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Class VI Permit Application Narrative

SYD Denova 1

Carbon America

[40 CFR 146.82(a)]

Prepared by:
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Submitted to:
U.S. Environmental Protection Agency Region 8
Denver, Colorado

Revision	Date	Notes	Written By	Approved By
A	11/30/2023	Issued for Approval		R. Keeling

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1. Attachments

See the list of attachments in the front matter.

2. Figures

See the list of figures in the front matter.

3. Project Background and Contact Information

3.1 Introduction

[redacted] The addition of CCS to the Plants would create substantial benefits to public health and welfare and the environment by removing carbon dioxide (CO_2) from facility emissions that would otherwise be released to the atmosphere and contribute to increasing greenhouse gas emissions.

This Permit Application Narrative serves as the primary document for the Class VI permit application and contains the main project information, site characterization, and summary of attachments. Attachments to this narrative contain specific plans and project requirements, including details for construction, operation, project conclusion, emergency response, and financial assurance.

[redacted] has prepared and submitted this application for review by the U.S. Environmental Protection Agency (EPA) Region 8 for an Underground Injection Control (UIC) Class VI permit. This application has been prepared in accordance with Title 40, Part 146, of the Code of Federal Regulations (40 CFR 146), Subpart H, Criteria and Standards Applicable to Class VI Wells. An injection depth waiver is not being requested, nor is an aquifer exemption expansion.

3.2 Proposed Project

[redacted]

[redacted]

The Plants produce ethanol for use as a renewable fuel through the process of fermenting feedstock. In addition to ethanol, several other products are produced by the ethanol production process, including distiller's grains for livestock and poultry, corn oils, and corn syrups.

Figure 2 demonstrates the ethanol production process. Feedstock includes raw corn from surrounding agricultural areas in [redacted]. The dry corn is first milled and cooked before entering fermentation tanks, where the corn mash is fermented to produce the primary product, ethanol. During fermentation, associated gases, approximately [redacted] with lesser parts of oxygen (O_2), are liberated and travel through a series of on-site pipes, ultimately being released to the atmosphere.

Appendix 1 presents site plans for each capture facility in relation to each ethanol plant.

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[redacted]

[redacted]

[redacted]

[redacted]

- [redacted]
  - [redacted]

3.3 Owner/Operator Information

[redacted]

[redacted]

[redacted]

3.4 Facility Permitting Information

[redacted]

- [redacted]
- [redacted]

[redacted]

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In addition to the Class VI UIC permit, a list of relevant project permits, and their status is included in Table 1.

Resource Conservation and Recovery Act (RCRA), National Emission Standards for Hazardous Pollutants (NESHAPS), Prevention of Significant Deterioration (PSD) permits, CAA Nonattainment Program permits, and Ocean Dumping permits are not applicable to this project. This project is not located on lands currently under Bureau of Indian Lands Management.

Table 1. Facility Permitting Information

Permit	Related Activity	Granting Authority	Status (including received or expected date)	Renewal Frequency
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

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Permit	Related Activity	Granting Authority	Status (including received or expected date)	Renewal Frequency
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]		[redacted]		[redacted]
[redacted]		[redacted]		[redacted]
[redacted]		[redacted]		[redacted]
[redacted]		[redacted]		[redacted]
[redacted]		[redacted]		[redacted]
[redacted]		[redacted]		[redacted]
[redacted]		[redacted]		[redacted]
[redacted]		[redacted]		[redacted]
[redacted]		[redacted]		[redacted]
[redacted]		[redacted]		[redacted]
[redacted]		[redacted]		[redacted]
[redacted]		[redacted]		[redacted]
[redacted]		[redacted]		[redacted]
[redacted]		[redacted]		[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

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Permit	Related Activity	Granting Authority	Status (including received or expected date)	Renewal Frequency
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

3.5 Public Outreach

[redacted] is characterized by a history of agriculture, cattle ranching, and oil and gas industry. EPA's environmental justice (EJ) screening tool (EJ Screen), Department of Energy's (DOE) EJ tool (Energy Justice Mapping Tool - Disadvantaged Communities Reporter), and the Council on Environmental Quality's (CEQ) EJ tool (Climate and Economic Justice Screening Tool, CEJST) were used to assess nearby community characteristics, such as per capita income and national percentile wastewater discharge. EPA's EJ screening tool identified disadvantaged communities in the state counties immediately surrounding the project location, including [redacted]. However, DOE's EJ screening tool did not identify any disadvantaged communities in the counties surrounding the project location. Regardless, [redacted] considered social impacts of the [redacted] project when selecting the injection well location.

The location of [redacted] avoids surface use conflict and population impact. The well is located on a large contiguous landholding of the [redacted] The injection site is favorable due to ease of access to pore space rights, minimal population density, avoids material conflicts with existing rights (e.g., surface use or areas of active oil and gas production), and avoids sensitive areas and fractionation of wildlife habitat.

The [redacted] project will permanently remove [redacted], equivalent to taking 70,000 passenger vehicles off the road, and will enable the Plants to reduce the carbon intensity of ethanol production. This CCS project will increase the Plants competitiveness in the market, while improving local air quality.

[redacted] is committed to the project being a model of successful community relations for CCS projects and has an inclusive outreach strategy that educates stakeholders and provides mechanisms for community feedback.

