



Underground Injection Control – Class VI Permit Application for

Orchard No. 1 to No. 7

Introduction

Gaines County, Texas

Prepared for *Orchard Storage Company LLC*
Odessa, Texas

By
Lonquist Sequestration, LLC
Austin, TX

May 2023



SECTION 0 – INTRODUCTION

TABLE OF CONTENTS

Project Overview.....	2
Project Key Attributes.....	5
Pore Space Agreement Discussion.....	6
Proposed CO ₂ Sequestration System Discussion.....	6
Injectate Information.....	6
Surface Facility Details	7
Site Suitability	8
Summary.....	10
Required Administrative Information.....	11
General Application Information	11
Additional Permits	12

Figures

Figure 0-1 – Emission Sources.....	2
Figure 0-2 – Project Overview Map	4
Figure 0-3 – Permian Basin West-East Cross Section.....	5
Figure 0-5 – Aerial Map of Orchard Project.....	9

Tables

Table 0-1 – Injectate Major Components	7
Table 0-2 – Additional Required Permits	12

Project Overview

The International Energy Agency (IEA) states that in 2021 just over 40 million metric tons per year (MMT/yr) of CO₂ were captured worldwide.¹ By 2070, the world will need to capture and store more than 10,000 MMT/yr of CO₂ to meet the Sustainable Development Scenario plan outlined by the IEA.² To meet these climate goals, real projects and investment are paramount—such as carbon capture, which is becoming an essential addition to industrial processes emitting carbon dioxide into the atmosphere.³

[REDACTED] provides integrated, end-to-end carbon capture and storage (CCS) solutions to owners of industrial and power facilities seeking to transition to low carbon products and address environmental, safety, and governance (ESG) goals. [REDACTED] is a CCS project management company that develops, designs, builds, owns, and operates carbon capture, transport, and storage projects throughout the United States. Orchard Storage Company LLC (Orchard Storage), [REDACTED] was established to develop and operate the Class VI CO₂ storage site discussed in this application. Orchard Storage team members have extensive expertise in the capture, transport, and geologic storage of CO₂. Carbon capture and storage represent meaningful, physical reductions in CO₂ emission—to dramatically decrease Scope 1, 2, and 3 emissions, as described in Figure 0-1.

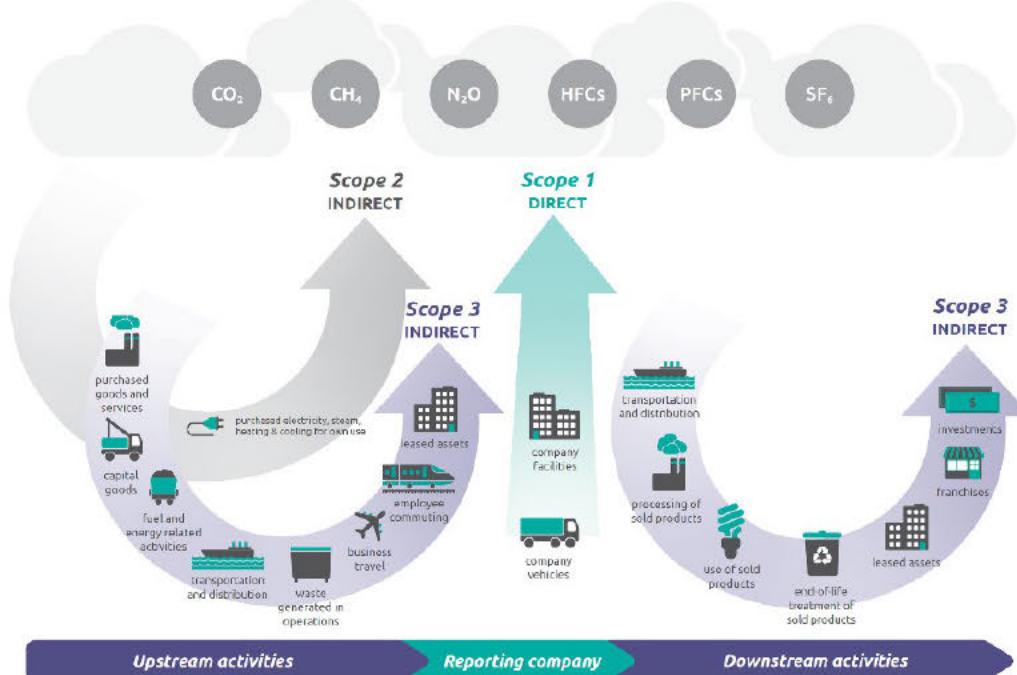


Figure 0-1 – Emission Sources⁴

¹ <https://www.iea.org/reports/about-ccus>

² <https://www.iea.org/reports/about-ccus>

³ <https://elysian.cc/about-us>

⁴ https://ghgprotocol.org/sites/default/files/standards/Corporate-Value-Chain-Accounting-Reporting-Standard_041613_2.pdf, page 5

