Subpart RR Monitoring, Reporting, and Verification (MRV) Plan

Lima Tango CCS 1

McMullen County, Texas

Prepared by

BKV dCarbon Ventures, LLC

May 16, 2025

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1 – INTRODUCTION

BKV dCarbon Ventures, LLC (dCarbon), a subsidiary of BKV Corporation (BKV), is authorized by the Texas Railroad Commission (TRRC) to inject up to 9.5 million standard cubic feet per day (MMscfd), equivalent to approximately 177,000 metric tons per year (MT/yr), of carbon dioxide (CO_2) into the proposed Lima Tango CCS 1 injection well in McMullen County, Texas. The permit issued by the TRRC allows injection into the Queen City formation at a depth of 3,508 feet to 4,870 feet with a maximum allowable surface pressure of 1,700 pounds per square inch gauge (psig).

dCarbon intends to dispose of CO_2 into the Lima Tango CCS 1 well produced from the nearby Las Tiendas Natural Gas Processing (NGP) Plant, operated by Energy Transfer LP (ET), which is a separate pre-existing facility. The Lima Tango CCS 1 injection well/facility and the ET Las Tiendas NGP Plant are not under common ownership or common control, and the ET Las Tiendas NGP Plant has a function separate and distinct from the injection well source category, making them separate and distinct facilities under 40 CFR 98.6.

The project site is 15.44 mi NW of Freer, Texas, as shown in **Figure 1**.

dCarbon anticipates drilling and completing the Lima Tango CCS 1 well in the third quarter of 2025 and beginning injection operations in early 2026. The Lima Tango CCS 1 well has approved Form W-14 injection and Form W-1 drilling permits with the TRRC permit number 17575, Underground Injection Control (UIC) number 000126980, and American Petroleum Institute (API) number 42-311-37581. Copies of the approved Form W-1 and W-14 permits are included in the **Appendix, Section 13.3.**

Although dCarbon intends to initiate injection with lower volumes, all calculations in this document have been performed assuming the maximum injection amount allowed by the TRCC permit (177,000 MT/yr). dCarbon plans to inject for 12 years.

dCarbon submits this Monitoring, Reporting, and Verification (MRV) plan for approval by the Environmental Protection Agency (EPA) in accordance with 40 CFR § 98.440-449, Subpart RR, of the Greenhouse Gas Reporting Program (GHGRP).

dCarbon's TRRC operator number is 100589.

dCarbon's Environmental Protection Agency Identification (EPA ID) number is 110071343305.

The Lima Tango CCS 1 well's Greenhouse Gas Reporting Program Identification (GHGRP ID) number is 590006. All aspects of this MRV plan refer to this well and this GHGRP ID number.

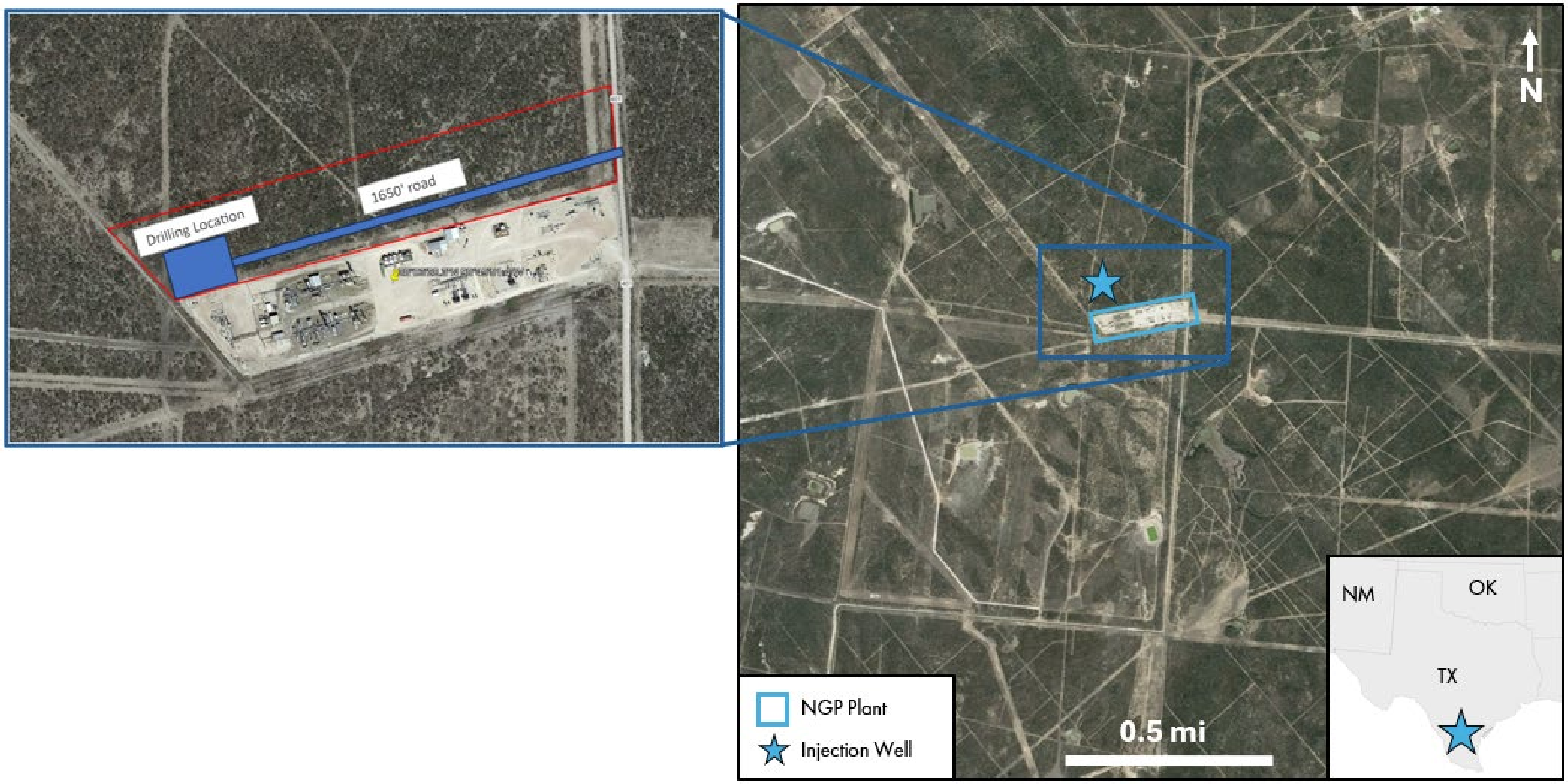


Figure 1. Location map of the Las Tiendas NGP Plant and the proposed Lima Tango CCS 1 injection well drilling location adjoining the plant in McMullen County, Texas.

2 – FACILITY INFORMATION

Gas Plant Facility Name:

Las Tiendas Plant
348 County Road 401
Freer, Texas 78357

Latitude: 27° 57.63' N
Longitude: 98° 35.64' W

Operator: Energy Transfer LP

GHGRP ID number: 1010735

Facility Registry Service Identifier (FRS ID): 110071159879

North American Industry Classification System (NAICS) Code: 486210

Reporting structure: Onshore Natural Gas Processing

Underground Injection Control (UIC) Permit Class:

The Oil and Gas Division of the Texas Railroad Commission (TRRC) regulates oil and gas activity in Texas and has primacy to implement the Underground Injection Control (UIC) Class II program for injection wells. The TRRC has permitted the Lima Tango CCS 1 well as an UIC Class II well. The Class II permit was issued to dCarbon in accordance with Statewide Rule 9.

Injection Well:

Operator: BKV dCarbon Ventures, LLC

Lima Tango CCS 1, API number 42-311-37581

UIC number: 000126980

Lima Tango CCS 1, GHGRP ID: 590006

3 – PROJECT DESCRIPTION

This section discusses the geologic setting, the lithology and reservoir characteristics of the planned injection and confining intervals, the formation fluid geochemistry, the potential for induced seismicity, the groundwater hydrology in the project area, the CO_2 project facilities, and the reservoir modeling performed for the proposed Lima Tango CCS 1 injection well. dCarbon has prepared this MRV plan to support the storage of CO_2 in McMullen County, Texas. The term interval is used for the composite layers and the term zone is used for the specific layers of rocks for the storage and confinement of CO_2.

3.1 Overview of Geology

Paleogene deposition began with the mud-rich Paleocene Midway Shale (**Figure 2**), which is widely present across the northern and western Gulf of Mexico margins. Sediment supply and sand content increased markedly thereafter, with deposition of the coarse siliciclastics of the Paleocene Lower and Middle Wilcox Formations and the Eocene Upper Wilcox Formation, followed by the Eocene Queen City and Sparta Formations. These deposits rapidly filled foreland troughs and prograded across the former Upper Cretaceous shelf margins. Sediment starved mud-rich intervals are present between the Upper Wilcox and Queen City Formations (as the Eocene Reklaw Shale) and between the Queen City and Sparta Formations (as the Eocene Weches Shale) as shown in **Figure 2**. The storage interval for this project is the Queen City Formation and the Reklaw and Weches Shales are lower and upper confining zones, respectively.

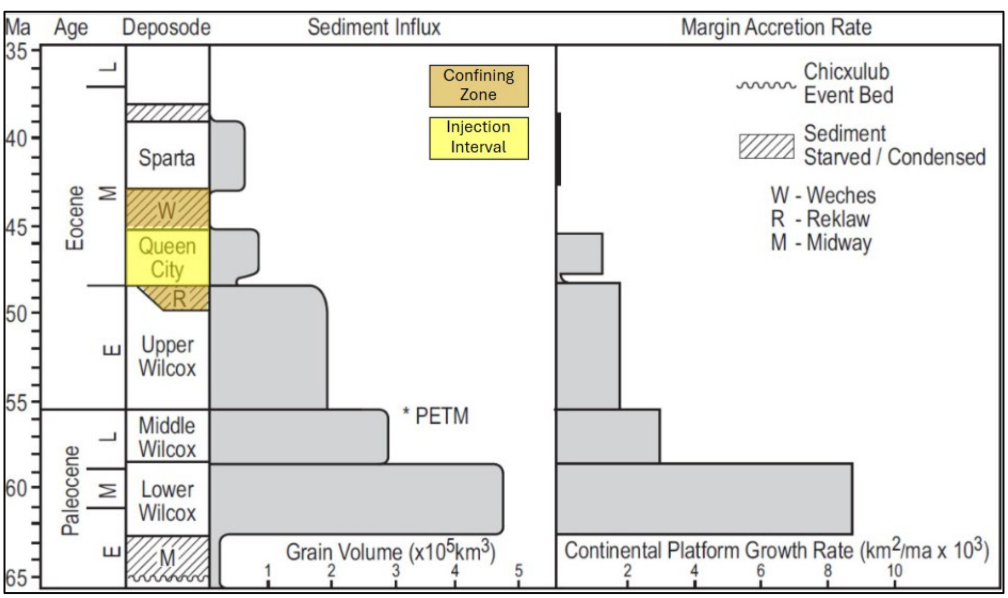


Figure 2. Regional stratigraphy at Lima Tango CCS 1 site in McMullen County, Texas, (modified from Snedden and Galloway, 2019). The Eocene sediment starved/condensed sections are in hachured fill and labeled R (Reklaw Shale) and W (Weches Shale). These are the lower and upper confining zones, respectively, for the Queen City Formation injection interval.

In this area, the Middle Eocene strata are tens of miles up dip from the shelf edge and the growth fault rafting that characterizes the time-equivalent section in the Gulf of Mexico. A published seismic section near the proposed injection site (**Figure 3**) illustrates the gentle dip and lack of growth faulting at the position of the proposed Lima Tango CCS 1 (red star). The strata in this setting are uniform in thickness, gently dipping towards the coast with less than two degrees of dip, and unimpacted by growth-fault related accommodation. We expect that the injected CO_2 will gradually migrate up dip to the west and northwest, owing to its buoyancy relative to the saline reservoir water. There are three faults mapped at the Queen City stratigraphic level in the Lima Tango CCS 1 model area. The most significant one is in northwestern part of the licensed 3D seismic area and is 1.2 miles from the modeled 98-year post-injection plume extent and 1.5 miles from the modeled 50-pounds per square inch (psi) change in pressure due to the injection. **Section 5.4** describes this fault further and addresses the lack of leakage risk that it presents given the fault's distance away from the modeled plume and pressure front.

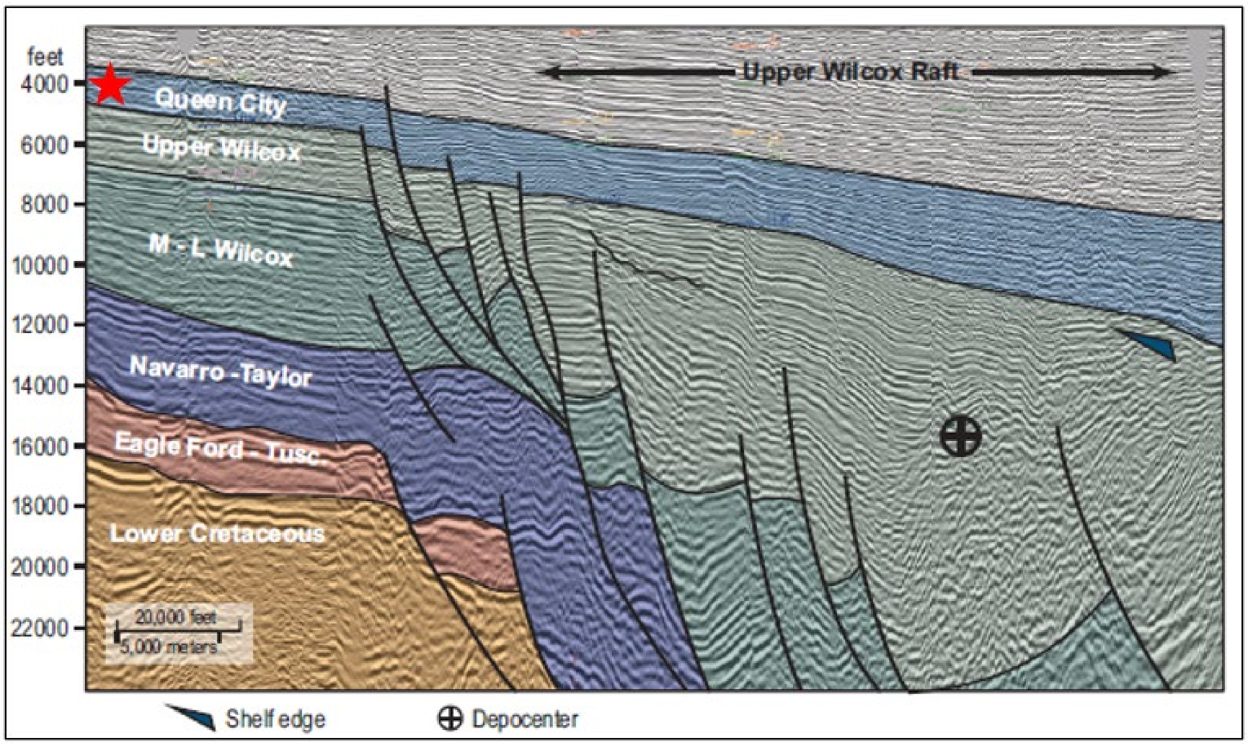


Figure 3. Representative northwest to southeast seismic cross section from Snedden and Galloway (2019) with the Queen City Formation and the Lima Tango project annotated with a red star. Figure 4 shows the line of section location.

3.2 Bedrock Geology

3.2.1 Basin Description

The proposed injection site lies in in McMullen County, Texas, just north of the border between McMullen and Duval Counties. The project takes place in the Gulf of Mexico basin, originally formed by rifting during the Jurassic (Snedden and Galloway, 2019). The basin began rapid filling thereafter in the Cretaceous and Paleogene with large volumes of continentally derived sediments transported to the coastal plain by the Rio Grande River system, with the shales representing times of sediment starvation or condensed section. **Figure 4** presents a regional paleogeographic construction representative of the time of deposition of the Queen City Formation injection interval (Middle Eocene) by Galloway and Snedden (2019).

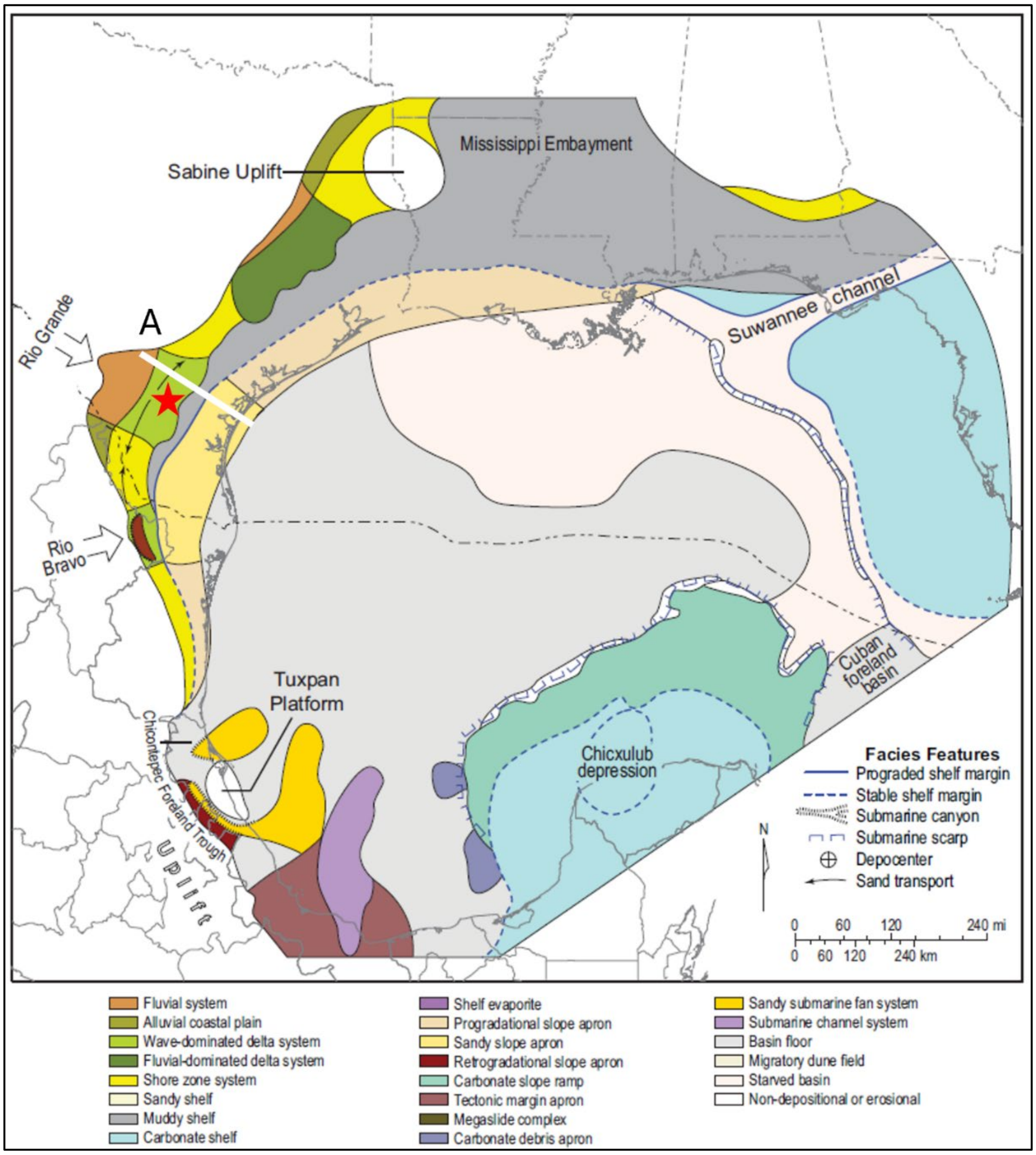


Figure 4. Middle Eocene paleogeographic reconstruction by Snedden and Galloway (2019). The Queen City Formation was deposited during this time, with the red star denoting the proposed injection site in the wave-dominated deltaic depositional environment. The location of the seismic line in Figure 3 is the white line marked by the letter "A".

