Plan revision number: 1
Plan revision date: 01/30/2024

CLASS VI PERMIT APPLICATION NARRATIVE
40 CFR 146.82(a)

Bluebonnet Sequestration Project

Plan revision number: 1
Plan revision date: 01/30/2024

1.0 Project Background and Contact Information

Facility name: Bluebonnet Sequestration Project
Bluebonnet CCS 1 Well

Facility contact: [redacted], Project Manager
5 Greenway Plaza Houston, TX 77046
[redacted]

Well location: [redacted]

The Bluebonnet CCS 1 well is part of the Bluebonnet Sequestration Hub, LLC objective to demonstrate technical feasibility of Carbon Capture and Storage (CCS), utilizing CO_2 from industrial emitters along the Texas Gulf Coast. The advancement of CCS technology is critically important in addressing CO_2 emissions and global climate change concerns. The Bluebonnet Sequestration Project is designed to demonstrate utility-scale integration of transport and permanent storage of captured CO_2 into a deep geologic formation (i.e., geologic sequestration). A commercial-scale CCS system will be designed, built, and operated with the capability of storing CO_2.

The Bluebonnet Sequestration Project will display that the geologic sequestration process can be done safely, ensuring that the injected CO_2 will be retained within the intended storage reservoir. By using safe and proven pipeline technology, the CO_2 will be transported to a storage site located near [redacted] where it will be injected into [redacted] in Bluebonnet CCS 1 at a proposed rate of [redacted] (MMT) of CO_2 each year for a planned duration of [redacted]

GSDT Submission - Project Background and Contact Information

GSDT Module: Project Information Tracking
Tab(s): General Information tab; Facility Information and Owner/Operator Information tab

Please use the checkbox(es) to verify the following information was submitted to the GSDT:
☒ Required project and facility details ***[40 CFR 146.82(a)(1)]***

2.0 Site Characterization

Bluebonnet Sequestration Project conducted a detailed review of the surface and subsurface features, geology, geochemistry, geomechanics, seismic history, injection, and confining zone characterization, among other.

Plan revision number: 1
Plan revision date: 01/30/2024

Figure AOR-1—Bluebonnet Sequestration Hub location with respect to DOE-identified CO_2 emitters in the Houston and Beaumont/Port Arthur area. The pore space leasing program is dynamic and evolving. The bright green outline of the core area may vary slightly in the subsequent maps. However, the leased pore space within the AOR remains consistent throughout.

Plan revision number: 1
Plan revision date: 01/30/2024

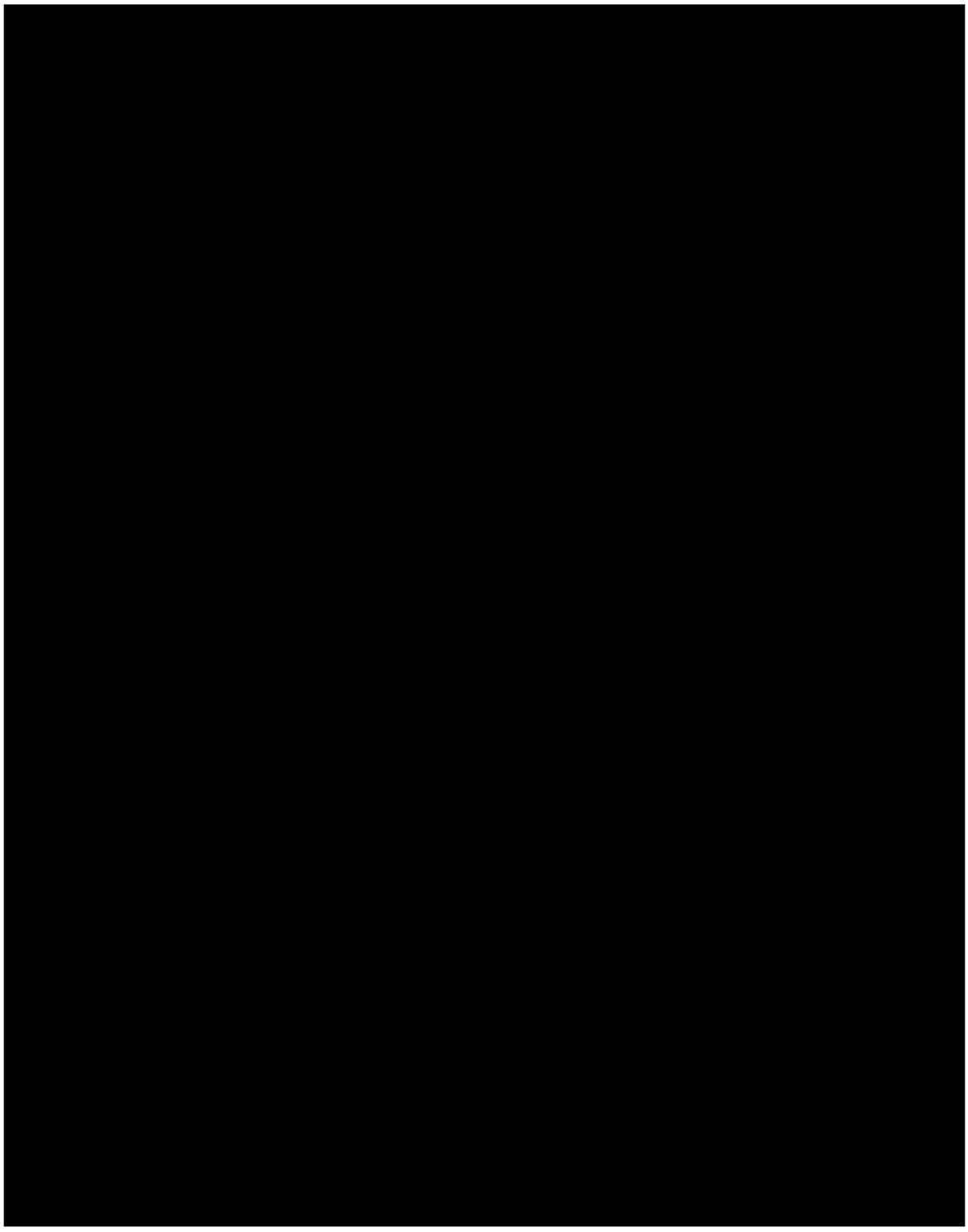

Figure NAR-1—Bluebonnet Sequestration Hub location with respect identifying potential remediation sites, existing legacy wells, water bodies, springs, mines, quarries, surface infrastructure, State, Tribal and Territory boundaries as well as roads.

The proposed Area of Review (AOR) has no known critical cultural sites or sites of archaeological significance. There are no known places of worship or known cemeteries within the AOR or within a 1-mile buffer zone surrounding the AOR. There are no known schools, hospitals, or nursing homes within the AOR. [redacted] within the boundaries of the AOR.

No Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), aka Superfund, or Resource Conservation and Recovery Act (RCRA) sites were identified in a database search of the Bluebonnet AOR (EPA 2022e). U.S. Environmental Protection Agency (EPA) 2022e. Hazardous Waste Sites. Available at: https://www.epa.gov/frs/geospatial-data-downloadservice.Accessed November 2022.

No springs were identified in the USGS Database of Historically Springs and Spring Flow Measurements in Texas. Report available at: USGS Open-File Report 03-315. Map available at: Maps | Data Basin Accessed December 2023.

No mines or mineral deposits were identified in the study area. USGS Mineral Resources Data System: Mineral Resources Data System: Records graded for completeness and consistency (usgs.gov) . University of Texas at Austin: Texas Mineral Resources Map (utexas.edu). Accessed December 2023.

No quarries were identified in database of registrations for Aggregate Production Operations, maintained by the Texas Commission on Environmental Quality.

A detailed subsurface evaluation was conducted both regionally and locally for the area pertaining to the Bluebonnet Sequestration Project site using geological, geophysical, petrophysical, and reservoir engineering data obtained from public literature and Oxy-licensed data.

