CLASS VI PERMIT APPLICATION NARRATIVE
40 CFR 146.82(a)

RIVER PARISH SEQUESTRATION PROJECT – RPN 2

May 2023

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FIGURES

[redacted]

[redacted]

[redacted]

[redacted]

APPENDICES

[redacted]

ACRONYMS AND ABBREVIATIONS

3D	three-dimensional
AoR	Area of Review
BHP	bottomhole injection pressure
BRI	brittleness index
CCS	carbon capture and storage
CO_2	carbon dioxide
DOE	Department of Energy
EJ	Environmental Justice
EPA	Environmental Protection Agency
FSP	Fault Slip Potential
gm/cm^3	gram(s) per cubic centimeter
kg	kilogram(s)
lb/ft^3	pound(s) per cubic foot
LDNR	Louisiana Department of Natural Resources
LLNL	Lawrence Livermore National Laboratory
LSU	Louisiana State University
Marg. 'A'	Marginulina ascensionesis
mg/L	milligrams per liter
MMtpa	million metric tons per annum
MMt	million metric tons
NGVD 29	National Geodetic Vertical Datum of 1929
OD	outer diameter
PBR	polished bore receptacle
PISC	Post-Injection Site Care
psi	pound(s) per square inch
psig	pound(s) per square inch gauge
QC	quality control
RPCC	River Parishes Community College
RPS	River Parish Sequestration, LLC
SONRIS	Strategic Online Natural Resource Information System

SP	spontaneous potential
TDS	total dissolved solids
TVDSS	true vertical depth sub sea
TVD	true vertical depth
UIC	Underground Injection Control
UCS	unconfined compressive strength
USDW	underground source(s) of drinking water
USGS	United States Geological Survey
Vshl	shale volume

1. PROJECT BACKGROUND AND CONTACT INFORMATION

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)]***

1.1. Project Background

This application is for an Underground Injection Control (UIC) Class VI Authorization to Construct for carbon dioxide (CO_2) injection well RPN-2-INJ, [redacted] in the River Parish Sequestration Project (RPS Project). The RPS Project includes aboveground facilities and CO_2 transportation infrastructure outside of the purview of the program. The application also includes the following attachments with additional detail, which are based on templates provided by the U.S. Environmental Protection Agency (EPA):

Attachment A	Summary of Requirements
Attachment B	Area of Review and Corrective Action Plan
Attachment C	Financial Responsibility Demonstration
Attachment D	Construction Details
Attachment E	Pre-Operational Well Testing Plan
Attachment F	Testing and Monitoring Plan (includes the Quality Assurance and Surveillance Plan)
Attachment G	Injection Well Plugging Plan
Attachment H	Post-Injection Site Care (PISC) and Site Closure Plan (includes Alternative PISC Demonstration)
Attachment I	Emergency and Remedial Response Plan

1.2. Project Description and Location

The RPS Project includes [redacted] Class VI injection wells, each capable of injecting [redacted] metric tons per annum (MMtpa) of CO_2 for a total annual CO_2 injection capability of [redacted]. When fully constructed, the RPS Project would be capable of storing [redacted] metric tons (MMt) of CO_2 over [redacted] using [redacted] Class VI wells.

The RPS Project is located on the west side of the Mississippi River near Donaldsonville, Louisiana, spread over approximately [redacted] of land (RPS Storage Site). The RPS Project [redacted]s:

- [redacted]
- [redacted]

The RPS Project's major project components are depicted on **Figure 1.2-1**. This permit application is specific to RPN-2-INJ, [redacted] The Area of Review (AoR) of this permit application is specific to RPN-2-INJ (**Figure 1.2-2**).

1.3. Sources of CO_2

RPS is developing a CO_2 storage hub in the Louisiana Chemical Corridor between Baton Rouge and New Orleans in Ascension, Assumption, and Iberville Parishes (RPS North Fairway). Currently, there are 15 MMtpa of CO_2 emissions within [redacted] of the RPS Storage Site and 60 MMtpa within [redacted] of the RPS Storage Sites from over 50 industrial emitters seeking to decarbonize their emissions. This industrial corridor is one of the most concentrated clusters of existing industrial emissions (CO_2 per square mile) in America. [redacted]

[redacted]

[redacted]

[redacted]

1.4. Project Goals

The goals of the RPS Project are to (1) provide industrial emitters with a timely, reliable, cost-competitive, and scalable CO2 transportation and storage service; (2) minimize negative impacts to communities and environmental resources; and (3) generate positive impacts for communities in the project area. The RPS Project is ideally situated to achieve these objectives given the RPS Project's location, large-scale storage capacity, and proximity to existing CO2 sources to minimize new-build CO2 pipeline infrastructure.

