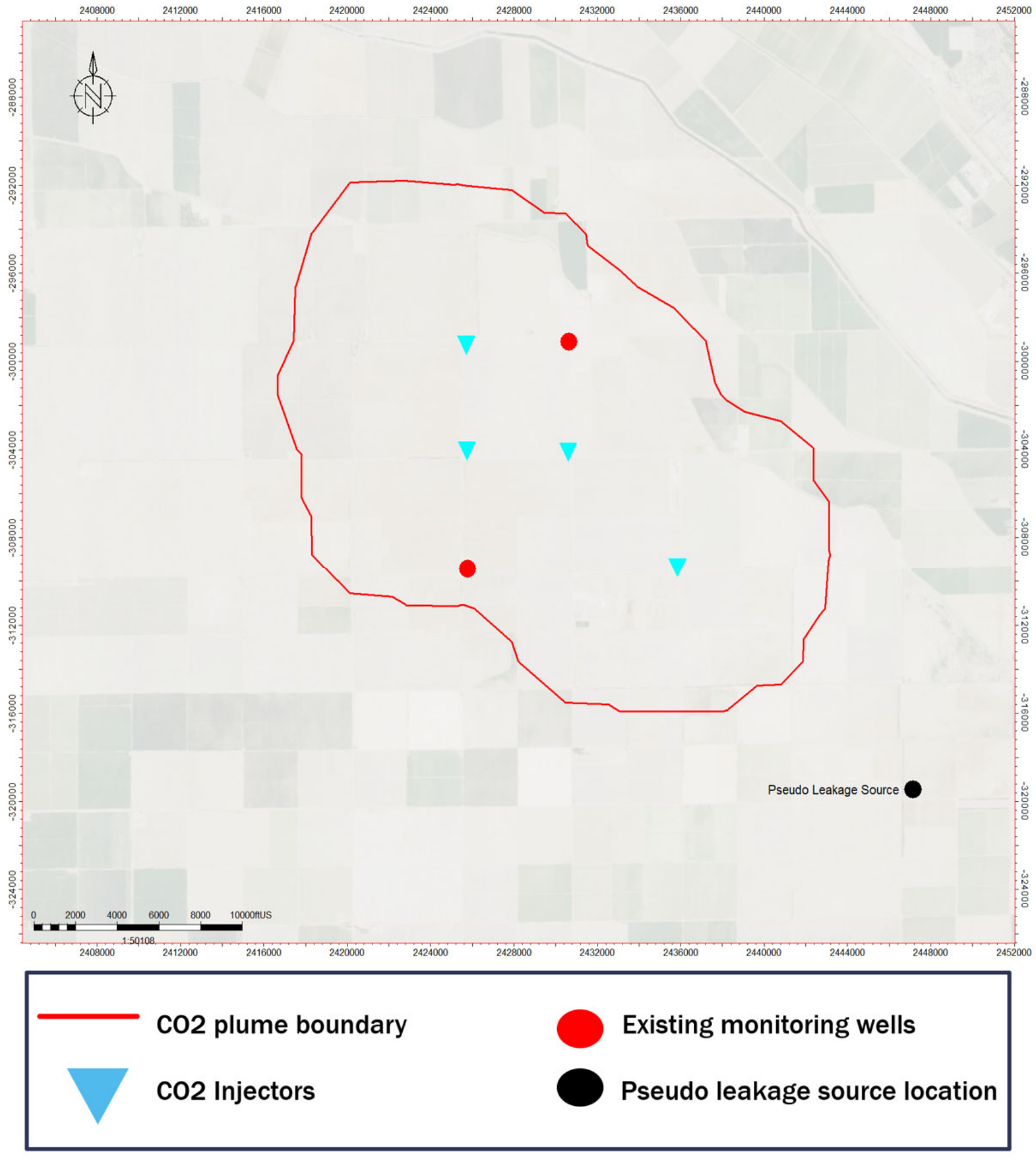
Section	Q #	Questions/Requests for CTV	Text Section Updated	CTV Response
Pre-Operational Testing Plan	73	Please describe in the POTP the specific logs to be conducted in each of the monitoring wells.	Attachment I, Section 5	Refer to **Attachment I,** new **Section 5**, Monitoring Well Testing, for the requested information.