An onshore storage complex has been identified in the Bluebonnet Sequestration Hub in [redacted] (Figure AOR-1), which is located in a structural province called the Houston Embayment. In this embayment, the formation dip is relatively flat and steepens with depth at varying rates ranging between 1.2 – 1.46°. The present-day structure is oriented towards the Southeast, i.e., in the direction of the Texas Gulf Coastline. Tertiary sediments were deposited by fluvial-deltaic processes associated with the Houston Delta. This resulted in a series of gulfward-thickening formations, comprised of stacked porous sandstones overlain by confining low-permeability strata. Within the Bluebonnet Sequestration Hub, a wide [redacted] trend was mapped, providing largescale storage capacity, which is capped by [redacted], the proposed confining unit. This storage complex will be developed first and is the subject of this Class VI permit.

Bluebonnet Sequestration Hub is strategically located near a concentration of industrial power generating plants, refineries, chemical production, natural gas processing, and natural gas liquefaction facilities along the Gulf Coast from the Beaumont/Port Arthur area in the East to the Houston area in the West. This proposed project includes capturing CO_2 from the main emitters and transporting it to the Bluebonnet Hub via a third-party pipeline. The intent at the time of the permit submittal is for [redacted] to serve as the third-party pipeline developer.

The overall site development plan is likely to include additional Class VI permits to develop an additional storage complex in the overlying [redacted] to tie in additional CO_2 emissions in the future and expand the Hub. The [redacted] sandstone may also be permitted for CO_2 sequestration, pending further evaluation.

Bluebonnet Sequestration Hub, LLC (through its affiliates) has leased approximately [redacted] acres across Chambers, Liberty, and Jefferson Counties. These agreements include control of the pore space, surface use, and land access that is necessary to facilitate this proposed carbon sequestration project. Bluebonnet Sequestration Hub, LLC has drilled and completed a Stratigraphic Test well in Chambers County in 2022. The data analysis from this well is in progress and based on preliminary results, is expected to confirm the feasibility of this project once completed.

2.1 Regional Geology, Local Structural Geology, and Hydrogeology

The Bluebonnet Sequestration Hub is located onshore Texas Gulf Coast within a structural province called the Houston Embayment, in which the Houston Delta deposited Tertiary siliciclastic sediments. These sediments were transported to the coastal margin by rivers and subsequently deposited in deltas or reworked by marine processes. One of these siliciclastic sedimentary systems is the [redacted], which is the proposed CO_2 injection zone. Contemporaneous growth faults developed parallel to the shelf margin and syndepositional movement resulted in sediment thickening on the downthrown side of the faults. The deposition of these gulfward-prograding depocenters was interrupted repeatedly by transgressions. These flooding events reflect increases in sea level and associated shale deposition, one of which is the prominent regional [redacted], which represents the proposed confining unit above the [redacted]

Various faulting styles within the Bluebonnet 3D seismic region were evaluated extensively to select an AoR (Area of Review) for the Bluebonnet Sequestration Project in which any faulting that impacts the integrity of the storage complex is absent.

A primary [redacted]-aged storage complex has been identified in the Bluebonnet Sequestration Hub in Chambers County, Texas. The CO_2 injection zone within the [redacted] storage complex is the [redacted] (Figure AOR-23), which is composed of a series of deltaic and marginal-marine sandstones and shales. In these sands, Bluebonnet Sequestration Hub, LLC is requesting to permanently sequester CO_2.

The [redacted] exhibit high porosity and permeability, both are critical parameters for input in the storage capacity and injectivity estimations. The structure of the injection zone is a gently Southeast-dipping monocline inside the proposed AOR. The average structural dip on top of the [redacted]. This formation dip impacts the CO_2 plume migration, which is driven by buoyancy forces in an updip direction. The [redacted] is laterally continuous in a North-South dip direction, beyond the limits of the AOR. T[redacted] log signatures are correlative and very similar among the offset wells, which indicates preferred connectivity of reservoir properties in a dip direction and might influence plume migration pathways together with structural formation dip.

The [redacted] zone is also laterally continuous in a West-East strike direction as well, beyond the limits of the AOR, however, small scale well-to-well lateral facies changes are expected, affecting the injectivity within the multiple stacked flow units of the [redacted] due to sedimentary distribution patterns, which are oriented perpendicular to the coastline.

The [redacted] is regionally overlain by a marine transgressive shale, the [redacted], which is an excellent stratigraphic marker and the upper confining zone for the injected CO_2. The [redacted] is a low-permeability confining zone that is regionally contiguous in both the North-South dip direction as well as in the East-West strike direction, beyond the limits of the AOR. This is due to the nature of a major marine transgression on a passive continental margin, where sea level changes affect large areas. The structure of the confining zone is a gently Southeast-dipping monocline inside the proposed AOR. The average structural dip of the [redacted]. Compared to the [redacted] zone with a slightly steeper dip of [redacted], the dip angle decreases with shallower depths towards the top of the confining zone, i.e., the structure is flattening.

Plan revision number: 1
Plan revision date: 01/30/2024

Figure AOR-23—Proposed storage complex at Bluebonnet, identifying formations and elements of the storage complex. This permit requests approval for CO_2 injection into [redacted], utilizing the [redacted] as the confining layer for containment of the injected CO_2. After BEG, 2017.

The Chicot Aquifer, the shallowest member of the Gulf Coast Aquifer, is the primary water production zone for drinking and municipal use in Chambers and Jefferson Counties (Tinsley, 1971). The minor flow units, which make up the Chicot aquifer, are hydrologically interconnected and supply usable quality water to Chambers and Jefferson counties (Figure AOR-60). "Usable" is defined by the Texas Water Development Board as 3,000 ppm TDS or less. In Chambers and Jefferson counties, the base of this usable water zone ranges from approximately less than 500 ft to around 1,500 ft below ground surface (BGS), with the majority of the two counties in the range of less than 500 ft to approximately 750 ft below ground surface. The Underground source of drinking water (USDW), which is defined by the USEPA as an aquifer or part of an aquifer that contains fewer than 10,000 ppm TDS, ranges in depth between 1,000 ft in the west and 2,000 ft BGS in the east, within these two counties. However, within the Area of Interest (AOI), the base of the USDW ranges from approximately [redacted] ft BGS. Fresh water quantities sourced by the Chicot aquifer within these two counties are relatively low and require supplementation of freshwater from neighboring Hardin and Orange Counties (Tinsley, 1971). The primary recharge mechanism of the fresh groundwater is through precipitation that has not been consumed as runoff or stream flow (Tinsley, 1971). Some portion of the water that reaches the aquifer's zone of saturation may end up returning to the surface as spring flow. Salinity values within the entire aquifer system, including the Evangeline and Jasper aquifers, typically increase with depth and vary laterally.

Plan revision number: 1
Plan revision date: 01/30/2024

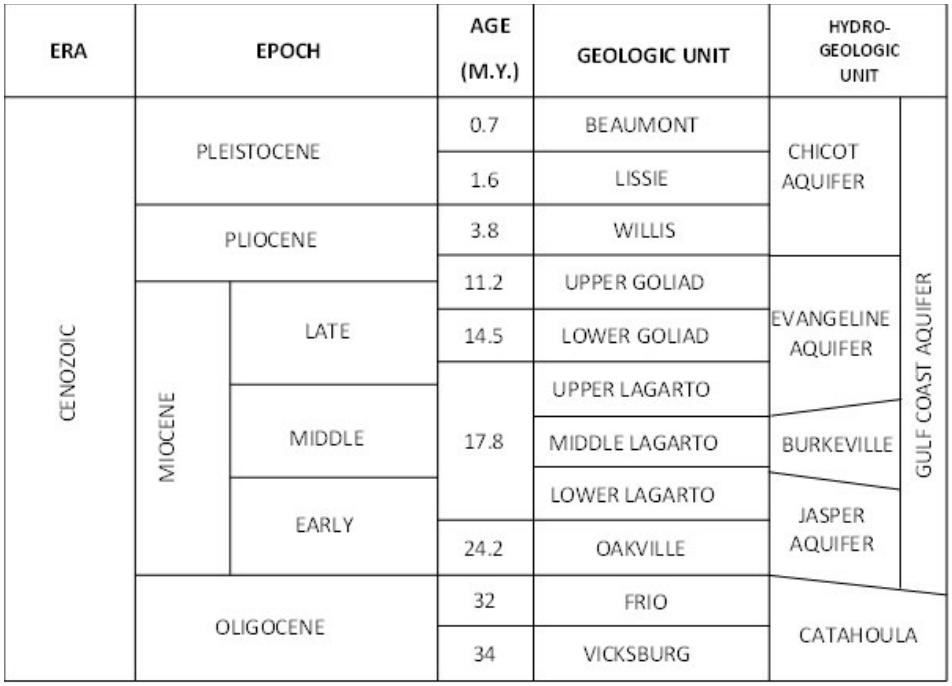

Figure AOR-60—Geologic and hydrogeologic units of the Gulf Coast Aquifer system, modified from Young et al. (2016)