The RPS Project will contribute significantly to the federal government's goal of a 50% to 52% reduction in greenhouse gas emissions from 2005 levels by 2030. The RPS Project can provide the avoidance of [redacted] MMtpa of CO2 emissions and [redacted] of aggregate CO2 storage, which also represent [redacted] and [redacted] of the Department of Energy's (DOE's) programmatic goals of 65 MMtpa of CO_2 injection capacity and 2,000 MMt of CO_2 storage capacity by 2030, respectively. Furthermore, the RPS Project will significantly contribute to Louisiana's ambitious goals of tiered CO_2 reductions (i.e., 26-28% of 2005 levels by 2025, 40-50% of 2005 levels by 2030, and net zero by 2050).

1.5. Partners/Collaborators

[redacted]

[redacted]

[redacted]

- [redacted]
- [redacted]

[redacted]

[redacted] [redacted]

[redacted] [redacted]

[redacted]

[redacted]

1.6. Project Timeframe

RPS plans to begin construction on the first injection well in [redacted] after receipt of a Class VI Authorization to Construct from EPA/Louisiana Department of Natural Resources (LDNR). Construction on a pipeline to [redacted] would also occur in [redacted] and would support the commencement of CO_2 injection into RPN-2-INJ in [redacted] **Figure 1.5-1** depicts the RPS Project schedule.

Figure 1.5-2 shows the expected annual storage build-up for the RPS Project.

1.7. Proposed Injection Mass/Volume and CO_2 Sources

The RPS Project in total proposes to inject [redacted] million MMtpa (approximately [redacted]n standard cubic feet per day) across all seven injection wells, and [redacted]t). RPN-2-INJ, the injection well that is the subject of this application, will be constructed to inject [redacted] MMtpa ([redacted]) for

[redacted]

As stated in Section 1.2, the specific sources of CO_2 are not known or contracted at this time.

1.8. Waiver/Exemption

RPS is not requesting an injection depth waiver or aquifer exemption.

1.9. State Contact

The RPS Project is located in the State of Louisiana. The Louisiana UIC program is led by:

Stephen Lee, PG, Esq.
Division Director
Injection & Mining Division
Louisiana Department of Natural Resources
617 North Third Street, 8th Floor
Baton Rouge, Louisiana 70802
(225) 342-5569

Monique M. Edwards
Commissioner
Office of Conservation
Louisiana Department of Natural Resources
617 North Third Street, 8th Floor
Baton Rouge, Louisiana 70802
(225) 342-5500

There are no state parks, state wildlife management areas, or other state conservation lands within the RPS North Fairway. There are no tribal or territory lands located in the RPS North Fairway.

[redacted]

2. SITE CHARACTERIZATION

The following sections provide documentation to fulfill the site characterization requirements of 40 CFR 146.82(a)(2), (3), (5), and (6).

2.1. Regional Geology, Hydrogeology, and Local Structural Geology [40 CFR 146.82(a)(3)(vi)]

[redacted]

2.1.1. Regional Geology

[redacted]

[redacted]

[redacted]

2.1.2. Geologic History

The Miocene Epoch was a period of global cooling that coincided with the initiation of permanent glaciation in Antarctica.[4] The global cooling resulted in more than 50 miles of shoreline

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[redacted]

advancement during the Miocene in South Louisiana (**Figure 2.1-2**). During the Early Miocene, the RPS North Fairway was located in an offshore, deltaic environment, and, by the Early Pliocene, the RPS North Fairway was located in a terrestrial depositional environment.

Global temperature fluctuations during this time, associated with Milankovitch Cycles as well as other environmental mechanisms, led to cyclical sediment sequences of sand capped by clays deposited during flooding events.[5] The flooding surfaces capping these depositional sequences are regionally extensive and serve as internal barriers to vertical flow (**Figure 2.1-3**). During the same period, rapid sedimentation and loading of the regionally extensive Jurassic Louann Salt also led to the emergence of the South Louisiana Salt Basin.[6]

The Lower Pliocene transgression was followed by a shift in sediment flux further to the west on the central Mississippi depositional axis, resulting in more condensed, fine-grained deposition in the RPS North Fairway.

The RPS North Fairway is situated in the South Louisiana Salt Basin on the northern edge of the Gulf of Mexico basin, as depicted by the northwestern Gulf of Mexico tectonic map (**Figure 2.1-4**). The Gulf of Mexico basin formed as part of Early-through-Middle Jurassic rifting during the breakup of the supercontinent Pangea and opening of the Gulf of Mexico.[7] Crustal extension initiated along pre-existing sutures of accreted terrain from the Ouachita orogeny.