3.2.2 Stratigraphy

Deposition of the Middle to Upper Eocene strata occurred in a wave-dominated deltaic setting along the margin of the early Gulf of Mexico basin (**Figure 4)**. The Queen City Formation is estimated to occur at depth ranging from 3,508-4,870 ft true vertical depth (TVD) with a reference datum of ground level at the Lima Tango CCS 1 proposed well site and has approximately 1,400 feet of uniform gross thickness across the modeled area. The Queen City Formation is the injection interval and is comprised of three potential injection zones (IZs). The Middle Eocene Weches Shale, with 110 feet of gross thickness, is the Upper Confining Zone (UCZ), and the lower Queen City shale and Early Eocene Reklaw Shale, with 965 feet of gross thickness, including over 50 feet of continuous impermeable shale, is the Lower Confining Zone (LCZ). **Figure 2** shows the stratigraphic relationship of the two confining zones and the injection interval.

Attractive attributes for CCS storage in the project area includes high storage capacity, minimal faulting, tight widespread confining shales, and gentle dip down to the coast. The injection interval is a package of thick, sheet-like, laterally continuous, porous, and permeable sandstone bodies characterized by low spontaneous potential (SP) and high deep resistivity (DRES) readings relative to the shales on wireline logs as shown in the type log (**Figure 5**) and cross section (**Figure 6)**. Individual sand bodies are separated by internal confining shales with higher SP and lower DRES wireline log signatures. The entire injection interval is bracketed by thick upper and lower confining shales, also with higher SP and lower DRES wireline log signatures. Both the injection interval and confining zones are laterally continuous and maintain constant thickness across the project area with a gentle up to the northwest dip (**Figure 6**). The upper confining shale (Weches Shale) is widespread and serves as the regional seal for the Queen City storage assessment unit (SAU) (Roberts-Ashby *et al*., 2014).

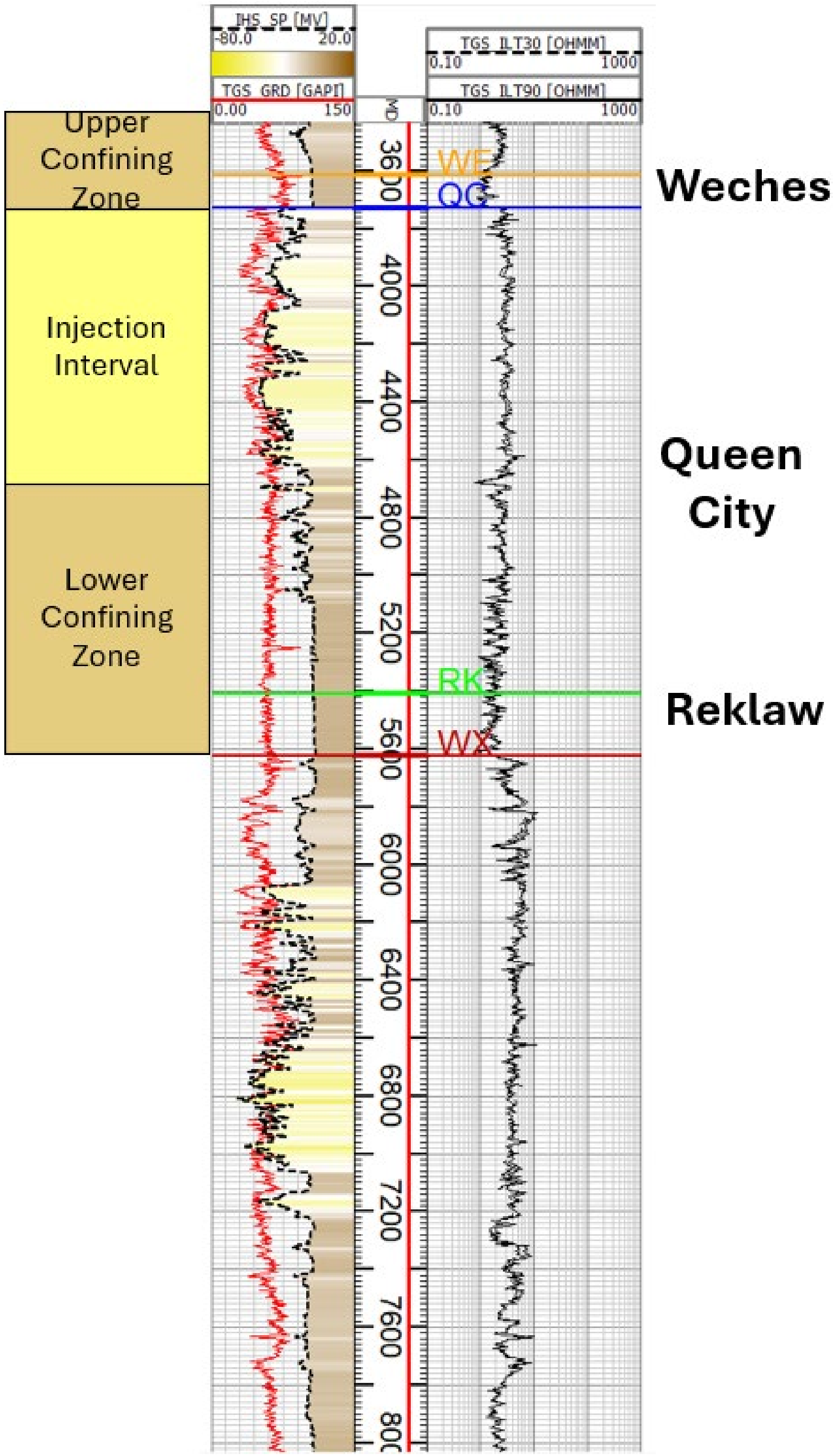


Figure 5. Nueces Mineral No. 1 (API 42-311-3181300) type log depicting the confining zones, injection interval, and associated formation names in the project area. The left column contains gamma ray (GR) (red) and SP (color-filled) curves, and the right column contains a DRES curve (black) on a logarithmic scale. Depth scale is in the middle column is in feet measured depth (MD).

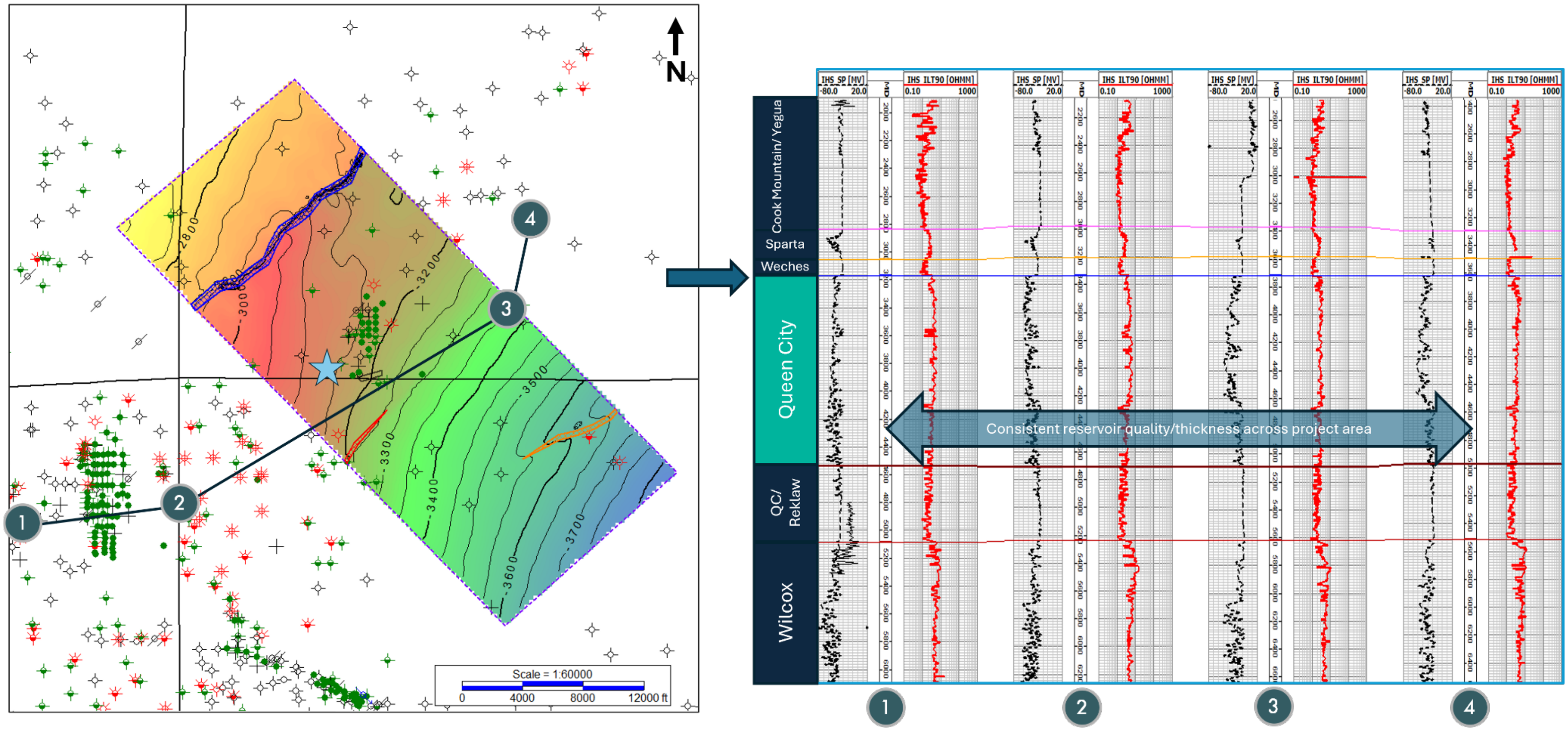


Figure 6. Map of the Lima Tango CCS 1 project area with proposed injection well (light blue star), existing wells, faults, seismic data, cross section wells, and numbered stratigraphic cross section flattened on the Queen City Formation top. The cross section is a four-well section from southwest to northeast across the project area with wells numbered on both the map and cross section. The licensed three dimensional (3D) seismic data is represented by the rectangular area of color filled structural contours on the top of the Queen City Formation in feet true vertical depth subsea (TVDSS) with a contour interval of 50 feet. The Weches Shale is the UCZ for the Queen City storage interval; the lowermost Queen City (QC) and Reklaw Shale are the LCZ for the Queen City and serves as an impermeable barrier between the Queen City and the Upper Wilcox aquifer.

3.2.3 Faulting

The Lima Tango CCS 1 well site is characterized by gentle dip (less than two degrees) and little faulting (**Figure 7**). Paleogene faulting along the western margin of the Gulf of Mexico was initiated by slump over Mesozoic shelf margins during very rapid sediment deposition. The Lima Tango CCS 1 site is located landward of these shelf margins (**Figure 3**) and much of the sediment bypassed this area to the offshore. As such, the deposition was more uniform in this area and the mechanisms for growth faulting were not in place.

There are three faults intersecting the Queen City Formation that have been mapped on the 3D seismic data licensed for this project (**Figure 7**). A late, down-to-the-coast fault with 100-250 feet of offset is on the northwestern portion of the seismic data (**Figure 7**, blue fault labeled 1). This fault is rooted in the Mesozoic section and continues nearly to the surface with consistent offset throughout the section indicating that it moved late.

An antithetic to this fault (**Figure 7**, orange fault labeled 3) is mapped on the southeastern portion of the seismic data, dipping to the northwest. This fault cuts down to the Upper Cretaceous and has offset up to 60 feet within the Queen City Formation.

A smaller fault (**Figure 7**, red fault labeled 2) was mapped in the middle portion of the seismic data. It also dips to the southeast, cutting down from the Eocene to Upper Paleocene section, with minimal offset.

Additional deep, normal faults with minor offset were mapped on the licensed three dimensional (3D) seismic and intersect neither the Queen City Formation nor the lower confining zone.

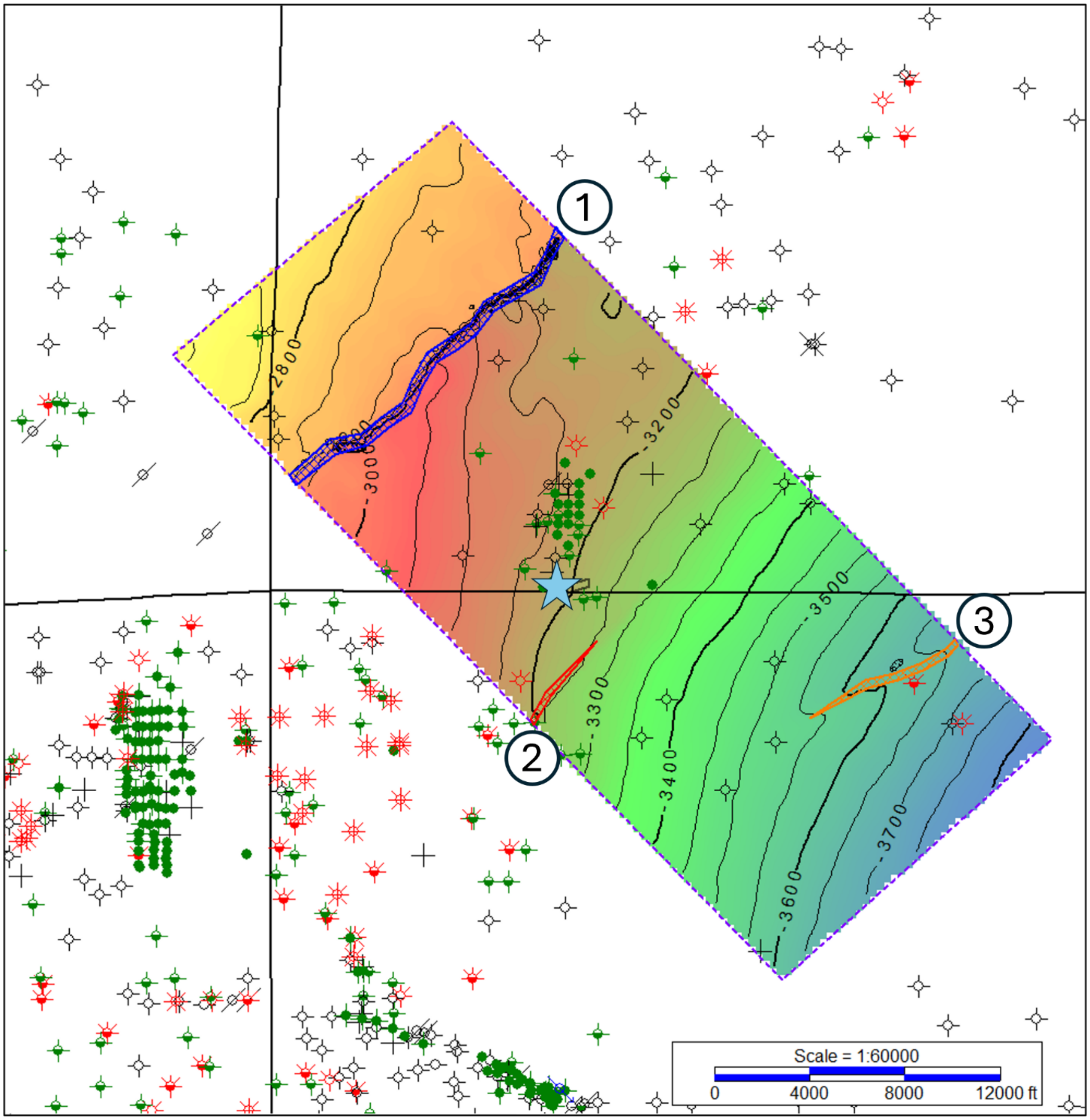


Figure 7. Top Queen City Formation structure in feet TVDSS with a contour interval of 50 feet. The injection well is highlighted with the blue star and all existing oil and gas wells are shown. Faults are indicated by the colored polygons and numbers. North is up.

3.3 Lithological and Reservoir Characterizations

A set of 69 digital well logs and 81 raster well logs that were deep enough to reach the Queen City Formation were used to map the subsurface. Formation tops were interpreted on well logs and tied to 20 square miles of licensed 3D seismic data. Digital logs from the Nueces Minerals No. 1 type log were used to construct a petrophysical model that included a porosity-permeability transform, water saturation calculation, geomechanical properties, and facies. **Figure 8** depicts the datasets utilized for interpretations described in this project.

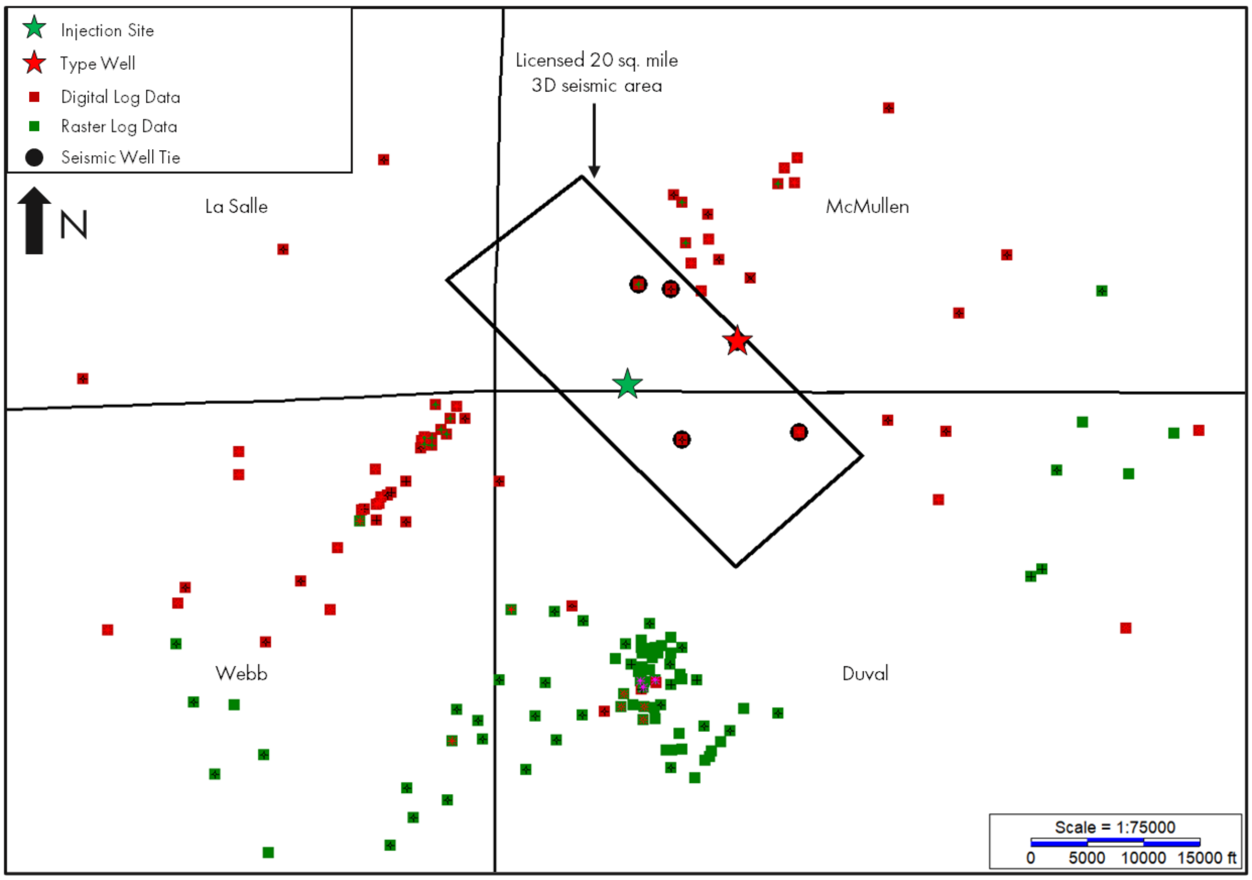


Figure 8. Data availability map depicting the 150 wells with digital wireline logs (red squares) and raster logs (green squares) in the mapped area. The Nueces Mineral No. 1 type log used for petrophysical interpretations (red star) and the 20 square miles of licensed and reprocessed 3D seismic data relative to the proposed Lima Tango CCS 1 injection well (green star) are also shown. Note that not all drilled wells are shown on this map.