Regional earthquakes were identified using the USGS online database, cross-checked against the Bureau of Economic Geology's TEXNET database to determine the location of events (Figure AOR-49). No recorded events of any magnitude from 1900 to present were identified within 50 miles of the Bluebonnet site. A single earthquake was identified within a 75-mile radius of the Bluebonnet project: this magnitude 3.8 event occurred 1 km WNW of Sulphur, Louisiana, in 1983 at a depth of 5.9 km. The USGS Long-Term Seismic Hazard Map indicates that this area is at relatively low risk for natural earthquake activity.

Plan revision number: 1
Plan revision date: 01/30/2024

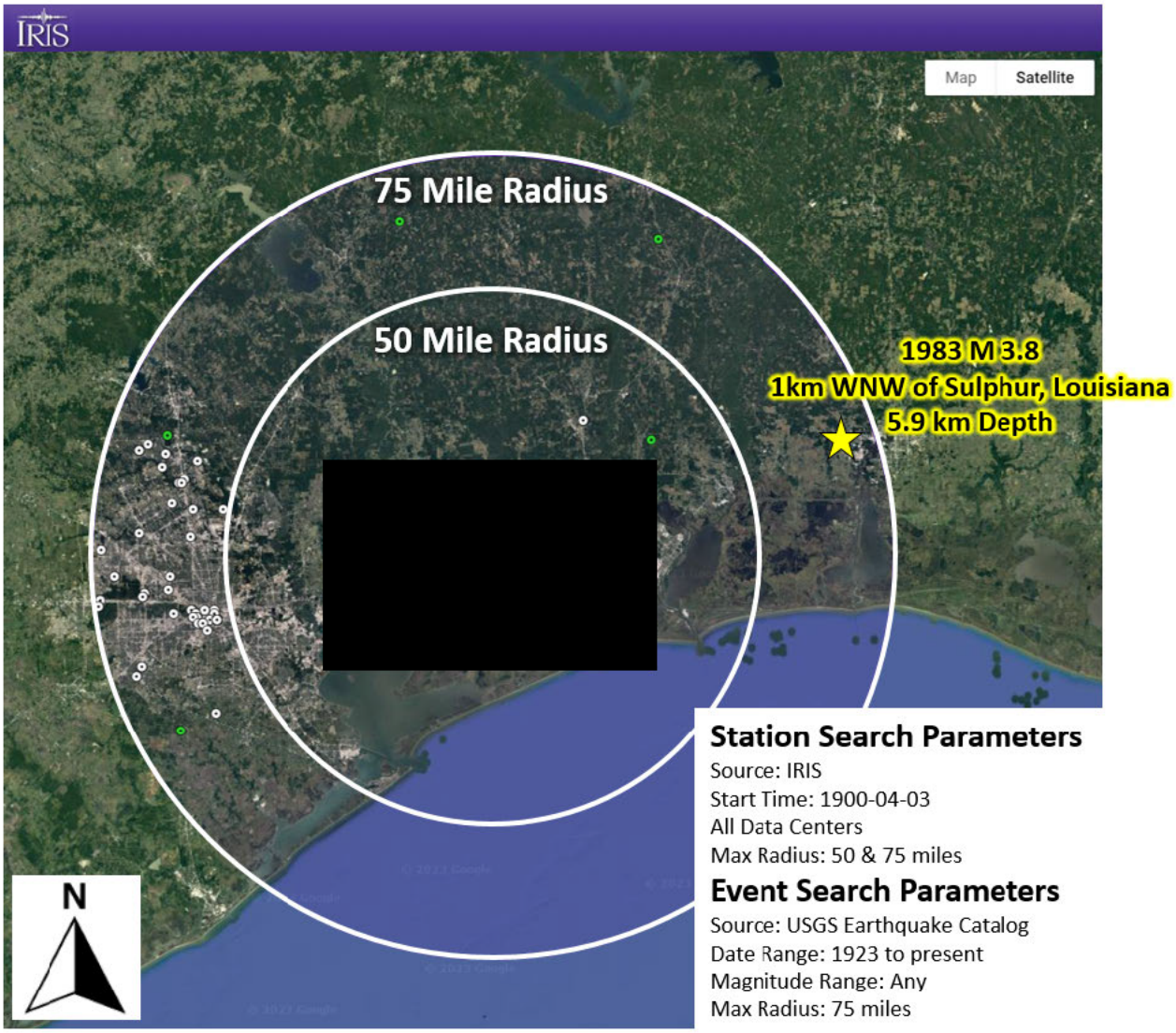

Figure AOR-49—Seismometer stations (green and white circles) and historic seismic activity (yellow star)

The total porosity of the injection zone is based on [redacted] from 33 wells within and around the Geologic Model Domain (**Figure AOR-80**). An interconnected (effective) porosity for wells with porosity logs was calculated from total porosity corrected for the shale volume. The remaining wells did not have neutron and/or density porosity logs but were required for porosity calculation in the petrophysical interpretation. A linear correlation between volume of shale and effective porosity from wells with porosity logs developed by the GCCC ([redacted] was used and corroborated with local data. The results of this method compared largely with the 33 well subset, so the linear correlation was applied to the remaining wells