	74	For clarity, in Section 4.3 (Page I-3), please move external mechanical integrity test to a separate bullet from the second bullet.	Attachment I, Section 4.3	**Attachment I, Section 4.3** has been updated as requested.

Section	Q #	Questions/Requests for CTV	Text Section Updated	CTV Response
Endangered Species Act Guidance	75	The Endangered Species Act (ESA) requires federal agencies to ensure that its actions are not likely to jeopardize the continued existence of any endangered or threatened species or adversely affect its critical habitat. In accordance with 50 CFR Part 402, EPA must make a determination, in consultation with U.S. Fish and Wildlife Service (USFWS), based on the best available information, whether there are any potential effects from the proposed project/permit to endangered or threatened species that may be found in the Action Area. To assist with that determination, we request that CTV submit a draft Biological Evaluation (BE) to EPA for review. The earlier in the permit review process that this material is provided to EPA the better positioned EPA is to meet statutory and regulatory requirements under ESA and ensure a timely review of permit applications. (Further Instructions on the BE are provided)	None	CTV acknowledges and aims to submit the ESA as early as possible in the permit review process to allow for a timely review. All guidance materials have been received, and CTV is actively working toward an estimated ESA submittal by end of February 2026.

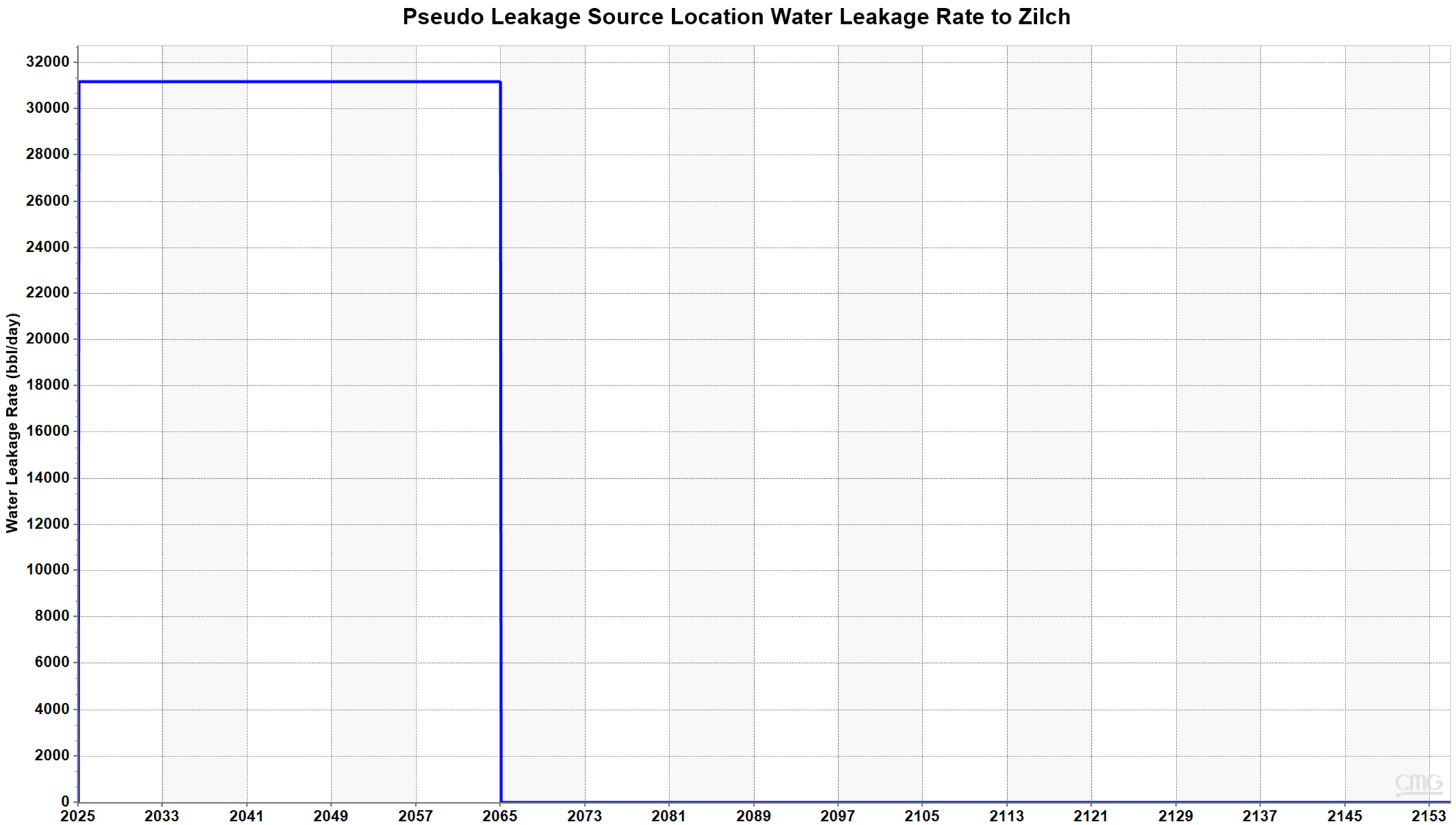
Section	Q #	Questions/Requests for CTV	Text Section Updated	CTV Response
National Historic Preservation Act Guidance	76	Section 106 of the National Historic Preservation Act (NHPA) requires federal agencies to identify and assess the effects its actions may have on historic properties. Historic properties include, among other things, archaeological sites, structures, historic districts, and cultural landscapes. Under Section 106, agencies must consider the views of the State Historic Preservation Office (SHPO), the Tribal Historic Preservation Office (THPO), and public input before making final decisions. To assist with compliance with the NHPA, we request that CTV submit a draft Archeological Report to EPA for review. The earlier in the permit review process that this material is provided to EPA the better positioned EPA is to meet statutory and regulatory requirements under NHPA and ensure a timely review of permit applications. (Further EPA Instructions on the Archaeological Report are included)	None	CTV acknowledges and aims to submit the NHPA as early as possible in the permit review process to allow for a timely review. All guidance materials have been received, and CTV is actively working toward an estimated NHPA submittal by end of February 2026.