3.3.1 Injection Interval

The Queen City Formation is the injection interval. It is comprised of three sand-rich injection zones (IZs) designated IZ-1 to IZ-3 (**Figure 9**). They have low volume clay (vClay) (less than 15 percent (%)) and a dominance of sand (greater than 60 %) in our petrophysical and facies models, respectively.

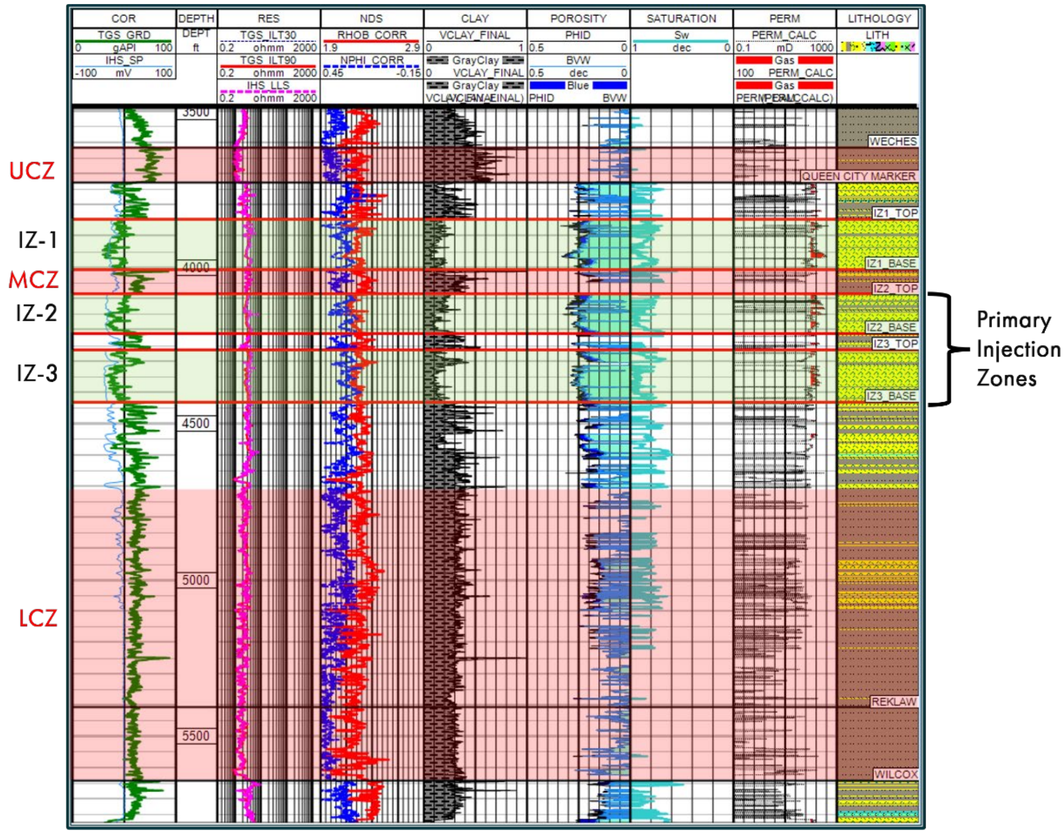


Figure 9. Petrophysical log of the Nueces Minerals No. 1 well with the Queen City Formation primary injection interval annotated on the right and the individual injection and confining zones annotated on the left. The injection interval is comprised of Injection Zone 2 (IZ-2) and Injection Zone 3 (IZ-3). Injection Zone 1 (IZ-1) was mapped but not included as part of the CO_2 plume model.

3.3.2 Confining Zones

The Weches Shale, which overlies the Queen City Formation, and the Reklaw Shale, which underlies the Queen City Formation, were identified as the UCZ and LCZ, respectively. These shales are comprised of starved, condensed, shale-dominated intervals with high gamma ray, low resistivity, and low porosity log signatures, as well as high vClay and a dominance of shale (greater than 30%) in our petrophysical and facies models.

3.3.3 Injection and Confining Zones and Properties

A petrophysical interpretation of wireline logs available at the Nueces Minerals No. 1 well is presented in **Figure 9**. The individual injection and confining zones are highlighted in green and red, respectively and labeled at the left. The modeled primary IZ is annotated at the right. The UCZ is compromised of the Weches Shale, Injection Zone 1 (IZ-1) is comprised of uppermost Queen City sand, the Middle Confining Zone (MCZ) is comprised of a shale within the Queen City, Injection Zone 2 (IZ-2) is comprised of the next major sand down in the Queen City, and Injection Zone 3 (IZ-3) is comprised of a well-developed sand in the middle of the Queen City. The LCZ was additionally identified as the Reklaw Shale but there are also shales with very thinly interbedded sands in the basal Queen City that have low porosity and permeability. This interval is highlighted as also contributing to the LCZ in **Figure 9**. The dominant lithology, thickness, porosity, and permeability of each zone is presented in **Table 1**.

Table 1. Properties of the Queen City Formation injection zones and the Weches Shale, Queen City, and Reklaw Shale confining zones assessed at the Lima Tango project area. Porosity is given in percent (%) and permeability is given in millidarcies (mD).

Subunit	Dominant Lithology	Thickness (feet)	Average Reservoir Porosity (%)	Average Reservoir Permeability (mD)	Description
Upper Confining Zone (UCZ)	Shale	110	1	0.002	Weches Shale
Injection Zone 1 (IZ-1)	Sand	160	16	75	Queen City sand (identified but not modeled)
Middle Confining Zone (MCZ)	Shale	90	3	0.2	Queen City intraformational shale
Injection Zone 2 (IZ-2)	Sand	125	20	120	Queen City sand
Injection Zone 3 (IZ-3)	Sand	168	19	100	Queen City sand
Lower Confining Zone (LCZ)	Shale	965	1.5	0.05	Lowermost Queen City interbedded sands and shales and the Reklaw Shale

3.4 Formation Fluid Chemistry

The available formation fluid chemistry analyses available from the United States Geological Survey (USGS) National Produced Waters Geochemical Database v2.3 for the targeted Queen City Formation injection interval are shown in in **Figure 10**. All values are located southeast or east of the Lima Tango CCS 1 site and have Total Dissolved Solids (TDS) values greater than 20,000 parts per million (ppm). The average, low, and high TDS values are presented in **Table 2** as are the corresponding values for potential of hydrogen (pH), sodium (Na), calcium (Ca), and chlorides (Cl).

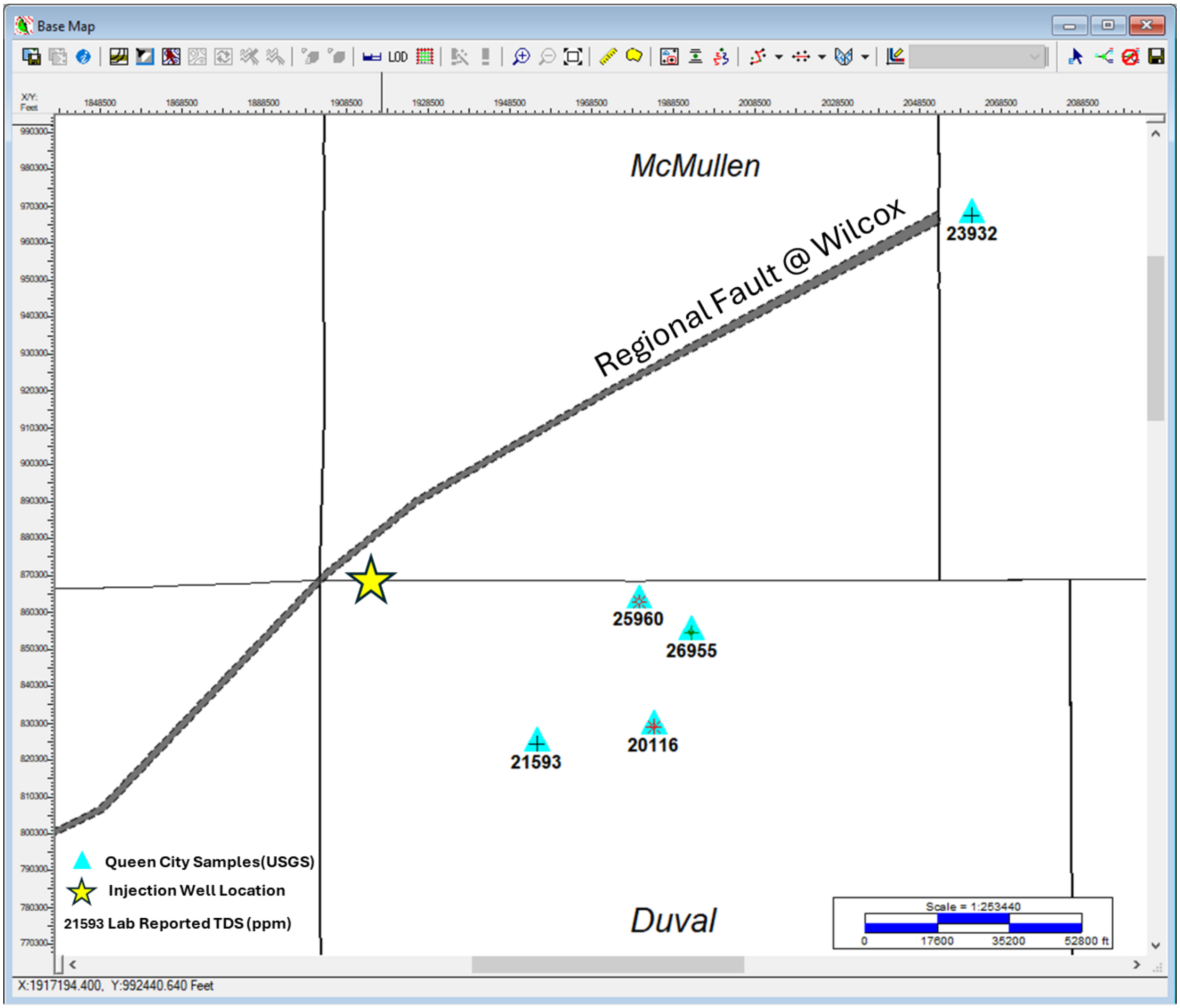


Figure 10. Map showing the location and values of TDS (ppm) in wells with of available USGS water samples values from the Queen City Formation. These were used in the formation fluid chemistry analysis. Regional fault location is from Kosters, *et al.*, 1989. North is up.

Table 2. Queen City Formation fluid chemistry.

	TDS (ppm)	pH	Na (ppm)	Ca (ppm)	Cl (ppm)
AVG	23,711	7.8	8,900	92	12,815
LOW	20,116	7.4	7,561	54	10,950
HIGH	26,955	8	10,100	152	14,700

3.5 Potential of Induced Seismicity

There has been no earthquake activity near the Las Tiendas NGP plant or within 25 kilometers (km) since 2017 according to the TexNet earthquake monitoring network. The earthquake activity present north of the site as shown in **Figure 11** is believed to result from oil and gas well completions activity in the Eagle Ford trend. The Queen City Formation proposed injection interval at the Lima Tango CCS 1 site is thousands of feet above the crystalline basement rock. As such, seismicity risk related to this project's injection of CO_2 is expected to be nominal.

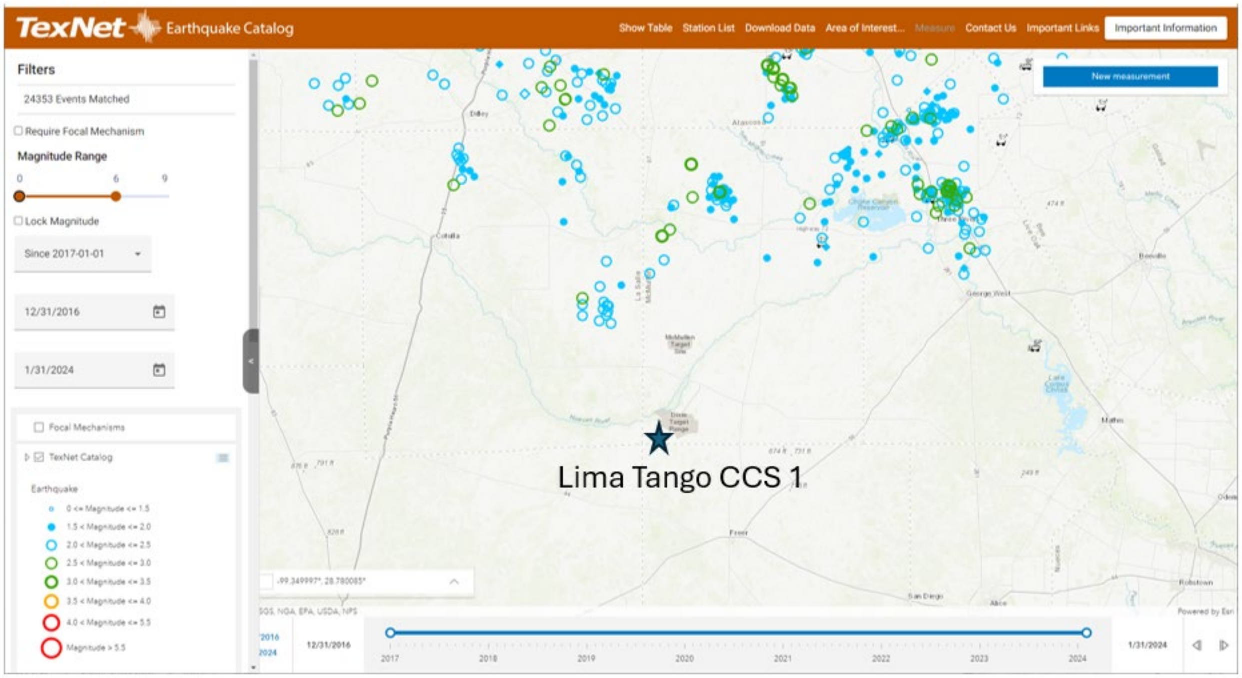


Figure 11. Map of historical seismic activity within 25 km of the proposed Lima Tango CCS 1 site from the Texas Seismological Network (TexNet) Seismic Monitoring Network. North is up.

3.6 Groundwater Hydrology

The proposed Lima Tango CCS 1 injection site lies on the southeastern edge of both the mapped limits of the Carrizo-Wilcox and the Jackson-Yegua aquifers (**Figures 12 and 13).** The proposed disposal interval (Queen City) is estimated to be 3,508 - 4,870 feet true vertical depth (TVD) at the injection site and is isolated from the shallow Underground Source of Drinking Water (USDW) (Jackson-Yegua) and the deep potential USDW (Carrizo-Wilcox). **Figure 14** depicts the injection interval and confining zones relative to both USDWs and the Base of Useable Quality Water strata (BUQW). Note that the Nueces Minerals No. 1 type log shown in this figure is approximately 170 feet downdip from the injection well and picks have been adjusted accordingly.

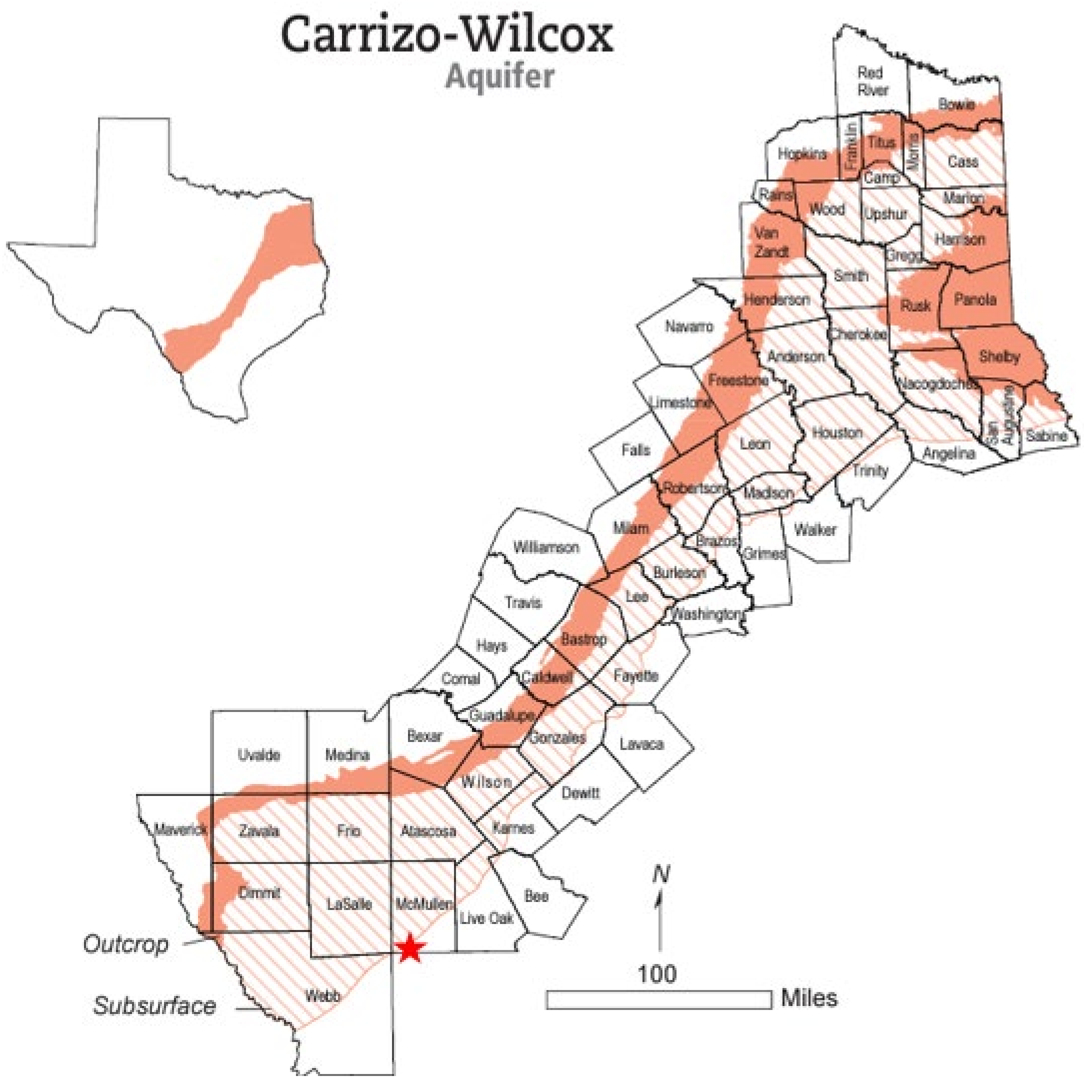


Figure 12. Carrizo-Wilcox aquifer map and recharge area, with outcrop shown in solid fill and subsurface in hachured fill, relative to proposed injection well (red star). Modified from George *et al.*, 2011.

Figure 13. Yegua-Jackson aquifer map and recharge area relative to proposed injection well (red star). Modified from George *et al*., 2011.