Plan revision number: 1
Plan revision date: 01/30/2024

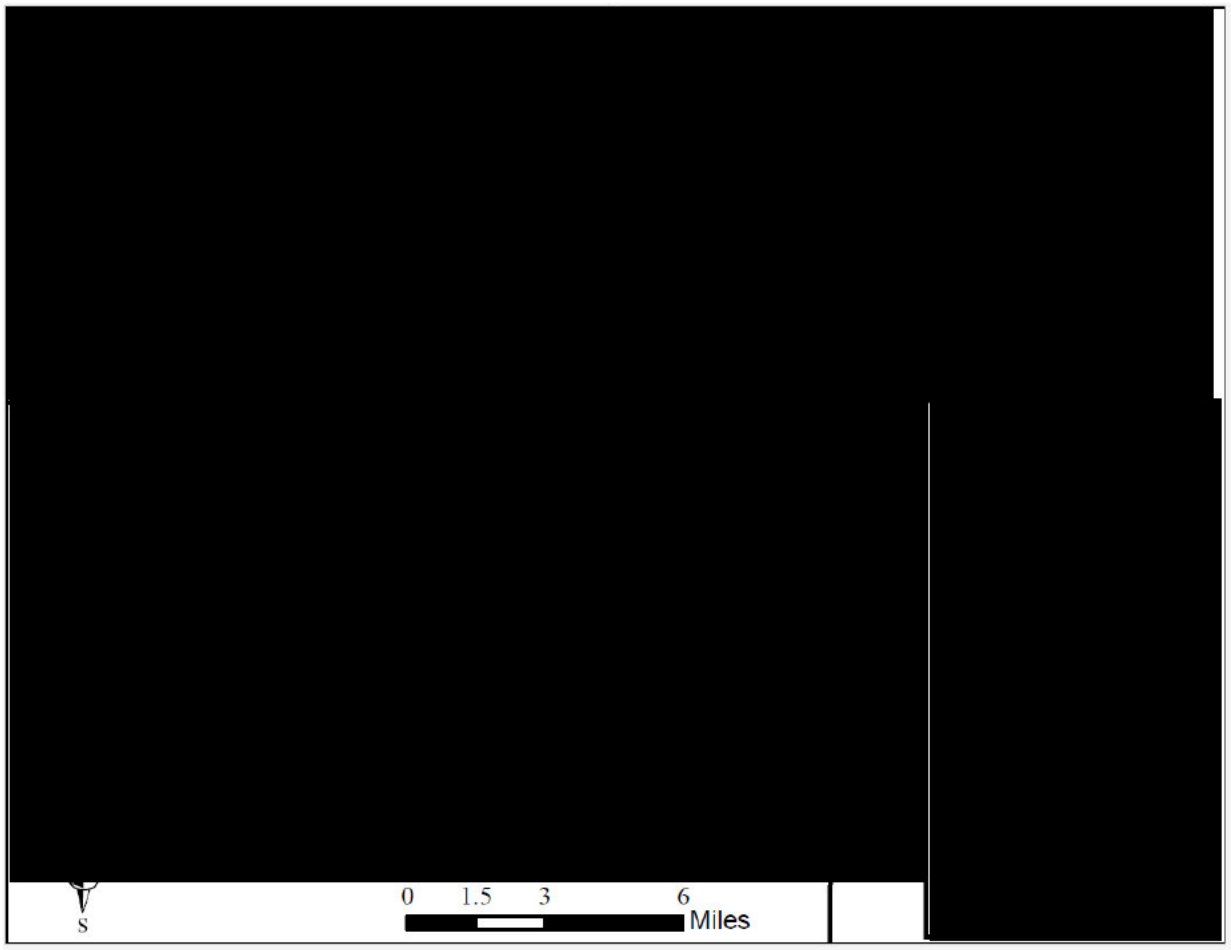

Figure AOR-80—Map representing 152 control wells within and surrounding the Bluebonnet Focus Area (dotted line) used for petrophysical interpretation of [redacted] Pie charts outlined in blue represent 33 wells with [redacted] The stratigraphic well, [redacted] is identified with a black star.

For the pre-construction static modeling effort, the horizontal permeability for the injection zones is based on a porosity permeability relationship [redacted] Using this method, an average horizontal permeability of [redacted] mD is calculated for the injection interval.

The state of stress indicates a fracture gradient of [redacted] psi/ft in the [redacted] The hydrostatic pore pressure model is [redacted] psi/ft, so the minimum pressure increase to reach critical stress in the highest risk scenario (optimally oriented fault/fractures present) in the [redacted] is [redacted] psi/ft or the equivalent of [redacted] si, meaning that it would take greater than [redacted] psi increase in the formation pressure from injection of CO_2 to cause failure in unobserved faults or fractures in the formation. Pressure increases to cause failure in the matrix are higher under all other conditions.

2.2 Site Storage Capacity

An initial estimation of the site storage capacity was performed using the U.S. DOE methodology provided by Goodman et. al. (2011) for storage in saline formations, described by Equation 1.

$$G_{CO_2} = 4.536x10^{-4} * A * h_g * \emptyset_{tot} * \rho_{CO_2} * E_{saline} \quad \text{.....(Equation 1)}$$

Where:

G_{CO_2} is the static storage capacity in ton;
A is area in ft^2;
h_g is gross formation thickness in ft;
$\emptyset_{tot}$ is total porosity (fraction);
ρ_{CO_2} is CO_2 density in lb/ft^3;
and E_{saline} is a saline formation storage efficiency factor (fraction).

The average properties of the storage formation were determined from the petrophysical analysis of 89 wells with logs nearest to the Bluebonnet project site. These average properties were used in Equation 1, along with estimated values for the efficiency factor term in clastic saline formations provided by Goodman et. al. (2011). The inputs and results are shown in Table NAR-1, using a basis of a 1 mi^2 unit area.

Table NAR-1—Input data and results of static storage capacity using DOE methodology

Formation	TVD (ft)	Pressure (psi)	Temp (°F)	Gross Formation Thickness (feet)	Total Porosity (P)	CO_2 Density (lb/ft^3)	P10 G_{CO_2} (tonne/ mi^2) E_{saline} = [redacted]	P50 G_{CO_2} (tonne/ mi^2) E_{saline} = [redacted]	P90 G_{CO_2} (tonne/ mi^2) E_{saline} = 0.[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

Using the total pore-space acreage of approximately [redacted] acres ([redacted] mi^2), the total storage capacity of the Bluebonnet Sequestration Hub in the [redacted] totals approximately [redacted] million tonnes CO_2. The DOE methodology provides an order-of-magnitude of variation in the storage capacity estimate and is considered a high-level estimate in order to assess the site's potential. The high sand permeability and the large regional extent of the saline aquifer are all indications that the realized storage capacity should fall towards the higher end of the probability estimate.

The dynamic simulation model is a more advanced method for determination of the storage capacity. Details of the construction and physics of the base case dynamic model are described in detail in the Area of Review and Corrective Action Plan. The base case model includes CO_2 dissolved in the aqueous phase or as free or trapped supercritical CO_2 but does not model trapping due to mineralization. Figure NAR-2 shows the change in storage capacity and CO_2 plume area with time from the dynamic simulation, forecasted to 100 years post the stop of injection. The storage capacity reaches a peak at the end of the injection period at [redacted] Million

mt/mi^2, then declines to a value of [redacted] Million mt/mi^2 at the stop of plume migration. The plume area is based on the area determined by [redacted]. The storage capacity on a per-area basis from dynamic modeling is ultimately higher near the injector than at the outer edges of the CO_2 plume due to the heterogeneity of the storage formation and the CO_2 migration updip but is averaged over the entire area.

Figure NAR-2—CO_2 plume area and storage capacity from dynamic simulation, from start of injection to 100 years post injection ([redacted] from start of injection).

3.0 AoR and Corrective Action

The Area of Review and Corrective Action Plan document meets the requirements of Environmental Protection Agency (EPA) document 40 CFR Subpart H - Criteria and Standards Applicable to Class VI Wells. The key challenges are detailed characterization of the injection and confining zones, delineating all underground sources of drinking water, and implementing corrective action on existing wells within the Area of Review. The document describes the subsurface characterization, computational modeling, current AoR delineation, corrective action plan and schedule, wells requiring corrective action, and future AoR re-evaluation plan and schedule.

The plan delineates the Area of Review (AoR) and provides any corrective action that is needed in the wells that penetrate the upper confining zone within the AoR. Delineation of the AoR is one of the key elements of the Class VI Rule to ensure USDWs in the region surrounding the geologic sequestration project may not be endangered by the injection activity.

At a fixed frequency specified in the Area of Review and Corrective Action Plan or more frequently when monitoring and operational conditions warrant, Bluebonnet Sequestration Hub, LLC must reevaluate the AoR and perform any required corrective action in the manner specified in 40 CFR 146.84. Bluebonnet Sequestration Hub, LLC must also update the Area of Review and Corrective Action Plan or demonstrate to the Director that no update is needed.

Following each Area of Review and Corrective Action Plan reevaluation or demonstration showing that no new evaluation is needed, Bluebonnet Sequestration Hub, LLC shall submit the resultant information in an electronic format to the Director for review and approval of the results. Once approved by the Director, the revised Area of Review and Corrective Action Plan will become an enforceable condition of this permit.