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[redacted] Community Engagement Plan is a living document with active input from stakeholders to ensure implemented methods are appropriate and facilitate large-scale social acceptance. This two-way engagement strategy has allowed stakeholders to participate in decisions and shape actions that benefit their local community. Since initial stakeholder analysis and early engagement with key stakeholders in 2022, outreach has continued in the community with no formal opposition to the project.

As the project advances, [redacted] will identify appropriate project agreements (community benefit agreements, memorandums of understanding, and/or good neighbor agreements) for community partnerships. This process will lay the groundwork to incorporate consent-based siting principles into the engagement plan.

To date, [redacted] has met with several stakeholders in Washington and Yuma counties. Prior to drilling for a stratigraphic well in April 2023, [redacted] conducted several public outreach activities, including:

- Briefings to [redacted] and [redacted] County Commissioners.
- Hosting emergency responders from both counties at the drill site for safety planning.
- Hosting a Community Open House in [redacted] County.
- Multiple articles in local newspapers about the project.
- Promoting the open house and educational materials through the [redacted] Chamber of Commerce.
- Sending a Project Education Mailer to 3,000 households, majority of the local population.
- Project webpage launched with mechanism for community feedback.
- A project article in the Colorado Agriculture Magazine.

In fall 2023, [redacted] held several public outreach activities, including publishing a Project Update Report, holding a Community Open House, and running a Social Media campaign that included a documentary video on the [redacted] stratigraphic well drilling operations and data collection.

Landowners: [redacted] has facilitated productive discussions with the [redacted] to aid the agency in determining a preferred framework for exploration, surface access, and permanent pore space sequestration for CCS projects. In April 2023, [redacted] primary stakeholder at the Colorado DNR presented the CCS Policy to the [redacted] In June 2023, [redacted] assisted in public meetings to educate [redacted] lessees on the impact of CCS projects to the local community. [redacted] project team will engage with adjacent landowners in the region using principles of consent-based siting to identify preferences for inclusion or exclusion to finalize the development plan.

Environmental Groups: [redacted] met with the [redacted], the Nature Conservancy and Public Land Trust in May 2023 to introduce surface impacts of a CO2 injection program. [redacted] has also met with Colorado chapters of the Sierra Club and Mothers Out Front, a mother-driven environmental justice organization. In March 2023, [redacted] assisted Colorado Parks and Wildlife (CPW) in conducting a drone field survey of prairie chicken habitat prior to drilling the [redacted] stratigraphic well.

Business and Policy: [redacted] engagement with the [redacted] Chamber of Commerce and the [redacted] County Economic Development Corporation has helped form strategic partnerships with several local business and civic leaders. [redacted] has started early discussions on how the CCS project can support local economic development goals and create a positive impact to local businesses.

Education and Workforce Development: [redacted] goal is to establish a strong mutually beneficial relationship with the community through two-way feedback and consent-based siting principles. [redacted] envisions including job opportunities and training commitments in both construction and operation phases of the project, as well as programs to advance science, technology, engineering, and math (STEM) education and diversity. Members of the project team have held early discussions with educators to help guide this work and ensure broad local engagement.

[redacted] anticipates significant overlap in skill needs between the region's existing fossil fuel industry and the emerging CCS industry. The translation of skill sets will be highlighted in the project team's recruiting efforts both in local communities and through college and trade school recruiting. There is a tremendous

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wealth of knowledge for field operations and technical subsurface analysis in Colorado that can be redeployed for CCS projects.

The [redacted] project will require short-term job needs in construction and engineering. It will require skills that the existing local and regional labor force possesses. A full-scope CCS project will require skilled electricians, welders, millwrights, and other specialty trades that are well-represented in the area. Permanent jobs in these fields can also be filled by individuals already employed in related roles, who will receive pre-employment or on-the-job training in skills particular to the CCS industry. [redacted] is in early discussions with the Vice President of Academic Affairs at [redacted] on aligning federal grant opportunities around workforce training with specific CCS jobs for the [redacted] project.

3.6 Report Organization

The following Section of this Permit Application Narrative describes the site geology and characteristics that make the project area suitable for CO_2 sequestration. Sections 3 through 14 of this document summarize detailed project plans and programs. Several sections include checkboxes for verification that required information has been submitted to the EPA through its online Geologic Sequestration Data Tool (GSDT). The various documents that make up this application have been developed based on the EPA's provided templates and guidelines.

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)]***

4. Site Characterization

Geologic and hydrogeologic data presented and discussed in this section were used to develop a conceptual site model ("geomodel") for the proposed CO_2 storage site. The geomodel provides foundational data reflecting the regional and local geology surrounding [redacted] This information has been used to support the site suitability for CO_2 storage, as the geomodel exhibits adequate injection zone storage and upper confining zone integrity of sufficient areal extent to inhibit the migration of sequestered CO_2 into the project area USDWs. Additionally, the geomodel was used to facilitate the generation of the computational model discussed in **Attachment A: Area of Review and Corrective Action** and was also used to develop the design, construction, operation, and plugging of the injection and monitoring wells discussed in **Attachment B: Construction Details**.

