In December 2024, CTV provided responses to EPA's August 2024 technical evaluation comments on site characterization information in the CTV-II Class VI permit application. EPA's evaluation of the responses is provided in red text below.

#	Section	Comment/Question for CTV	Report Section Updated	CTV Response	EPA Evaluation	Response (December 2024)
1	Maps and Cross Sections of the AoR [40 CFR 146.82(a)(2), 146.82(a)(3)(i)]	· ***Please provide a map that contains all of the elements required at 40 CFR 146.82(a)(2).***	Attachment A Section 2.2	Required elements are displayed on new Figures A-8 and A-9. Figure A-8 displays all required elements for the project area and Figure A-9 displays wells present in the AoR. Table A-1, A-2, and A-3 list the oil and gas wells, DWR WCR water wells and GAMA water wells referenced in Figure A-8, respectively.	Most of the requested information is provided on the two figures. State or EPA Subsurface Cleanup Sites, which are required to be on the map per 40 CFR 146.82(a)(2), are not included. However, these are on Figure A-18.	N/A **EPA evaluation of CTV's response:** State or EPA Subsurface Cleanup Sites are included on Figure A-8. **Follow-up Request for CTV:** Please include any known or suspected faults for the project area on Figure A-8.
2	Faults and Fractures [40 CFR 146.82(a)(3)(ii)]	· ***Please provide documentation of historical pressure measurements in the Union Island Gas Field; the mud logs used to assert pressure compartmentalization and/or pressure data derived from the mud logs (including the locations of the wells) or other data about the mud logs that show different pressures in the Winters Formation on opposite sides of the Stockton Arch Fault.***	Attachment A Section 2.3.2	An example mudlog comes from the Sonol Securities 11 (0407720724) well drilled in 2008, located in section 10, township 1S, range 5E within the Union Island Field. This well is drilled through the Winters in the hanging wall of the SAF in the depth interval 7993 feet to 8214 feet MD. The mudweight above and below that interval was 10.1 ppg or 0.53 psi/ft equivalent. The well did not encounter any drilling issues, losses, or drop in mudweight in this zone indicating zonal isolation from the depleted Winters in the footwall of the SAF. Electric logs indicate the Winters is not hydrocarbon bearing in this zone. The well was then further drilled until the Winters sands were hit in the footwall of the fault. Once the presence of Winters sand was confirmed the well casing point was called and the final casing depth was set at 9396 feet to isolate the depleted Winters in the footwall from all formations above in the well.	The Sonol Securities well is inside the AoR on the same side of the fault as the AoR and does not contribute to an evaluation of pressure sealing across the fault. Based on information in the application, (which discusses high pressures in Union Island field at 5,040 psi), this appears to provide evidence for assertions that the fault can withstand the pressures to which it would be exposed during CO2 injection. Additional information about the sealing nature of the Stockton Arch Fault is provided in the updated application. **See item 4 below.**	The Sonol Securities 11 well is inside the AoR but drills through the Winters in the hanging wall of the fault as discussed in the initial response. Therefore, it does provide indirect evidence of fault seal without taking direct pressure measurements. See the cross-section schematic at the end of this response to comments (RTC) that shows the location of the Sonol Securities 11 well relative to the fault and injection zone. Additional supporting information on the sealing nature of the Stockton Arch Fault has been provided and updated in Section 2.3.2. Additionally, a new monitoring well, M-2, has been added to the Testing & Monitoring Plan to monitor the hanging wall of the fault. **EPA evaluation of CTV's response:** The figure at the end of the response matrix clarifies how the Sonol Securities 11 well penetrates the Winters through the hanging wall as it overlaps the proposed injection interval within the AoR. The expanded Section 2.3.2 provides additional information on AoR historical formation pressure, mud logs, fault juxtaposition, gas-water contacts, and the SGR calculation. The new monitoring well M-2 is intended for temperature and pressure monitoring on the eastern fault block of the Stockton Arch Fault to monitor for injectate leakage and the pressure front on the hanging wall. M-2 appears to be