During the Callovian (Middle Jurassic), the crust attenuated sufficiently to subside and form a shallow sea. Climatic conditions and shallow, restricted sea water at this time resulted in evaporitic deposition of the Louann Salt. As extension continued, the basin rapidly deepened and clastic sedimentation ensued. This early evaporitic deposition set up the structural framework that would influence the Miocene deposition.

2.1.3. Structural Geology

The dominant faulting style in South Louisiana is eastward striking, southern dipping, normal faults (**Figure 2.1-5**). These faults initiated and propagated because of crustal subsidence and movement of the underlying Jurassic Louann Salt due to differential sediment loading. Maximum fault and salt movement was interpreted to initiate during the Marg. 'A' time in the Lower Miocene, as evidenced locally by the thicker Lower Miocene section northeast of the Napoleonville Dome (**Figure 2.1-6**).

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[5] Fillon and Lawless, "Lower Miocene-Early Pliocene," 2000.
[6] Worrall, D. M., and Snelson, S., "Evolution of the northern Gulf of Mexico, with emphasis on Cenozoic growth faulting and the role of salt," in Bally, A. W., and Palmer, A. R., eds., *The Geology of North America- An overview: Boulder, Colorado,* volume A (1989): Geological Society of America.
[7] Pindell, J. and Dewey, J.F., "Permo-Triassic reconstruction of western Pangea and the evolution of the Gulf of Mexico/Caribbean region," *Tectonics* vol. 1, no. 2 (1982): 179–211. DOI: 10.1029/TC001i002p00179.

Antithetic, down-to-the-north normal faults often dip into these main growth faults. Over time, the Louann Salt has migrated up into numerous salt diapirs, often migrating along regional faults, and in some cases migrating nearly to surface.

The formation of these diapirs has resulted in tensional and compressional faulting in radial patterns above the domes and normal faulting in various directions off the flanks of the domes. Syndepositional movement of both the regional faults and the salt diapirs has resulted in thickened sediment packages updip of the salt diapirs and downdip of the growth faults.

[redacted]

[redacted]

2.1.4. Regional Hydrogeology

The RPS Project is located in the southeastern Louisiana hydrogeologic system and collocated with two primary groundwater aquifers: The Mississippi River Alluvial Aquifer and the Chicot Equivalent Aquifer System. The areal extent of the Mississippi River Alluvial Aquifer and Chicot Equivalent Aquifer System is shown in **Figure 2.1-8**. The principal Chicot equivalent units include the Gramercy, Norco, Gonzalez-New Orleans, and "1200-Foot Sand" aquifers. Groundwater occurs throughout the multiple interbedded and interconnected alluvial and terrace deposits ranging in age from Holocene to Lower Pleistocene and Upper Pliocene. Deposits generally contain coarser material at the base and fine upward from pea- and cobble-sized gravel to very fine sand and silt with interbedded clay units. The Grammercy aquifer, where present, overlies the Norco aquifer, which overlies the Gonzalez-New Orleans aquifer separated by a clay bed nearly 200 feet thick. The dip and general flow direction of the Chicot equivalent packages is to the south-southwest and the equivalent sands outcrop to the northeast near the northern edge of Livingston

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[redacted]

and St. Tammany Parishes.[10] The AoR is located along the southeastern portion of the Mississippi River Alluvial Aquifer and the southwestern portion of the Chicot Equivalent Aquifer System.

Detailed descriptions of the principal aquifers in the AoR are included in Section 2.7.2 and 2.7.3, respectively.

2.2. Maps and Cross Sections of the AoR [40 CFR 146.82(a)(2), 146.82(a)(3)(i)]

The following sub-sections introduce maps, cross sections, and other key figures and tables relevant to the RPS Project, as described in by 40 CFR 146.82(a)(2) and (3)(i).

2.2.1. RPS Storage Site Map

[redacted]

2.2.2. Sources of Subsurface Data and Methodology

Subsurface structure mapping using seismic data and log data from existing wells and oil field papers [redacted]

- [redacted]
- [redacted]

[redacted]

- [redacted]

2.2.2.1. Reflection Seismic Data

[redacted]

[redacted]

2.2.2.2. Subsurface Interpretation Methods

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

2.2.3. RPS Regional Structural Maps

[redacted]

[redacted]

[redacted]

[redacted]

2.2.4. RPS Regional Thickness Maps

[redacted]

2.2.5. Spatial Relationships

The sub-sections below describe the spatial relationships between the proposed project site and regional geologic structures and USDWs.