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

[redacted]

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[redacted]

[redacted]

[redacted]

4.1.a Regional Geology

Regional geology of the DJ Basin is well documented by a number of methods, including well logs, cores, geophysical datasets (i.e., seismic), outcrop studies associated with aquifer resource studies, mineral exploration, and hydrocarbon development. This section is a synthesis of research describing the regional and local geologic structure and stratigraphy, with emphasis on the relevance to the [redacted] project site.

The DJ basin is a sedimentary basin located along the Rocky Mountain Front Range and encompasses parts of Colorado, Wyoming, Nebraska, and Kansas. The basin is bounded by the Apishapa Arch and Las Animas Arch to the south, Ellis Arch and Cambridge Arch to the east, and the Chadron and Hartville Uplift to the north (Figure 4). The present-day DJ Basin is a strongly asymmetric syncline with its axis positioned close to and parallel the Front Range with a steep western limb and a gentle eastern flank (Figure 5). Structural relief from the bottom of the basin to the top of the Front Range margin is approximately 21,000 ft. The basin geometry formed primarily through tectonic processes related to the uplift of the Rocky Mountains during two major tectonic events that also generated the sedimentary facies within the DJ Basin: The Pennsylvanian Ancestral Rockies Uplift and the Cretaceous Laramide Orogeny (Figure 6). The [redacted] project site is located in [redacted] Colorado in [redacted] County on the shallowing edge of the DJ Basin.

DJ Basin Tectonic and Depositional Timeline

Precambrian

The Proterozoic was a time of major crustal accretion in western North America. The area of present-day Colorado was accreted onto the existing Archean Wyoming Province. The Colorado Front Range is composed of Proterozoic rocks of the Yavapai tectonic province (Selverstone et al.,1997) and three northeast-trending Precambrian fault and shear zones: the Idaho Springs-Ralston, Moose Mountain, and the Skin Gulch shear zones (Tweto,1980; Warner, 1980). These faults are recognized as seismicity and geohazards for the oil and gas industries in the deep DJ basin in Weld County, but do not extend to the [redacted] Colorado [redacted] Project area (Figure 7).

Paleozoic

Once Precambrian igneous and tectonic activity diminished, erosion of the Front Range area reduced topography to a smoothed lowland. Lower Paleozoic strata are absent from outcrops due to erosion or depositional breaks along the Front Range and in the subsurface of [redacted] Colorado near the [redacted] Project area. Remnants of Cambrian, Ordovician, Devonian, and Mississippian systems are present in thin sequences in the southern Front Range.

During the Mississippian a major north-trending land area correlating with the present Front Range position was subjected to repeated uplift (DeVoto, 1980). Pennsylvanian fault-block uplifting along reactivated Precambrian faults resulted in mountain ranges with as much as 10,000 ft of relief, creating the Ancestral Front Range Highland (DeVoto, 1980).

The Ancestral Front Range Highland was a source area for a thick sequence of Pennsylvanian to Permian clastics deposited along its eastern margin ranging from 800 to 4,000 ft thick. Fault movement was active

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during the Pennsylvanian as evidenced through abrupt facies changes and thicknesses across fault boundaries. Iron rich arkosic sandstones and conglomerates of the Fountain Formation were deposited along the ancestral Front Range uplift prograding eastward and transitioned into eolian sandstones and marginal lacustrine carbonates and shales toward an epeiric seaway to the east.

The Permian Period brought a decrease in uplift of the Ancestral Front Range highland and the establishment of near present-day DJ basin extents with two major subbasins: the Alliance Basin (Nebraska panhandle) and the Sterling Basin (northeastern Colorado), separated by the paleo high of the Transcontinental Arch (Figure 8). Permian deposition east of the front range within the present-day DJ basin was dominated by eolian sandstones of the [redacted] Formation and sequences of evaporites. Figure 9 is a paleogeographic reconstruction of the late Permian 253 million years ago (Ma), superimposed on modern-day North America. The Rocky Mountain uplift can be clearly observed in central modern-day Colorado with northeastern trending sand to the east across eastern Colorado into Nebraska and Kansas. The [redacted] project location is noted within the eolian deposition. The Permian ended with multiple sequences of evaporites capping the [redacted] sandstone in [redacted] Colorado.

Mesozoic

The Mesozoic began with a depositional hiatus until the Late Jurassic when the Morrison Formation was deposited over a large area (Bryant and Naeser, 1980). The Morrison Formation is typically greater than 200 ft across the DJ Basin and consists of sedimentary rock deposited in continental depositional systems. The Cretaceous brought a large inland sea called the Western Interior Seaway that extended from the Arctic Ocean to the Gulf of Mexico. Through sea level transgressions and regressions, a thick sequence (>8,000 ft) of continental and marine sediments were deposited. This included the Lower Cretaceous sands of the Dakota Group (Lakota M and O Sands, Dakota D and J Sands), shales and limestones of the Graneros and Greenhorn, Niobrara chalks and marls, and the Pierre shale (Figure 6).

Cenozoic

The Paleogene Laramide Orogeny (70-65 Ma) was a time of aggressive tectonism and block-fault mountain building in Colorado forming the present-day Front Range mountains and DJ Basin largely by reactivation of Late Paleozoic basement faults and shear zones (Tweto, 1980). The north-northwest orientation of the Front Range is controlled by the north-northwest Precambrian age faults. Regional uplift of the Front Range and surrounding areas occurred through the Miocene, Pliocene, and Pleistocene and may continue to this day as is indicated by widespread canyon cutting (Tweto, 1980; Scott, 1960, 1963, and 1975; Trimble, 1980).