The Orchard Project is being developed to accommodate and sequester, in secure geologic storage, anthropogenic CO₂ sourced regionally from various emitters. The Orchard Project plans to use multiple wells at the storage site to accommodate the captured CO₂ volumes. The extensive screening process for Orchard's site selection resulted in a site that meets Underground Injection Control (UIC) requirements with minimal existing wellbores, an injection interval with requisite and appropriate reservoir properties, and substantial sealing intervals. The storage site is also relatively near existing CO₂ pipeline infrastructure to accommodate the economic delivery of sourced CO₂ volumes to the Orchard Project.

This permit application is for drilling, completing, operating, and monitoring seven Class VI CCS injection wells, Orchard No. 1 through No. 7, located in Gaines County, Texas (Figure 0-2). The CO₂ injection wells are designed to meet the requirements of American Petroleum Institute (API) 1171, along with the regulatory requirements outlined in 16 Texas Administrative Code (TAC) **§5.206(c)** [Title 40, U.S. Code of Federal Regulations (40 CFR) **§146.86**].

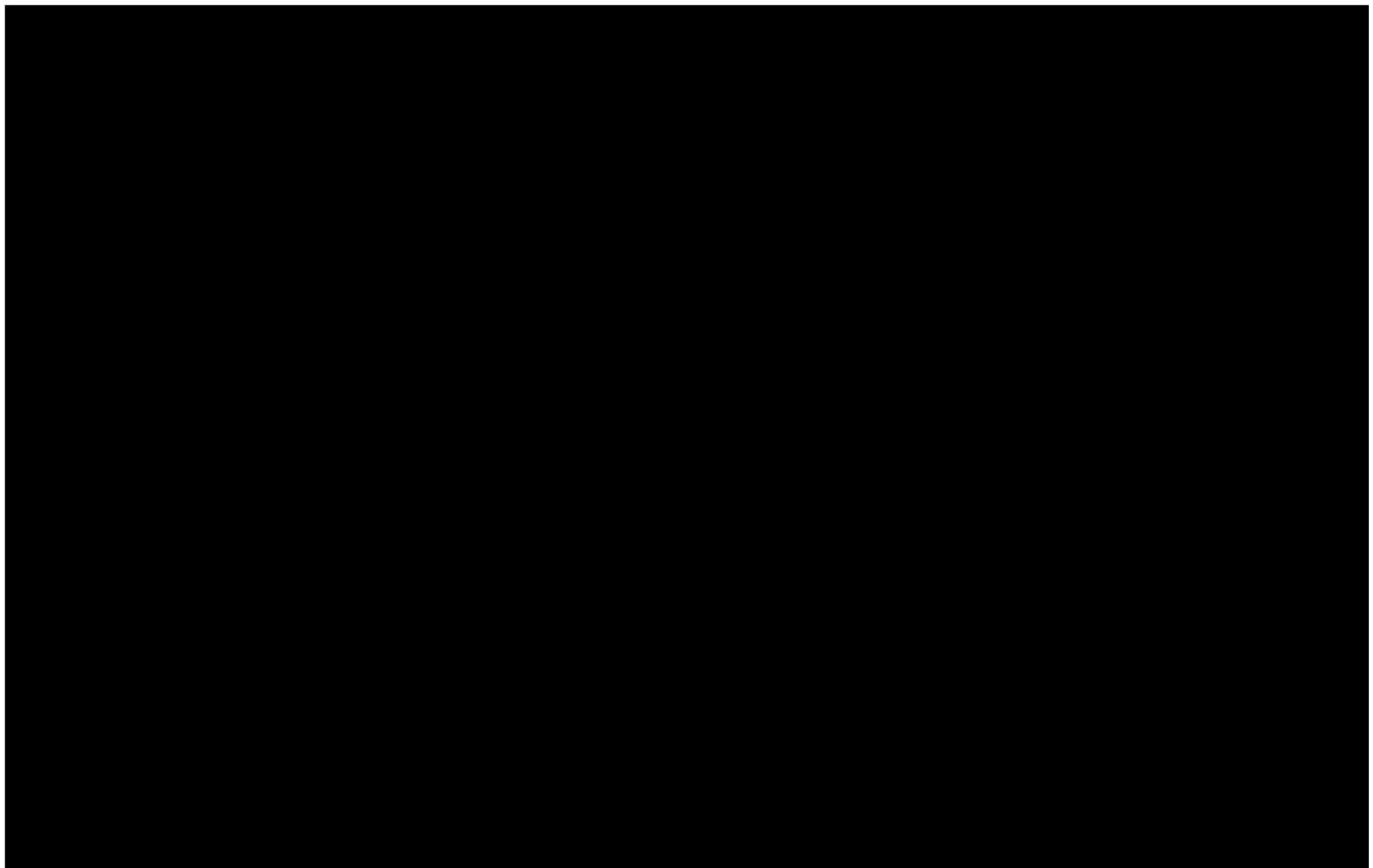


Figure 0-2 – Project Overview Map

Each of the Orchard wells will target the [REDACTED] formation for injection. The [REDACTED] is a [REDACTED]

millidarcys (mD), making it a suitable reservoir for the storage of CO₂. *Section 1 – Site Characterization* of this permit application will detail the geology and reservoir characterization of this project.