						placed approximately 800 feet east of the AoR per Figure C-1. **Follow-up Request for CTV:** Please add the cross-section schematic illustrating Sonol Securities 11 to the Narrative document.
3		· ***When and where was the "current" 1,200 psi pressure measurement taken? If it was not within the past 2-3 years, please provide evidence that field operations since the pressure measurement have not affected pressures in the reservoir, and the data are therefore still accurate.***	Attachment A Section 2.3.2	The current reservoir pressure of 1,200 psi is based on the Pool B-2 pressure and temperature gradient measured in 2022 (new Figure A-21). Minor gas production has occurred since this measurement, and the field production was shut down in June, 2023. We also obtained a Fluid level shot on Sonol Securities 3 (6,776 feet), which corresponds to a Reservoir pressure of 1,231 psi. Reservoir pressure will be further confirmed during preoperational testing.	The requested information was provided. While the depth cited is shallower than the proposed injection zone, CTV plans to determine the current reservoir pressure as part of pre-operational testing. **Please provide the gas production data since 2022.**	The Pool B-2 pressure and temperature gradient was measured in March, 2022. Between the Pool B-2 measurement and June, 2023, when the field was shut in, the cumulative gas production was 0.348 billion cubic feet (BCF), approximately 0.1% of the total gas production for the Union Island field. The Cumulative water production was 0.019 million barrels (MMbbl), approximately 0.6% of the total water production for the Union Island field. **EPA evaluation of CTV's response:** CTV revised Section 2.3.2 to clarify that the current reservoir pressure is based on the 2022 measurement, and that gas production data since 2022 indicates that production is likely to have caused only minor changes to reservoir pressure. Based on post-2022 production rates, the value of 1,200 psi is an acceptable approximation for pre-construction modeling, as the value will be revised with pre-operational testing data once available; no further questions.

4		· ***Please provide any other site-specific evidence that the Stockton Arch Fault is sealing, e.g., Allan charts demonstrating the juxtaposition of units by the Stockton Arch Fault; and any other available data to support the fault sealing assertion including calculation of shale gouge ratio, a characterization of catalysis and diagenesis, and pore pressure measurements on both sides of the fault. See Section 3.5.2 of EPA's Class VI Site Characterization Guidance for acceptable lines of evidence and associated data.***	Attachment A Section 2.3	Additional information supporting the sealing nature of the Stockton Arch Fault was added to Section 2.3.	Additional evidence was provided. A Stockton Arch Fault Allan diagram (Figure A22) shows the juxtaposition of the Winters Formation against the Lathrop Sands. SGR calculation results show that a majority of the Stockton Arch fault has an SGR ≥ 15%, supporting that the fault is sealing. Figure A-24 is a cross section based on 4 wells across the Stockton Arch Fault (including Sonol Securities 8 inside the AoR). Differences in the logs demonstrate that hydrocarbon accumulation is not continuous across the fault, supporting the assertion that the fault acts as a barrier to fluid flow. CTV also describes discovery pressure gradients at Union Island and Lathrop Gas Fields. Both fields had similar initial discovery pressures, despite 11 years of production in the Lathrop field before the Union Island was initially drilled. CTV cites this as evidence that production in one field did not affect pressures in the other due to the sealing nature of the fault. **Please provide documentation of the SGR calculation.** **Also see the response to Item #1 of the computational modeling comment enclosure**.	Attachment A, Section 2.3.2 has been updated with the following information on the Shale Gouge Ratio (SGR): The SGR calculation was completed using the following equation: $SGR = \frac{\sum(Vcl \times \Delta z)}{throw} \times 100\%$ (Eq-1) where Vcl is the clay volume content, Δz is the stratigraphic layer thickness, and $throw$ is the offset of the layer of interest. SGR values can vary along a fault as stratigraphic changes occur (Freeman et al., 1998). For the Stockton Arch Fault, the SGR was calculated at 10 different cross section locations along the length of the fault, each approximately a half mile from the other. Each Cross Section ID has two SGR values, the first for the top of the Injection Zone, and the second for the bottom of the Injection zone. This gives a total of 20 SGR values for the length of the Stockton Arch Fault in the CTV II Project area. The SGR was calculated at each point by using the Δz and Vcl of each layer that moved past the Top and Bottom of the Winters Injection Zone. $throw$ was calculated using the offset of both the top and bottom of the hanging wall Winters Formation from the top and bottom of the footwall Winters Injection Zone. The stratigraphic thickness and throw values were calculated using the Allan Diagram described above. The Vcl values were calculated from well logs from 11 different Project area wells located on both sides of the fault. Well locations are displayed in **Figure A-29**. **Table A-4** displays the Vcl values calculated for each well and the averaged stratigraphic value used in the SGR calculation. **Figure A-30** shows the Allan Diagram with SGR results and example calculations, using Eq-1, for cross section ID 4. Cross section ID 4 exhibits an SGR value of 35% at the top of the Winter Injection Zone and 43% at the bottom of the Winters Injection Zone. SGR values range from 35% to 42% and 37% to 43% along the top of Winters Sands, and bottom of Winters sands at the Stockton Arch Fault, respectively. Overall, the