AoR and Corrective Action GSDT Submissions
GSDT Module: AoR and Corrective Action ***Tab(s):*** All applicable tabs Please use the checkbox(es) to verify the following information was submitted to the GSDT: ☒ Tabulation of all wells within AoR that penetrate confining zone ***[40 CFR 146.82(a)(4)]*** ☒ AoR and Corrective Action Plan ***[40 CFR 146.82(a)(13) and 146.84(b)]*** ☒ Computational modeling details ***[40 CFR 146.84(c)]***

4.0 Financial Responsibility

Bluebonnet Sequestration Hub, LLC shall maintain financial responsibility and resources to meet the requirements of 40 CFR 146.85 and the conditions of this permit. Financial responsibility shall be maintained through all phases of the project. The approved financial assurance mechanisms are found in the Financial Assurance Plan document of this permit. The financial instrument(s) must be sufficient to cover the cost of:

- Corrective action (meeting the requirements of 40 CFR 146.84);
- Injection well plugging (meeting the requirements of 40 CFR 146.92);
- Post-injection site care and site closure (meeting the requirements of 40 CFR 146.93);
- Emergency and remedial response (meeting the requirements of 40 CFR 146.94).

During the active life of the geologic sequestration project, Bluebonnet Sequestration Hub, LLC must adjust the cost estimate for inflation within 60 days prior to the anniversary date of the establishment of the financial instrument(s) and provide this adjustment to the Director in an electronic format. Bluebonnet Sequestration Hub, LLC must also provide to the Director written updates of adjustments to the cost estimate in an electronic format within 60 days of any amendments to the Project Plans that addresses the cost items covered in the financial assurance plan.

Bluebonnet Sequestration Hub, LLC shall provide notification to meet the requirements of 40 CFR 146.85 and the conditions of this permit.

- Whenever the current cost estimate increases to an amount greater than the face amount of a financial instrument currently in use, Bluebonnet Sequestration Hub, LLC, within 60 days after the increase, must either cause the face amount to be increased to an amount at least equal to the current cost estimate and submit evidence of such an increase to the Director, or obtain other financial responsibility instruments to cover the increase. Whenever the current cost estimate decreases, the face amount of the financial assurance instrument may be reduced to the amount of the current cost estimate only after Bluebonnet Sequestration Hub, LLC has received written approval from the Director.

- Bluebonnet Sequestration Hub, LLC must notify the Director by certified mail and in an electronic format of adverse financial conditions, such as bankruptcy, that may affect the ability to carry out injection well plugging, post-injection site care and site closure, and any applicable ongoing actions under the Corrective Action and/or Emergency and Remedial Response.

    - If Bluebonnet Sequestration Hub, LLC or third-party provider of a financial responsibility instrument is going through a bankruptcy, Bluebonnet Sequestration Hub, LLC must notify the Director by certified mail and in an electronic format of the commencement of voluntary or involuntary proceedings under Title 11 (Bankruptcy), U.S. Code, which names Bluebonnet Sequestration Hub, LLC as the debtor within 10 days after commencement of the proceeding.

    - A guarantor of a corporate guarantee must make such a notification, if he or she is named as debtor, as required under the terms of the guarantee.

    - A permittee who fulfills the requirements of financial assurance by obtaining a trust fund, surety bond, letter of credit, escrow account, or insurance policy, will be deemed to be without the required financial assurance in the event of bankruptcy of the trustee (or issuing institution) or suspension/revocation of the authority of the trustee institution to act as trustee of the institution issuing the trust fund, surety bond, letter of credit, escrow account, or insurance policy.

Bluebonnet Sequestration Hub, LLC must establish other financial assurance or liability coverage, acceptable to the Director, within 60 days of a change to the Area of Review and Corrective Action Plan.

Plan revision number: 1
Plan revision date: 01/30/2024

Financial Responsibility GSDT Submissions

GSDT Module: Financial Responsibility Demonstration
Tab(s): Cost Estimate tab and all applicable financial instrument tabs

Please use the checkbox(es) to verify the following information was submitted to the GSDT:
☒ Demonstration of financial responsibility ***[40 CFR 146.82(a)(14) and 146.85]***

Plan revision number: 1
Plan revision date: 01/30/2024

5.0 Injection Well Construction

The Bluebonnet CCS 1 injection well is designed with the highest standards and best practices for drilling and well construction (Figure CON-1). The operational parameters and material selection are aimed to ensure mechanical integrity in the system and to optimize the operation during the life of the project.

The Bluebonnet CCS 1 well design includes two main sections: 1) surface casing and 2) long string section to cover the USDW, provide integrity while drilling the injection zone, acquire formation data, and isolate the target formation while running the upper completion.

Plan revision number: 1
Plan revision date: 01/30/2024

Figure CON-1—Bluebonnet CCS 1 Well Proposed Schematic

5.1 Proposed Stimulation Program [40 CFR 146.82(a)(9)]

Stimulation to enhance the injectivity potential of the [redacted] in the Bluebonnet CCS 1 well is not anticipated at this time. The need for stimulation will be determined once the characterization data from the Bluebonnet Sequestration Project wells are available and have been evaluated (i.e., results of geophysical logs, core analyses, and hydrogeologic testing). If it is determined that stimulation techniques are needed, a separate plan will be developed and submitted for review and approval before conducting any stimulation.

5.2 Construction Procedures [40 CFR 146.82(a)(12)]

The Bluebonnet CCS 1 well design includes two main sections: 1) surface casing and 2) long string section to cover the USDW, provide integrity while drilling the injection zone, acquire formation data, and isolate the target formation while running the upper completion.

The [redacted]" surface section will be drilled to [redacted] ft to cover base of the USDW estimated at [redacted] ft and to provide mechanical integrity on the surface shoe to continue the next section. While drilling, a deviation survey will be taken every [redacted] ft. Once total depth (TD) is reached, the well will be circulated and conditioned to run [redacted] logs according to the testing program. Then, [redacted] casing will be run and cemented to the surface with conventional [redacted]. If there are no cement returns to the surface, the Project Manager will inform the EPA Director, determine the top of cement with a temperature log or equivalent, and complete the annular cement program with a top job procedure after approval by the Director. After the tail cement reaches at least [redacted] psi compressive strength, the rig will install Section A of the wellhead and blowout preventor (BOP) equipment. The rig will then test the BOP, test the casing, and pick up the drilling assembly. After drilling out the shoe track, [redacted]

A [redacted] hole will be drilled from [redacted] ft to TD while taking deviation surveys every [redacted] ft. Once TD is reached, the well will be circulated and conditioned to run [redacted] logs and acquire samples based on the testing program. During this run, [redacted] casing logs will be acquired over the previously set [redacted] surface casing. Then, the long string of [redacted] casing will be deployed with [redacted]. The casing will be cemented to the surface with a combination of CO_2-resistant and conventional cement slurries. Based on simulations, a stage tool will be used to perform a two-stage cementing job to ensure good cement from bottom to surface. The depth of the divi-tool or stage tool will be adjusted based on actual conditions of the well after drilled.

After the tail slurry cement develops a minimum compressive strength of [redacted] psi, Section B of the wellhead will be installed, and the DTS/DAS cable will be connected to the surface equipment. Once the cable has been installed and tested, the team will install the tubing head and the rest of the tree.

During the completion operations, the rig will test the casing to [redacted] psi, condition the long string with a bit and scraper, run a [redacted] log to evaluate cement bonding and casing conditions, perforate the injection zone, and run the upper completion. The [redacted]" tubing and packer completion will be run to approximately [redacted] ft, in conjunction with [redacted] The fluid in the well will be displaced with packer fluid and the packer will be set. Once the packer is set, an annular pressure test will be performed to [redacted] psi on surface to validate the mechanical seal and integrity in the annular between the tubing

and casing. The well will be tested for injectivity with a step rate test procedure and a fall off test before starting injection.

Materials and metallurgy selections in well construction provide protection from corrosion and assurance of external and internal mechanical integrity. The injection casing materials were selected based on corrosion modeling with OLI software and materials testing, as well as best practices to be able to withstand downhole and surface operating conditions based on the projected CO_2 specifications and reaction with the formation waters.

Additional construction details are available in the Injection Well Construction Plan document of this permit.