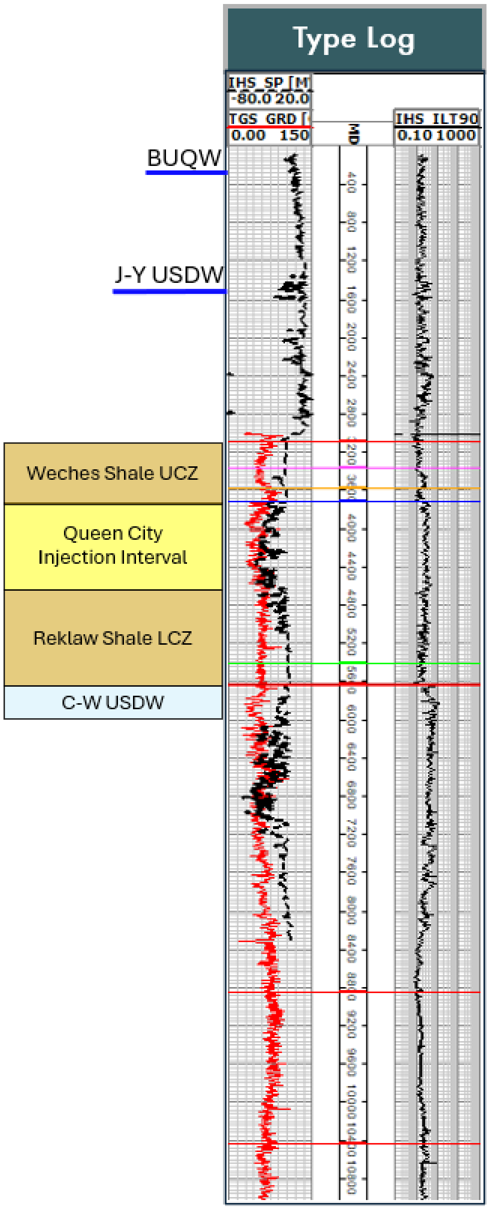


Figure 14. The Nueces Minerals No. 1 type log annotated with the BUQW, the Jackson-Yegua (J-Y) USDW, the Weches Shale UCZ, the Queen City injection interval, the Reklaw Shale LCZ, and the Carrizo-Wilcox (C-W) USDW.

The Jackson-Yegua aquifer is 2,300 feet above the Queen City injection interval and separated from the injection interval by multiple low-porosity and low-permeability formations, most notably, the Weches Shale which is identified as the UCZ (**Figure 14**). The Carrizo-Wilcox aquifer is 965 feet below the Queen City injection interval and isolated from it by the Reklaw Shale LCZ. Both the Weches and Reklaw Shales have been mapped as aquitards in numerous Texas Water Development Board (TWDB) publications, (Galloway *et al.*, 1991; Sharp *et al.*, 1991). Water samples from the Carrizo-Wilcox aquifer illustrate the increasing salinity of the aquifer downdip to the southeast (**Figure 15**). Owing to the transitional nature and the uncertainty of the water quality at the Lima Tango CCS 1 injection site, the TRRC Groundwater Advisory Unit (GAU) considers the Carrizo-Wilcox aquifer a potential USDW. Therefore, dCarbon demonstrated geologic isolation between the proposed injection zone and the Carrizo-Wilcox potential USDW and the TRRC GAU agreed that sufficient isolation existed to support dCarbon's W-14 injection permit. There are no water wells within the two-mile radius of the Lima Tango CCS 1 injection site as shown in **Figure 16**.

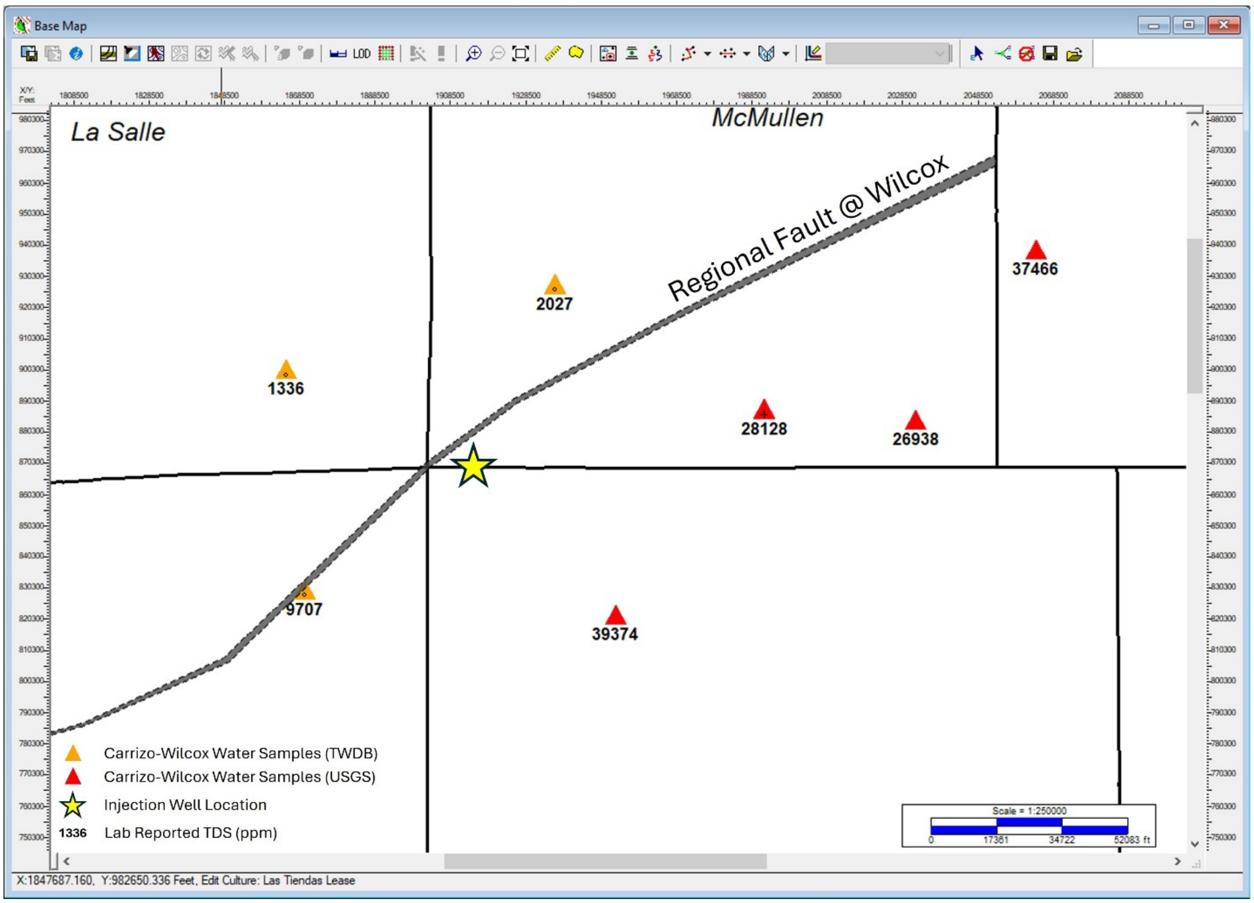


Figure 15. Carrizo-Wilcox water sample data from the USGS and TWDB. Posted values are in ppm TDS and the source denote by the color of the triangle in the legend in the lower left corner. North is up.

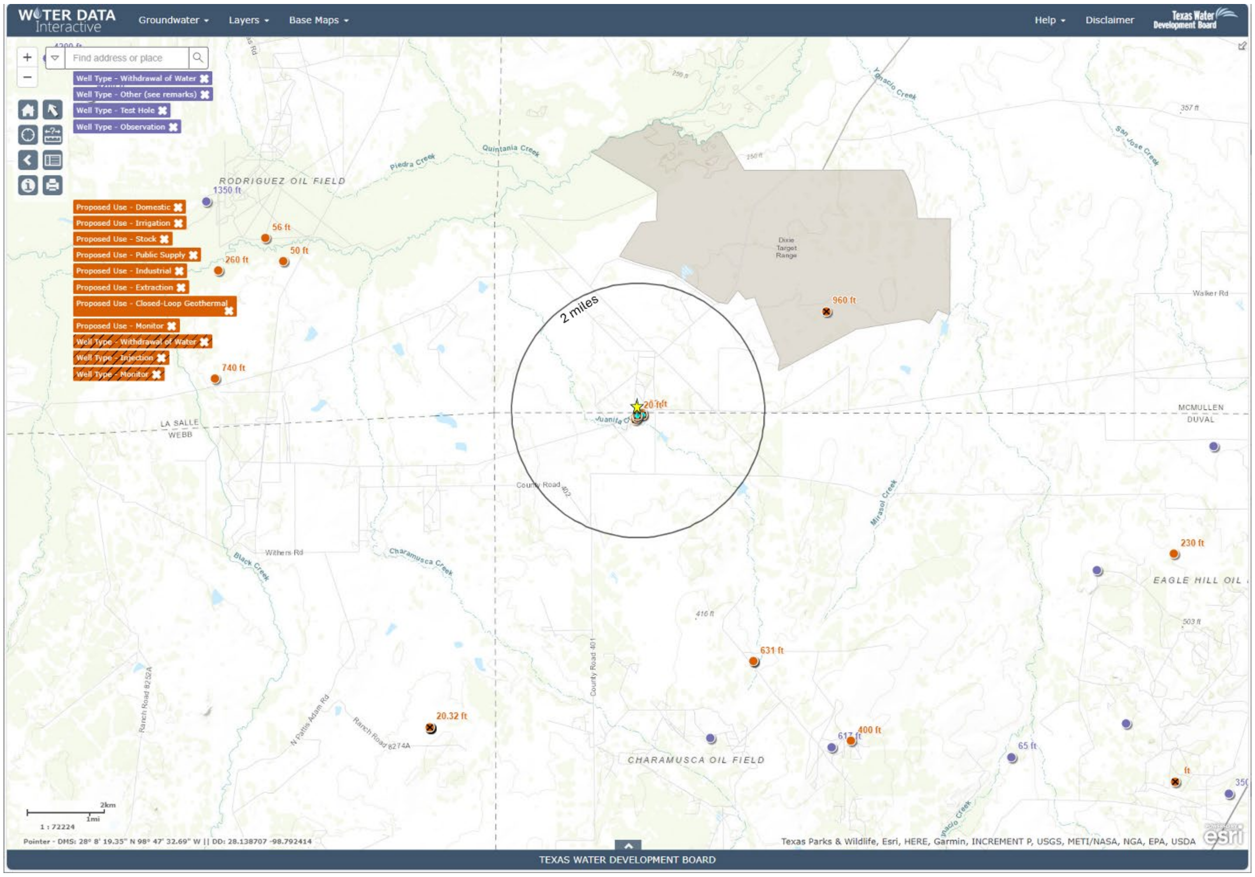


Figure 16. Water wells within the greater Lima Tango CCS 1 area from the TWDB interactive viewer. The yellow star denotes the injection site, and the black circles depict a two-mile radius circle around the proposed injection site. No water withdrawal wells fall within these areas. Monitoring wells at the ET Las Tiendas NGP Plant site have been plugged. North is up.

3.7 DESCRIPTION OF CO_2 PROJECT FACILITIES

dCarbon will accept CO_2 from the ET Las Tiendas NGP Plant (**Figure 17**). The temperature, pressure, composition, and quantity of CO_2 will be measured and metered according to industry standards, with an orifice meter, Coriolis meter, or similar device. dCarbon will compress the CO_2 to a supercritical physical state at the Lima Tango CCS 1 injection site. The CO_2 stream will be metered to verify quantity. The CO_2 will then be injected into the Queen City Formation, which is not known to be productive of oil and gas in the area. A gas analysis of the CO_2 stream is shown in **Table 3**. Although industry-standard sampling of the CO_2 stream is expected to be representative of the composition of the gas, it is possible that the composition will vary slightly over time.

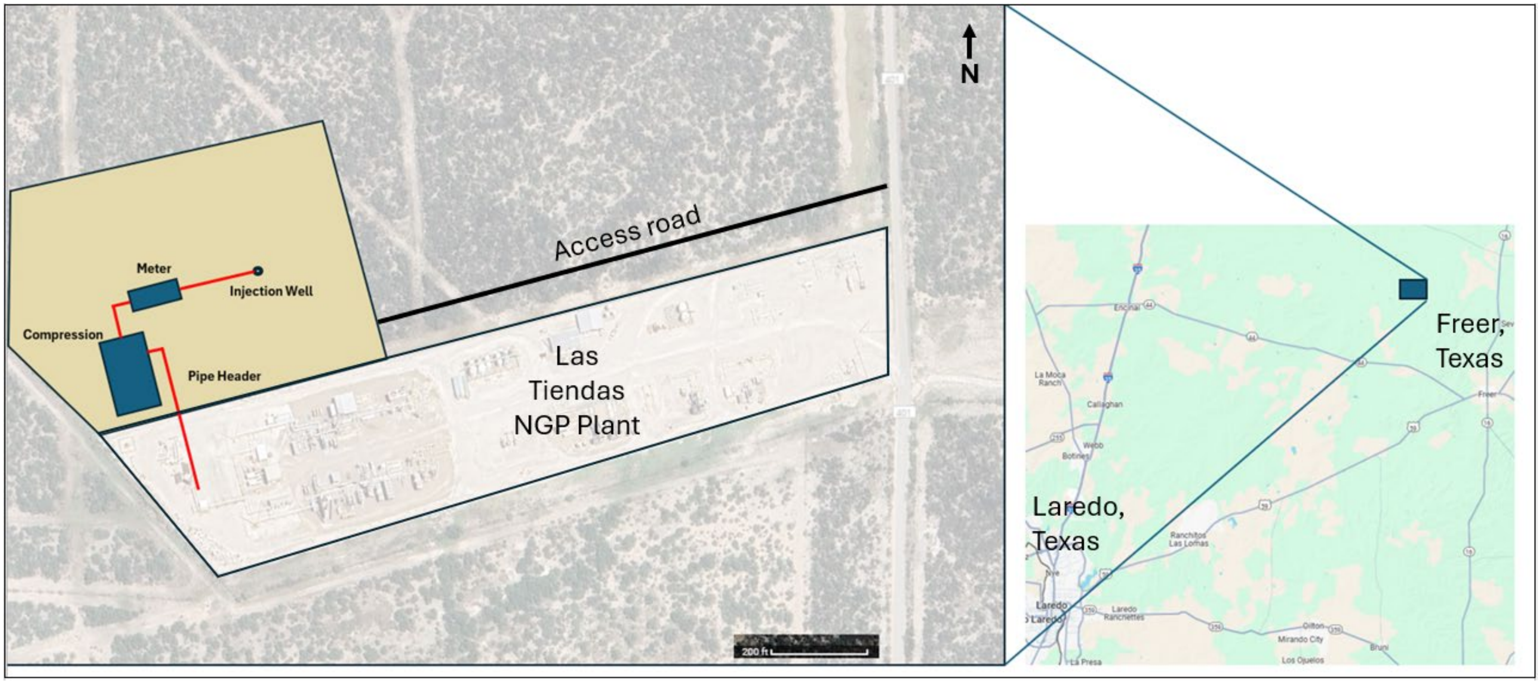


Figure 17. Lima Tango CCS 1 injection well proposed plot plan and location map relative to cities in south Texas.

Table 3. Inlet CO_2 stream analysis for the Lima Tango CCS 1 site in mol percent.

	DESIGN	DESIGN
Water	9.62	Dry Basis
Hydrogen Sulfide	0.01	55 ppmv / 0.006
Nitrogen	0.01	0.010
Carbon Dioxide	87.46	96.774
Methane	2.51	2.776
Ethane	0.34	0.381
Propane	0.01	0.013
i-Butane	0.01	0.009
n-Butane	0.00	0.003
i-Pentane	0.02	0.017
n-Pentane	0.01	0.011
n-Hexane	0.00	0.000
TOTAL	100.00	100.000

Note – *Gas is water saturated at inlet conditions (120 degrees Fahrenheit (F) and 3 pounds per square inch gas (psig) using Bryan Research and Engineering's Promax chemical process simulation software and the GERG 2008 Equation of State (EOS)). Ppmv is pounds per million by volume.

3.8 Reservoir Characterization Modeling

To develop an MRV plan for monitoring, reporting, and verification of geologic sequestration at the Lima Tango CCS 1 facility as required under §98.448(a)(1)-(2) of Subpart RR, dCarbon first constructed a Static Earth Model (SEM) and then a dynamic reservoir simulation model to determine the active and maximum monitoring areas (AMA and MMA, respectively) as defined in §98.449. The primary objectives of the simulation model were to:

1. Estimate the maximum areal extent of the injectate plume and its migration post injection

2. Determine the ability of the Queen City injection interval to handle the required injection rate

3. Characterize potential interaction between the injected CO_2 and any nearby potential leakage pathways

dCarbon employed Schlumberger's Petrel software and Rock Flow Dynamic's tNavigator software to construct the static earth and dynamic plume models, respectively. The initial modeling was the area of licensed 3D seismic data (20 square miles) as shown in **Figure 18**. The model utilizes structural and petrophysical interpretations made from available well and 3D seismic data described in **Section 3.3** as primary inputs.

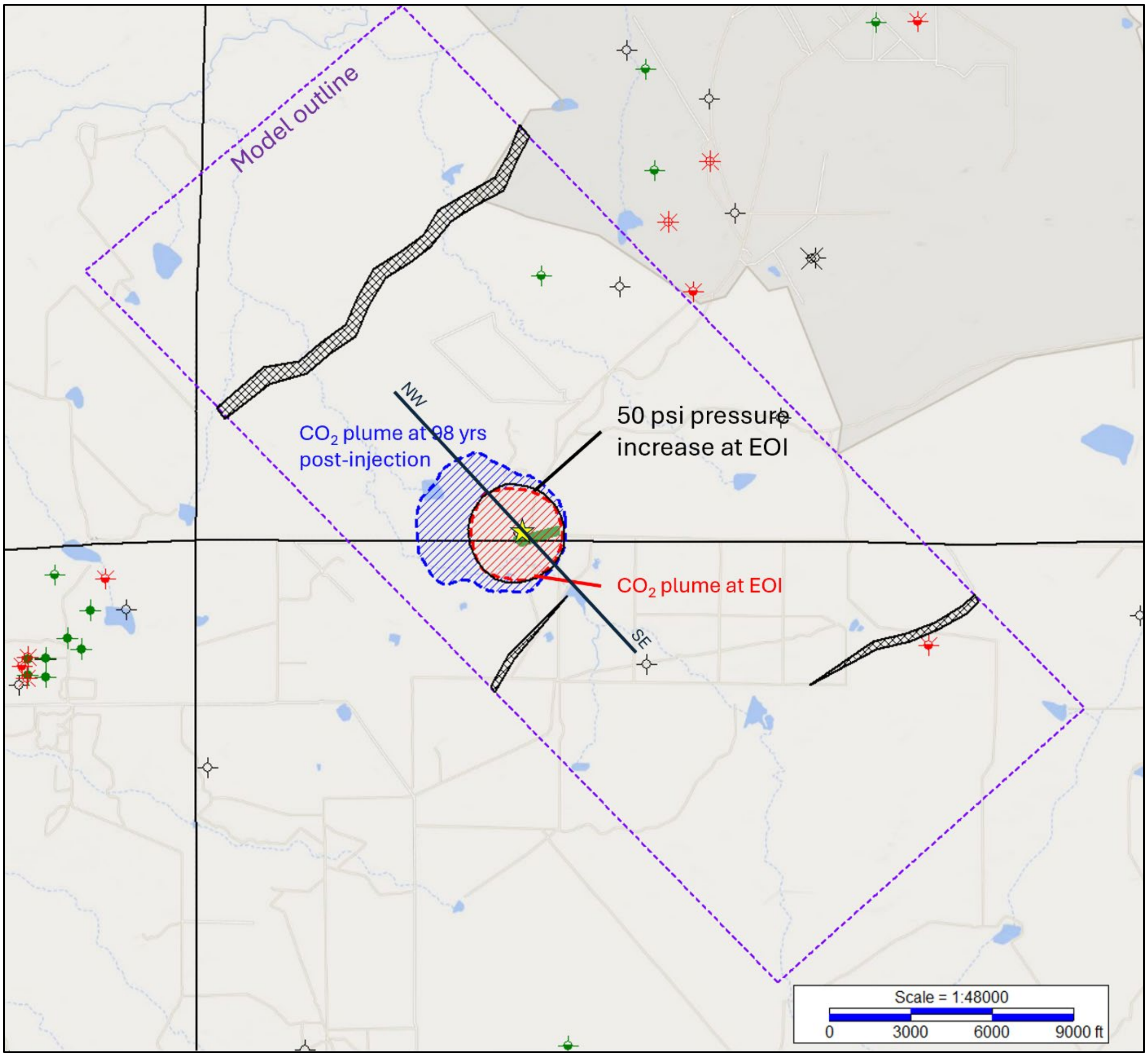


Figure 18. Simulation results showing CO_2 plumes at the end of injection (EOI) for 12 years in red, after 98 years post- injection in blue, and the model extent in violet, which is also the area of licensed 3D seismic. The 50-psi pressure plume at the end of injection is in black. Only wells deep enough to penetrate the top of the Queen City Formation are shown. The yellow star indicates the Lima Tango CCS 1 well location and the green polygon is the gas plant location. The black hachured polygons are the locations of the seismically mapped faults from the 3D seismic data at the Queen City stratigraphic level. North is up.