Section	Q #	Questions/Requests for CTV	Text Section Updated	CTV Response
Area of Review Delineation (Risk-Based Approach)	77	Please explain the use of 20m dispersivity for all directions. Standard practice is to use 1/10 the flow path for longitudinal dispersivity and 1/100 the flow path length for transverse dispersivity.	Appendix 9	An additional sensitivity was added for dispersivity using 1/10 and 1/100 of the flow path as requested for longitudinal and transverse dispersivity. Vertical dispersivity was assigned as 1/10 of transverse dispersivity (see Gelhar et al., 1992). Reference: Gelhar, L. W., Welty, C., & Rehfeldt, K. R. (1992). A critical review of data on field-scale dispersion in aquifers. Water Resources Research, 28(7), 1955–1974. July 1992.
	78	Longitudinal dispersivity is along the flow and transverse is perpendicular to the flow. There should be no vertical dispersivity. Explain what was done.	Appendix 9	Vertical dispersivity is a standard parameter assigned in solute transport modeling. Per U.S. EPA guidance (Aziz et al., 2000): "Dispersion refers to the process whereby a dissolved solvent will be spatially distributed longitudinally (along the direction of ground-water flow), transversely (perpendicular to ground-water flow), and **vertically (downward)** because of mechanical mixing and chemical diffusion in the aquifer." Setting vertical dispersivity to a high value in the CTV VI MODFLOW modeling (equal to longitudinal) is a conservative assumption because vertical dispersivity increases the transport of TDS within the borehole. To address this comment an additional sensitivity was conducted with vertical dispersivity set to a low value (see Response to Area of Review Delineation (Risk-Based Approach) question #79, below). Reference: Aziz, C. E., Newell, C. J., Gonzales, J. R., Haas, P., Clement, T. P., Sun, Y., & Jewett, D. G. (2000). BIOCHLOR Natural Attenuation Decision Support System User's Manual Version 1.0 (EPA/600/R-00/008). U.S. Environmental Protection Agency, Office of Research and Development. https://nepis.epa.gov/Adobe/PDF/P1000YUW.pdf
	79	Uncertainty should be shown on the AoR given a range of realistic parameters for primary transport. The USDW gradient, dispersivity, and permeability are likely key parameters that should be varied to show a range of possible AoR behavior.	Appendix 9	Additional sensitivity analyses were added for dispersivity and USDW gradient, as requested. Sensitivity analyses had already been included for USDW permeability.