						Stockton Arch Fault has an average SGR value of 39 percent, with an average of 38 percent for the top of the Winters Injection Zone and 41 percent for the bottom of the Winters Injection Zone. SGR values >20 percent imply that there is a high chance of fault-zone seal (Yielding et al, 2010); therefore, the SGR values calculated for the Stockton Arch Fault in the project vicinity support that the fault is sealing. **EPA evaluation of CTV's response:** CTV added their response with the SGR calculation and explanation to Section 2.3.2. CTV also added the new Figure A-29, which depicts the locations of wells used to calculate clay volumes. The 11 wells seem to be evenly distributed across both sides of the Stockton Arch Fault. The new Figure A-30 illustrates the SGR calculation for one of ten equidistant cross-sections. Each cross-section has its own calculations for SGR at the top and bottom of the Winters Formation which are provided in a table in Figure A-30. The average SGR is 39 percent across all calculations. **Follow-up Request for CTV:** Please also provide in Attachment A, a shale smear factor (SSF) analysis and documentation of the SSF calculation that supports the sealing nature of the Stockton Arch Fault.

#	Section	Comment/Question for CTV	Report Section Updated	CTV Response	EPA Evaluation	Response (November 2024)
5	Injection and Confining Zone Details [40 CFR 146.82(a)(3)(iii)]	**Cores collected during construction will need to be analyzed to confirm site-specific properties, including porosity, permeability, capillary pressure, pore pressure, mineralogy, etc.**	None	The CTV II Pre-Operational Testing Plan already stated that these tests will be conducted (Section 6); no edits were made based on this comment.	Acknowledged. The intent of this statement (and similar statements in EPA's evaluation) was to document a common understanding of EPA's expectations for pre-operational testing.	N/A
6		**Collection of capillary pressure data for the upper confining zone is stated as an objective for pre-operational testing; this data will be needed to reduce uncertainty in model inputs and confirm these estimations.**	None	The CTV II Pre-Operational Testing Plan already stated that these tests will be conducted (Section 6); no edits were made based on this comment.	Acknowledged.	N/A
7		Because the upper confining zone is at least 2,000 ft thick, there is no concern about confinement. **Pre-operational testing data will need to be collected to reduce uncertainty in model inputs and confirm these estimations.**	Pre-Operational Plan Section 7	The Pre-Operational Testing Plan was edited to add confirmation of the thickness of the Upper Confining Zone (Section 7)	The additional objective was added to the pre-operational testing plan.	N/A
8	*Injection Zone Properties*	Capillary pressure data was obtained from a core sample from well Sonol_Securities_5 within the AoR**. Additional data collection during pre-operational testing will be useful to confirm its representativeness of the entire AoR.**	None	The CTV II Pre-Operational Testing Plan already stated that these tests will be conducted (Section 6); no edits were made based on this comment.	Acknowledged.	N/A
9	Injection and Confining Zone Details [40 CFR 146.82(a)(3)(iii)]	· ***Are any porosity and permeability data available for the Tracy Formation confining zone?***	None	No core porosity/permeability data for the Tracy Formation has been found.	Acknowledged. CTV plans to collect this data during pre-operational testing.	N/A
10		· ***Does CTV have core data from drilling in any wells in nearby oil fields or from any other research on GS in the state of California that can provide porosity, permeability, capillary pressure, pore pressure, mineralogy, etc., data about the injection or confining zones to increase the number of data points on which the site characterization is based?***	Attachment A Section 2.4.2	Core data is available in 3 wells in the Union Island Gas field (Sonol_Securities_4, Sonol_Securities_5, Sonol_Securities_6) for the Winters formation. This includes capillary pressure and relative permeability. This data is site specific and is sufficient for the injection zone. This data has been included in new Table A-5. Core data in the form of porosity, permeability and XRD is available for the lower confining zone (Delta Shale) in the GP_Dohrmann_1_RD1 well. The XRD data was provided in the application (originally labeled Table 2.4-1, newly labeled Table A-4) from this well for both the Winters formation and the Delta Shale. Additional data has been included in new Table A-6.	The tables show data from multiple depths within the injection zone and lower confining zone. The average reported porosities are similar to those reported elsewhere in the permit application: injection zone average porosity of 21 %/ permeability of 13 mD; Delta Shale 15%/0.4 mD. No additional data for the upper confining zone was provided; however, this will be collected during pre-operational testing. The response is acceptable, as the intent of this request was to expand the discussion of available data.	N/A

