Coastal Bend Carbon Management Project

CarbonSAFE Phase II FE0032265

Recipient:

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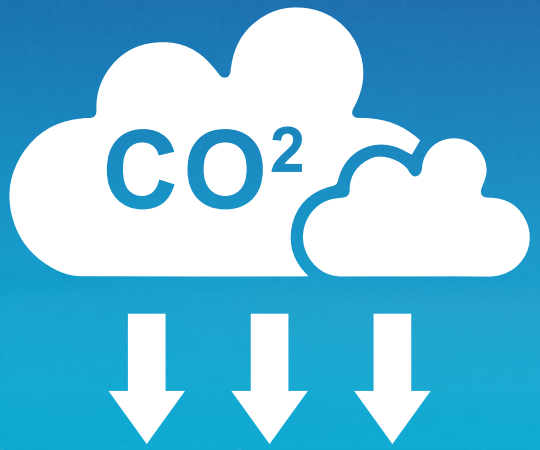
The Port of Corpus Christi's Role in CCUS



- Send clear signal to marketplace that centralized CCS solution IS coming
- Cultivate CCS opportunities (new projects/Port customers)
- Identify/vet/permit route alternatives for CO_2 delivery infrastructure
- Lease Port-owned pore space for CO_2 injection and storage
- Facilitate logistical/commercial connections between emitters & CCS service providers
- Deploy Port capital to fund key infrastructure elements
- Pursue/leverage federal capital
- Advocate for appropriate state and federal policy

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Two Discrete Projects: (This is the ONshore Project)

US DOE awards Port of Corpus Christi with $16.4M in CarbonSAFE grants

BUSINESS DEVELOPMENTS & PROJECTS

February 2, 2023, by Aida Čučuk

The Port of Corpus Christi has been allocated $16.4 million through the US Department of Energy's (DOE) Carbon Storage Assurance Facility Enterprise (CarbonSAFE) initiative to evaluate the technical and economic feasibility of permanently storing captured carbon dioxide (CO2) from industrial operations.

Objectives:

- Quantify subsurface storage resources available
- Refine reservoir targets/priorities for permanent storage of commercial quantities of CO_2
- Design surface facilities to ensure safety, identify risks, and mitigants, costs, and legal and regulatory requirements as a key step in developing Mitigation and Monitoring Plan
- Conduct full spectrum cost-benefit analysis that captures the environmental and socio-economic impacts, focusing on benefits to disadvantaged communities in the region
- Develop two-way outreach and engagement program that promotes equitable, inclusive economic development and seeks to prioritize benefits to historically disadvantaged communities

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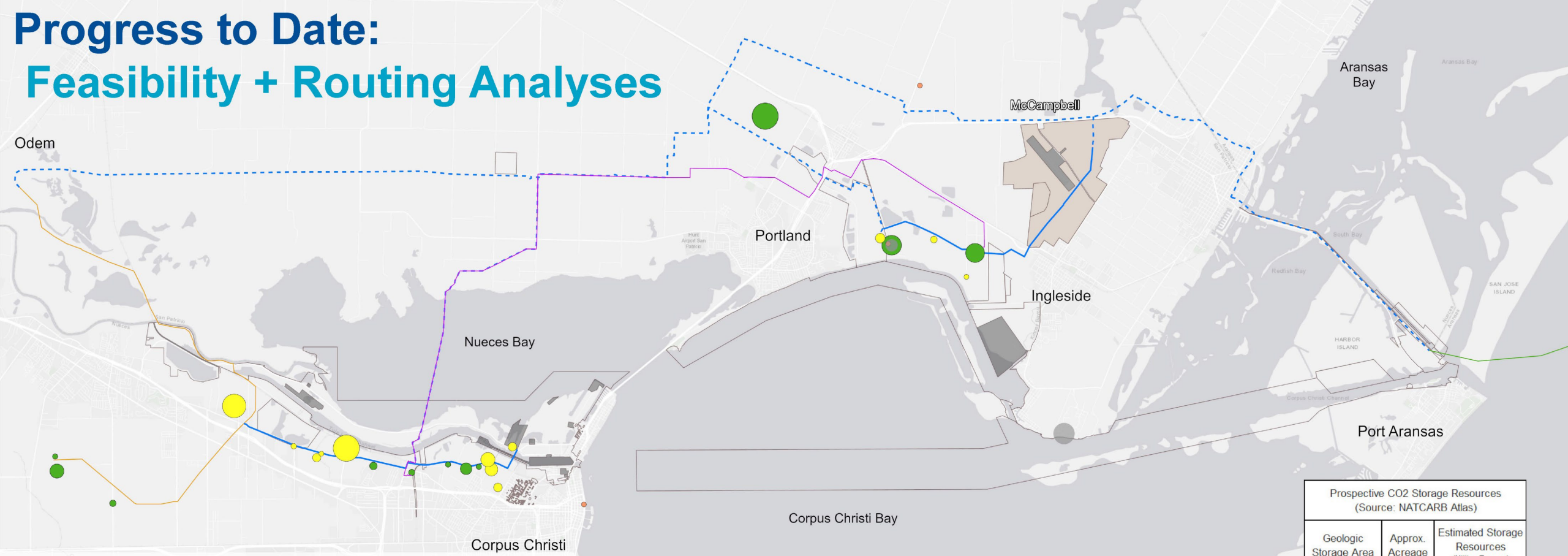
Progress to Date:
Feasibility + Routing Analyses