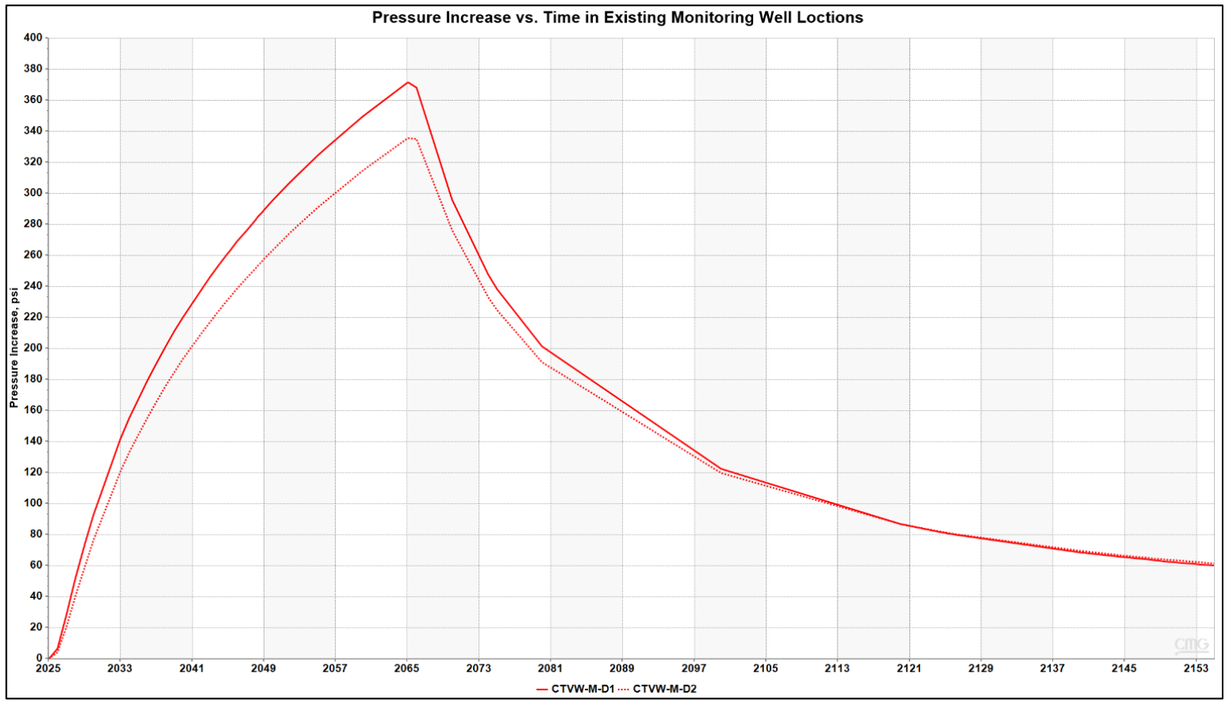
Section	Q #	Questions/Requests for CTV	Text Section Updated	CTV Response
	80	Justify the claim that no risk would be posed to the USDW due to the calculated maximum total dissolved solids increase.	Appendix 9	The EPA Area of Review (AoR) and Corrective Action Guidance states regarding risk-based AoR delineation: "…An additional pressure increase may be allowable if it can be demonstrated to the UIC Program Director that negligible degradation of the USDW would result from increased fluid leakage rates." To address this, fluid migration modeling was conducted using conservative assumptions. The results show that any TDS increase is strictly confined to the immediate vicinity of the borehole (see **Appendix 9**, **Figures 4 and 5a through 5f**), with no measurable impact beyond this localized area. Appendix 9 includes an "Interpretation" section that applies three independent methods to evaluate whether the modeled brine leakage results in negligible USDW degradation: • Comparison to water quality standards • Assessment of the potential TDS increase relative to observed concentrations and natural variability in the Westside Subbasin aquifer • Statistical analysis using the DOE National Risk Assessment Partnership methodology and local TDS data (Last et al., 2016) All methods consistently demonstrate that the predicted TDS increase is minor compared to existing aquifer conditions and regulatory thresholds. The "Summary and Conclusions" section states: "Risk-based methods, including standard statistical techniques, indicate that brine leakage would not pose a risk to water supplies in the USDW." In summary, the modeling results, supported by multiple lines of evidence and regulatory criteria, confirm that the calculated maximum TDS increase outside the CO_2 plume area does not pose a risk to the USDW. Reference: Last, G.V., C.J. Murray, and Y. Bott. 2016. Derivation of groundwater threshold values for analysis of impacts predicted at potential carbon sequestration sites. International Journal of Greenhouse Gas Control 49: 138-148.