#	Section	Comment/Question for CTV	Report Section Updated	CTV Response	EPA Evaluation	Response (November 2024)
11	Injection and Confining Zone Details [40 CFR 146.82(a)(3)(iii)] (cont.)	· ***Based on stratigraphic maps in the application, the Tracy Formation occurs between the Starkey and Sawtooth Shales. Are the Starkey, Tracy, and Sawtooth (i.e., all three formations) intended to serve as the primary confining zone together?***	Attachment A Section 2.1.3.	Yes, the Starkey, Tracy, and Sawtooth formations act as the primary upper confining zone. Attachment A, section 2.1.3 was edited to add confirmation that the Tracy Formation is part of the Upper Confining Zone.	Acknowledged.	N/A
12	Geomechanical and Petrophysical Information [40 CFR 146.82(a)(3)(iv)]	Figure 2.5-1 presents log-based unconfined compressive strength and ductility calculations from well Sonol_Securities_6; **however, EPA recommends that CTV perform a triaxial load test as part of pre-operational testing, consistent with EPA's Class VI Site Characterization Guidance.**	Pre-Operational Testing Plan Section 6	See response #45, #46.	Addition confirmed; the response is acceptable.	N/A
13		· ***Please clarify where the 0.94 psi/ft overburden stress gradient was referenced, or state how it was determined.***	Attachment A Section 2.5.2.	The overburden gradient was calculated by integrating density logs (8 wells were used, new Table A-9). The method for calculating the overburden gradient was to integrate the density logs using methodology laid out in Fjaer et al (2008): $\sigma_v = \int_0^D \rho(z) g \, dz$ where ρ is the density of the sediments, g is the acceleration due to gravity, D is the depth of interest, z is the vertical depth interval, and σv is the vertical stress.	Response is acceptable. **Please provide documentation of the overburden gradient calculation.**	The overburden gradient calculation was completed using the "Overburden Gradient Calculation" module in the software Interactive Petrophysics 5.1.0. **Figure A-43** displays the overburden gradient calculation inputs and outputs from the software. **EPA evaluation of CTV's response:** Track 7 of the new Figure A-43 depicts the overburden pressure and overburden gradient alongside the Sonol Securities 8 well logs, which CTV indicates were used as inputs to the software. The response is acceptable.
14	Seismic History [40 CFR 146.82(a)(3)(v)]	· ***Regarding the statement there is no correlation between induced seismicity and historical oil and gas production, does this include evaluation of fields where injection (e.g., in Class II wells) was occurring?***	Attachment A Section 2.6	Figure A-41 has been revised in the updated Attachment A narrative which shows the location of four Class II injection wells nearby the AoR, and Table A-12 was added. Seismic history shows no clustering of events around these wells or increased levels of seismicity due to injection. Well "A. Lucas 1" is in proximity to a seismic event that occurred in 2010 (event 1 in the map and table). However, this well was abandoned in 1988 having been drilled to 11,503 feet total depth in 1975. The event also had a recorded depth of 14.6km, much deeper than the Class II well and the base of the sedimentary section in this locale (estimated to be 14,000 feet to 17,000 feet or 4.3km to 5.2km across the SAF).	The narrative text and figure were updated as described. **There was a magnitude 3.0 earthquake in/near Discovery Bay that occurred in February 2024. Please update the seismic history section of the application with the most updated information.**	**Figure A-47** and **Table A-12** have been updated to include the February 2024 seismic event. **EPA evaluation of CTV's response:** The Figure and Table were updated with the new event; the response is acceptable.