5.2.1 Casing and Cementing

Specific details on the proposed casing properties and cementing program are found in section 4.0 of the Injection Well Construction Plan document of this permit.

6.0 Pre-Operational Logging and Testing

The Bluebonnet CCS 1 well testing program aims to obtain the chemical and physical characteristics of the injection and confining zone(s). This program includes a combination of logging, sidewall coring, formation hydrogeologic testing, and other activities performed during the drilling and construction of the CO_2 injection well, monitoring well(s), and any stratigraphic characterization well(s).

The pre-operational testing program will determine or verify the depth, thickness, mineralogy, lithology, porosity, permeability, and geomechanical information of the injection zone, overlying confining zone, and other relevant geologic formations. In addition, formation fluid characteristics are to be obtained from the injection zone to establish baseline data against which future measurements may be compared after the start of injection operations.

Specific details on the proposed pre-operational logging and testing program are found in Pre-Operational Testing Plan of this permit.

Pre-Operational Logging and Testing GSDT Submissions
GSDT Module: Pre-Operational Testing ***Tab(s):*** Welcome tab Please use the checkbox(es) to verify the following information was submitted to the GSDT: ☒ Proposed pre-operational testing program ***[40 CFR 146.82(a)(8) and 146.87]***

7.0 Well Operation

The well was designed to maximize the rate of injection as well as reduce the surface pressure and friction alongside the tubing, while maintaining the bottomhole pressure below 80% of the frac gradient. The selected design provides enough clearance to deploy the pressure and temperature gauges on tubing and to ensure continuous surveillance of external integrity and conformance through the external fiber optic cable.

7.1 Operational Procedures [40 CFR 146.82(a)(10)]

The operational procedures detailed below describe how Bluebonnet Sequestration Hub, LLC will initiate injection and conduct startup-specific monitoring of the Bluebonnet CCS 1.

The multi-stage (step-rate) startup procedure and period only apply to the initial start of injection operations until the well reaches the full injection rate. Monitoring frequencies and methodologies after the initial startup will follow the Testing and Monitoring Plan document of this permit.

During the startup period, the permittee will submit a daily report summarizing and interpreting the operational data. At the request of the EPA, the permittee may be required to schedule a daily conference call to discuss this information. A series of successfully higher injection rates, controlled with variable frequency drive pumps, will be performed. The elapsed time and pressure values will be read and recorded for each rate and time step. At no point during the procedure will the injection pressure be allowed to exceed the maximum injection pressure of [redacted] psig, which is measured at the wellhead. The injection rate will be measured and recorded using an orifice flow meter.

A spinner log will be conducted during each change (step) in rate and the project ream will look for any evidence of anomalous pressure behavior. If during the startup period any anomalous pressure behavior is observed, the project team may conduct additional logging and modify the injection rate program to characterize the anomaly better.

Additional operational parameters are detailed in the Summary of Operating Conditions document of this permit.

Plan revision number: 1
Plan revision date: 01/30/2024

Table OP-1—Injection Well Operating Conditions

Parameter/Condition	Limitation or Permitted Value	Units
Maximum Injection Rate	[redacted]	tonnes per day
Average Injection Rate	[redacted]	tonnes per day
Maximum Surface Wellhead Injection Pressure	[redacted]	psig
Maximum Bottomhole Injection Pressure at Gauge	[redacted]	psig
Maximum Bottomhole Injection Pressure at Gauge (recompletion)	[redacted]	psig
Minimum Annulus Pressure Differential	[redacted]	psig

Automatic alarms and automatic shut-off systems will be installed and maintained. Successful function of the alarm system and shut-off system will be demonstrated prior to injection and once every twelfth month after the last approved demonstration.

At all times, pressure will be maintained on the well that will prevent the return of the injection fluid to the surface. The wellbore must be filled with a high specific gravity fluid during workovers to maintain a positive (downward) gradient and/or a plug shall be installed, which can resist the pressure differential. A blowout preventer must be installed and kept in proper operational condition whenever the wellhead is removed to work on the well.

Injection shall cease when any of the following circumstances arises:

- Failure of the well to pass a mechanical integrity test;
- A loss of mechanical integrity during operation;
- The automatic alarm or shut-off system is triggered;
- A significant unexpected change in the annulus or injection pressure;
- The Director determines that the well lacks mechanical integrity; or

Permittee will cease injection according to the guidelines provided below:

- The permittee must shut-in the well by gradual reduction of the injection pressure as outlined in the Summary of Operating Conditions document of this permit; or
- The permittee must immediately cease injection and shut-in the well as outlined in the Emergency and Remedial Response Plan document of this permit.

7.2 Proposed Carbon Dioxide Stream [40 CFR 146.82(a)(7)(iii) and (iv)]

The proposed carbon dioxide stream composition is as shown below in Table TM-3. No injectant other than that identified in this permit shall be injected into the well except fluids used for stimulation, rework, and well tests as approved by the Director.

Table TM-3—CO_2 Stream Composition

Component	Specification
CO_2 (% mol)	>95
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]

7.3 Reporting and Record Keeping

Electronic reports, submittals, notifications, and records made and maintained by Bluebonnet Sequestration Hub, LLC, under this permit, must be in an electronic format approved by EPA. The permittee shall electronically submit all required reports to the Director.

Bluebonnet Sequestration Hub, LLC shall submit semi-annual reports containing:

- Any changes to the physical, chemical, and other relevant characteristics of the CO_2 stream from the proposed operating data;
- Monthly average, maximum, and minimum values for injection pressure, flow rate and daily volume, temperature, and annular pressure;
- A description of any event that exceeds operating parameters for the annulus or injection pressure specified in the permit;
- A description of any event that triggers the required shut-off systems and the responses taken;

- The monthly volume and/or mass of the CO_2 stream injected over the reporting period and volume and/or mass injected cumulatively over the life of the project;
- Monthly annulus fluid volume added or produced; and
- Results of the continuous monitoring required including:
    - A tabulation of the (1) daily maximum injection pressure, (2) daily minimum annulus pressure, (3) daily minimum value of the difference between simultaneous measurements of annulus and injection pressure, (4) daily volume, (5) daily maximum flow rate, and (6) average annulus tank fluid level; and
    - Graph(s) of the continuous monitoring required or of daily average values of these parameters. The injection pressure, injection volume and flow rate, annulus fluid level, annulus pressure, and temperature shall be submitted on one or more graphs, using contrasting symbols or colors, or in another manner approved by the Director; and
- Results of any additional monitoring identified in the Testing and Monitoring Plan.

Any permit noncompliance shall be reported to the Director within 24 hours as described below:

- Bluebonnet Sequestration Hub, LLC shall report to the Director any permit noncompliance, which may endanger human health or the environment, and/or any events that require implementation of actions in the Emergency and Remedial Response Plan document of this permit. Any information shall be provided orally within 24 hours from the time the permittee becomes aware of the circumstances. Such verbal reports shall include, but not be limited to, the following information:
    - Any evidence that the injected CO_2 stream or associated pressure front may have caused an endangerment to an USDW or any monitoring or other information, which indicates that any contaminant may have caused endangerment to an USDW;
    - Any noncompliance with a permit condition or malfunction of the injection system, which may have caused fluid migration into or between USDWs;
    - Any triggering of the shut-off system;
    - Any failure to maintain mechanical integrity;
    - Pursuant to compliance with the requirement at 40 CFR 146.90 (h) for surface air/soil gas monitoring or other monitoring technologies, if required by the Director, any release of CO_2 to the atmosphere or biosphere; and
    - Actions taken to implement appropriate protocols outlined in the Emergency and Remedial Response Plan document of this permit.
- A written submission shall be provided to the Director in electronic format within five (5) days of the time Bluebonnet Sequestration Hub, LLC becomes aware of the circumstances. The submission shall contain a description of the noncompliance and its cause; the period of noncompliance (including the exact dates and times); and if the noncompliance has not been corrected, then the anticipated time it is expected to

continue, as well as actions taken to implement appropriate protocols outlined in the Emergency and Remedial Response Plan document of this permit. This submission should also include the steps taken or planned to reduce, eliminate, and prevent recurrence of the noncompliance.