Legend

- PCC Pore Space Under Lease Option
- PCC Property
- Not Owned by PCC

CO2 Target Source Locations (approx.)/Volumes (EPA, 2020) Tiers*

- 1 - Currently Viable
- [1] - Pending
- 2 - Economically Limited
- 3 - Economically and Logistically Unavailable

2020 CO2 Emission (Tonnes)

- 0 - 950,000
- 950,001 - 1,910,00
- 1,910,001 - 2,870,000
- >2,870,000

Preliminary⁰ Delivery Infrastructure Routing

Phase†	Type	Symbol	Approx. Length (Miles)
Phase 1	Trunk		15
	Collection/Distribution		17
Phase 2B (Overland Alternative)	Trunk		35-42
Offshore Deployment			TBD
Existing Pipeline/Repurpose Opportunity			20

3 1.5 0 3 6 9 12 Miles

Prospective CO2 Storage Resources (Source: NATCARB Atlas)		
Geologic Storage Area	Approx. Acreage	Estimated Storage Resources (Million Tonnes)
Inner Harbor	6,400	239
Tule Lake	770	20
McCampbell	3,300	102
Outer Harbor 1	1,700	60
Outer Harbor 2	1,400	45

Estimated Tonnes of CO2 Emitted Annually		
Tier	Inner Harbor	Outer Harbor
1	3,157,099	8,367,187
[1] Pending	432,946	3,217,600
2	9,294,157	903,093
3	0	0

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PRELIMINARY CONCEPT FOR EVALUATION AND PLANNING PURPOSES ONLY

Progress to Date: Feasibility + Routing Analyses

01

Review of existing infrastructure

02

Probabilistic analysis of known emitters (volumes and likelihood/timing of participating in centralized CO_2 mgmt. system)

Scope:

- Identification of additional "in-scope" emitters
- Data gathering for all "in-scope" emitters:
  - Likely volumes of CO_2
  - Type & concentration (power gen, cement, etc)
  - Distance emitter's CO_2 / environmental commitments
  - Established relationship / discussions underway
  - CO_2 sequestration incentives (45Q or other carbon tax)
  - For new sources, does timeline meet 45Q
  - Data review and probability weighting

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Progress to Date: Feasibility + Routing Analyses

01

Review of existing infrastructure

02

Probabilistic analysis of known emitters (volumes and likelihood/timing of participating in centralized CO_2 mgmt. system)

03

Economic assessment of infrastructure costs that can be supported by available storage resources under current 45Q regulations

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Project Overview

Project Objectives:

- Characterize the target subsurface reservoirs for the permanent storage of at least 50 MMt CO_2.
- Design surface facilities in a manner that ensures the safety of all inhabitants and property in the region.
- Quantify subsurface storage resources available for permanent and economical storage of commercial quantities of CO_2.
- Conduct a full spectrum cost-benefit analysis that captures the environmental and socio-economic impact of the Project, focusing in particular on the benefits to Department of Energy identified disadvantaged communities in the region.

Project Objectives:

- Identify risks and mitigants, costs, and legal and regulatory requirements of the Project as key steps in developing a robust mitigation and monitoring plan.
- Develop an outreach and engagement program which promotes equitable, inclusive economic development that prioritizes benefits to historically disadvantaged communities.

Project Performance Dates:

- 01 Oct 2023 to 30 Sep 2025.

Funding Summary:

- The project begins ≈01 Oct 2023.