2.2.5.1. Proximity to Structures

[redacted]

[redacted]

[redacted]

[redacted] e [redacted]

2.2.5.2. Proximity to USDWs

To establish the base of the lowermost USDW for dynamic reservoir simulation and monitoring plan development, RPS used Raster log data and USDW depths reported on LDNR SONRIS to map the lowermost USDW in the RPS Storage Site. [redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

2.2.6. Lateral Continuity of Formations

The sub-sections below document the lateral extent of the proposed injection and confining formations in the vicinity of the RPS Storage Site.

2.2.6.1. Injection zones

[redacted]

[redacted]

[redacted]

2.2.6.2. Confining zones

[redacted]

2.3. Faults and Fractures [40 CFR 146.82(a)(3)(ii)]

2.3.1. Regional Faulting

Regional fault systems identified in Louisiana occur in two broad groups in the northwestern and southern parts of the state, as depicted in **Figure 2.1-5**.[24] The faults in the southern part of the state, from the Tepetate-Baton Rouge Fault Zone to the Gulf of Mexico, are characterized as growth faults—normal faults that are active during sedimentary deposition, which are distinguished by differential thickening of sediments on the downthrown block and increasing displacement with depth. Recent research using LiDAR and other methods has identified fault-line scarps associated with many of these faults, indicating that they intersect the ground surface and are active within the late Quaternary.[25] Recency and magnitude of displacement appear to increase to the south, and significant twentieth century subsidence and land loss in coastal Louisiana has been attributed to movement along the southernmost fault systems.[26] Although many of the regional faults in Southern Louisiana may be considered to be active (to have slipped within the Holocene epoch, or the last 11,700 years), most of their recent motion appears to be accommodated by aseismic creep, as earthquakes in Louisiana are infrequent and of relatively low magnitude.[27]

[redacted]

[redacted]

[redacted]

2.3.2. AoR Investigation

[redacted]

[redacted]

2.3.3. Regional Implications on Fluid Flow

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

2.3.4. Addressing Uncertainties

[redacted]

[redacted]

[redacted]

2.3.4.1. Fault Stability Assessment

[redacted]

[redacted]

2.4. Injection and Confining Zone Details [40 CFR 146.82(a)(3)(iii)]

2.4.1. Depth, Aerial Extent, and Thickness

[redacted]

[redacted]

[redacted]

[redacted]

2.4.1.1. Injection Zone

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

2.4.2. Porosity, Permeability, and Capillary Pressure

2.4.2.1. Petrophysical Methods

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

2.4.2.2. Injection Zone Porosity and Permeability

[redacted]

[redacted]

[redacted]

2.4.2.3. Confining Zone Porosity and Permeability

[redacted]

[redacted]

[redacted]

[redacted]

2.4.2.4. Capillary Pressure

[redacted]

[redacted]

2.4.2.5. Net to Gross

[redacted]

2.4.3. Mineralogy and Petrology

[redacted]

[34] Bachu,"Drainage and imbibition," 2013.

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

2.4.4. Storage Capacity, Injectivity, and Integrity

[redacted]

[redacted]

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[38] Goodman, A. et al. "U.S. DOE methodology for the development of geologic storage potential for carbon dioxide at the national and regional scale," *International Journal of Greenhouse Gas Control*, vol. 5 (2011): 952–965

[redacted]

2.4.5. Additional Data Collection

[redacted] ntal capture spectroscopy tool to achieve a refined understanding of the elemental distribution.

[redacted]

2.5. Geomechanical and Petrophysical Information [40 CFR 146.82(a)(3)(iv)]

2.5.1. Geomechanical and Petrophysical Characteristics of the Confining Zone

[redacted]

2.5.2. Average Rock Strength

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

2.5.3. Average Ductility

[redacted]

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39 Ingram and Urai, "Top-seal leakage," 1999.
40 Zoback, M.D., *Reservoir Geomechanics* (New York, Cambridge University Press, 2007).

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

2.5.4. Fractures

[redacted]

[41] Ingram and Urai, "Top-seal leakage," 1999.
[42] Ingram and Urai, "Top-seal leakage," 1999.
[43] Dobson, P. and Houseworth, J., *Inventory of shale formations in the US including geologic, hydrologic, and mechanical characteristics*, 2013, Fuel Cycle Research & Development, FCRD-UFD-2014-000513 LBNL-6633E.
[44] Dobson and Houseworth, "*Inventory of shale formations,*" 2013.

[redacted]

2.5.5. In-situ Stress Field

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

2.5.6. Average Pore Pressure

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

2.5.7. Addressing Geomechanical Uncertainties

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

2.6. Seismic History [40 CFR 146.82(a)(3)(v)]

2.6.1. Historical Seismicity Review

RPS reviewed the United States Geologic Survey (USGS) earthquake catalogue and South Louisiana seismicity literature to collect information on historic seismicity for the RPS North

[53] Bray and Hanor, "Spatial variations," 1990.