The [redacted] project area is tectonically stable, and modern occurrences of earthquakes magnitude 3.0 and larger have not been recorded and are likely uncommon. See Section 4.6 for seismic history. The occurrences of earthquakes in the DJ Basin are often linked to hydrocarbon development and are associated with the presence of wrench faults that do not extend into the project area (Figure 7). Existing three-dimensional (3D) seismic data were purchased and analyzed for the [redacted] Project area to identify fault concerns, as discussed in Section 4.3.

4.1.b Major Stratigraphic Units

The following discussion focuses on the regional and local characteristics of the major stratigraphic units for the [redacted] Project area and the [redacted] stratigraphic well. Stratigraphic units from deep to shallow in order of deposition are as follows: [redacted]

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Table 2. Characteristics of Zones and Formations of the major stratigraphic units from [redacted] Stratigraphic Test Well

Zone	Formation	Formation Division	Denova 1 Depth (ft)	Thickness (ft)	Porosity (%)	Permeability (mD)
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
		[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
		[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

Note: mD = millidarcy
Values with * are calculated from well logs where core data were not available.

[redacted]

[redacted]

[redacted]

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[redacted]

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[redacted]

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[redacted]

4.1.c Seismic Interpretation

Seismic interpretation was performed on data licensed from an existing 3D seismic survey to assess the geometry and structure of lateral and vertical containment elements for injected CO_2. Reservoir and confining units were mapped, as well as any discontinuities transecting the injection zone that could be interpreted as faults or fracture networks.

[redacted]

Table 3. Well Names and Logs Used for [redacted] 3D Survey Interpretation

Well Name	API No	Logs
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]

[redacted]

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Seismic interpretation deliverables of relevant horizons include seismic cross sections, depth structure maps, amplitude attribute maps, seismic thickness (isochron) maps, fault and/or fracture network identification, and associated digital files for the above.

[redacted]

Figure 21 displays an interpreted seismic profile along synthetic tie wells showing all key horizons within the seismic coverage for the project. Figure 22 shows a west to east seismic cross section zoomed in to the [redacted] well and displays the primary formation zones of the [redacted] project: lower confining zone, injection zone, and the primary upper confining zone.

[redacted]

The depth grids were used to plot additional maps and cross sections of relevant formations throughout the AoR, as detailed in Section 4.2.

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

[redacted]

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

[redacted]

4.3.a Fault Presence

[redacted]

[redacted]

4.3.b Fault Sealing Potential

There are no interpreted faults present within the AoR; therefore, a fault seal analysis was not performed.

4.4 Injection and Confining Zone Details

[redacted]

Table 4. Injection and Confining Zone Details within the AoR

Zone	Formation	Average Surface Elevation of Formation (ft below msl)	Average Thickness (ft)	Coverage	Lithology
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

Note: msl = mean sea level

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4.4.a Determination of Injection and Confining Zone

[redacted]

[redacted]

[redacted]

4.4.b Injection and Confining Zone Properties

[redacted]

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Table 5. Geophysical Logs Collected and Analyzed in the [redacted] Stratigraphic Well

Log Type	Log Mnemonic	Purpose/Comments
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	
[redacted]	[redacted]	
[redacted]	[redacted]	
[redacted]	[redacted]	
[redacted]	[redacted]	
[redacted]	[redacted]	
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]		[redacted]

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Table 6. Wells and Corresponding Logs Used to Characterize Petrophysical Properties within the Geomodel

Well Name	UWI	Latitude (degree)	Longitude (degree)	Logs	Predicted Logs
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted] POR, K_SDR

Porosity and Permeability

[redacted]

[redacted]

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Table 7. Average Porosity and Permeability of the Injection and Confining Zones from Core Measurement, Geophysical Log Analysis, and Geocellular Modeling

Zone	Formation Division	Average Core Porosity (%)	Average Log Porosity (%)	Average Static Model Domain Porosity (%)	Average Core Permeability (mD)	Average Log Permeability (mD)	Average Static Model Domain Permeability (mD)
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

Mineralogy

[redacted]

Sealing Capacity and Integrity

[redacted]

[redacted]

[redacted]

[redacted]

Table 8. Primary Upper Confining Zone Petrophysical Properties Measured from MICP and Seal Capacity at the [redacted] Stratigraphic Well

Zone	Formation Division	Sample	MICP Porosity (%)	Swanson Permeability (mD)	Median Pore Throat (µm)	Pore Radius (µm)	P_e (psi)	T_h (ft)
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

Note: µm = micrometer

[redacted]

Table 9. Compiled CO_2 Seal Types, Air-Hg Entry Pressure, and Range in CO_2 Column Height Based on MICP analysis

Seal Type	Entry Pressure (psi)	CO_2 Column Height (ft)
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]

[redacted]

Storage Capacity

[redacted]

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[redacted]

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

[redacted]

Table 102. Rock Mechanic Core Analyses Conducted by Formation

Formation	Depth (ft)	Unconfined Compressive Strength (UCS)	Triaxial and Ultrasonic Testing	Uniaxial Pore Volume Compressibility (UPVC)	Brazilian Tensile Strength
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

Table 11. Key Geomechanics Properties Reported from Rock Mechanic Testing and Mechanical Earth Modeling Report

Formation	Depth (ft)	UPVC (psi^{-1})	Static Young's Modulus (x 10^6 psi)	Static Poisson's Ratio	Biot's Constant	Tensile Strength (psi)	SHmin (psi)	SVertical (psi)
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

[redacted]

- [redacted]

[redacted]

4.5.a Fracture Gradient Estimation

[redacted]

4.5.b Effective Horizontal Stress

[redacted]

[redacted]

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

Seismicity and fault information surrounding the [redacted] project site were compiled from the U.S. Geological Survey (USGS) and Colorado Geological Survey (CGS). CGS maps (Morgan and Fitzgerald, 2019) do not identify any known faults near the project site (Figure 33).