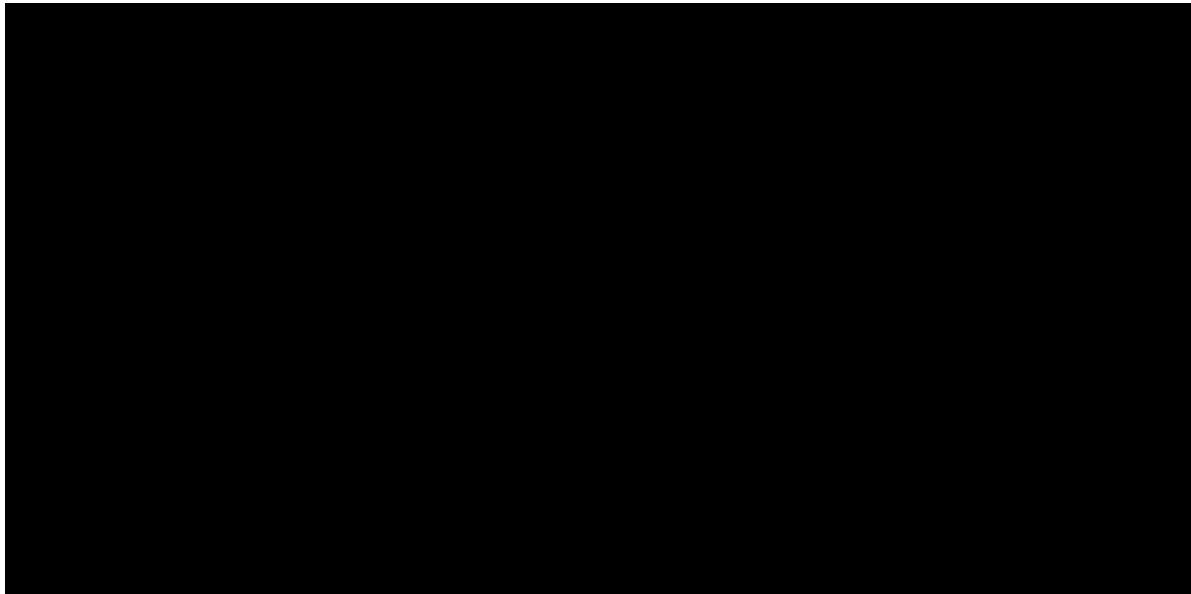


Figure 0-3 – Permian Basin West-East Cross Section⁵

By injecting 2 MMT/yr of CO₂, [REDACTED] is supporting the world's carbon reduction efforts by removing the equivalent of 60,331 gasoline-powered passenger vehicles each year.⁶

Project Key Attributes

- The Orchard Project consists of seven wells with a goal of more than 2 MMT/yr of CO₂ injection for the overall project.
- The wells will be located near various CO₂ and natural gas pipelines, many of which transport CO₂ in a supercritical (or dense phase) state.
- The well locations have been placed outside the existing pivot irrigation to minimize the impact on the agricultural business in the area.
- [REDACTED]

⁵ <https://www.enverus.com/permian-basin/central-basin>

⁶ <https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator>

- [REDACTED]
- No major shallow faults, which may cause CO₂ to breach containment and contaminate Underground Sources of Drinking Water (USDWs), were observed.
- No artificial penetrations, which could cause CO₂ to breach containment and contaminate USDWs, were identified in the CO₂ plume area of review (AOR) of the Orchard Project.
- No Environmental Protection Agency (EPA)-identified environmental justice communities exist within the Orchard Project area.
- No adverse disproportionate effects on populations in environmental justice areas will arise from the construction, operation, and maintenance of the Orchard Project.