Fairway. The USGS catalogue was queried for all earthquakes magnitude 0 and greater within the [redacted] The seismicity review concluded that the RPS North Fairway exhibits a low level of seismic activity, with 11 seismic events (**Table 2.6-1**) of record between 1843 and 2023. [redacted]

2.6.2. Seismic Sources

Although there are numerous regional faults in Southern Louisiana (**Figure 2.1-5**), many of which are potentially active,[55] slip on these faults is accommodated by aseismic creep and they are not known seismic sources.[56] None of the 11 historic earthquake events described in Section 2.6.1 have been definitively attributed to any of the mapped regional fault systems.[57] In addition, none of the mapped regional faults in Louisiana are included in the USGS Quaternary Fault and Fold Database – a national database of faults with demonstrated geologic evidence of seismic deformation occurring in the last 1.6 million years. [redacted]

[redacted]

2.6.3. Seismic Risk

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

2.6.4. Seismicity Mitigation

[redacted]

2.7. Hydrologic and Hydrogeologic Information [40 CFR 146.82(a)(3)(vi), 146.82(a)(5)]

2.7.1. Regional Hydrogeology

[redacted] The United States Geologic Survey "Water Resource Assessments," performed for Ascension,[59] Assumption,[60] Iberville,[61] and St James Parishes,[62] provided regional characterization of the spatial distribution, thickness, and composition of the USDWs within each respective parish. [redacted]

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[59] Griffith, J.M., and Fendick, R.B., "Water resources of Ascension Parish, Louisiana," U.S. Geological Survey Fact Sheet 2009-3063 (2009): 4 p. (Revised September 2011).
[60] Prakken, L.B., and Lovelace, J.K., "Water resources of Assumption Parish, Louisiana," U.S. Geological Survey Fact Sheet 2013–3061 (2013): 6 p., https://pubs.usgs.gov/fs/2013/3061/.
[61] Lindaman, M.A., and White, V.E., "Water resources of Iberville Parish, Louisiana," U.S. Geological Survey Fact Sheet 2021–3014 (2021), 6 p., https://doi.org/10.3133/fs20213014.
[62] White, V.E., and Prakken, L.B., "Water resources of St. James Parish, Louisiana," U.S. Geological Survey Fact Sheet 2015–3038 (2015), 6 p., https://dx.doi.org/10.3133/fs20153038.

[redacted]

2.7.2. Mississippi River Alluvial Aquifer

[redacted]

According to Prakken and Lovelace, the aquifer deposits range in depth from near surface level to 300 feet below National Geodetic Vertical Datum of 1929 (NGVD 29) within northern Assumption Parish. The aquifer fines upward from course sand and gravel at the base to fine and medium grade sand near the top. [redacted]

According to Griffith and Fendick, water levels within the aquifer are roughly 12 feet above NGVD 29 but can fluctuate 10-15 feet seasonally. Reported yield from wells range from 10 to over 2,800 gallons per minute across Ascension,[63] Assumption,[64] Iberville,[65] and St James Parishes.[66]

[redacted]

[redacted]

2.7.3. Chicot Equivalent Aquifer System

In the Southeastern Louisiana hydrogeologic system, the aquifers equivalent to the Chicot aquifer system of southwestern Louisiana have been given individual aquifer names.[69] The aquifers which comprise the Chicot Equivalent Aquifer System are described below.

2.7.3.1. Gramercy Aquifer

The Pleistocene Gramercy aquifer is located primarily in St. James Parish, with the freshwater limits confined to the northeastern half of the parish.[70] According to Dial and Kilburn, the aquifer fines upward from a gravel and coarse sand in the lower and middle sections to fine sand at the top. The aquifer is thin or nonexistent in the northwestern areas of St. James Parish, as well as adjacent portions of Ascension, northeastern Assumption, and southern Iberville Parishes, potentially due to truncation by Mississippi River alluvium, according to the cited U.S. Geological Survey "Water Resource Assessments" by Griffith and Fendick, Prakken and Lovelace, and White and Prakken. The Gramercy formation is not interpreted to exist within the AoR.