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Project Background

CO2 Emissions:

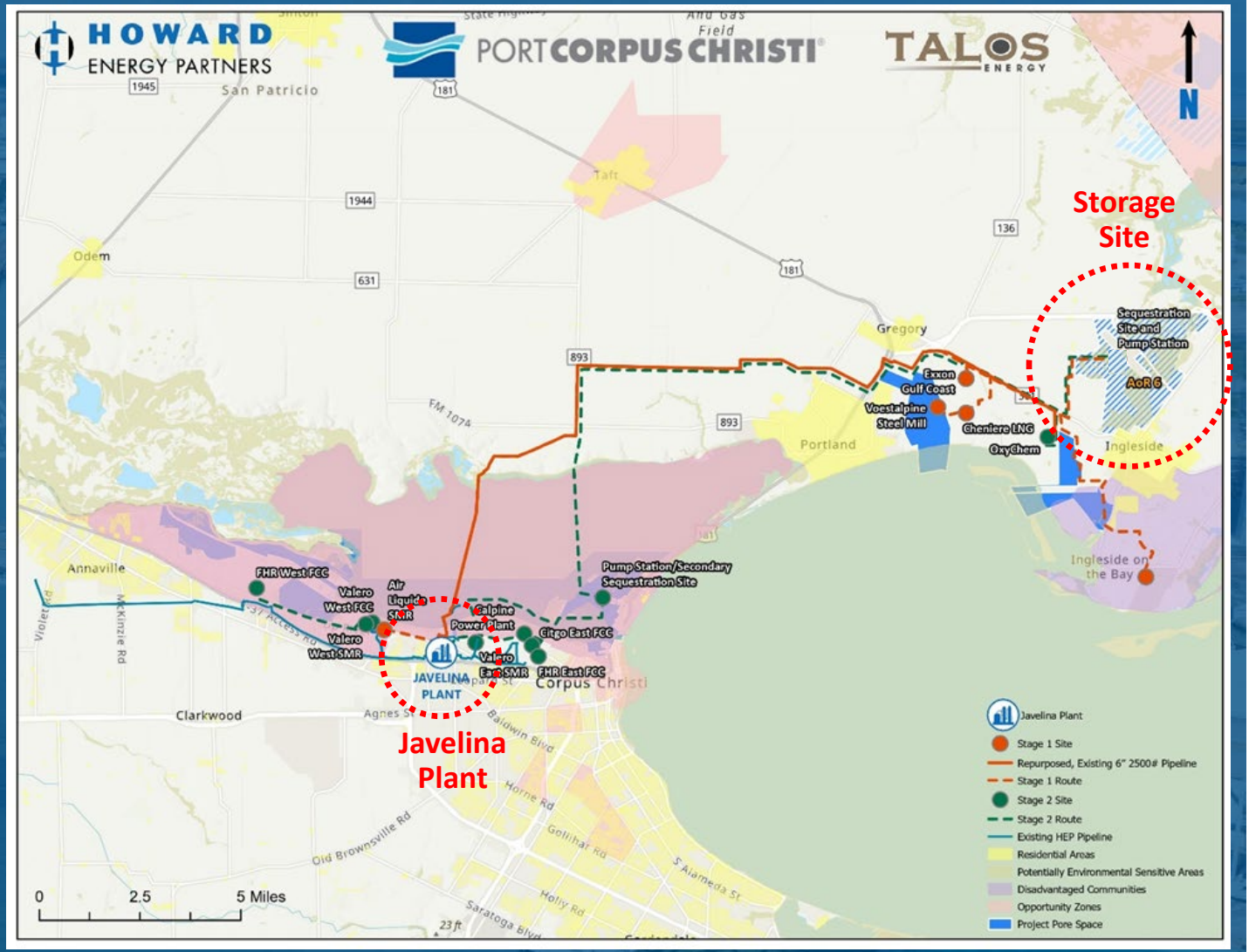
- Proposed Gathering Site has a connection 11 MMtpa of the 20 MMtpa in the regional CO_2 emissions.
- 95% CO_2 (industry standards).

Transportation Infrastructure:

- Proposed Stage 1 Transportation System
- Existing Gathering footprint consists of 55 miles of pipeline connected to emitters.

Storage Site:

- Pre-Feasibility Estimates of at least 50 MMt total storage capacity.
- AoR-6 (3,300 acres).
- POCCA is pore space owner.
- Stratigraphic well planned H1/24.
- 3D seismic planned for H1/24 (this will be a Talos purchase, NOT DOE).



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Technical Approach — Project Execution Plan (1/3)

Task 1.0 – Project Mgmt & Plg:

- Policies, costs, scope related to PMP.