Pore Space Agreement Discussion

The Orchard Project CO₂ plume AORs [REDACTED]

[REDACTED] A map and list of the landowners associated with the AORs are provided in Appendices A-3 and A-4.

Proposed CO₂ Sequestration System Discussion

The Orchard Project will be accessing supercritical CO₂ from [REDACTED]

[REDACTED] Flowline distribution infrastructure to the wells will be installed, and it is currently anticipated that no compression or treating equipment will be required, resulting in a small surface impact.

Injectate Information

All seven of the Orchard Project sequestration wells are designed to inject for [REDACTED] years, with a perforated interval in the [REDACTED] formation, ranging from [REDACTED] ft in thickness, acting as the injection and storage reservoir.

The injectate stream, from an existing [REDACTED] [REDACTED] The injectate will consist of a minimum of [REDACTED] and comprise the following:

Table 0-1 – Injectate Major Components

Component	Value
CO ₂	
Water	
Temperature	
H ₂ S	
Nitrogen	
Sulphur	
Oxygen	
Hydrocarbons	
Glycol	
Carbon Monoxide	
NO _x	
SO _x	
Particulates	
Amines	
Hydrogen	
Mercury	
Ammonia	
Argon	
Liquids	
Lube Oil	

Surface Facility Details

Minimal surface equipment will be required

as shown in Figure 0-4.

Site Suitability

The chosen surface location was selected largely to avoid disturbing the existing agricultural operations in the project area. Figure 0-4 shows the planned surface sites for the seven Orchard injection wells and the associated irrigation patterns.

Higher resolution versions of the following maps are in *Appendix A*:

- Appendix A-1 Project Overview Map
- Appendix A-2 Aerial AOR Map
- Appendix A-3 Pore Space Owner – Landowner Maps
- Appendix A-4 Pore Space Owner – Landowner Lists