2.7.3.2. Norco Aquifer

The Pleistocene Norco aquifer is the shallowest Chicot Equivalent aquifer of the Assumption Parish region and is only salt water within the parish.[63]

Tomaszewski[71] describes the aquifer as containing fine to coarse sand and perhaps fine gravel. In northern Assumption Parish, the Norco contains only saltwater and is confined from the overlying Mississippi River Alluvial Aquifer by a 10-50-foot thick clay bed.[7264] [redacted]

2.7.3.3. Gonzalez-New Orleans Aquifer

The Gonzalez-New Orleans Aquifer (Holocene-Upper Pleistocene) extends from approximately 400 to 600 feet below NGVD 29 across Assumption Parish and ranges from 150 to 300 feet thick. Griffith and Fendick report that aquifer deposits consist of very fine to medium-grained sand. [redacted]

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[69] Stuart et al., Guide to Louisiana's Ground-water Resources, 1994.
[70] Dial, D.C., and Kilburn, Chabot, *Ground-water resources of the Gramercy area, Louisiana*, Louisiana Department of Transportation and Development, Office of Public Works Water Resources Technical Report no. 24 (1980), 39 p.
[71] Tomaszewski, Ground-Water Resources, 2003.
[72] Prakken and Lovelace, "Water resources of Assumption," 2021.

2.7.3.4. 1200-foot Sand Aquifer

The Pleistocene 1200-foot sand aquifer is described as fine to medium sand by Tomaszewski. The aquifer is interpreted by Tomascewski and Stuart et al.[73] as completely saline and is not targeted for water usage within Assumption Parish. However, following the resistivity criteria discussed in Section 2.2.5.2, the 1200-foot sand is classified as an USDW in the project area. Within the AoR, the top of the 1,200-foot sand ranges from approximately 800 to 840 feet TVDSS (**Figure 2.7-8**).

2.7.3.5. Recharge and Flow

Primary recharge of the Chicot Equivalent Aquifer System occurs in the northern part of the aquifer system along the Louisiana-Mississippi State line (**Figure 2.7-9**). Primary recharge of the aquifer system functions as rainfall, leakage from surficial sands, or leakage from underlying aquifers.[74, 75]

[redacted]

2.7.4. Surface Water Bodies

[redacted]

[redacted]

2.7.5. Water Chemistry

[redacted]

[redacted]

---

[73] Stuart et al., Guide to Louisiana's Ground-water Resources, 1994.
[74] Stuart et al., Guide to Louisiana's Ground-water Resources, 1994.
[75] Tomaszewski, "Water-level surface," 2011.
[redacted]

[redacted]

2.7.6. Additional Hydrologic Data Collection

[redacted]

2.8. Geochemistry [40 CFR 146.82(a)(6)]

2.8.1. Baseline Geochemistry

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

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[redacted]

[redacted]

[redacted]

2.8.5. Additional sampling and analysis

[redacted]

[redacted]

2.9. Other Information (Including Surface Air and/or Soil Gas Data, if Applicable)

[redacted]

[redacted]

2.10. Site Suitability [40 CFR 146.83]

[redacted]

2.10.1. Distribution of Lithological Facies

[redacted]

[redacted]

[redacted]

2.10.2. Sealing Capacity and Integrity of the Confining Zone

[redacted]

[redacted]

[redacted]

[redacted]

2.10.3. Geochemical Reactions

When CO_2 injected into a storage reservoir reacts with water, carbonic acid is formed, which dissociates into bicarbonate and causes the concentration of hydrogen ions to increase, resulting

[redacted]

in a decrease in brine pH. When this occurs, additional chemical reactions may be induced in the well materials and subsurface formations, including the injection and confining zones.

[redacted]

[redacted]

[redacted]

[redacted]

2.10.4. Storage Capacity and Injectivity of the Injection Zone

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

2.10.5. Secondary Confinement

[redacted]

3. AREA OF REVIEW AND CORRECTIVE ACTION

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)]***

The Area of Review and Corrective Action Plan is provided in this permit application as **Attachment B**. The Computation Modeling Approach section describes in detail how the simulation model was set up in CMG-GEM to meet the 40 CFR 146.84(c) requirements. RPS followed the guidelines set by the EPA to delineate the AoR to meet the 40 CFR 146.82(a)(13) and 146.84(b). The AoR delineation is described in Computational Modeling Results and the AoR Delineation sections of the Area of Review Delineation and Corrective Action Plan. There are no wells within the AoR that penetrate the confining zone.

4. FINANCIAL RESPONSIBILITY

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]***

The Financial Responsibility Demonstration, uploaded to GSDT as **Attachment C**, describes how River Parish Sequestration, LLC (RPS), will meet the requirements for 40 Code of Federal Regulations (CFR) 146.85 and Louisiana Administrative Code (LAC) 43.XVII.3609. The financial assurance for Class VI projects consists of four components: Corrective Action, Injection Well Plugging and Abandonment (P&A), Post-Injection Site Care (PISC) and Site Closure, and Emergency and Remedial Response Plan (ERRP). The Financial Responsibility Demonstration discusses the methodology used to determine the costs for each of the four components, the financial responsibility instrument to be used, and the frequency with which the financial assurance will be reassessed.