Petrophysical calculations, including a porosity-permeability model, were derived from well logs at the Nueces Minerals No. 1 well, which is two miles away from the proposed injection site. Local core data was not available to calibrate the petrophysical model so an analog from a sandstone reservoir with comparable porosity and permeability was used (the Bandera Brown B from the Department of Energy (DOE) CO_2 Brine Relative Permeability Database (CO2BRA) (Araujo de Itriago *et al.*, 2024)). The mapping of uniform thickness and consistent correlations of wireline log characteristics with other available logs in the area supports the conclusion that the

Nueces Minerals No. 1 well is representative of the proposed injection site and the modeled area. The model will be further updated and calibrated when the injection well is drilled and additional data, including whole or rotary sidewall cores, is collected over the injection and confining intervals.

Utilizing the previously described inputs, grid layers and cells were created in Schlumberger's Petrel software at the increments listed in **Table 4**, resulting in an SEM model depicted in **Figure 19**. Reservoir properties were distributed in a layer cake manner throughout the modeling area based on petrophysics calculated from wireline logs at the Nueces Mineral No. 1 well. A dip and strike swath of cells through the injection site were gridded at a finer increment of 150 feet by 150 feet to allow for better resolution of plume behavior around the proposed injection well as shown in the central portion of **Figure 19**.

Table 4. SEM parameters by the i, j, and k directions (dir).

	i-dir	j-dir	k-dir
Average Increment (feet)	511	331	12
Layer count	71	45	93
Total length (feet)	36,298	14,904	1,110
Total cell count	297,135		

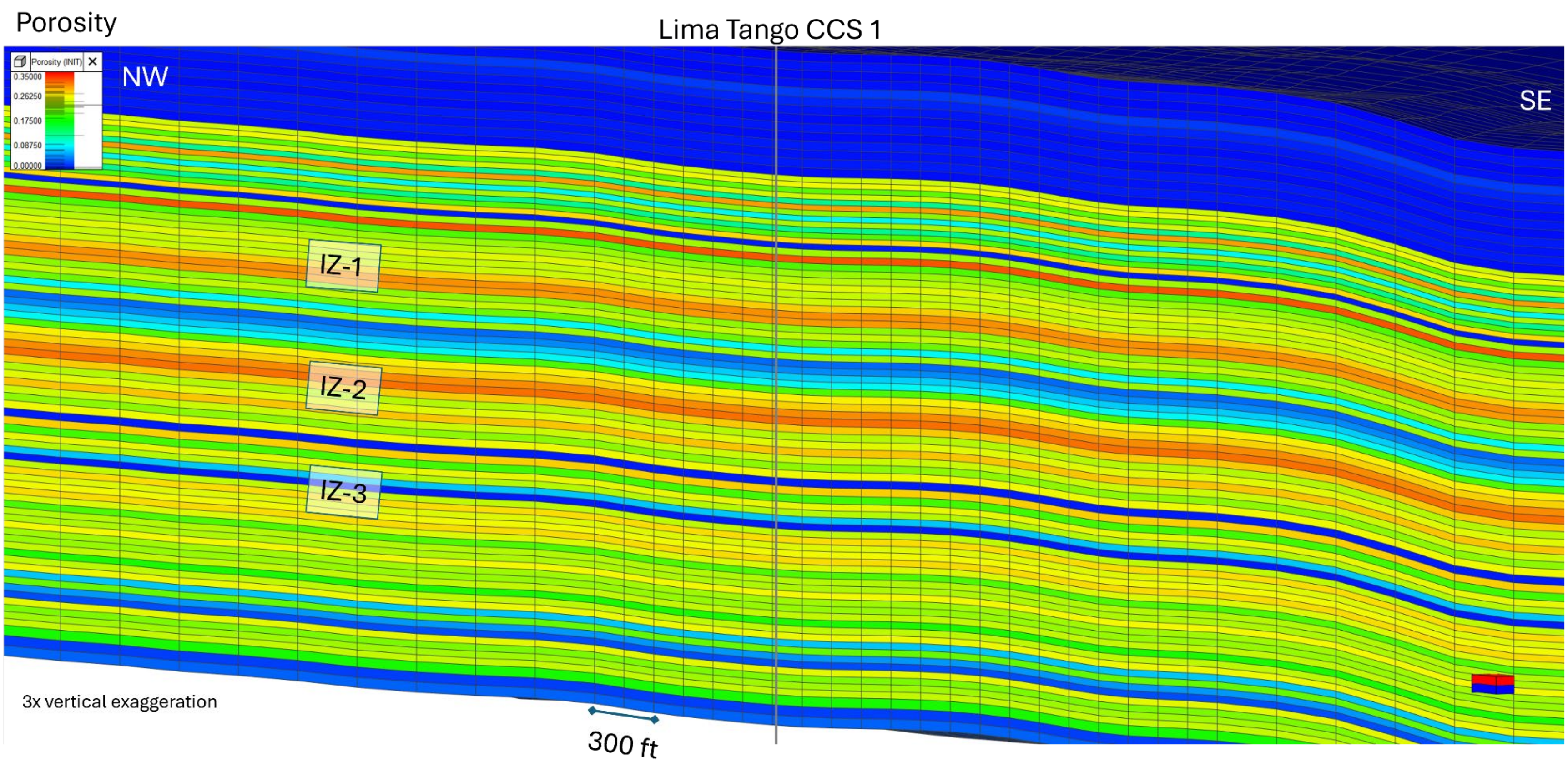


Figure 19. Porosity of the Queen City interval of the SEM. Porosity was calculated from the nearby Nueces Minerals No. 1 wireline well logs. Cross section location is shown on Figure 18.

A fit-for-purpose reservoir simulation model was created from the SEM to assess average injectivity based on empirical and analytical methods and to simulate CO_2 injection scenarios to aid in project design.

Pore and frac gradients, temperature, salinity, water saturation, porosity, and relative permeability model inputs are given in **Table 5**. The pore pressure gradient was assumed to be 0.48 psi/foot based on regional trends in South Texas. The fracture pressure gradient was estimated as 0.7 psi/foot from regional data and then an additional safety factor of 90% was applied, resulting in 0.6 psi/foot of the bottomhole constraint. The surface temperature is the mean annual temperature at the Lima Tango CCS 1 site. Fluid salinity is an average of the regional values described in **Section 3.4**. The relative permeability-porosity data are from a similar sandstone reservoir, the Bandera Brown B, in the DOE's CO2BRA database as cited by Araujo de Itriago *et al.*, 2024 and plotted in **Figure 20**. There are no active injectors in the simulation area from which to source these data.

Table 5. Input reservoir modeling parameters.

Parameter	Value
Pore Pressure Gradient (psi/foot):	0.48
Frac Pressure Gradient (psi/foot):	0.6
Temperature Gradient (degrees Fahrenheit (F) /foot):	0.015
Surface Temp (degrees F):	70
Fluid Salinity (ppm TDS)	30,000
Connate Water Saturation (decimal percent (%)):	0.47
Porosity (decimal %):	0.256
Relative permeability (mD):	133.85
Net-to-gross (ratio):	1
Rate constraints (MT/yr)	177,000
Pressure constraints (% of fracture pressure)	90

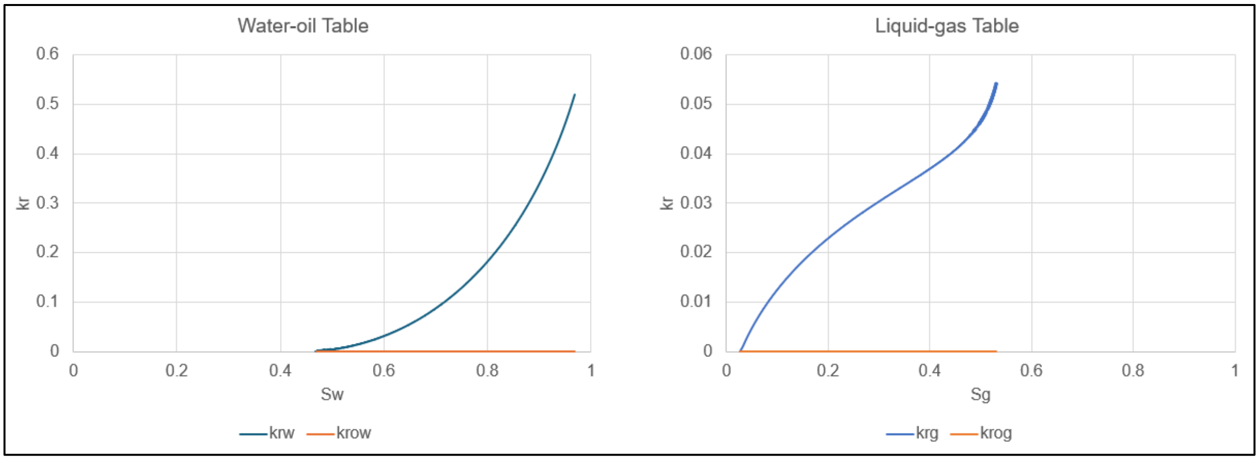


Figure 20. Relative permeability tables for water-oil (left) and liquid-gas (right). Relative permeability-porosity data are from a similar sandstone reservoir, the Bandera Brown B, in the DOE's CO2BRA database as cited by Araujo de Itriago et al., 2024.

dCarbon identified three injection zones in the model construction (IZ-1, IZ-2, and IZ-3) but the final model run selected for the Lima Tango CCS 1 project only injects CO_2 into IZ-2 and IZ-3. This case had a yearly injection rate of 177,000 MT/yr for a cumulative injection of 2,124,000 MT after 12 years as shown in **Table 6**. This injection over time is presented graphically in **Figure 21**. The size of the maximum plume extent and 50-psi pressure plume extent at the end of 12 years of injection are also given in **Table 6**, presented graphically in **Figure 22**, and depicted in map view in **Figure 18**. This figure also shows the plume outline at the end of injection compared to the outline at the end of the 98-year post-injection period. The plume stays within the area of the injection well.

Table 6. Injection parameters by zone and total plume extents.

Injection zone	Yearly rate (MT/yr)	Cumulative injection (MT)	Maximum CO_2 plume extent 98 years after end of injection	50-psi pressure plume extent at end of injection
IZ-2	75,684	908,206		
IZ-3	101,316	1,215,794		
Total IZ-2/IZ-3	177,000	2,124,000	0.78 square miles	0.36 square miles

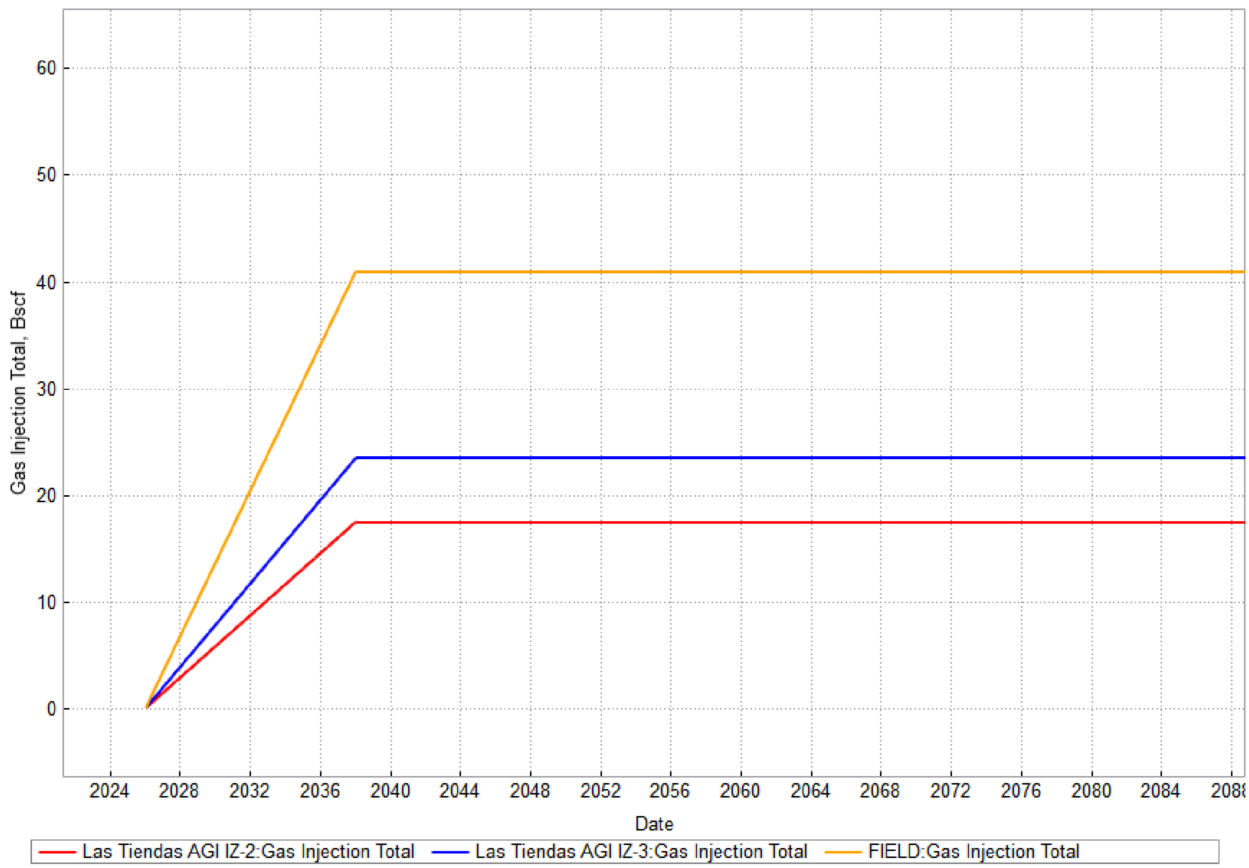


Figure 21. Plot of injection versus time at the Lima Tango CCS 1 injection well.

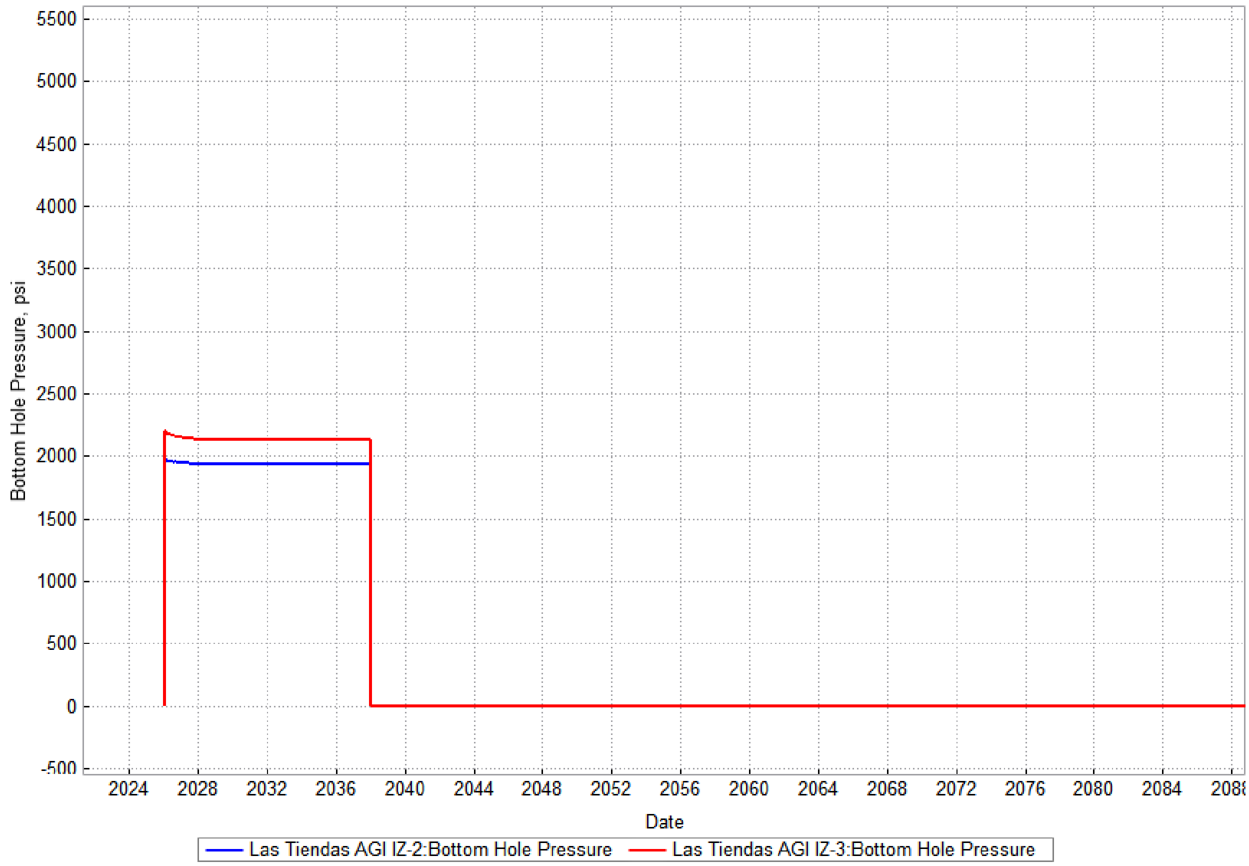
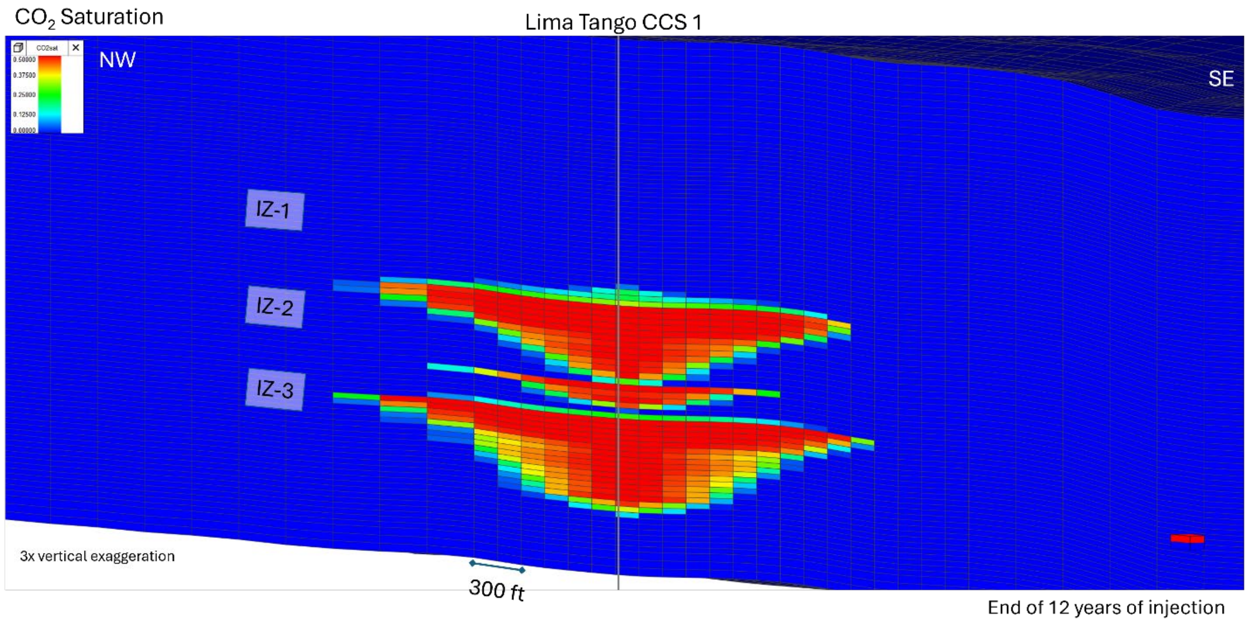


Figure 22. Pressure versus time at the Lima Tango CCS 1 injection well. The pressure constraint is 2412.8 psi for IZ-2 and 2524.3 psi for IZ-3.