Task 2.0 – Project Mgmt & Plg:

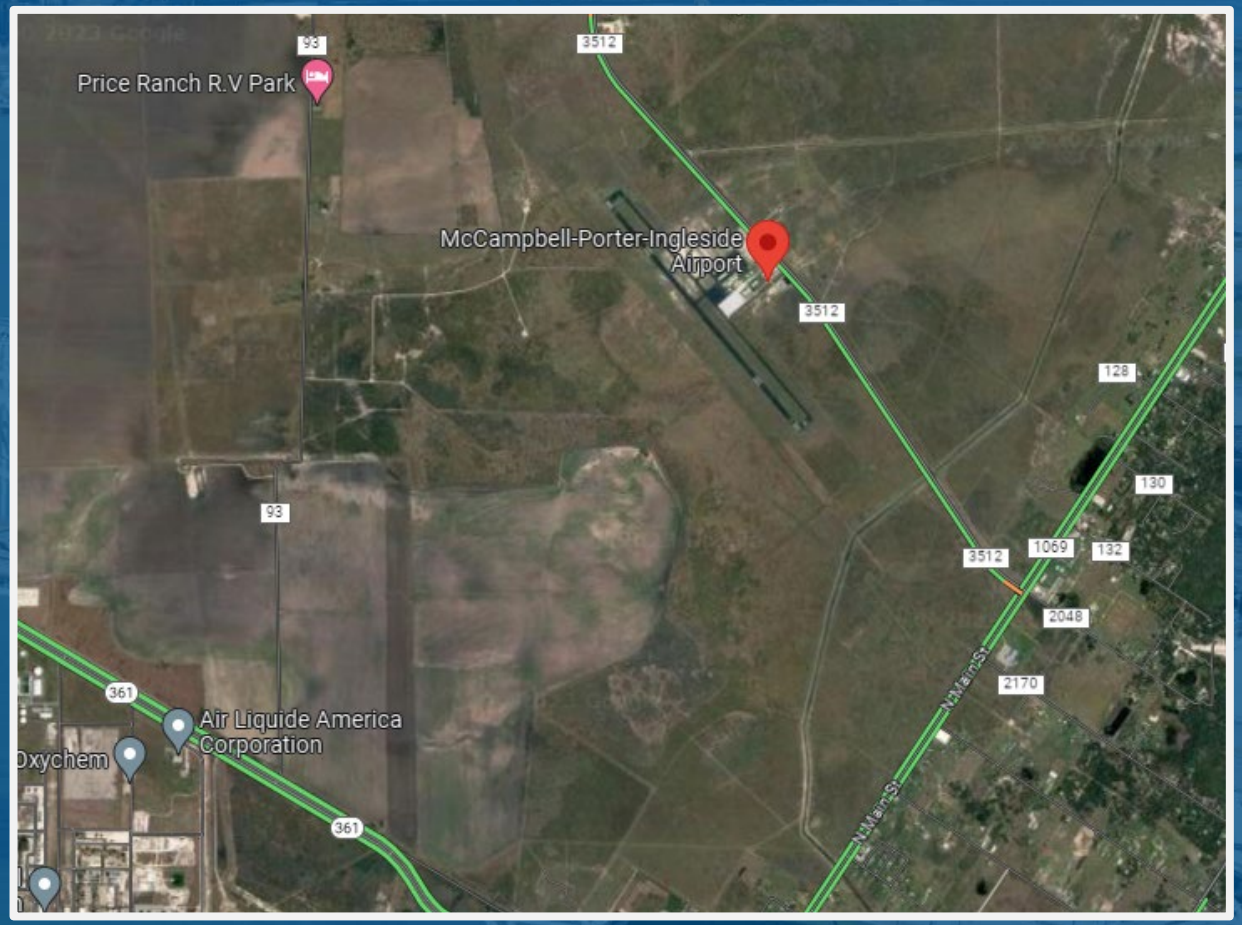
2.1 Community and Workforce Engagement
2.2 Job Quality/Skilled Workforce
2.3 DEI and Accessibility
2.4 Justice40 Initiative

Task 3.0 – Permitting/Site-Access:

3.1 National Environmental Policy Act (NEPA)
3.2 Permitting and Site Survey

Task 4.0 – Site Characterization:

4.1 Surface Characterization
4.2 Acquisition/Assessment of Existing Data
4.3 Regional Geologic Model
4.4 Geology, Sealing Capacity, and Trap
4.5 Petrophysics, Geochemistry, Geomechanics
4.6 Fault Prediction and Sealing Potential



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Technical Approach — Project Execution Plan (2/3)