#	Section	Comment/Question for CTV	Report Section Updated	CTV Response	EPA Evaluation	Response (November 2024)
15		· ***Please provide data to support statements in the narrative about past (i.e., 5,050 psi) and predicted (i.e., 4,500 psi) reservoir pressures.***	Attachment A Section 2.3.2	The following statements support the historical reservoir pressure of 5,040 psi: 1. SONOL_SECURITIES_1-A was drilled in February 1972 with perforation intervals between 9,697 feet to 9,707 feet, 9,714 feet to 9,735 feet, 9,780 to 9,784 feet, and 9790 feet to 9793 feet. A shut in pressure test was performed and returned a reservoir pressure of 5,040 psi. Data was sourced from CalGEM. 2. DOGGR (1998) shows Union Island Gas field initial reservoir pressure is 5,040 psi 3. A paper presented at the Society of Petroleum Engineers Western Regional Meeting in March 1994 displays (Table 1) initial reservoir pressure for the Winters formation in the Union Island gas reservoir is 5,040 psi (Leong and Tenzer, 1994). The proposed final reservoir pressure post-injection of 4,500 psi is equivalent to 90 percent of the discovery pressure (0.9 x 5,040 psi = 4,536 psi).	The response is acceptable, but **please provide supporting documents for the statements about the historical reservoir pressure of 5,040 psi.**	**SPE Paper 27886** is attached. **EPA evaluation of CTV's response:** SPE Paper 27886 indicates that the initial reservoir pressure is 5,040 psi; the response is acceptable.
16	Hydrologic and Hydrogeologic Information [40 CFR 146.82(a)(3)(vi), 146.82(a)(5)]	**Additional characterization of the lowermost USDW to satisfy the requirements of 146.82(a)(5) is required.**	Attachment A Section 2.7.2	Figure A-13 (previously Figure 2.2-4) displays a stratigraphic cross-section through the AoR showing the base of USDW and its relation to project stratigraphy. New Figure A-46 displays a map view of the base of USDW across the model boundary in elevation depth.	The intent of this statement in the evaluation was to indicate that TDS data for the USDW from within the AoR are needed. None of the wells depicted on Figures A-45 and A-50 are in the AoR. This information will be important to establish baseline geochemistry inside the AoR and confirm that the injection wells (e.g., surface casing) are constructed to protect all USDWs. However, planned pre-operational testing to characterize the baseline geochemistry of the USDW will address this concern. The response is acceptable at this point of the permit application review.	N/A
17		· ***Is any information available about the TDS content of the non-marine sediments that contain the USDW?***	Attachment A Section 2.7.5	Available TDS data from GEI (2021) was already included in Section 2.7.5; additional TDS data was obtained from GAMA (2023) and plotted on new Figure A-50.	See item 16.	N/A
18		· ***Where are the wells on which the geophysical logs used for the salinity calculations are based?***	Attachment A Section 2.7.2	The salinity calculations were performed on 41 wells in the area in order to create a regional USDW surface. See new Table A-13 for well list and a map at Figure A-45.	See item 16.	N/A

#	Section	Comment/Question for CTV	Report Section Updated	CTV Response	EPA Evaluation	Response (November 2024)
19		· ***Please confirm the total completion depths of the wells showed as "NA" in Table 2.7-1.***	None	As mentioned in Attachment A, water well data was obtained from GAMA, DWR, CASGEM, and other public databases. Total completion depths for the wells shown as 'NA' are unavailable from the source databases. Note that it is common for domestic and water-supply well depth information to be unavailable in public databases.	Acknowledged. **Are there any additional sources CTV can use to confirm total completion depths for the wells shown as 'NA'?**	There are no additional resources available for CTV to confirm completion depths of the wells shown as 'NA'. **EPA evaluation of CTV's response:** Acknowledged.
20	Confining Zone and Injection Zone Geochemistry [40 CFR 146.82(a)(6)]	CTV evaluated the mineralogy of the H&T shale from the Speckman_Decarli_1 well and the Delta Shale from the GP_Dohmann_1_RD1 well (both wells are 6 miles to the north of the AoR). **Because this data from 6 miles outside the AoR form the basis of the geochemical modeling (as described further in CO_2 Stream Compatibility), collection of site-specific data during pre-operational testing is needed to eliminate uncertainties about CO_2-rock-fluid compatibility.**	Pre-Operational Testing Plan Section 7	The Pre-Operational Testing Plan already included minerology analyses of cores (Section 6) and was edited to specifically add confirmation of geochemistry of the Upper Confining Zone (Section 7).	Acknowledged.	N/A
21		**Additional collection of site-specific data during the pre-operating phase will be necessary to confirm assumptions of site parameters and reduce uncertainty in modeling inputs.**	None	See response to specific comments regarding the pre-operational testing plan.	Acknowledged.	N/A
22	Site Suitability [40 CFR 146.83], *Facies Changes*	The Winters Formation injection zone is a silica rich formation. CTV states that regional thickness and lateral continuity will allow the reservoir to accommodate the injection of CO2. This appears to be the case based on information provided in the application (including some cores taken within the AoR); **however, CTV should provide evaluations based on pre-operational core sampling of the Winters Formation injection zone to confirm these assertions and reduce uncertainties in the characterization of facies changes and allow final approval of the AoR.**	None	The CTV II Pre-Operational Testing Plan already stated that these tests will be conducted (Section 6, Section 7); no edits were made based on this comment.	Acknowledged.	N/A