A northwest to southeast cross-sectional view of the CO_2 plume in IZ-2 and IZ-3 is presented in **Figure 23**. The CO_2 plume profiles for both zones are funnel-shaped, indicative of the higher porosity and permeability at the top of these zones as well as the buoyancy of the CO_2 relative to the formation water.



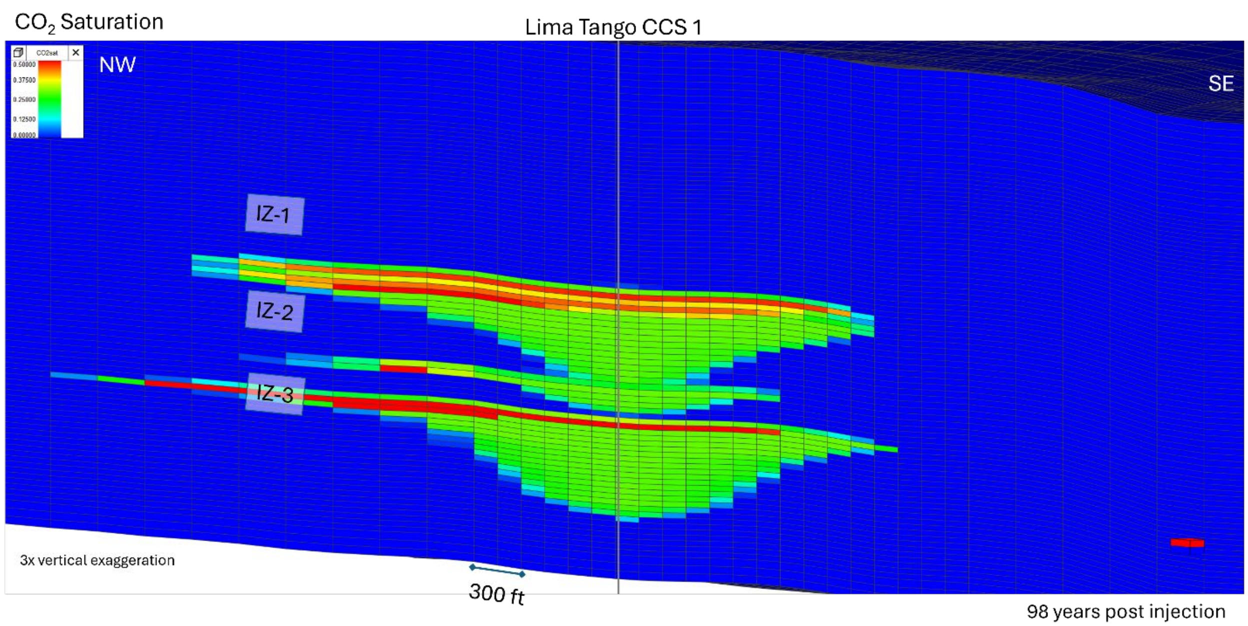


Figure 23. Northwest to southeast cross section depicting the CO_2 saturation profile of the model for the injection from Lima Tango CCS 1 after 12 years of injection (upper) and after 98 years after injection stops (lower). Color scale at the upper left indicates CO_2 gas saturation. Queen City injection zones are annotated. Injection was only modeled for IZ-2 and IZ-3. Cross section location is shown on Figure 18.

4 – DELINEATION OF MONITORING AREAS

This section describes the Maximum and Active Monitoring Areas.

4.1 Maximum Monitoring Area (MMA)

The MMA is defined as equal to or greater than the area expected to contain the free-phase CO_2 plume until the CO_2 plume has stabilized plus an all-around buffer of at least one-half mile. The numerical simulation using tNavigator was used to estimate the size and migration of the CO_2 plume. We modeled injection of CO_2 into IZ-2 and IZ-3 for 12 years followed by 190 years of post-injection modeling. Results indicated that the plume had ceased to migrate by 98 years post injection. A five percent cutoff of gas saturation was used to determine the boundary of the CO_2 plume. The area of the MMA was determined to be 0.88 square miles with the greatest extent reaching 0.72 miles from the injector (**Figure 24**).

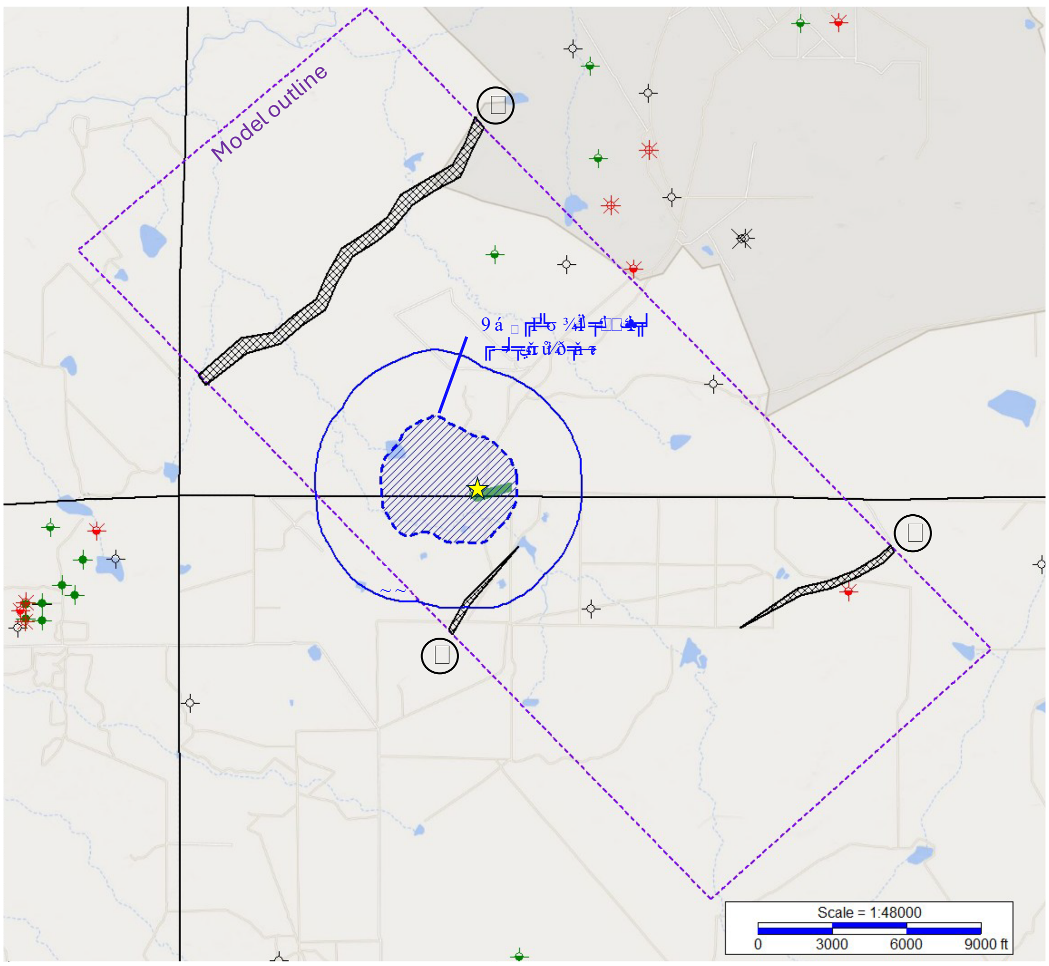


Figure 24. The proposed MMA (blue) and the stabilized CO2 plume (at 98 years post-injection as modeled). Only wells penetrating the Queen City Formation are shown. The red lines represent down-to-the-coast normal faulting mapped on the 3D seismic and described in Section 3.2.3. The yellow star indicates the Lima Tango CCS 1 well location and the green polygon is the gas plant location. The black hachured polygons are the locations of the seismically mapped faults at the Queen City stratigraphic level. North is up.

4.2 Active Monitoring Area (AMA)

dCarbon adhered to the definition of Active Monitoring Area (AMA) provided in 40 CFR 98.449 to delineate the AMA for this project (40 CFR Part 98 Subpart RR (Dec. 13, 2024)):

"*Active monitoring area* is the area that will be monitored over a specific time interval from the first year of the period (n) to the last year in the period (t). The boundary of the active monitoring area is established by superimposing two areas:

> (1) The area projected to contain the free phase CO_2 plume at the end of year t, plus an all-around buffer zone of one-half mile or greater if known leakage pathways extend laterally more than one-half mile.
>
> (2) The area projected to contain the free phase CO_2 plume at the end of year t + 5."

dCarbon proposes to monitor the injection site from year one through year 12, which is projected to be the EOI, thereby defining t as 12 years. dCarbon determined AMAs using methods (1) and (2) above and determined (1) to be larger. dCarbon then compared the larger AMA (red solid, **Figure 25**) with the MMA from **Figure 24** and found the AMA to be fully contained within the MMA. We propose to use the slightly larger MMA as both the AMA and MMA and will refer to this common area of monitoring as the AMA/MMA or just as the MMA in subsequent sections. As described in **Section 4.1**, the MMA is a one-half mile buffer after of the CO_2 plume stabilizes post-injection, which exceeds the definition of AMA set forth in 40 CFR § 98.449. By using the MMA as the AMA, dCarbon is employing an active monitoring program that exceeds the regulations of Subpart RR.

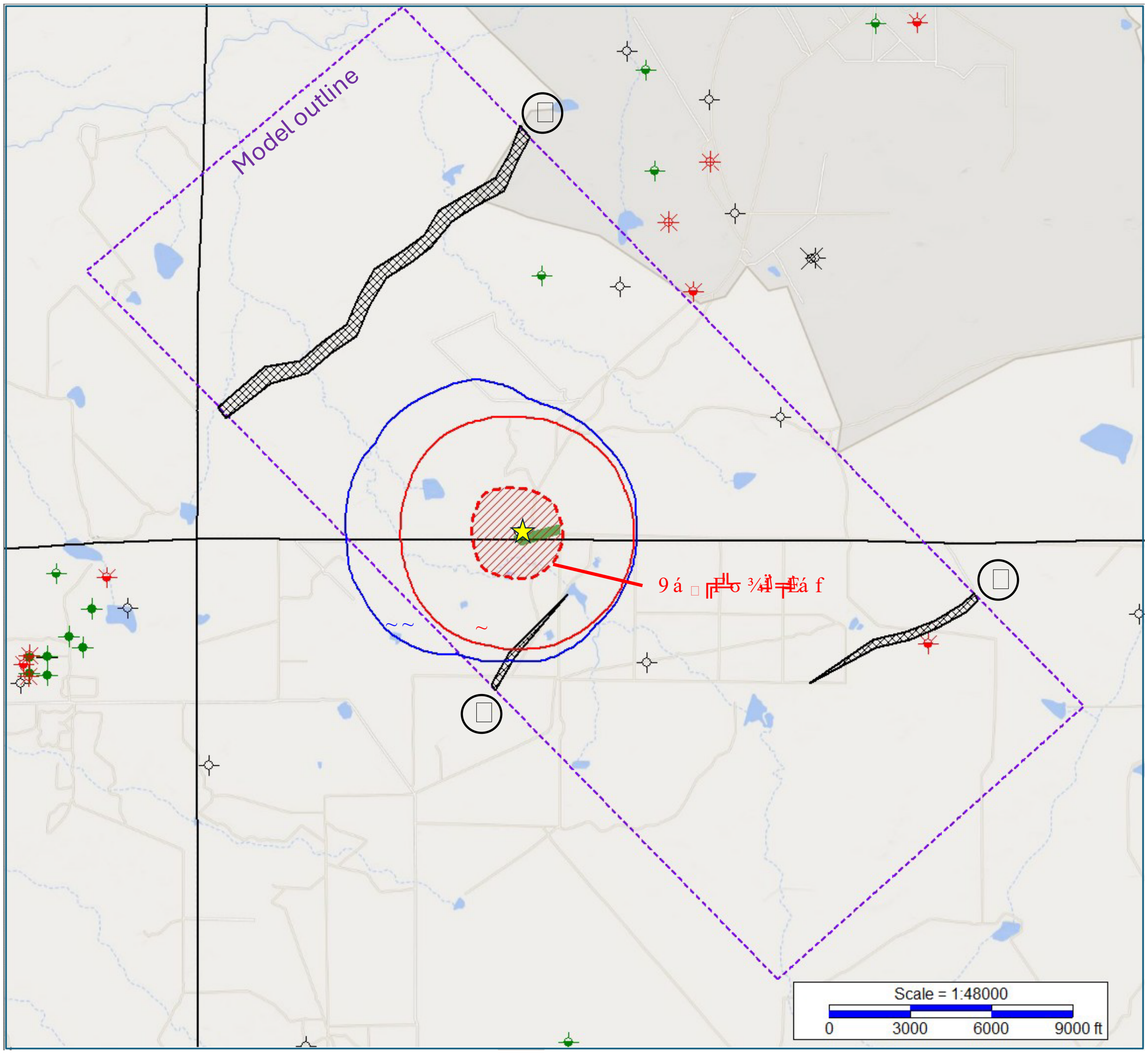


Figure 25. The AMA (red solid) outline and the EOI CO_2 plume (red dashed) outline as modeled. We propose to use the larger MMA (blue solid line) as both the AMA and MMA and will refer to it as the AMA/MMA or just the MMA. Wells penetrating the Queen City are posted with the well symbol at the bottomhole location. The black hachured polygons represent faulting at the Queen City mapped on the 3D seismic data and described in Section 3.2.3. The yellow star indicates the Lima Tango CCS 1 well location and the green polygon is the gas plant location. The black hachured polygons are the locations of the seismically mapped faults at the Queen City stratigraphic level. The Lima Tango CCS 1 well is represented by the yellow star and the gas plant is shown with a green polygon. Faults are numbered for discussion in the text. North is up.

5 – IDENTIFICATION AND EVALUATION OF POTENTIAL LEAKAGE PATHWAYS TO SURFACE

This section describes each of the required potential leakage pathways and assesses the likelihood, potential timing, and magnitude based upon the California Air and Resources Board's CCS Protocol Section C.2.2(d). **Table 7** describes the basis for event likelihood and **Table 8** provides the details of the leakage likelihood, timing of occurrence, and estimated magnitude of leakage for each type of leak risk.

Table 7. Risk likelihood matrix (developed based on comparable projects).

Risk Factor for Probability		Description
1	Improbable	<1% chance of occurring*
2	Unlikely	1-5% chance of occurring*
3	Possible	> 5% chance of occurring*
*During the life of the project or 100 years after project closure, whichever is shorter		

Table 8. Description of leakage likelihood, timing, and magnitude.

Leakage Pathway	Likelihood	Timing	Magnitude
Potential Leakage from Surface Equipment	**Possible**	Anytime during project operations, but most likely during start-up / transition or maintenance periods	**<100 MT per event** (100 MT represents approximately 5 hours of full flow facility release)
Leakage from Approved, Not Yet Drilled Wells	**Improbable**, as there are no approved not yet drilled wells	After new wells are permitted and drilled	**<1 MT per event**
Leakage from Existing wells	**Improbable**, as there are several thousand feet of impermeable rock between the injection interval and the total depth of the nearby existing wells	When the CO_2 plume expands to the lateral locations of existing wells	**<1 MT per event** due to natural dispersion of CO_2 within the Queen City Formation before it would laterally reach an existing well combined with thickness and low porosity / permeability of the UCZ
Potential Leakage from Fractures and Faults	**Improbable**, as there are several thousand feet of impermeable rock between the injection interval and surface or USDW that would need to be compromised and there are no mapped faults within the 98-year EOI plume outline (**Figure 27**)	Anytime during operation	**<100 MT per event**, due to natural dispersion of CO_2 within the Queen City Formation before it would laterally reach a fault or fracture significant enough to cause leakage
Leakage Through Confining Layers	**Improbable**, as the UCZ is 110 feet thick and very low porosity and permeability	Anytime during operations	**<100 MT per event**, due to natural dispersion of CO_2 within the Queen City Formation and thickness/properties of the UCZ
Leakage from Natural or Induced Seismicity	**Improbable**, as there are several thousand feet of impermeable rock between the injection interval and surface or USDW that would need to be compromised and there are no mapped faults within the 98-year EOI plume outline (**Figure 27**)	Anytime during operations	**<100 MT per event**, due to natural dispersion of CO_2 within the Queen City Formation before it would laterally reach a fault or fracture significant enough to cause leakage
Leakage from Lateral Migration	**Improbable**, as the Queen City Formation is a very thick and laterally continuous formation with the closest well penetration over a mile downdip	More likely late in life as plume expands	**<1 MT per event** due to natural dispersion of CO_2 within the Queen City Formation and continuity / thickness of the UCZ

5.1 Potential Leakage from Surface Equipment

dCarbon's surface facilities at the injection site located near the ET Las Tiendas NGP Plant are specifically designed for injecting the CO_2 stream described in **Table 3**. The facilities minimize leakage points such as valves and flanges by following industry standards and best practices. A shut-in valve is located at the wellhead in case of emergency. The compressor will also have emergency shut down switches that can be activated automatically in case of unexpected operating conditions.

Additionally, the compressor facility, pipeline, and injection well location will all be subjected to Auditory, Visual, and Olfactory (AVO) leak detection per dCarbon safety and operations standards. These monthly inspections, which are standard for detecting leaks and malfunctioning equipment in the gas production industry, will aid in the rapid detection of any potential leaks that may occur. As a part of these inspections, operations personnel are frequently able to repair leaks immediately by tightening valves, flanges, or similar equipment. Leakage from surface equipment is assessed as possible, however, any leaks that are detected will be analyzed to determine the amount of CO_2 that may have leaked and these leakage quantities, if any exist, will be included in recurring reporting.

5.2 Leakage from Approved, Not Yet Drilled Wells

A search of the TRRC's online GIS viewer (accessed December 9, 2024) in a 6,500 foot radius (which is roughly the size of the AMA/MMA) around the proposed injection site indicated one cancelled/abandoned location from 2012 and three permits that were so old that they had no API number or permit number, and the location source was cited as a hardcopy map (**Appendix, Table 9**). These search results indicate that there are no approved, not yet drilled, wells in the AMA/MMA and leakage from such wells is assessed as improbable.

5.3 Leakage from Existing Wells

There are 36 wells within the MMA listed in **Tables 9 and 10** in the **Appendix Section 13.2**, including at least one cancelled permit**.** These wells are shown in map view depiction of all wells relative to the proposed injection well in **Figure 26.** All wells targeted shallow oil reservoirs or were unsuccessful dry holes targeting shallow formations with no well exceeding a depth of 2,500 feet MD. There is over 2,000 feet of separation (including the UCZ of the Weches Shale) between these penetrations and the Queen City target injection interval. The likelihood of leakage from existing wells is assessed as improbable.