5. INJECTION WELL CONSTRUCTION

RPS will construct a new injection well RPN-2-INJ, one [redacted] in the RPS Project and the subject of this application. [redacted] Additional construction specifications for the RPN-2-INJ and the RPN-2 monitoring wells can be found in **Attachment D**. Testing and monitoring details for these wells can be found in the Testing and Monitoring Plan (**Attachment F**).

5.1. Introduction

The design, construction, and operation of injection wells fall under the jurisdiction of EPA's UIC Program. The Class VI injection well was established by the federal requirements under the UIC Program for Carbon Dioxide Geologic Sequestration wells (75FR 77320, December 10, 2010) and codified in the U.S. Code of Federal Regulations (40 CFR 146.81 et seq.). Class VI injection wells are designed for the sole purpose of injection and storage of CO_2 safely targeted in injection zones and contained within those zones to ensure protection of USDWs.

The requirements for both the design and the safe operation of a CCS Class VI well are described in the following sections. Summarized details for Class VI injection wells are provided in the attached well construction document (**Attachment D**).

5.2. Engineering Design

The primary concern for the design of a Class VI well is to ensure the protection of the USDW from any CO_2 injectate contamination. [redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

- [redacted]
- [redacted]
- [redacted]
- [redacted]

5.3. Construction Procedures [40 CFR 146.82(a)(12)]

Summarized construction procedures for RPN-2-INJ are provided below to meet the requirements of 40 CFR 146.82(a)(12). Additional specifics for each component of the injection well are provided in Section 5.4 and **Attachment D**.

[redacted]

5.4. Discussion of Injection Well Design

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

- [redacted]
- [redacted]
- [redacted]

[redacted]

5.4.1. Drive Pipe

[redacted]

[redacted]

5.4.2. Surface Casing

[redacted]

[redacted]

5.4.3. Production Casing

[redacted]

- [redacted]
- [redacted]
- [redacted]
- [redacted]
- [redacted]
- [redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

5.4.4. Centralizers

[redacted]

- [redacted]
- [redacted]
- [redacted]
- [redacted]

[redacted]

- [redacted]
- [redacted]
- [redacted]

5.4.5. Injection Tubing

[redacted]

[redacted]

5.4.6. Top Liner Packer and PBR Discussion

[redacted]

[redacted]

5.4.7. Subsurface Safety Valve

[redacted]

5.5. <u>Testing and Logging During Drilling and Completion Operations</u>

5.5.1. Coring Plan

[redacted]

5.5.2. Logging Plan

[redacted]

5.5.3. Formation Fluid Testing

[redacted]

5.5.4. Step-Rate Injectivity Test

[redacted]

- [redacted]
- [redacted]

[redacted]

5.5.4.1. Regulatory Information

Injection wells in the State of Louisiana are regulated by LDNR. A Form UIC-WH1 will be submitted to the LDNR Injection and Mining Division at the conclusion of all tests, along with a report that includes an in depth analysis of the step-rate falloff tests.

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

[redacted]

6. PRE-OPERATIONAL LOGGING AND TESTING

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]***

The Pre-Operational Testing Plan has been submitted to the GSDT as **Attachment E**. The plan describes the schedule and the type of open-hole and cased-hole logs that RPS will take at the injection well and all the monitoring wells, to collect pre-injection data and ensure cement bond quality and casing integrity. Methods to ensure internal and external mechanical integrity of the wellbore are described. The plan meets the 40 CFR 146.82(a)(8) and 146.87 requirements.

7. WELL OPERATION

[redacted]

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

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

- [redacted]
- [redacted]
- [redacted]
- [redacted]
- [redacted]
- [redacted]
- [redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

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

[redacted]

[redacted]

[redacted]

[redacted]

ProMax is a process engineering simulation software used in the chemical, petrochemical, natural gas, and refinery industries. It has been used in the engineering field for several years and is one of the preferred modeling software programs of many that are in use today.

ProMax has a built-in library of chemicals, which includes all the chemical properties for each. The software also has several thermodynamic property packages that are specific for various types of chemicals. When a model is set up (or built), chemicals and the thermodynamic property are selected.

In the case of mixing gas streams to create a new composite gas stream, weighted averaging is done within the software taking all the chemicals and their properties under a set of conditions; (i.e., temperature/pressure/flowrate/concentrations) to be considered in each of the incoming streams.