#	Section	Comment/Question for CTV	Report Section Updated	CTV Response	EPA Evaluation	Response (November 2024)
23	*Site Suitability [40 CFR 146.83], Structural Information*	**However, additional characterization of the Stockton Arch Fault during pre-operational testing is needed to confirm these assertions.** **(CTV should provide additional evidence of fault sealing, i.e., data to clarify the juxtaposition of units, potential for leakage along faults, catalysis, diagenetic sealing, shale gouge ratio, and/or additional pressure compartmentalization)**	Attachment A Section 2.3	Additional information supporting the sealing nature of the Stockton Arch Fault was added to Section 2.3.	Acknowledged; see EPA's evaluation of items 2-4 above.	N/A
24	*Site Suitability [40 CFR 146.83], CO2 Stream Compatibility*	**However, given the limited amount of geochemical and mineralogic data on the injection and confining zones from within the AoR, geochemical modeling inputs will need to be updated with site-specific data collected within the AoR during pre-operational testing to reduce uncertainty about the geologic characterization of the site and ultimately approve the AoR delineation before CTV is authorized to inject CO_2.**	Pre-Operational Testing Plan Section 7	The Pre-Operational Testing Plan was revised to state that geochemical modeling will be revised with new data.	Acknowledged.	N/A
25	*Site Suitability [40 CFR 146.83], Confining Zone Integrity*	**Additionally, step-rate testing to determine fracture pressure will be needed to ensure that operating pressures are appropriate to confining zone geomechanical properties.**	None	The CTV II Pre-Operational Testing Plan already stated that these tests will be conducted (Section 7); no edits were made based on this comment.	Acknowledged.	N/A
26	Site Suitability [40 CFR 146.83]	· ***Please provide additional information and calculations regarding how CTV determined the storage capacity of the injection zone, and how site-specific properties of the injection zone from within the AoR and operational conditions were factored into this evaluation.***	Attachment A Section 2.10.	Additional information supporting the storage volume was added to Section 2.10 as requested.	The narrative now includes a discussion of how dynamic modeling for the AoR delineation predicted a storage volume of 22.7 MMT at 23.5 years (the planned injection volume). The narrative also cites a Stanford University study of estimated CO2 storage volumes of reservoirs near the Union Island gas reservoir. **Also see the response to Item #52 of the computational modeling comment enclosure.**	Attachment A, Section 2.10 was updated with the following information: The Lathrop gas reservoir located approximately 4 miles east of the Union Island gas reservoir provides a fair comparison based on similar geology. Cumulative gas production from the Lathrop gas reservoir is 365 bcf plus minor water, while cumulative gas production from Union Island gas reservoir is 292 bcf plus minor water. Using the Stanford University methodology CTV expects the Union Island Gas Field to have a similar CO2 storage capacity as the Lathrop Gas Field. This methodology shows that the dynamic model predicted storage volume of 22.7 million metric tons (MMT) is conservative. **EPA evaluation of CTV's response:** CTV clarified in Section 2.10 that they expect the Union Island Gas Field to have a similar CO_2 storage capacity to the Lathrop Gas Field based on similar field geologies and the Stanford study's methodology

						for determining capacity. The Stanford study predicted a capacity of 43.5 MMT in the Lathrop Gas Field, which makes CTV's modeling prediction of 22.7 MMT for the Union Island Gas Field more conservative than that of the study. Site-specific information collected during pre-operational testing should be used to confirm modeling inputs to provide a more precise storage capacity. The response is acceptable at this point in the permit application review. **Follow-up Request for CTV:** Please provide a copy of the Stanford study for reference.