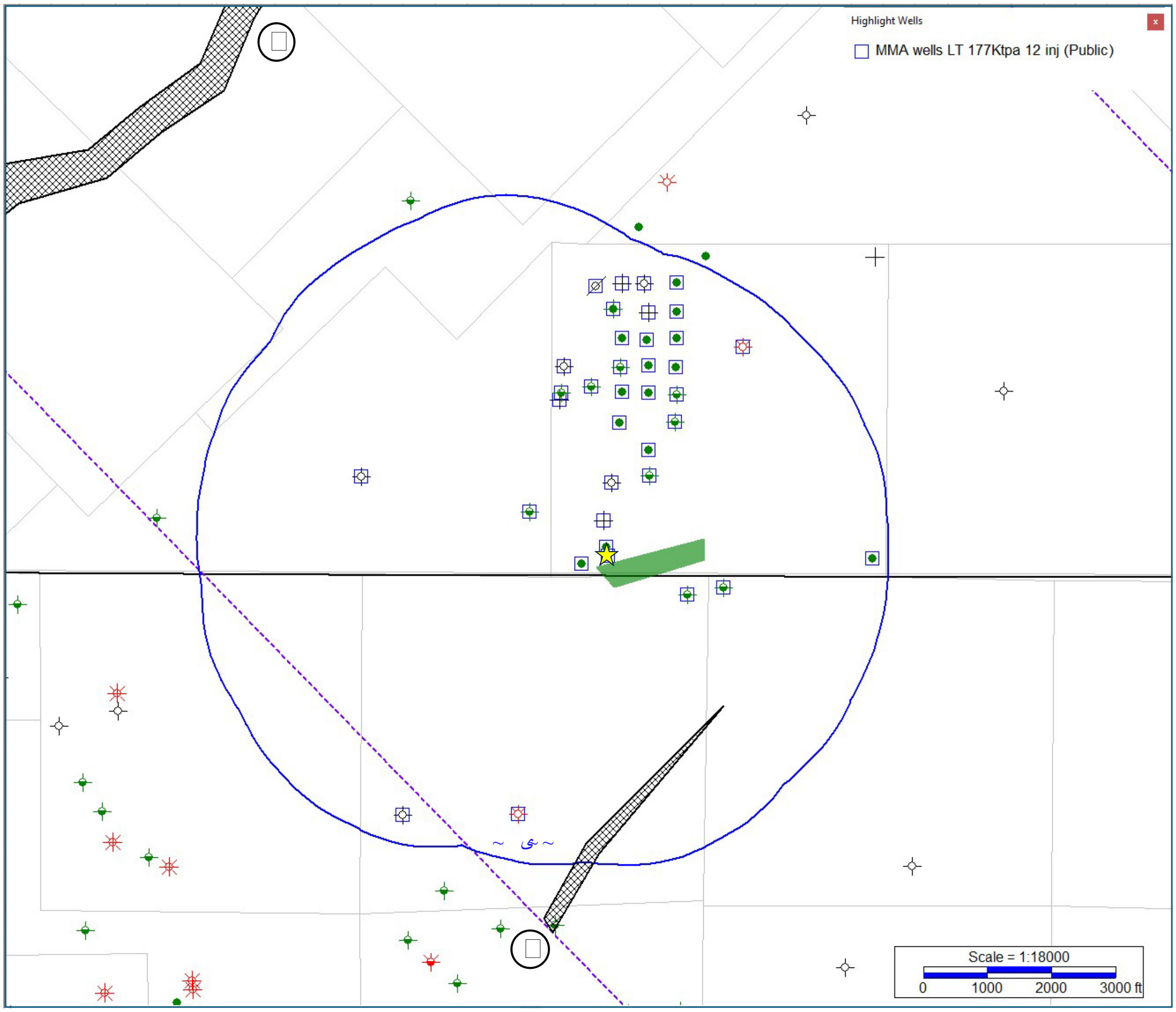


Figure 26. Wells in the AMA/MMA of Lima Tango CCS 1 highlighted with blue squares. The Lima Tango CCS 1 location is shown with a yellow star. The Las Tiendas NGP Plant is shown with a green polygon. Faults are numbered for discussion in the text. North is up.

5.4 Potential Leakage from Fractures and Faults

There are three faults intersecting the Queen City Formation in the modeled area, which is also the area of licensed 3D seismic data. Fault 1 vertically offsets the Queen City Formation by 100-250 feet and is deeply rooted below 10,000 feet (**Figure 27**). The fault cut continues nearly to the surface with consistent minor offset throughout the section indicating that it has had late movement. This fault is well outside of the AMA/MMA (3,200 feet away to the northwest) and, as such, no fault-CO_2 plume interactions are expected.

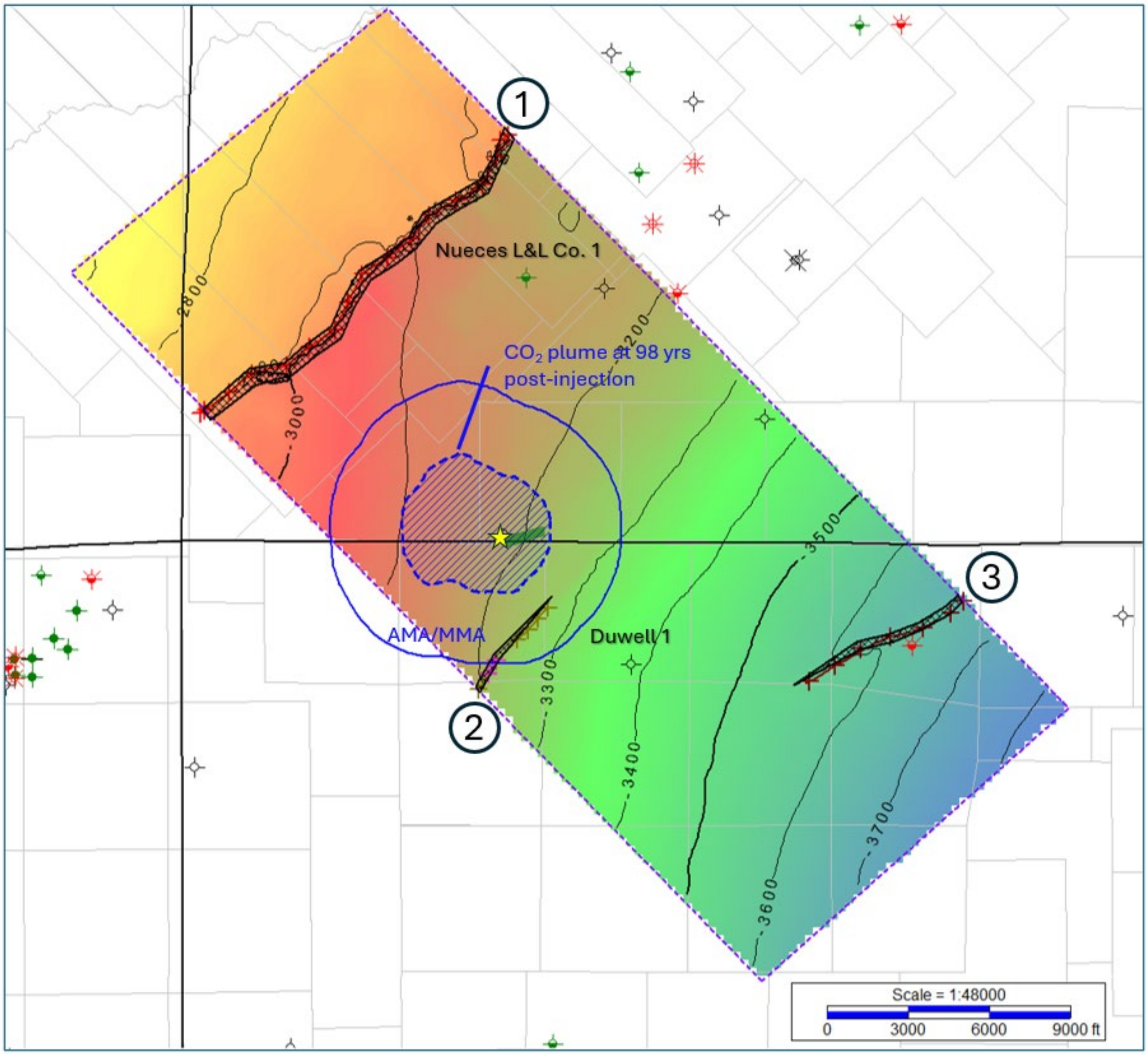


Figure 27. The top Queen City Formation structural contours (feet TVDSS), mapped Queen City Formation faults, AMA/MMA (blue solid line) and 98 years post-injection modeling (blue dashed line). Only wells penetrating the Queen City are shown, with the two closest wells to the injection site labeled. The Lima Tango CCS 1 location is highlighted with a yellow star. Faults are numbered for discussion in the text. North is up.

Fault 2 is much smaller and has a minor vertical offset of 40 to 60 feet within the Queen City Formation (**Figure 27**). In map view, the shortest distance between Fault 2 and the CO_2 plume outline at 98-years post-injection is approximately 1000 feet. The corresponding shortest distance between Fault 2 and the end of injection plume outline is 1200 feet. Fault 3 is located 1.5 miles downdip and southeast from the AMA/MMA; it is not expected to have any fault-CO_2 plume intersections. Both Fault 2 and Fault 3 do not show any displacement beyond a couple hundred feet above the top of the Queen City, thereby limiting their ability to serve as a leak pathway to the shallow USDW and the surface. The likelihood of leakage from fractures and faults is assessed as improbable.

5.5 Leakage Through Confining Layers

The Queen City Formation injection interval is confined by the overlying Weches Shale (the UCZ) and the underlying lower Queen City shales and Reklaw Shale (the LCZ) as described in **Section 3.3.2** and shown in **Figure 10**. The UCZ is comprised of 110 feet of impermeable shale (1% average porosity and 0.002 mD average permeability) as documented in **Table 1**. The LCZ is comprised of 965 feet of impermeable shale (1.5% average porosity and 0.05 mD average permeability) as documented in **Table 1**. These confining zones are supplemented by multiple low-porosity and low-permeability formations separating the Queen City injection interval from the base of the overlying Yegua USDW by a total of 2,300 feet and from the underlying Carrizo-Wilcox USDW by a total of 1,355 feet as described in **Section 3.6**. There are no existing wellbores that penetrate the confining layers in the modeled plume area. There are five wells that penetrate the confining layers in the 20 square mile project area that could serve as potential leakage pathways, but they are all greater than one mile away from the proposed injection well and outside of the AMA/MMA (**Figure 27**). Based on the limited CO_2 plume migration and thick shales above and below the injection interval, the risk of leakage through the confining layers is assessed as improbable.

5.6 Leakage from Natural or Induced Seismicity

The Lima Tango CCS 1 site has no historical seismicity within 19 miles of the proposed well. Mapped faults do not cut down to crystalline basement and have thousands of feet of separation between their deepest offset and the basement. Additionally, injection modeling indicates such minimal pore pressure change at any fault that it is insufficient to cause fault slip. No faults are mapped within the area of the CO_2 plume after 12 years of injection. Based on these factors, the leakage risk due to natural or induced seismicity is assessed as improbable.

Should any unexpected increases in formation pressure be detected, dCarbon can perform Fault Slip Potential (FSP) analysis (Walsh *et al.*, 2017) to evaluate the risk of induced seismicity on the closest mapped faults. dCarbon plans to build this model based on geologic data collected during drilling the Lima Tango CCS 1 well. If there is a concern related to abnormal pressures or seismicity related to operations at the well, dCarbon will shut-in the well and investigate further.

5.7 Leakage from Lateral Migration

The regional dip in the Lima Tango CCS 1 project area is gentle, at approximately two degrees, and therefore lateral migration is expected to be slow and well-behaved. There are five wells in the project area that penetrate the Queen City Formation, but these are all located outside of the AMA/MMA. The wells are depicted in **Figure 27**. The closest well (Duwell 1) is located 6,800 feet down dip and then next closest well (Nueces L&L Co. 1) is located 9,500 feet on strike to the Lima Tango CCS 1 injection well. The Queen City Formation is laterally continuous and of uniform thickness in the project area, making the risk from lateral migration improbable.

6 – PLAN OF ACTION FOR DETECTING AND QUANTIFYING SURFACE LEAKAGE OF CO_2

This section discusses the strategy that dCarbon will employ for detecting and quantifying surface leakage of CO_2 through the pathways identified in previous sections to meet the requirements of 40 CFR § 98.448(a)(3). Monitoring will occur during the planned 12-year injection period, or until the cessation of operations, plus a proposed two-year post-injection period.

6.1 Leakage from Surface Equipment

As the CO_2 compressor station, pipeline, and injection well are all designed to handle the expected concentrations, temperatures, and pressures of H_2S and CO_2, any leakage from surface equipment will be quickly detected and addressed. The concentrations of H_2S and CO_2 are 0.01 and 87.46 mol % as stated in **Table 3**. The facility is designed to minimize potential leakage points by following the American Society of Mechanical Engineers (ASME) standards, API standards, and other industry standards, including standards pertaining to material selection and construction. Additionally, connections are designed to minimize corrosion and leakage points. The facility and well will be monitored for a lack of oxygen in high-risk areas. This monitoring equipment will be set with a low alarm setpoint for O_2 that automatically alerts field personnel of abnormalities. Additionally, all field personnel are required to wear gas monitors, which will trigger the alarm at low levels of oxygen (O_2) (typically 19.5%) and industry standard low and high alarm levels for H_2S. The injection facility will be continuously monitored through automated systems that are designed to identify abnormalities in operational conditions. In addition, field personnel will conduct daily inspections and monthly AVO field inspections of gauges, monitors, and leak indicators. The effectiveness of the internal and external corrosion control program is monitored through the periodic inspection of the system and analysis of liquids collected from the line. These inspections, in addition to the automated systems, will allow dCarbon to quickly identify and respond to any leakage situation. Monitoring will occur for the duration of injection and the post-injection period. Should leakage be detected during active injection operations, the volume of CO_2 released will be calculated based on operating conditions at the time of the event, per 40 CFR § 98.448(a)(5).

The CO_2 for injection will be metered in one location. Once the CO_2 is compressed to a supercritical state, it will pass through a Coriolis meter for measurement and then be transported approximately 150 feet via surface pipeline (see **Figure 17**) to the injection well. The injection stream will also be analyzed with a CO_2 gas chromatograph at the well site to determine the final concentration. The meter will be calibrated to industry standards. Any CO_2 leakage from equipment between the flow meter used to measure injection and the injection wellhead will be quantified using the procedures specified in subpart W of the GHGRP, reported as specified in 40 CFR § 98.448(a)(5) & reflected in term CO_{2FI} of equation RR-12. Leakage will not be separately subtracted from the injection volumes. Gas samples will be taken and analyzed per manufacturer's recommendations to confirm stream composition and calibrate or re-calibrate meter, if necessary. At a minimum, these samples will be taken quarterly. Minimal variation of concentration and composition are expected but will be included in regulatory filings as appropriate.

6.2 Leakage from Existing and Future Wells within the Monitoring Area

There are no wells in the AMA/MMA currently existing, approved, or pending that penetrate as deep as the Queen City injection interval. However, dCarbon will reverify the status and public information for all proposed and approved drilling permits within the MMA quarterly. If any wells are proposed, permitted, or drilled within the MMA, dCarbon will investigate the proposal and determine if any additional risks are introduced through the new well proposal. Additionally, dCarbon will continuously monitor and collect injection volumes, pressures, temperatures, and gas composition data for the injection well. This data will be reviewed by qualified personnel and will follow response and reporting procedures when data is outside acceptable performance limits. Finally, dCarbon will update the MRV plan if any new wells are drilled within the MMA, or if any other material changes to the project occurs.

The injection well design has pressure and temperature gauges monitoring the injection stream at the wellhead as well as bottomhole pressure and temperature gauges near the bottom of the tubing. The downhole gauges will monitor the inside of the tubing (injection stream) as well as the annulus. A change of pressure on the annulus would indicate the presence of a possible leak requiring remediation. Mechanical Integrity Tests (MITs) performed annually would also indicate the presence of a leak. Upon a negative MIT, the well would immediately be isolated, and the leak mitigated.

In the unlikely event that any CO_2 leaks occur into existing or future wells in the monitoring area, dCarbon will endeavor to work with the operator(s) of those wells and/or midstream providers to take wellhead gas samples to quantify variations or increases of CO_2 compared with historical or baseline CO_2 concentrations. Any measurable increases in CO_2 which may be confidently attributed to injection volumes from the Lima Tango CCS 1 well will be calculated using standard engineering procedures for estimating potential well leakage determined to be appropriate for the situation. These volumes will be documented and reported in the annual monitoring report and subtracted from reported injection volumes. Additionally, dCarbon will evaluate and execute any additional downhole remediations (*e.g.*, well workovers, which may include adding plugs or remedial cement jobs) that could address leakage from the injection well to the existing and future wells in the area if necessary and practical.

6.3 Leakage from Faults and Fractures

No faults or fractures have been identified that would allow CO_2 to migrate vertically to zones with USDWs or to the surface. The closest fault to the Lima Tango CCS 1 well has minor offset and does not extend into the shallow formations (Fault 2 in **Figure 27**). It is also outside of the modeled plume after 12 years of injection and plume stabilization. Larger faults in the study area are outside the modeled AMA/MMA.

In the unlikely event that such leakage from faults or fractures occurs, dCarbon will determine which standard engineering techniques for estimating potential leakage from the faults and fractures are appropriate for the situation to estimate any leakage from faults and fractures and report such leakage estimates and the methodology employed in the annual monitoring report.

6.4 Leakage through Confining Layers

Leakage through confining layers is improbable, given the number and thickness of layers between the injection interval and any possible potable groundwater. There are not any groundwater wells near the Lima Tango CCS 1 site as shown in **Figure 16**. dCarbon has reviewed offsetting logs through the possible groundwater interval above the shallow base of USDW and not observed a freshwater response on the resistivity logs. When dCarbon drills the Lima Tango CCS 1 well, logs will be obtained over the potential shallow water zone and evaluated for the presence of porosity and a freshwater response. Should a freshwater response be observed, dCarbon proposes to drill a monitoring well over the groundwater interval and would amend this MRV plan to reflect this change.

Should any CO_2 leakage occur, dCarbon will determine which standard engineering techniques for estimating potential leakage are appropriate for the situation to estimate any leakage and report such leakage estimates and the methodology employed in the annual monitoring report.

6.5 Leakage through Natural or Induced Seismicity

While the likelihood of a natural or induced seismicity event is extremely low, dCarbon plans to monitor for seismic activity using the existing TexNet monitoring system. If a seismic event of 3.0 magnitude or greater is detected, dCarbon will review the injection volumes and pressures at the Lima Tango CCS 1 well to determine if any significant changes occurred that would indicate potential leakage. To suspect leakage due to natural or induced seismicity, the evidence would need to suggest that the earthquakes are activating faults that intersect the confining zones.

In the unlikely event CO_2 leakage occurs due to natural or induced seismicity, dCarbon will determine which standard engineering techniques for estimating potential leakage are appropriate for the situation and report such leakage estimates and the methodology employed in the annual monitoring report.

6.6 Leakage through Lateral Migration

The distances to the closest penetration of the Queen City injection interval are 2,200 feet from the AMA/MMA boundary and 6,800 feet away from the Lima Tango CCS 1 injection site in a down dip direction (the Duwell 1 well). The next closest penetration is 4,300 feet from the AMA/MMA boundary and 9,600 feet from the injection site on strike (Nueces L&L Co. 1 well). The map in **Figure 27** shows the location of these two wells, which are both plugged dry holes. Given the distance and status of these wells, leakage through lateral migration is not expected.