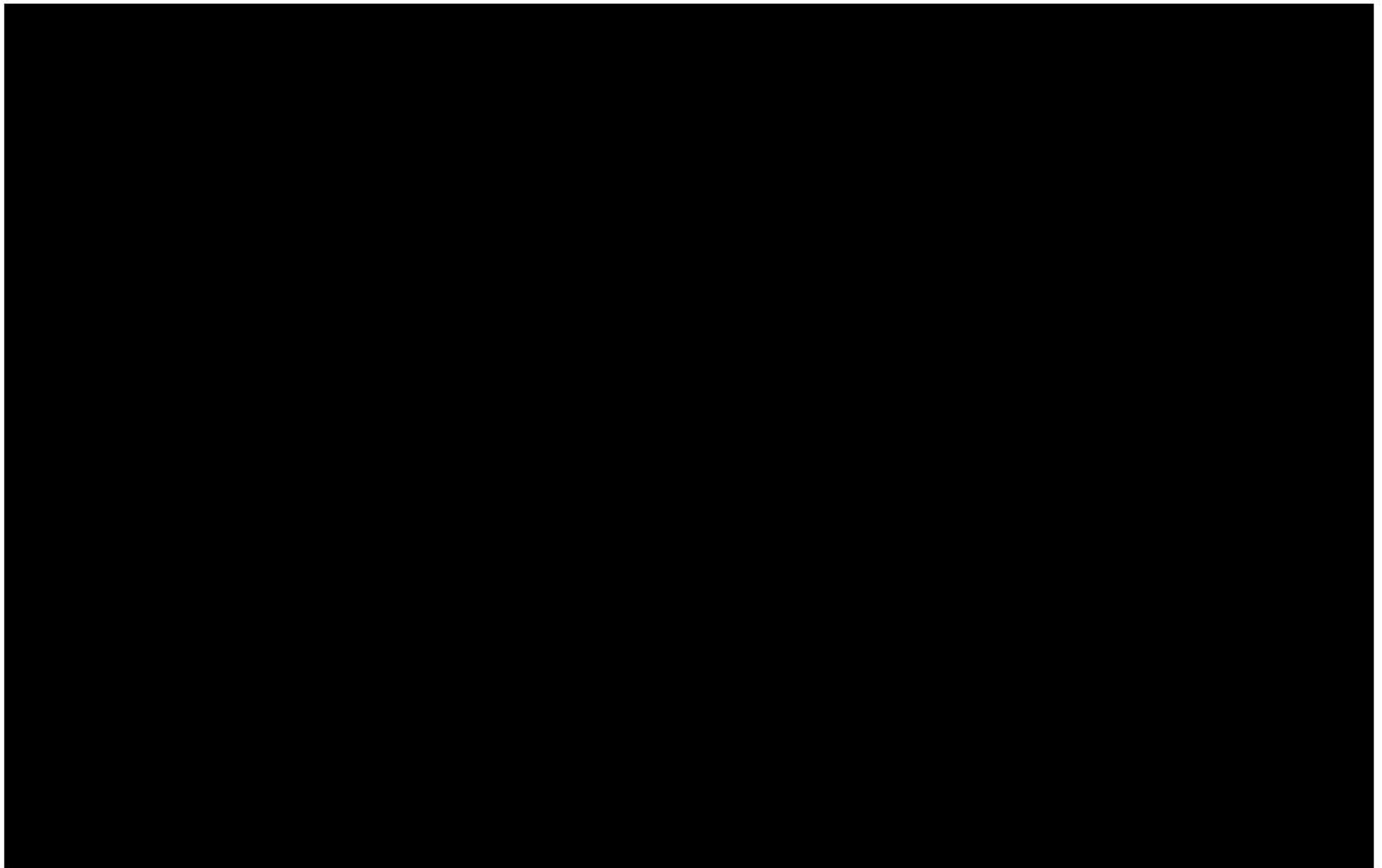


Figure 0-4 – Aerial Map of Orchard Project

In compliance with regulations, an evaluation of the proposed site ("Site Suitability") was conducted by assessing factors such as:

- Location of the proposed project site
- Consideration of the project area relative to federal sites/buildings/facilities, etc.
- Endangered species research
- Flood zone
- Existing infrastructure, surface, and subsurface mines or quarries
- Faults or fractures in the project area based on seismic analysis or geophysical well log characterization
- State or federal subsurface cleanup sites within the project area
- Environmental justice issues
- Artificial penetrations in the project area
- Drinking water in the project area
- Any other site-related issues

The results of this site assessment make up the content of this permit application.

Summary

Orchard No. 1 through No. 7 are the seven planned injection wells in the Orchard Project area. Individual wells are designed to accommodate injection rates ranging from approximately [REDACTED] years.

This permit application includes a detailed assessment of the overall geologic environment (*Section 1 – Site Characterization*) and the resulting plume model and results (*Section 2 – Plume Model*) used to determine the arial extent of the plumes and the resulting AOR. As detailed in *Section 3 – Area of Review and Corrective Action Plan*, the AOR for the proposed Orchard Project has eight existing artificial penetrations that will require corrective action. These wells are only found in the pressure front AOR for the project and are not in any of the CO₂ plumes. Well design and construction plans that take into consideration the needs of the project, the modeling results, and the requirements to ensure the protection of the USDWs are detailed in *Section 4 – Engineering Design and Operating Strategy*.

To ensure that the CO₂ plumes are being monitored over the life of the project, a detailed Testing and Monitoring Plan has been assembled in *Section 5 – Testing and Monitoring Plan*. The plan consists of (1) two above-confining-zone monitoring wells, (2) an in-zone [REDACTED] monitoring well, (3) USDW monitoring wells, (4) soil-gas monitoring stations, and (5) the use of fiber optics in conjunction with vertical seismic profile (VSP) technology to monitor the growth of the CO₂ plume over the life of the project.

The proposed Orchard Project addresses all the requirements for Class VI sequestration wells. These wells are ideally located to sequester significant amounts of CO₂ with minimal impact to the surface and surrounding communities.

Required Administrative Information

General Application Information

Location details for Orchard No. 1 through No. 7 are provided in Table 0-2.

Table 0-2 – Injection Well Location Details

Well Name	County	Location	Latitude (NAD83)	Longitude (NAD83)
Orchard No. 1	Gaines			
Orchard No. 2	Gaines			
Orchard No. 3	Gaines			
Orchard No. 4	Gaines			
Orchard No. 5	Gaines			
Orchard No. 6	Gaines			
Orchard No. 7	Gaines			

Applicant:

Facility contacts

Ownership Status

Limited Liability Company

Entity Status

Private

Standard Industrial Classification (SIC) Codes:

- 4925 – Mixed, Manufactured, or Liquified Petroleum Gas Production and/or Distribution
- 4953 – Refuse Systems (nonhazardous waste disposal sites)

This facility is not located on federal or tribal lands.

Additional Permits

Table 0-3 – Additional Required Permits

Agency	Permit & Authorization	Anticipated Filing Date	Anticipated Receipt Date	Status
Texas Railroad Commission	Drilling Permit	TBD	TBD	To be filed
EPA	Class VI Injection Well Permit – 40 CFR 146			