#	Section	Comment/Question for CTV	Report Section Updated	CTV Response	EPA Evaluation	Response (November 2024)
27		· ***Please provide information about the resolution of the 3D seismic surveys used to characterize faults near the project. Specifically, given the large area surveyed, what information exists that smaller faults would be identified?***	Attachment A Section 2.2.1	The 3D seismic surveys used to characterize faults in the area were part of a 2013 processing effort to merge over 1,100 square miles of data in to a single, seamless set of volumes with improved image quality. Each survey was processed individually then merged using industry leading techniques provided by a major industry service provider. The volume used to interpret the area for CTV II contained a number of pre-stack and post-stack enhancements along with 5D trace regularization to fill in data gaps and provide the best image possible for structural and fault interpretation. Acquisition parameters for the survey that encompasses CTV II are industry standard for seismic acquisition. The seismic traces are binned in to a 110 feet x 110 feet grid to provide dense spatial resolution for identifying smaller faults.	The requested information was added to the narrative; the response is acceptable.	N/A
28		· ***Please characterize the H&T Shale, the Capay Shale, Domengine Sandstone, Nortonville Shale as secondary confining zones to satisfy the requirements of 40 CFR 146.83(b).***	None	According to EPA Class VI regulation and guidance, formal definition of Secondary Confining Zones is needed only when the Primary Confining Zone is determined to be potentially insufficient for containment (e.g., see the Class VI Site Characterization Guidance Section 3.6). In this case the Upper Confining Zone exhibits sufficient thickness, low permeability, extent and integrity and no Secondary Confining Zone is needed. The presence of overlying low-permeability zones (e.g., H&T shale) provides redundant containment and this is noted in Attachment A. However, CTV does not agree that definition of the H&T shale or other zones as Secondary Confinement Zones under the Class VI regulations is necessary to demonstrate site suitability.	The response is acceptable pending confirmation of the physical and geomechanical properties of the primary confining zone.	N/A
29	Site Geomodel	**As data are collected from within the AoR during pre-operational testing, the grid inputs should be revised as necessary to reflect any heterogeneities identified and reduce uncertainty in the model inputs.**	Pre-operational testing plan Section 7	Pre-operational testing plan was edited to add site geomodel revision.	Acknowledged.	N/A
30		**(Table 3.6) The fracture pressure used in the model is assumed, and CTV plans to perform a step rate test to confirm these values as part of the preoperational testing.**	None	Comment noted, and is already acknowledged in the Pre-Operational Testing Plan.	Acknowledged.	N/A

#	Section	Comment/Question for CTV	Report Section Updated	CTV Response	EPA Evaluation	Response (November 2024)
31		• ***Please further elaborate on the data sources listed in Table 3.4 and provide the data that were used to determine formation initial conditions.***	Attachment B Table B-5	Attachment B Table B-5 (formerly Table 3.4) has been updated with additional data on sources, as requested.	The requested information was provided.	N/A
32		• ***Please provide the data source used to estimate the fracture pressure value used in the geomodel.***	Attachment A Section 2.5.2	The 8 wells used to estimate the fracture gradient are shown on Figure A-37 (formerly 2.5-4) and are provided in new Table A-8. All data is sourced from the drilling histories available on the CalGEM website. Fracture gradient was determined by formation integrity tests (FIT) or leak off tests (LOT), as specified in the "Test Type" column of Table A-8.	The Figure shows the locations of the 6 wells; 5 are within the AoR. The response is acceptable.	N/A
33	Summarized Objectives for Pre-Operational Testing	**Approval of all pre-operational testing procedures will be needed prior to well construction and testing.**	Pre-Operational Testing Plan Section 3.	The Pre-Operational Testing Plan was edited to add that approval is required prior to well construction and testing.	Acknowledged.	N/A
34	*Pre-Operational Testing Objectives*	· **Identify site-specific mineral composition and petrophysical characteristics of the injection and confining zones, in particular to correlate available data from the H&T Shale to the Starkey-Sawtooth upper confining zone.**	None	The Pre-Operational Testing Plan already stated that these tests will be conducted (Section 3); no edits were made based on this comment.	Acknowledged.	N/A
35		· **Clarify formation ductility, principal stresses, pore pressure, fracture gradient, and other petrophysical parameters to confirm geomechanical assumptions.**	Pre-operational testing plan Section 7	The Pre-Operational Testing Plan was updated as requested.	Acknowledged.	N/A
36		· **Determine static fluid levels (per 40 CFR 146.87(c)).**	None	The Pre-Operational Testing Plan states that "Methods for tests will be consistent with U.S. EPA (2013), and testing methods listed in the Testing and Monitoring Plan (Attachment C)." Attachment C, Section 6.5 discusses procedures to be taken during sampling methods includes the collection of depth and elevation measurements. No edits were made based on this comment.	Acknowledged.	N/A
37		· **Characterize the hydrogeologic characteristics of the injection zones using a pump test or injectivity test (per 146.87(e)).**	Pre-operational testing plan Section 5.3	The Pre-Operational Testing Plan was updated as requested.	Injectivity testing was added to the pre-operational testing plan. The response is acceptable.	N/A
38		· **Identify potential fractures within the carbonates of the upper confining zone and evaluate their effect on confinement.**	None	It is unclear what carbonates the commenter is referring to, as stated in Attachment A Section 2.8.3 the Upper Confining Zone has low carbonate content. Existing logging, coring and testing procedures listed in the Pre-Operational Testing Plan are sufficient to demonstrate confining-zone integrity. No changes were made based on this comment.	Acknowledged. The addition of the word carbonates in the sentence was erroneous. However, the planned testing (including core sampling) as described in the pre-operational testing plan is adequate to understand the geomechanical properties of the confining zone.	N/A