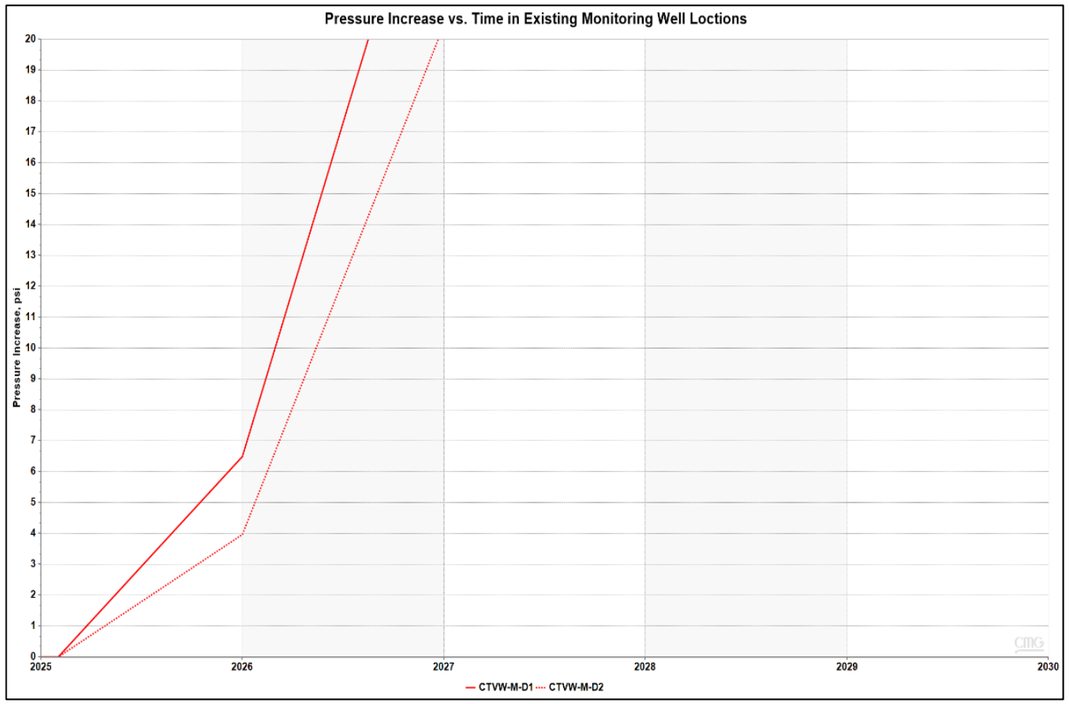


RTC Figure 1: Pseudo leakage source location, existing monitoring well locations and proposed CO_2 injectors. Figure added in response to EPA question #17.