Within 30 days, the permittee will report to the Director the results of periodic tests of mechanical integrity; any well workover, including stimulation; any other test of the injection well conducted by the permittee, if required by the Director; and any test of any monitoring well required by this permit.

The following items require advance notification from the permittee to the Director:

- Well Tests – Bluebonnet Sequestration Hub, LLC shall give at least 30 days advance written notice to the Director in an electronic format of any planned workover, stimulation, or other well test.
- Planned Changes – Bluebonnet Sequestration Hub, LLC shall give written notice to the Director in an electronic format, as soon as possible, of any planned physical alterations or additions to the permitted injection facility other than minor repair/replacement or maintenance activities. An analysis of any new injection fluid shall be submitted to the Director for review and written approval at least 30 days prior to injection. This approval may result in a permit modification.
- Anticipated Noncompliance – Bluebonnet Sequestration Hub, LLC shall give at least 14 days advance written notice to the Director in an electronic format of any planned changes in the permitted facility or activity that may result in noncompliance with the permit requirements.

The following are some other reporting requirements:

- Compliance Schedules – Reports of compliance or noncompliance with or any progress reports on, interim and final requirements contained in any compliance schedule of this permit, shall be submitted in an electronic format by Bluebonnet Sequestration Hub, LLC no later than 30 days following each schedule date.
- Transfer of Permits – This permit is not transferable to any person except after notice is sent to the Director in an electronic format at least 30 days prior to the transfer and requirements of 40 CFR 144.38 (a) have been met. Pursuant to the requirements at 40 CFR 144.38 (a), the Director will require modification or revocation and reissuance of the permit to change the name of the permittee and incorporate such other requirements as may be necessary under the SDWA.
- Other Noncompliance – Bluebonnet Sequestration Hub, LLC shall report in an electronic format all other instances of noncompliance not otherwise reported in the next monitoring report. The reports shall contain the information previously listed in Section N (3)(b) of this permit.

- Other Information – When Bluebonnet Sequestration Hub, LLC becomes aware of a failure to submit any relevant facts in the permit application or incorrect information has been submitted in a permit application or in any report to the Director, the permittee shall submit such facts or corrected information in an electronic format, within 10 days in accordance with 40 CFR 144.51 (l)(8).
- Report on Permit Review – Within 30 days of receipt of this permit, Bluebonnet Sequestration Hub, LLC shall certify to the Director in an electronic format that he or she has read and is personally familiar with all terms and conditions of this permit.

The following guidelines are provided for record keeping:

- Bluebonnet Sequestration Hub, LLC shall retain records and all monitoring information, including all calibration and maintenance records and original chart recordings for continuous monitoring instrumentation and copies of all reports required by this permit (including records from pre-injection, active injection, and post-injection phases) for a period of at least 10 years from collection.
- Bluebonnet Sequestration Hub, LLC shall maintain records of all data required to complete the permit application form for this permit and any supplemental information (e.g., modeling inputs for AoR delineations and re-evaluations and plan modifications) submitted under 40 CFR 144.27, 144.31, 144.39, and 144.41 for a period of at least 10 years after site closure.
- Bluebonnet Sequestration Hub, LLC shall retain records concerning the nature and composition of all injected fluids until 10 years after site closure.
- The retention periods may be extended at any time at a request of the Director. Bluebonnet Sequestration Hub, LLC shall continue to retain records after the specified retention period of this permit or any requested extension thereof expires, unless the permittee delivers the records to the Director or obtains written approval from the Director to discard the records.
- Records of monitoring information shall include:
    - The date, exact place, and time of sampling or measurements;
    - The name(s) of the individual(s) who performed the sampling or measurements;
    - A precise description of both the sampling methodology and handling of samples;
    - The date(s) analyses were performed;
    - The name(s) of the individual(s) who performed the analyses;
    - The analytical techniques or methods used; and
    - The results of such analyses.

8.0 Testing and Monitoring

This Testing and Monitoring Plan document of this permit describes how Bluebonnet Sequestration Hub, LLC will monitor the Bluebonnet Sequestration Project site pursuant to 40

CFR 146.90. In addition to demonstrating that the well is operating as planned, the carbon dioxide plume and pressure front are moving as predicted, and that there is no endangerment to USDWs, the monitoring data will be used to validate and adjust the geological models used to predict the distribution of the CO_2 within the storage zone to support AoR reevaluations and a non-endangerment demonstration.

Results of the testing and monitoring activities described below may trigger action according to the Emergency and Remedial Response Plan.

8.1 Mechanical Integrity

Other than during periods of well workover or maintenance approved by the Director, in which the sealed tubing-casing annulus is disassembled for maintenance or corrective procedures, the injection well must have and maintain mechanical integrity consistent with 40 CFR 146.89. To meet these requirements, mechanical integrity tests/demonstrations must be witnessed by the Director or an authorized representative of the Director, unless prior approval has been granted by the Director to run an un-witnessed test. In order to conduct testing without an EPA representative, the following procedures must be followed.

- The permittee must submit prior notification in an electronic format, including the information that no EPA representative was available, and permission was received from the Director to proceed;
- The test must be performed in accordance with the Testing and Monitoring Plan document of this permit and documented by using either a mechanical or digital device that records the value of the parameter of interest;
- A final report, including any additional interpretation necessary for the evaluation of the testing, must be submitted in an electronic format.

Bluebonnet Sequestration Hub, LLC shall conduct a casing inspection log and mechanical integrity testing as follows:

- Prior to receiving the authorization to inject, the permittee shall perform the following testing to demonstrate internal mechanical integrity pursuant to 40 CFR 146.87 (a)(4):
    - A pressure test with liquid or gas; and
    - A casing inspection log; or
    - An alternative method approved by the Director and EPA Administrator pursuant to the requirements at 40 CFR 146.89 (e).
- Prior to receiving authorization to inject, the permittee shall perform the following testing to demonstrate external mechanical integrity pursuant to 40 CFR 146.87 (a)(4):
    - A tracer survey, such as an oxygen activation log; or
    - A temperature or noise log; or
    - An alternative method approved by the Director and EPA Administrator pursuant to requirements at 40 CFR 146.89 (e).

- Other than during periods of a well workover approved by the Director, in which the sealed tubing-casing annulus is disassembled for maintenance or corrective procedures, the permittee must continuously monitor injection pressure, rate, and volumes; pressure on the annulus between tubing and long string casing; and annulus fluid volume as specified in 40 CFR 146.88 (e), and 146.89 (b).
- At least once per year, the permittee must perform the following testing to demonstrate external mechanical integrity pursuant to 40 CFR 146.89 (c):
    - An Administrator-approved tracer survey, such as an oxygen-activation log; or
    - A temperature or noise log. The Director may require such tests whenever the well is worked over; or
    - An alternative approved by the Director and EPA Administrator pursuant to requirements at 40 CFR 146.89 (e).
- After any workover that may compromise the internal mechanical integrity of the well, the wellbore shall be tested by means of a pressure test approved by the Director and must pass this test to demonstrate mechanical integrity.
- Prior to plugging the well, the permittee shall demonstrate external mechanical integrity of the well as described in the Injection Well Plugging Plan that meets the requirements of 40 CFR 146.92 (a).
- The Director may require the use of any other tests to demonstrate mechanical integrity, other than those listed above, with the written approval of the EPA Administrator pursuant to requirements at 40 CFR 146.89 (e).

Bluebonnet Sequestration Hub, LLC shall notify the Director in an electronic format of his or her intent to demonstrate mechanical integrity at least 30 days prior to such demonstration. However, at the discretion of the Director, a shorter time may be allowed.

Reports of mechanical integrity demonstrations that contain logs must include an interpretation of the results by a knowledgeable log analyst. The permittee shall report in an electronic format the results of a mechanical integrity demonstration.