CGS currently maintains an earthquake database that catalogs 1.3 magnitude and larger earthquakes that have occurred since 2016. USGS earthquake data was queried to provide historical earthquake events that have occurred between 1960 and 2023. There have been no recorded seismic events within a 25-mile radius of the [redacted] project site. No earthquakes have occurred in the sedimentary column above the granitic basement or associated with known faults in the area.

Figure 33 displays the locations of earthquakes from the USGS and CGS that occurred from 1960 to September 2023. Identified faults are shown, along with the [redacted] injection well location. No significant seismicity has occurred proximally to identified faults or in the project area.

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

Regional hydrologic and hydrogeologic characteristics were compiled using resources from the CGS Groundwater Atlas (Barkmann et al., 2020), Colorado State University Groundwater Resources Water Center, Republican River Water Conservation District (RRWCD), and multiple USGS and academic publications.

Local geology was characterized using well logs, published water data, and analysis of data from the [redacted] stratigraphic test well. The apparent water resistivity (RWA) method, also known as the resistivity-porosity (RP) method, was used to calculate salinity for zones where fluid was not collected. The RWA method utilizes Archie's equation to determine formation water resistivity to calculate salinity and has been documented as the most reliable method for estimating formation water resistivity in saturated zones (Lyle, 1988).

Fresh Water Aquifers

High Plains Aquifer – Quaternary Dunes and Ogallala Formation

[redacted]

[redacted]

Denver Basin Aquifers – Laramie Fox Hills, Arapaho, Denver, and Dawson Aquifers

[redacted]

USDW Zones

[redacted]

Cretaceous [redacted] Sandstones

[redacted]

[redacted]

Cretaceous [redacted] Carbonates

[redacted]

[redacted]

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Cretaceous [redacted] Sandstone

[redacted]

Cretaceous [redacted] Sandstones

[redacted]

Cretaceous [redacted] Sandstone

[redacted]

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[redacted]

Hydrogeology of Non USDWs

Cretaceous [redacted] Sandstone

[redacted]

Jurassic [redacted] Sandstones

[redacted]

Permian [redacted]

[redacted]

4.7.a Water Wells within the AoR

[redacted]

4.7.b Aquifer Depths

[redacted]

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Table 12. Depths of Aquifers at the [redacted] Stratigraphic Well

Aquifer/Formation	Depth (ft MD)	Thickness (ft)	TDS (mg/L)
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]

4.7.c Baseline Geochemistry

[redacted]

[redacted]

[redacted]

4.7.d Oil and Gas Production

[redacted]

4.8 Geochemistry

[redacted]

- [redacted]
- [redacted]

4.8.a Injection Zone Fluid Geochemistry

[redacted]

Table 13. Comprehensive Fluid Analysis for the Injection Zone

Parameter	Result for [redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]

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Parameter	Result for [redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]

*While included in the sample analysis, brine chemistry did not return discrete levels of antimony, beryllium, cadmium, cobalt, copper, lead, phosphorous, selenium, silver, vanadium, iodide, nitrite, or phosphate.

4.8.b Injection Zone and Upper Confining Zone Mineralogy

[redacted]

[redacted]

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Table 14. Average Mineralogy of the Injection Zone and Upper Confining Zone

Mineral	Average Mineralogy			
	Injection Zone		Upper Confining Zone	
	Core Measured Depths			
	[redacted]	[redacted])	[redacted]	[redacted])
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

4.8.c Injectate Chemistry

[redacted]

4.8.d Equilibrium Geochemical Modeling

[redacted]

Geochemical Database

[redacted]

[redacted] [redacted]

[redacted] [redacted]

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[redacted]

Saturation Indices

[redacted]

[redacted]

[redacted]

[redacted]

Geochemical Model Input

[redacted]

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[redacted]

Table 15. Mineral Molar Ratios for the [redacted] and [redacted] Formations

Mineral	Mineral Molar Ratio			
	Injection Zone		Upper Confining Zone	
	Core Measured Depths			
	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

[redacted]

Geochemical Modeling Results and Discussion

[redacted]

[redacted] [redacted]

[redacted] [redacted]

[redacted] [redacted]

[redacted] [redacted]

[redacted] [redacted]

[redacted]

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Table 16. PHREEQC Equilibrium Model Results

Mineral	Mineralogy Change (grams)			
	Injection Zone		Upper Confining Zone	
	Core Measured Depths			
	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

[redacted]

4.9 Site Suitability [40 CFR 146.83]

The proposed [redacted] project site is suitable for the injection and containment of CO_2 as demonstrated in the sections above. Responses to recommended U.S. EPA questions are given below.