The software takes into account the concentration of each chemical in each stream and creates a new composite or mixed stream with new concentrations and properties based on the mix of all the streams.

[redacted]

[redacted]

[redacted] [redacted]

[redacted] [redacted]

[redacted] [redacted]

[redacted] [redacted]

[redacted]

8. TESTING AND MONITORING

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]***

The Testing and Monitoring Plan and its Quality Assurance and Surveillance Appendix are uploaded to the GSDT system as **Attachment F**. RPS has followed EPA's guidance to satisfy minimum requirements for rules 40 CFR 146.82(a) and 40 CFR 146.90. [redacted]

9. INJECTION WELL PLUGGING

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)]***

The Injection Well Plugging Plan is submitted to the GSDT system as **Attachment G**. [redacted]

10. POST-INJECTION SITE CARE (PISC) AND SITE CLOSURE

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)]***

RPS has submitted its PISC and Site Closure Plan to satisfy the 40 CFR 146.82(a)(17) and 146.93(a) requirements. [redacted]

11. EMERGENCY AND REMEDIAL RESPONSE

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)]***

RPS has submitted the Emergency and Remedial Response Plan (ERR Plan) to satisfy the requirements of 40 CFR 146.82(a)(19) and 146.94(a). The Emergency and Remedial Response Plan describes actions that RPS will take to address movement of the injection fluid or formation fluid in a manner that may endanger an USDW during construction, operation, or post-injection site care periods, as well as the actions that RPS will take if evidence of a potential endangerment to an USDW is found. The ERR Plan is uploaded to the GSDT system as **Attachment I**.

12. INJECTION DEPTH WAIVER AND AQUIFER EXEMPTION EXPANSION

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)]***

No injection depth waiver is submitted for this permit application. [redacted]

13. OPTIONAL ADDITIONAL PROJECT INFORMATION [40 CFR 144.4]

Several federal and state laws and regulations apply to the injection well. Table 13-1 identifies the applicable permits and authorizations required for the Class VI injection well and the anticipated submittal and receipt timing for each.

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

14. OTHER INFORMATION

This section provides additional information to support the application.

14.1. Environmental Justice Assessment

EPA defines Environmental Justice (EJ) as "the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of laws, regulations, and policies." [redacted]

14.1.1. Analysis of Communities

[redacted]

Figure 14.1-1 shows the locations of the census tracts in relation to the North Fairway injection wells.

EJScreen

EPA has developed a publicly available tool, called "EJScreen" (www.ejscreen.epa.gov/mapper/), to provide users with a dataset and approach to understand and evaluate environmental and demographic indicators and whether there are environmental justice concerns in a given location. [redacted] presents demographic data for the census tracts.

EJScreen combines environmental and socioeconomic indicators to create EJ indexes that assist in understanding the potential EJ issues affecting a community. Percentiles are provided to compare each census tract to the State of Louisiana and the United States. [redacted]

[redacted]

CEJST

The EJScreen tool also provides data from the Climate and Economic Justice Screening Tool (CEJST) maintained by the Council on Environmental Quality. This tool evaluates census tracts across several burden categories by comparing census tract percentile rankings against burden thresholds and an associated socioeconomic threshold (e.g., low income or high school education attainment). The tool then categorizes census tracts as disadvantaged if they meet more than one burden threshold and the associated socioeconomic threshold. The burden categories include the following:

- Climate change
- Energy
- Health
- Housing
- Legacy pollution

- Transportation
- Water and wastewater
- Workforce development

Table 14.1-3 shows the CEJST burden categories, the percentile thresholds, and the percentile scores that exceed the threshold for each census tract. [redacted]

[redacted]

14.1.2. Project Benefits and Impacts

Development and operation of the RPS Project will have numerous socioeconomic and environmental benefits in the local communities. Some of these benefits will directly address the burdens and challenges identified in the analyses provided in the previous section such as the following:

- [redacted]
    - [redacted]
    - [redacted]
    - [redacted]
    - [redacted]
    - [redacted]
- [redacted]

- [redacted]

[redacted]

[redacted]

- [redacted]
- [redacted]
- [redacted]
- [redacted]

[redacted]

- [redacted]
- [redacted]
- [redacted]
- [redacted]

[redacted]

[redacted]

14.2. Recordkeeping

In accordance with the requirements of 40 CFR 146.91(f), RPS will retain all data collected for and in support of this Class VI permit application throughout the life of the Project and for 10 years following site closure or as otherwise requested by the UIC Program Director. Further recordkeeping requirements are detailed in the Testing and Monitoring Plan, AoR and Corrective Action Plan, and the Post-Injection Site Care and Site Closure Plan.