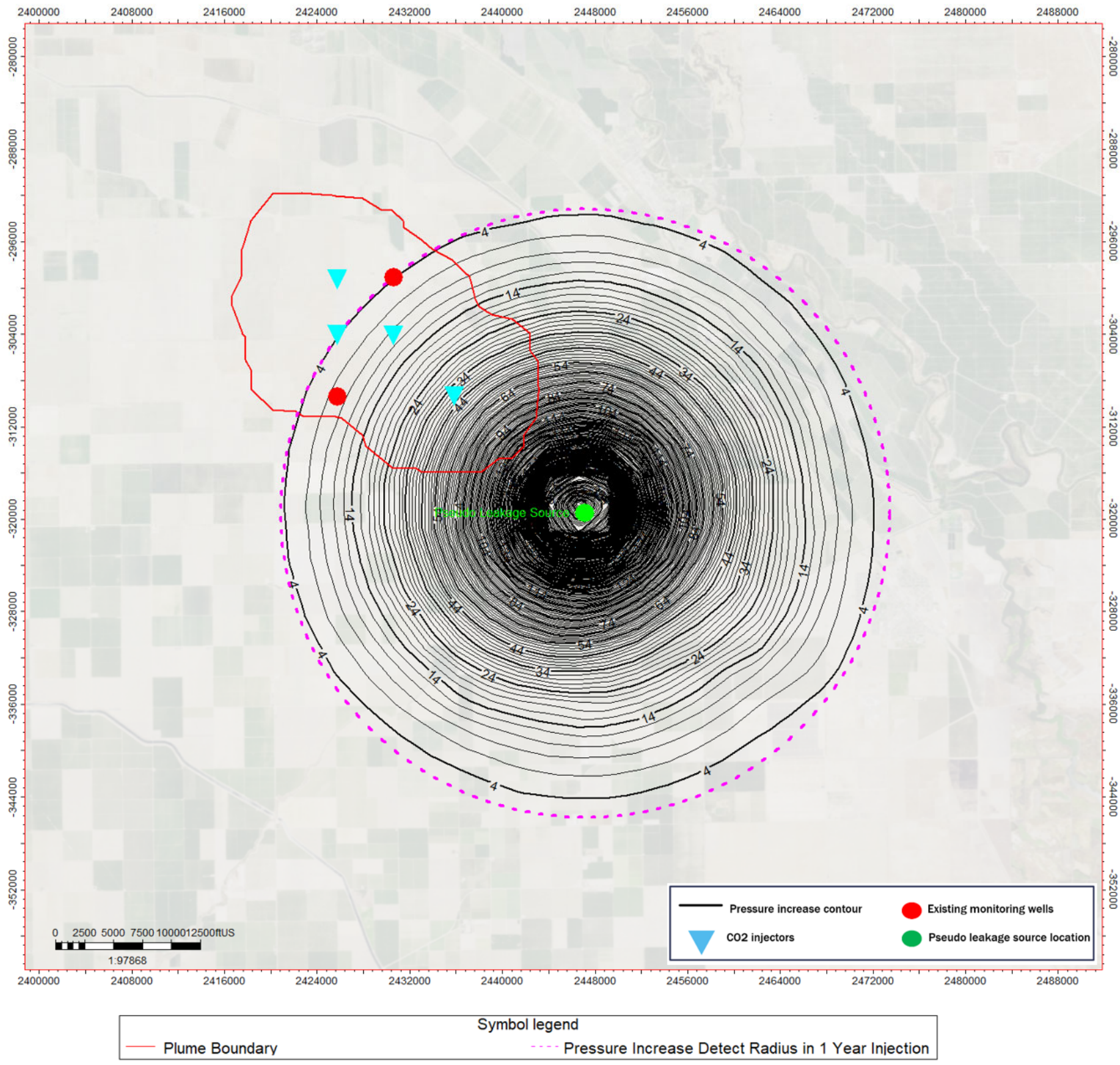


RTC Figure 2: Water leakage summary for the Zilch formation. Figure added in response to EPA question #17.