In the unlikely event CO_2 leakage occurs due lateral migration, dCarbon will determine which standard engineering techniques for estimating potential leakage are appropriate for the situation and report such leakage estimates and the methodology employed in the annual monitoring report.

6.7 Quantification of Leakage

In the unlikely event that CO_2 moves vertically past the primary and secondary confining layers as described earlier in **Section 6**, there are not existing groundwater wells present in this region to use to monitor for leaks.

The well most suited to use a monitor for leaks into the shallow USDW is the Lima Tango CCS 1 injection well itself. Open hole logs will be collected over each casing interval to screen for evidence of freshwater. Should an aquifer be identified during the drilling and logging of the injection well, a separate groundwater monitoring well will be drilled and used to monitor water quality and sampled annually. If dCarbon notices an increase in groundwater CO_2 concentration compared to baseline measurements, the increase in concentration will be analyzed volumetrically to provide a preliminary estimate of CO_2 leakage.

Any leakage that did extend to the surface could be characterized and quantified through surface surveillance in the project area paired with direct pressure, volume, and temperature (PVT) measurements. Currently available (and continuously improving) atmospheric sensing technology could be used to establish a baseline of ambient CO_2 concentration in the project area and identify any fluctuations. Deviations from baseline concentration along with understanding of the distance from potential leak sources can then be coupled with temporally matched meteorological data to semi-quantitatively determine leak attribution and rate. Based on the size of leak, these qualified or quantified leak rates can be compared with spatiotemporally monitored PVT data to co-index or further refine leaked volumes from likely point sources.

Any diffuse leak or leak without an obvious single point source may require additional identification and quantification methods. dCarbon is working with a leading environmental services and data company that specializes in monitoring and quantifying gas leaks in various industrial settings. One such quantification method involves utilizing fixed monitoring systems to detect CO_2. Additional system capabilities also include the deployment of an unmanned aerial vehicle (UAV), which is outfitted with an industry leading high fidelity CO_2 sensor capable of measuring concentrations as little as parts per billion (ppb). The UAV mobile surveillance platform possesses the ability to be flown on a programmable and highly replicable pattern across the MMA in both X and Y axis (longitude + latitude) as well as Z axis (height). Depending on the system's ability to obtain a reliable baseline across the MMA, areal deviation in CO_2 concentration could be measured, and diffuse leak sources could potentially be identified, provided the emissions reach a sufficient threshold. dCarbon will also consider similar technologies with less spatial resolution or fidelity such as fixed wing flyovers and/or improving satellite data with UAV technology to screen for and support diffuse emissions identification and investigation.

Depending on the applicability and monitoring needs, dCarbon will also consider other monitoring quantification methods such as the Eddy Covariance Method (ECM) (Korre *et al.*, 2011). This method utilizes gas fluxes and ambient meteorological conditions to detect and quantify leaks, although the ability to detect smaller leaks may be limited. Additionally, long open path tunable diode lasers could be used to measure distance averaged concentrations of CO_2 in the air, which could help quantify a leak of CO_2. This system could be paired with an array of short, closed path detectors (*e.g.*, gas chromatographs) that are typically placed around a suspected leak or leak area to monitor point-source CO_2 concentration increases and to quantify leakage. dCarbon may also evaluate other emerging technologies for quantifying CO_2 leakage such as Non-Dispersive Infra-Red (NDIR) CO_2 sensors and soil flux detectors. dCarbon may also utilize three-dimensional reservoir models that factor in faults and surface topography to predict CO_2 leakage locations, quantity, and timing. The applicability of such models in predicting and quantifying gas leaks has been tested and documented at the Leroy natural gas storage site in Wyoming, USA. (Chen, 2013)

As the technology and equipment to quantify CO_2 leakage is rapidly evolving and expected to improve over time, dCarbon will continue to update its leak detection and quantification plans as appropriate. If dCarbon detects a leak associated with CO_2 injection at the Lima Tango CCS 1 well, all methods discussed in this section will be considered in addition to emerging technologies to determine the most applicable and effective method of quantification.

7 – BASELINE DETERMINATIONS

This section identifies the strategies that dCarbon will undertake to establish the expected baselines for monitoring CO_2 surface leakage per § 98.448(a)(4).

Prior to the beginning of injection operations, baseline groundwater quality and properties will be determined and monitored through the installation of a groundwater well near the injection well site if the potential for a freshwater aquifer is observed when drilling the injection well. Samples will be taken and analyzed by a third-party laboratory to establish the baseline properties of the groundwater in the area. dCarbon will sample the groundwater monitoring well quarterly initially to establish the baseline water quality. dCarbon may adjust to annual sampling after one year.

Prior to the beginning of injection operations, baseline seismicity in the area near the Lima Tango CCS 1 will be determined through the historical data from USGS and the TexNet seismic array data hosted by the Texas Bureau of Economic Geology. The TexNet seismic array has been in operations in south Texas since 2017 and was expanded in late 2018. Using the historical data from the TexNet array, dCarbon will establish the seismicity baseline beginning in 2019 for the Lima Tango CCS 1 project.

Once injection operations begin in early 2026, the operational performance data recorded by the continuous data collection systems will be used to establish operational performance baselines and any deviations from those trends will be investigated. Examples of continuous data that will be used in establishing operational baselines are injection pressure and temperature, injection rate, and well annulus pressure and temperature. Any deviations from the established baselines will be investigated as a possible leak indicator.

Non-continuous data will also be collected periodically throughout the life of the project and will aid in leak detection. Daily to weekly AVO inspections will monitor for signs of leakage from surface equipment as outlined in in **Sections 5.1 and 6.1**. Field personnel will carry gas monitors that will monitor for low O_2 levels or high H_2S levels, both a sign of a potential CO_2 leak. Annual MIT testing, as outlined in **Section 6.2**, will test for potential leaks related to the well.

8 – SITE SPECIFIC CONSIDERATIONS FOR DETERMINING THE MASS OF CO_2 SEQUESTERED

This section identifies how dCarbon will calculate the mass of CO_2 injected, emitted, and sequestered. This also includes site-specific variables for calculating the CO_2 emissions from equipment leaks and vented emissions of CO_2 between the injection flow meter and the injection well, per 40 CFR § 98.448(a)(5).

8.1 Mass of CO_2 Received

Per 40 CFR § 98.443, the mass of CO_2 received must be calculated using the specified CO_2 received equations "unless you follow the procedures in 40 CFR §98.444(a)(4)." 40 CFR § 98.444(a)(4) states that "if the CO_2 you receive is wholly injected and is not mixed with any other supply of CO_2, you may report the annual mass of CO_2 injected that you determined following the requirements under paragraph (b) of this section as the total annual mass of CO_2 received instead of using Equation RR-1 or RR-2 of this subpart to calculate CO_2 received."

The CO_2 received by dCarbon for injection into the Lima Tango CCS 1 injection well is wholly injected and not mixed with any other supply and the annual mass of CO_2 injected will equal the amount received. Any future streams will be metered separately before being combined into the calculated stream.

8.2 Mass of CO_2 Injected

Per 40 CFR § 98.444(b), since the flow rate of CO_2 injected will be measured with a volumetric flow meter, the total annual mass of CO_2, in metric tons, will be calculated by multiplying the volumetric flow at standard conditions by the CO_2 concentration in the flow and the density of CO_2 at standard conditions, according to Subpart RR Equation 5:

$$CO_{2,u} = \sum_{p=1}^{4} Q_{p,u} * D * C_{CO_{2,p,u}}$$

Where:

$CO_{2,u}$	=	Annual CO_2 mass injected (metric tons) as measured by flow meter u.
$Q_{p,u}$	=	Quarterly volumetric flow rate measurement for flow meter u in quarter p at standard conditions (standard cubic meters per quarter).
D	=	Density of CO_2 at standard conditions (metric tons per standard cubic meter): 0.0018682.
$C_{CO2,p,u}$	=	CO_2 concentration measurement in flow for flow meter u in quarter p (vol. percent CO_2, expressed as a decimal fraction).
p	=	Quarter of the year.
u	=	Flow meter.

8.3 Mass of CO_2 Produced

The Lima Tango CCS 1 well will receive CO_2 produced from the nearby ET Las Tiendas NGP Plant and the CO_2 will be injected for geologic sequestration only. No CO_2 will be produced from the injection well. The injection will occur into a saline, non-productive aquifer and is not part of an enhanced oil recovery project. Natural gas processed at the ET Las Tiendas NGP Plant primarily comes from gas wells producing from the Eagle Ford Formation which is stratigraphically deeper than the Queen City injection intervals and well outside the MMA/AMA. The closest Eagle Ford wells are roughly eight miles northwest of the injection location.

8.4 Mass of CO_2 Emitted by Surface Leakage

Mass of CO_2 emitted by surface leakage and equipment leaks will not be measured directly as the injection stream for this well contains hydrogen sulfide (H_2S), which may be hazardous for field personnel to perform a direct leak survey. Any leakage would be detected and managed as a major upset event. Gas detectors and continuous monitoring systems would trigger an alarm upon a release. The mass of the CO_2 released would be calculated for the operating conditions at the time, including pressure, flow rate, size of the leak point opening, and duration of the leak. This method is consistent with 40 CFR § 98.448(a)(5), allowing the operator to calculate site-specific variables used in the mass balance equation.

In the unlikely event that CO_2 was released because of surface leakage, the mass emitted would be calculated for each surface pathway according to methods outlined in the plan and totaled using 40 CFR Part 98-Subpart RR Equation 10 as follows:

$$CO_{2,E} = \sum_{x=1}^{X} CO_{2,x}$$

Where:

$CO_{2,E}$	=	Total annual mass emitted by surface leakage (metric tons) in the reporting year
$CO_{2,x}$	=	Annual CO_2 mass emitted (metric tons) at leakage pathway x in the reporting year
X	=	Leakage pathway

Annual mass of CO_2 emitted (in metric tons) from any equipment leaks and vented emissions of CO_2 from equipment located on the surface between the flowmeter used to measure injection quantity and injection wellhead will comply with the calculation and quality assurance/quality control requirement proposed in Part 98, Subpart W and will be reconciled with the annual data collected through the monitoring plan.

8.5 Mass of CO_2 Sequestered

The mass of CO_2 sequestered in the subsurface geologic formations will be calculated using 40 CFR Part 98, Subpart RR Equation 12, as this well will not actively produce any oil or natural gas or any other fluids, as follows:

$$CO_2 = CO_{2I} - CO_{2E} - CO_{2FI}$$

Where:

CO_2	=	Total annual CO_2 mass sequestered in subsurface geologic formations (metric tons) at the facility in the reporting year.
$CO_{2,I}$	=	Total annual CO_2 mass injected (metric tons) in the well or group of wells covered by this source category in the reporting year.
$CO_{2,E}$	=	Total annual CO_2 mass emitted (metric tons) by surface leakage in the reporting year.

CO_{2FI}	=	Total annual CO_2 mass emitted (metric tons) from equipment leaks and vented emissions of CO_2 from equipment located on the surface between the flow meter used to measure injection quantity and the injection wellhead, for which a calculation procedure is provided in Subpart W of Part 98.

9 – ESTIMATED SCHEDULE FOR IMPLEMENTATION OF MRV PLAN

The injection well is expected to begin operation at a to-be-determined date in early 2026. Baseline data will be collected before injection begins and the MRV plan will be implemented upon receiving Environmental Protection Agency (EPA) MRV plan approval. Collection of data for calculating the total amount of CO_2 sequestered will begin at the same to-be-determined date in early 2026 that the injection well is operational, and CO_2 is being injected.

10 – QUALITY ASSURANCE

10.1 CO_2 INJECTED

- The flow rate of the CO_2 being injected will be measured with a volume flow meter, consistent with industry best practices. These flow rates will be compiled quarterly.
- The composition of the CO_2 stream will be measured upstream of the volume flow meter with a gas composition analyzer or representative sampling consistent with industry best practices.
- The gas composition measurements of the injected stream will be averaged quarterly.
- The CO_2 measurement equipment will be calibrated according to manufacturer specifications.

10.2 CO_2 EMISSIONS FROM LEAKS AND VENTED EMISSIONS

- Gas detectors will be operated continuously, except for maintenance and calibration.
- Gas detectors will be calibrated according to manufacturer recommendations and API standards.
- Calculation methods from Subpart W will be used to calculate CO_2 emissions from equipment located on the surface between the flow meter used to measure injection quantity and the injection wellhead.

10.3 MEASUREMENT DEVICES

- Flow meters will be continuously operated except for maintenance and calibration.
- Flow meters will be calibrated according to the requirements in 40 CFR § 98.3(i).
- Flow meters will be operated per an appropriate standard method as published by a consensus-based standards organization.
- Flow meter calibrations will be traceable to the National Institute of Standards and Technology (NIST).

All measured volumes of CO_2 will be converted to standard cubic feet at a temperature of 60 degrees Fahrenheit and an absolute pressure of 1.0 atmosphere.

10.4 MISSING DATA

In accordance with 40 CFR § 98.445, dCarbon will use the following procedures to estimate missing data if unable to collect the data needed for the mass balance calculations:

- If a quarterly quantity of CO_2 injected is missing, the amount will be estimated using a representative quantity of CO_2 injected from the nearest previous period at a similar injection pressure.
- Fugitive CO_2 emissions from equipment leaks from facility surface equipment will be estimated and reported per the procedures specified in Subpart W of 40 CFR § 98.

11 – RECORDS RETENTION

dCarbon will retain records as required by 40 CFR § 98.3(g). These records will be retained for at least three years and include:

- Quarterly records of the CO_2 injected.
- Volumetric flow at standard conditions.
- Volumetric flow at operating conditions.
- Operating temperature and pressure.
- Concentration of the CO_2 stream.
- Annual records of the information used to calculate the CO_2 emitted by surface leakage from leakage pathways.
- Annual records of information used to calculate CO_2 emitted from equipment leaks and vented emissions of CO_2 from equipment located on the surface between the flow meter used to measure injection quantity and the injection wellhead.

12 – REFERENCES

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13 - APPENDIX

13.1 Expired Permits from the TRRC

Table 9 – Expired permits from TRRC database*.

API	Well No.	Symbol_Description	Location_Source	Latitude	Longitude
311	2B	Permitted Location	Commission`s hardcopy map	28.0660035	-98.7681379
311	8	Permitted Location	Commission`s hardcopy map	28.0695958	-98.7640217
311	4	Permitted Location	Commission`s hardcopy map	28.0636247	-98.7627483

* These permitted wells may exist as dry holes in the S&P Global database well list below

13.2 Wells in MMA

Table 10 – Wells in the MMA (sourced from S&P Global database).

API	Well Name	Well Num	Latitude	Longitude	Status	Total Depth	Operator
421310007000	SOC FOR PROPAGATI	1	28.0565397	-98.7603987	Dry Hole with Oil Show	1350	PETROLEUM PRODUCERS INC
421310007100	NUECES LD & LVESTCK	1	28.0562470	-98.7621096	Dry Hole with Oil Show	1227	BASOM G W TRUSTEE
421313171800	NUECES LD&LVSTCK	1	28.0467414	-98.7758977	Dry Hole	2154	GULF OIL CORP
421313316400	NUECES MINERALS CO	1	28.0467787	-98.7703195	Dry Hole with Gas Show	2500	VICTORIA MINERALS
423110147400	NUECES LD LSTK	1	28.0613037	-98.7779357	Dry Hole	2225	PARKER PETROLEUM CO
423110147500	NUECES LAND & LIVESTOCK CO	1	28.0597908	-98.7697815	Dry Hole with Oil Show	1193	SMITH & COSNER
423110147900	NUECES LAND & LIVESTOCK	1	28.0683736	-98.7640390	Unknown	1215	SECONDARY OIL CORP INC
423110148000	NUECES LAND & LIVESTOCK	2	28.0684014	-98.7626783	Oil Well	1220	OHIO FUEL SUPPLY CO
423110148100	NUECES LAND & LIVESTOCK	3	28.0696469	-98.7626704	Oil Well	1215	OHIO FUEL SUPPLY CO
423110148200	NUECES LAND & LIVESTOCK	4	28.0578346	-98.7531587	Oil Well	1212	SECONDARY OIL CORP INC
423110148400	NUECES LAND & LIVESTOCK	6	28.0696207	-98.7653094	Unknown	1208	SECONDARY OIL CORP INC
423110148500	NUECES L & 6 CO	9	28.0649230	-98.7640330	Oil Well	1220	GRAHAM TOM
423110148600	NUECES L&L CO	10	28.0660888	-98.7640133	Oil Well	1215	GRAHAM BROTHERS
423110148700	NUECES L&L CO	11	28.0671777	-98.7641023	Oil Well	1221	GRAHAM TOM
423110148800	NUECES L&L CO	12	28.0672632	-98.7626518	Oil Well	1227	GRAHAM BROTHERS
423110148900	NUECES L&L CO	13	28.0660097	-98.7627152	Oil Well	1224	GRAHAM BROTHERS

423110149000	NUECES L & L CO	14	28.0648630	-98.7626668	Dry Hole with Oil Show	1223	GRAHAM BROTHERS
423110149200	NUECES LND & LVSTCK	2-A	28.0624432	-98.7640137	Oil Well	1213	BISHOP OIL CO
423110149300	NUECES LD & LIVESTOCK	3-A	28.0613433	-98.7639772	Dry Hole with Oil Show	1216	BISHOP OIL CO
423110149400	NUECES LAND & LIVESTOCK	4A	28.0636782	-98.7627331	Dry Hole with Oil Show	1251	BISHOP OIL CO
423110149500	NUECES LAND & LIVESTOCK	1B	28.0649387	-98.7653312	Oil Well	1206	SECONDARY OIL CORP INC
423110149600	NUECES L&L CO	2B	28.0660141	-98.7653893	Dry Hole with Oil Show	1348	BISHOP OIL CO
423110149700	NUECES LAND & LIVESTOCK	3B	28.0651833	-98.7668115	Dry Hole with Oil Show	1199	BISHOP OIL CO
423110149800	NUECES L & L CO	4B	28.0672593	-98.7653290	Oil Well	1208	SECONDARY OIL CORP INC
423110149900	NUECES LD & LVSTK	1B	28.0646304	-98.7683287	Unknown	1213	KRASNER SAM
423110150000	NUECES LD & LVSTK	2B	28.0660570	-98.7681225	Dry Hole	1222	KRASNER SAM
423110150100	NUECES LD LSTK	2D	28.0583058	-98.7660810	Oil Well	1200	KRASNER SAM
423110150200	NUECES LD LSTK	3D	28.0575764	-98.7672696	Oil Well	1195	KRASNER SAM
423110150300	NUECES LD & LIVE ST	1	28.0649237	-98.7682537	Dry Hole with Oil Show	1505	DUNCAN N V
423110150400	NUECES LAND & LIVESTOCK	1	28.0668838	-98.7594553	Dry Hole with Gas Show	1268	TAYLOR REFINING CO
423110150500	NUECES LAND & LIVESTOCK	1-A	28.0636250	-98.7654534	Oil Well	1213	SECONDARY OIL CORP INC
423110150600	NUECES LAND & LIVESTOCK CO	8	28.0696167	-98.7642548	Dry Hole	1222	NUGENT GEORGE V & L V OIL ACCT
423110236100	NUECES LD LIVESTOCK	1-D	28.0594141	-98.7661765	Unknown	1196	KRASNER SAM & WOODMAN L L
423113141700	NUECES MINERALS	1	28.0610659	-98.7658244	Dry Hole	1358	DKD JOINT VENTURE
423113143500	NUECES MINERALS	2	28.0685222	-98.7657277	Abandoned Oil Well	1280	DKD JOINT VENTURE
423113508200	SCOPE-MUNSON	1	28.0695062	-98.7665958	Abandoned Location		SCOPE PRODUCTION CO LLC

13.3 Approved W-14, W-1, and Drilling Permits