#	Section	Comment/Question for CTV	Report Section Updated	CTV Response	EPA Evaluation	Response (November 2024)
39		· **Determine precise storage capacity based on site-specific injection zone characteristics.**	Pre-operational testing plan Section 7	The Pre-Operational Testing Plan was updated as requested.	Acknowledged.	N/A
40		· **Confirm the absence of faults that transect the confining zone within the AoR.**	None	There are no observed faults that transect the confining zone within the AoR beyond the bounding SAF that controls the eastern edge of the AoR. Extensive 3D seismic data has already been collected covering the area and therefore no new data will be collected during pre-operational testing.	Acknowledged.	N/A
41		· **Confirm pressure isolation within the injection zone and other stratigraphic intervals across the footwall and hanging wall of the Stockton Arch Fault.**	Attachment A Section 2.3.	Additional information supporting the sealing nature of the Stockton Arch Fault was added to Section 2.3.	Acknowledged. Per CTV's response to item 3, reservoir pressure will be further confirmed during pre-operational testing.	N/A
42		· **Characterize formation fluid geochemistry and identify potential geochemical reactions and interactions between the injection and confining zone mineralogies and formation brines with the CO2 injectate to confirm the assumptions and results of the initial geochemical modeling to predict changes in formation water chemistry, mineral precipitation, and dissolution reactions.**	Pre-Operational Testing Plan Section 7	Please refer to response to EPA question #24	Acknowledged.	N/A
43		· **Characterize geochemistry in the above confining zone formation to be monitored, including data on CO2 concentrations and fluxes, to serve as a baseline for comparison to CO2 levels during and after the operational phase of the project in order to detect any potential leakage.**	Pre-Operational Testing Plan Section 7	The Pre-Operational Testing Plan was edited to add the Mokelumne Formation to the Geochemistry/Geochemical Data Section.	Acknowledged.	N/A

#	Section	Comment/Question for CTV	Report Section Updated	CTV Response	EPA Evaluation	Response (November 2024)
44		• ***On which wells will CTV perform an SRT?***	Pre-Operational Testing Plan	An SRT will be performed in the injection zone on new injection wells UI-INJ 1 and UI-INJ 2. CTV plans to perform an SRT on one of the wells in the confining layer during the routine abandonment of wells within the project AoR, including one of the following (the final selected well will be submitted to EPA for approval prior to performing the SRT): UWI Well Name 040772028700 GALLI_2 040772018000 MARCHINI_A_1 040772072401 SONOL_SECURITIES_11_ST1 040772019100 SONOL_SECURITIES_5 040772022400 SONOL_SECURITIES_7 040772036000 SONOL_SECURITIES_8 040772019700 UNION_PROPERTIES_1 040772050100 BROOKS_10-2 040772027401 POOL_B_1_RD1 040772028900 YAMADA_LW_1 040772071300 SONOL_SECURITIES_10 040772049301 BROOKS_10-1 RD1 040772050100 BROOKS_10-2	Acknowledged; the response is acceptable.	N/A

#	Section	Comment/Question for CTV	Report Section Updated	CTV Response	EPA Evaluation	Response (November 2024)
45		• ***How many cores does CTV plan to take and analyze from within the injection and confining zones during drilling?***	Pre-Operational Testing Plan Section 6	CTV plans to take cores in multiple formations in order to better understand the site characterization. Formations to be cored are: -Winters Formation (injection zone) -Sawtooth Shale (confining zone) -Tracy Formation (confining zone) -Starkey Formation (confining zone) -H&T Shale Tests that are planned to be performed are: -Routine core analysis (Porosity, permeability, saturation, grain density): All zones -Rock mechanics (including triaxial load testing): Injection zone and confining layers -Capillary pressure (MICP): All zones -Threshold entry pressure (TEP): All confining layers & H&T Shale -X-ray diffraction (XRD): All Zones -CO2-Water relative permeability: Injection zone -Pore volume compressibility: Injection zone -Geochemical compatibility: Injection zone & Sawtooth Shale -Thermal conductivity: Injection zone & Sawtooth Shale	It is recognized that the exact number of samples cannot be determined in advance of drilling. *However, EPA encourages the applicant to take a sufficient number of core samples at regular intervals to characterize the entire vertical extent of the injection and confining zones.*	CTV understands. No question related, no response required. **EPA evaluation of CTV's response:** No comment
46		***Please include triaxial load testing as part of pre-operational testing, consistent with the site characterization guidance.***	Pre-Operational Testing Plan Section 6	The Pre-Operational Testing Plan was updated as requested.	Addition confirmed; the response is acceptable.	N/A