What is the subsurface distribution of lithological facies? What are the implications for CO_2 plume migration?

[redacted]

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How will CO_2 be confined to the injection zone? How do the site characterization data demonstrate the lack of potential leakage pathways?

[redacted]

[redacted]

How will the CO_2 stream interact with well materials and subsurface formations (injection and confining zones)?

[redacted]

[redacted]

[redacted]

What is the total storage capacity of the injection zone? How was this determined? How is this sufficient to receive the proposed amount of CO_2?

[redacted]

[redacted]

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[redacted]

Are there any potential concerns regarding confining zone integrity? What site characterization data support this determination?

[redacted]

5. AoR and Corrective Action

The [redacted] project Area of Review and Corrective Action Plan is included as **Attachment A: AoR and Corrective Action Plan**. This attachment has been developed in compliance with 40 CFR §146.84, area of review and corrective action, which requires that the owner or operator of a Class VI well prepare, maintain, and comply with a plan to delineate the area of review for a proposed geologic sequestration project, as well as periodically reevaluate the delineation and perform corrective action if necessary. **Attachment A: AoR and Corrective Action Plan** has been submitted to the GSDT as follows:

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)]***

6. Injection Well Construction

The [redacted] Project will convert the [redacted] stratigraphic test well to a Class VI injection well for CO_2 sequestration. Construction details are included in **Attachment B: Construction Details**, which includes information about construction procedures, casing and cement, tubing and packer, and continuous monitoring. The injection well construction details have been developed in compliance with 40 CFR 146.86, injection well construction requirements. **Attachment B: Construction Details** has been submitted to the GSDT as follows:

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Injection Well Construction GSDT Submissions
GSDT Module: Project Information Tracking ***Tab(s):*** Initial Permit Application Please use the checkbox(es) to verify the following information was submitted to the GSDT: ☒ Injection Well Construction Requirements ***[40 CFR 146.86]***

7. Proposed Stimulation Program

A Stimulation Plan has been developed for the [redacted] Project in compliance with 40 CFR 146.82(a)(9), and is included as **Attachment C: Stimulation Plan**. [redacted] The Stimulation Plan describes methods and procedures for stimulation, including fluids, additives, and diverters necessary. Compatibility of the stimulation fluids with the injection and confining zones will be demonstrated [redacted] **Attachment C: Stimulation Plan** has been submitted to the GSDT as follows:

Stimulation Plan GSDT Submissions
GSDT Module: Project Information Tracking ***Tab(s):*** Initial Permit Application Please use the checkbox(es) to verify the following information was submitted to the GSDT: ☒ Proposed stimulation program ***[40 CFR 146.82(a)(9)]***

8. Pre-Operational Logging and Testing

A Pre-Operational Testing Program has been developed in compliance with 40 CFR 146.87, logging, sampling, and testing prior to injection well operation, and is included as **Attachment D: Pre-Operational Testing Plan**. The Pre-Operational Testing Program describes deviation checks, tests and logs that were performed during the drilling of [redacted] and remaining tests and logs to be performed during [redacted] Additionally, pre-operational tests and logs to be performed in the [redacted] monitoring wells are discussed in this plan. **Attachment D: Pre-Operational Testing Plan** has been submitted to the GSDT as follows:

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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]***

9. Well Operation

The [redacted] Project well operations are described in **Attachment E: Operating and Reporting Conditions**. Attachment E includes information that fulfills requirements for this Class VI permit application listed at 40 CFR 146.82(a)(7) and (10) and 40 CFR 146.88, injection well operating requirements. This includes proposed operating data such as average and maximum daily rate and volume and/or mass, total anticipated volume and/or mass, average and maximum injection pressure, source of the CO_2 stream, and an analysis of the chemical and physical characteristics of the CO_2 stream. It also describes overall operational procedures, routine shutdown procedures, and reporting requirements. **Attachment E: Operating and Reporting Conditions** has been submitted to the GSDT as follows:

Operating and Reporting Conditions GSDT Submissions
GSDT Module: Project Information Tracking ***Tab(s):*** Initial Permit Application Please use the checkbox(es) to verify the following information was submitted to the GSDT: ☒ Proposed operating data ***[40 CFR 146.82(a)(7)]*** ☒ Proposed injection procedure ***[40 CFR 146.82(a)(10)]*** ☒ Injection well operating requirements ***[40 CFR 146.88]***

10. Testing and Monitoring

A Testing and Monitoring Plan prepared pursuant to 40 CFR 146.90, testing and monitoring requirements, is included as **Attachment F: Testing and Monitoring Plan**. The Testing and Monitoring Plan will be used for ongoing project monitoring to verify that the CCS project is operating as permitted and is not endangering USDWs. Additionally, a Quality Assurance and Surveillance Plan (QASP) prepared pursuant to 40 CFR 146.90(k) is included as **Attachment G: QASP**. **Attachment F: Testing and Monitoring Plan** and **Attachment G: QASP** have been submitted to the GSDT as follows:

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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]