Bluebonnet Sequestration Hub, LLC shall calibrate all gauges used in mechanical integrity demonstrations and other required monitoring to an accuracy of not less than 0.5 percent of full scale, within one year prior to each required test. The date of the most recent calibration shall be noted on or near the gauge or meter. A copy of the calibration certificate shall be submitted to the Director in an electronic format with the report of the test. Pressure gauge resolution shall be no greater than five (5) psi. Certain mechanical integrity and other testing may require greater accuracy and shall be identified in the procedure submitted to the Director prior to the test.

Bluebonnet Sequestration Hub, LLC must adhere the following guidelines regarding failure to maintain mechanical integrity:

- If the permittee or Director finds that the well fails to demonstrate mechanical integrity during a test; is unable to maintain mechanical integrity during operation; or that a loss of

mechanical integrity as defined by 40 CFR 146.89 (a)(1) or (2) is suspected during operation (such as a significant unexpected change in the annulus or injection pressure), the permittee must:

- Cease injection;
- Take all steps reasonably necessary to determine whether there may have been a release of the injected CO_2 stream or formation fluids into any unauthorized zone. If there is evidence of USDW endangerment, the Permittee shall implement the Emergency and Remedial Response Plan document of this permit;
- Follow the reporting requirements as directed in the Emergency and Remedial Response Plan;
- Restore and demonstrate mechanical integrity to the satisfaction of the Director and receive written approval from the Director prior to resuming injection; and
- Notify the Director in an electronic format when injection is expected to resume.

- If a shut-down (i.e., downhole or at the surface) is triggered, Bluebonnet Sequestration Hub, LLC must immediately investigate and identify, as expeditiously as possible, the cause of the shut-down. If upon such investigation, the well appears to be lacking mechanical integrity or if monitoring required indicates that the well may be lacking mechanical integrity, the permittee must take the actions as described in the Emergency and Remedial Response Plan.
- If the well loses mechanical integrity prior to the next scheduled test date, then the well must either be plugged or repaired and retested within 30 days of losing mechanical integrity. Bluebonnet Sequestration Hub, LLC shall not resume injection until the mechanical integrity is demonstrated and the Director gives written approval to recommence injection in cases where the well has lost mechanical integrity.

Bluebonnet Sequestration Hub, LLC shall demonstrate mechanical integrity at any time upon written notice from the Director.

Testing and Monitoring GSDT Submissions
GSDT Module: Project Plan Submissions ***Tab(s):*** Testing and Monitoring tab Please use the checkbox(es) to verify the following information was submitted to the GSDT: ☒ Testing and Monitoring Plan ***[40 CFR 146.82(a)(15) and 146.90]***

9.0 Injection Well Plugging

Upon the end of life for Bluebonnet CCS 1, this injection well will be plugged and abandoned relevant to the requirements of Environmental Protection Agency (EPA) document 40 CFR Subpart H – Criteria and Standards Applicable to Class VI Wells. The plugging procedure and materials will be designed to prevent any unwanted fluid movement, resist the corrosive aspects

of carbon dioxide (CO_2) with water mixtures, and protect any underground sources of drinking water (USDWs).

Injection Well Plugging GSDT Submissions
GSDT Module: Project Plan Submissions ***Tab(s):*** Injection Well Plugging tab Please use the checkbox(es) to verify the following information was submitted to the GSDT: ☒ Injection Well Plugging Plan ***[40 CFR 146.82(a)(16) and 146.92(b)]***

10.0 Post-Injection Site Care (PISC) and Site Closure

The Post-Injection Site Care and Site Closure (PISC) plan describes the activities that Bluebonnet Sequestration Hub, LLC will perform to meet the requirements of 40 CFR 146.93. Bluebonnet Sequestration Hub, LLC will monitor ground water quality and track the position of the carbon dioxide plume and pressure front for 50 years. Bluebonnet Sequestration Hub, LLC may not cease post-injection monitoring until a demonstration of non-endangerment of USDWs has been approved by the UIC Program Director pursuant to 40 CFR 146.93(b)(3). Following approval for site closure, Bluebonnet Sequestration Hub, LLC will plug all monitoring wells, restore the site to its original condition, and submit a site closure report and associated documentation.

PISC and Site Closure GSDT Submissions
GSDT Module: Project Plan Submissions ***Tab(s):*** PISC and Site Closure tab Please use the checkbox(es) to verify the following information was submitted to the GSDT: ☒ PISC and Site Closure Plan ***[40 CFR 146.82(a)(17) and 146.93(a)]***
GSDT Module: Alternative PISC Timeframe Demonstration ***Tab(s):*** All tabs (only if an alternative PISC timeframe is requested) Please use the checkbox(es) to verify the following information was submitted to the GSDT: ☐ Alternative PISC timeframe demonstration ***[40 CFR 146.82(a)(18) and 146.93(c)]***

11.0 Emergency and Remedial Response

The Emergency and Remedial Response Plan (ERRP) document of this permit describes actions that Bluebonnet Sequestration Hub, LLC shall take to address movement of the injection fluid or formation fluid in a manner that may endanger an underground source of drinking water (USDW) during the construction, operation, or post-injection site care periods.

If Bluebonnet Sequestration Hub, LLC obtains evidence that the injected CO_2 stream and/or associated pressure front may cause an endangerment to a USDW, Bluebonnet Sequestration Hub, LLC will initiate shutdown plan for the injection well, take all steps reasonably necessary to identify and characterize any release, notify the permitting agency (UIC Program Director) of the emergency event within 24 hours, and implement applicable portions of the approved ERRP.

Emergency and Remedial Response GSDT Submissions
GSDT Module: Project Plan Submissions ***Tab(s):*** Emergency and Remedial Response tab Please use the checkbox(es) to verify the following information was submitted to the GSDT: ☒ Emergency and Remedial Response Plan ***[40 CFR 146.82(a)(19) and 146.94(a)]***

12.0 Injection Depth Waiver and Aquifer Exemption Expansion

Injection depth waivers are not requested in this permit application.

Injection Depth Waiver and Aquifer Exemption Expansion GSDT Submissions
GSDT Module: Injection Depth Waivers and Aquifer Exemption Expansions ***Tab(s):*** All applicable tabs Please use the checkbox(es) to verify the following information was submitted to the GSDT: ☐ Injection Depth Waiver supplemental report ***[40 CFR 146.82(d) and 146.95(a)]*** ☐ Aquifer exemption expansion request and data ***[40 CFR 146.4(d) and 144.7(d)]***

13.0 References

Goodman, A., Hakala, A., Bromhal, G., Deel, D., Rodosta, T., Frailey, S., Small, M., Allen, D., Romanov, V., Fazio, J., Huerta, N., McIntyre, D., Kutchko, B., and Guthrie, G., 2011. U.S. DOE Methodology for the Development of Geologic Storage Potential for Carbon Dioxide at the National and Regional Scale, J. Greenhouse Gas Control, Vol 5, pp 952-965.

Hovorka, S.D., Holtz, M.H., Sakurai, S., Knox, P.R., Collins, D., Papadeas, P., and Stehli, D., 2003, Frio pilot in CO2 sequestration in brine-bearing sandstones: The University of Texas at Austin, Bureau of Economic Geology, report to the Texas Commission on Environmental Quality to accompany a class V application for an experimental technology pilot injection well. GCCC Digital Publication Series #03- 04.

Tinsley, W. E., Shurbet, M., Gilmore, R. B., Potts, M. T., McCoy, J. H., Illig, C., Burleigh, H. P., Arnow, S., 1971, Report 133: Ground-Water Resources of Chambers and Jefferson Counties,

Texas. Prepared by United States Geological Survey in cooperation with the Texas Water Development Board.

Young, S. C., Jigmong, M., Deeds, N., Blainey, J., et al., 2016, Final Report: Identification of Potential Brackish Groundwater Production Areas – Gulf Coast Aquifer System, Texas Water Development Board Contract Number 1600011947, Intera Incorporated.