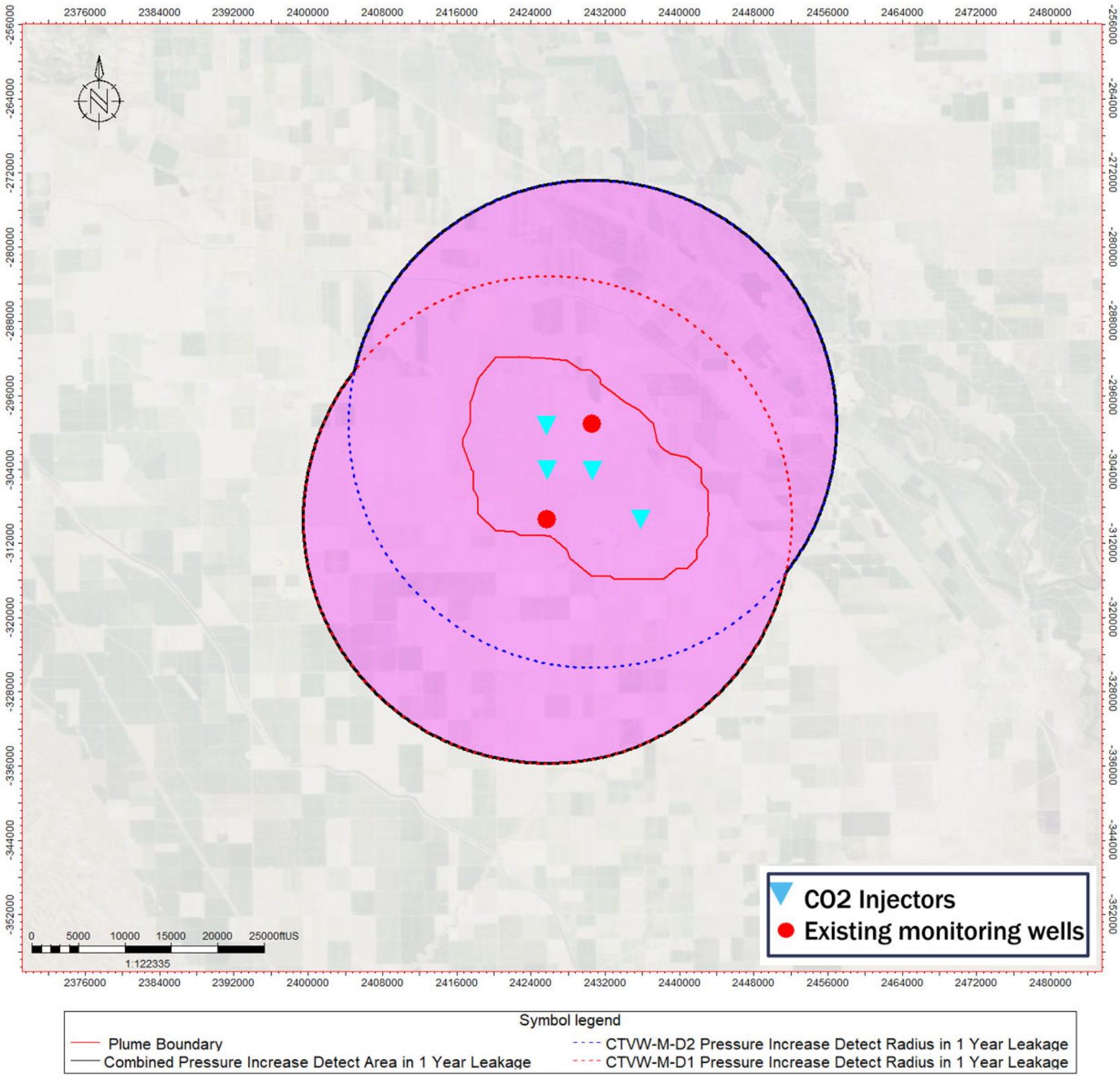




RTC Figure 3: Pressure increase vs time at monitoring well locations in the Zilch formation. Figure added in response to EPA question #17.



RTC Figure 4: Pressure increase detection radius (4 psi limit) in one year of Injection in the Zilch formation from the pseudo leakage source location. Figure added in response to EPA question #17.



RTC Figure 5: Pressure increase detection area (4 psi limit) in one year of leakage with 0.1% total storage volume equivalent brine in Zilch formation for 2 existing monitoring well locations. Figure added in response to EPA question #17.