11. Injection Well Plugging

The [redacted] Project Injection Well Plugging Plan is included as **Attachment H: Injection Well Plugging Plan**, and has been prepared pursuant to 40 CFR 146.92(b), well plugging plan. The Injection Well Plugging Plan includes appropriate tests or measures for determining bottomhole reservoir pressure and ensuring external mechanical integrity, the type, number, placement, and method of placement of plugs, and the type, grade, and quantity of material to be used in plugging that is compatible with the CO_2 stream. **Attachment H: Injection Well Plugging Plan** has been submitted to the GSDT as follows:

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)]

12. PISC and Site Closure

The [redacted] Project PISC and Site Closure Plan is included as **Attachment I: PISC and Site Closure Plan**, and has been prepared pursuant to 40 CFR 146.93, post-injection site care and site closure. [redacted] **Attachment I: PISC and Site Closure Plan** has been submitted to the GSDT as follows:

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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: [redacted] ***Tab(s):*** All tabs ([redacted] Please use the checkbox(es) to verify the following information was submitted to the GSDT: ☒ [redacted] / [redacted]

13. Emergency and Remedial Response

The [redacted] Project Emergency and Remedial Response Plan (ERRP) is included as **Attachment J: ERRP**, and has been prepared in accordance with 40 CFR 146.94, emergency and remedial response. The ERRP describes actions that the owner or operator must take to address movement of the injection or formation fluids that may cause an endangerment to a USDW during construction, operation, and post-injection site care based on potential risk scenarios. **Attachment J: ERRP** has been submitted to the GSDT as follows:

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)]*

14. Financial Responsibility

The [redacted] Project Financial Assurance Demonstration is included as **Attachment K: Financial Assurance Demonstration**, and has been prepared in accordance with 40 CFR 146.85, financial responsibility. This attachment describes the qualifying financial instrument(s) applicable to the proposed project that are sufficient to cover the cost of corrective action, injection well plugging, post-injection site care and site closure,

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and emergency and remedial response, as well as potential endangerment of USDWs. **Attachment K: Financial Assurance Demonstration** has been submitted to the GSDT as follows:

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]***

15. Optional Additional Project Information

This section summarizes additional project information based on 40 CFR 144.4, considerations under federal law, which lists the following laws that must be considered if applicable:

- Wild and Scenic Rivers Act
- National Historic Preservation Act
- Endangered Species Act
- Coastal Zone Management Act
- Fish and Wildlife Coordination Act
- Executive orders including the Clean Water Act, Safe Drinking Water Act, Clean Air Act, and the Resource Conservation and Recovery Act

There are currently no known historic resources within the AoR subject to the National Historic Preservation Act, nor does the Coastal Zone Management Act apply due to the [redacted] project inland location. [redacted] performed an environmental and cultural resources desktop review to identify potential areas of concern for pipeline constructability and environmental compliance for a 1-mile-wide study corridor centered around the proposed [redacted] project pipeline alignment. Field surveys will commence in spring 2024, which will include a wetland delineation, aquatic resource reporting, a greater prairie chicken habitat and lek sites field survey, an eagle and hawk survey, and a Migratory Bird Treaty Act (MBTA) compliance survey. Should any of these resources be identified, the pipeline route has flexibility to reroute. Results of the surveys can be provided to EPA upon request.

15.1 National Historic Preservation Act

The National Historic Preservation Act of 1966, 16 U.S.C. 470 et seq. Identify properties listed or eligible for listing in the National Register of Historic Places that may be affected by the activities associated with the proposed project. If previous historic and cultural resource survey(s) have been conducted, provide the results of the survey(s).

An environmental and cultural resource survey will be conducted during pipeline construction. Results of the survey will be provided to EPA.

15.2 Wild and Scenic Rivers Act

The Wild and Scenic Rivers Act, 16 U.S.C. 1273 et seq. Identify any national wild and scenic river that may be impacted by the activities associated with the proposed project.

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There are no national wild and scenic rivers that will be impacted by the proposed [redacted] project.

15.3 Endangered Species Act

The Endangered Species Act, 16 U.S.C. 1531 et seq. Identify any endangered or threatened species that may be affected by the activities associated with the proposed project. If a previous endangered or threatened species survey has been conducted, provide the results of the survey.

An environmental and cultural resource survey will be conducted during pipeline construction. Results of the survey will be provided to EPA.

15.4 Fish and Wildlife Coordination Act

An environmental and cultural resource survey will be conducted during pipeline construction. Results of the survey will be provided to EPA.

16. References

[redacted]

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[redacted]

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[redacted]

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Figures

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[redacted]

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Appendix 7
Water Quality Data

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Well Name: USGS 400716102435901 SB00204822CDB

	Parameters	Value	Sample Date	Sample Depth (ft bgs)	Formation
	Carbon dioxide (3 samples in 3 minutes)	4.7, 4.5, 3.7	8/11/2015	230	Ogallala
	Total dissolved solids (TDS, mg/L)	257	8/11/2015	230	Ogallala
Dissolved Metals (ug/L)	Sr	522	8/11/2015	230	Ogallala
	Zn	< 2.0	8/11/2015	230	Ogallala
Anions (mg/L)	B	70	8/11/2015	230	Ogallala
	Br	0.092	8/11/2015	230	Ogallala
	Cl	8.18	8/11/2015	230	Ogallala
	F	0.86	8/11/2015	230	Ogallala
	NO	N/A	8/11/2015	230	Ogallala
	NO3	10.7	8/11/2015	230	Ogallala
	SO4	17.2	8/11/2015	230	Ogallala
Cations (mg/L, unless otherwise noted)	Al (ug/L)	4.8	8/11/2015	230	Ogallala
	Ba (ug/L)	169	8/11/2015	230	Ogallala
	Mn (ug/L)	< 0.40	8/11/2015	230	Ogallala
	As (ug/L)	6.9	8/11/2015	230	Ogallala
	Cd (ug/L)	< 0.030	8/11/2015	230	Ogallala
	Cr (ug/L)	1	8/11/2015	230	Ogallala
	Cu (ug/L)	< 0.80	8/11/2015	230	Ogallala
	Pb (ug/L)	0.439	8/11/2015	230	Ogallala
	Sb (ug/L)	0.074	8/11/2015	230	Ogallala
	Se (ug/L)	2.5	8/11/2015	230	Ogallala
	Ti	N/A	8/11/2015	230	Ogallala
	Ca	39.8	8/11/2015	230	Ogallala
	Fe	< 4.0	8/11/2015	230	Ogallala
	K	8.59	8/11/2015	230	Ogallala
	Mg	11.4	8/11/2015	230	Ogallala
	Na	16.4	8/11/2015	230	Ogallala
	Si	N/A	8/11/2015	230	Ogallala
	Isotopes (baseline only; δ13C)	N/A	8/11/2015	230	Ogallala
	Alkalinity (mg/L)	144	8/11/2015	230	Ogallala
	pH (field)	7.8	8/11/2015	230	Ogallala
	Specific conductance (µS/cm @ 25 deg C, field)	341	8/11/2015	230	Ogallala
	Temperature (deg C, field)	15.5	8/11/2015	230	Ogallala

Well Name: USGS 400735102571901 SB00205022CAA

	Parameters	Value	Sample Date	Sample Depth (ft bgs)	Formation
	Carbon dioxide (3 samples in 3 minutes)	3.9, 4.4, 4.1	8/12/2015	296.5	Ogallala
	Total dissolved solids (TDS, mg/L)	259	8/12/2015	296.5	Ogallala
Dissolved Metals (ug/L)	Sr	584	8/12/2015	296.5	Ogallala
Dissolved Metals (ug/L)	Zn	< 2.0	8/12/2015	296.5	Ogallala
Anions (mg/L)	B	70	8/12/2015	296.5	Ogallala
Anions (mg/L)	Br	0.181	8/12/2015	296.5	Ogallala
Anions (mg/L)	Cl	18.4	8/12/2015	296.5	Ogallala
Anions (mg/L)	F	0.64	8/12/2015	296.5	Ogallala
Anions (mg/L)	NO	N/A	8/12/2015	296.5	Ogallala
Anions (mg/L)	NO3	18.7	8/12/2015	296.5	Ogallala
Anions (mg/L)	SO4	23	8/12/2015	296.5	Ogallala
Cations (mg/L, unless otherwise noted)	Al (ug/L)	7.3	8/12/2015	296.5	Ogallala
Cations (mg/L, unless otherwise noted)	Ba (ug/L)	153	8/12/2015	296.5	Ogallala
Cations (mg/L, unless otherwise noted)	Mn (ug/L)	< 0.40	8/12/2015	296.5	Ogallala
Cations (mg/L, unless otherwise noted)	As (ug/L)	7.7	8/12/2015	296.5	Ogallala
Cations (mg/L, unless otherwise noted)	Cd (ug/L)	< 0.030	8/12/2015	296.5	Ogallala
Cations (mg/L, unless otherwise noted)	Cr (ug/L)	< 0.30	8/12/2015	296.5	Ogallala
Cations (mg/L, unless otherwise noted)	Cu (ug/L)	< 0.80	8/12/2015	296.5	Ogallala
Cations (mg/L, unless otherwise noted)	Pb (ug/L)	< 0.040	8/12/2015	296.5	Ogallala
Cations (mg/L, unless otherwise noted)	Sb (ug/L)	0.078	8/12/2015	296.5	Ogallala
Cations (mg/L, unless otherwise noted)	Se (ug/L)	4.2	8/12/2015	296.5	Ogallala
Cations (mg/L, unless otherwise noted)	Ti	N/A	8/12/2015	296.5	Ogallala
Cations (mg/L, unless otherwise noted)	Ca	43.5	8/12/2015	296.5	Ogallala
Cations (mg/L, unless otherwise noted)	Fe	< 4.0	8/12/2015	296.5	Ogallala
Cations (mg/L, unless otherwise noted)	K	8.34	8/12/2015	296.5	Ogallala
Cations (mg/L, unless otherwise noted)	Mg	13.9	8/12/2015	296.5	Ogallala
Cations (mg/L, unless otherwise noted)	Na	18	8/12/2015	296.5	Ogallala
Cations (mg/L, unless otherwise noted)	Si	N/A	8/12/2015	296.5	Ogallala
	Isotopes (baseline only; δ13C)	N/A	8/12/2015	296.5	Ogallala
	Alkalinity (mg/L)	132	8/12/2015	296.5	Ogallala
	pH (field)	7.8	8/12/2015	296.5	Ogallala
	Specific conductance (µS/cm @ 25 deg C, field)	383	8/12/2015	296.5	Ogallala
	Temperature (deg C, field)	15.5	8/12/2015	296.5	Ogallala