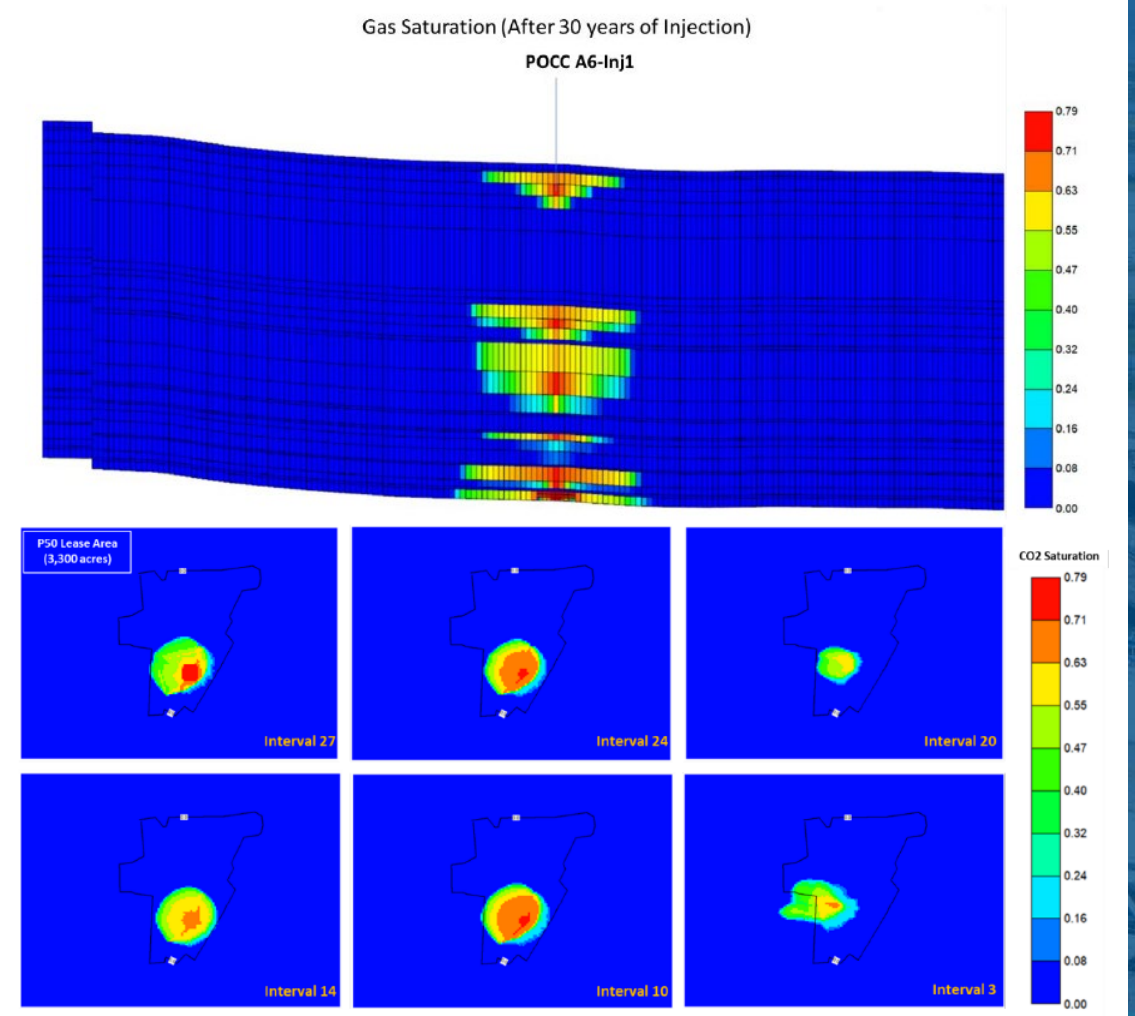
Task 5.0 – Modeling/Development Plan:

- 5.1 3D Reservoir Model
- 5.2 Numerical Modeling/Flow Simulation
- 5.3 Plume Migration and Sensitivities
- 5.4 Storage Volume Est. (SRMS Guidelines)
- 5.5 Development Plan

Task 6.0 – Risk Assess/Mitigation/Monitor:

- 6.1 Risk Register
- 6.2 Risk Assessment using NRAP
- 6.3 Fault Reactivation and Seal Risk
- 6.4 Legacy Well Leaking
- 6.5 Transportation and Environmental Risks
- 6.6 Monitor Plan, Fiber Optic, Geophysics

Examples of Initial Reservoir Modelling



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Technical Approach — Project Execution Plan (3/3)

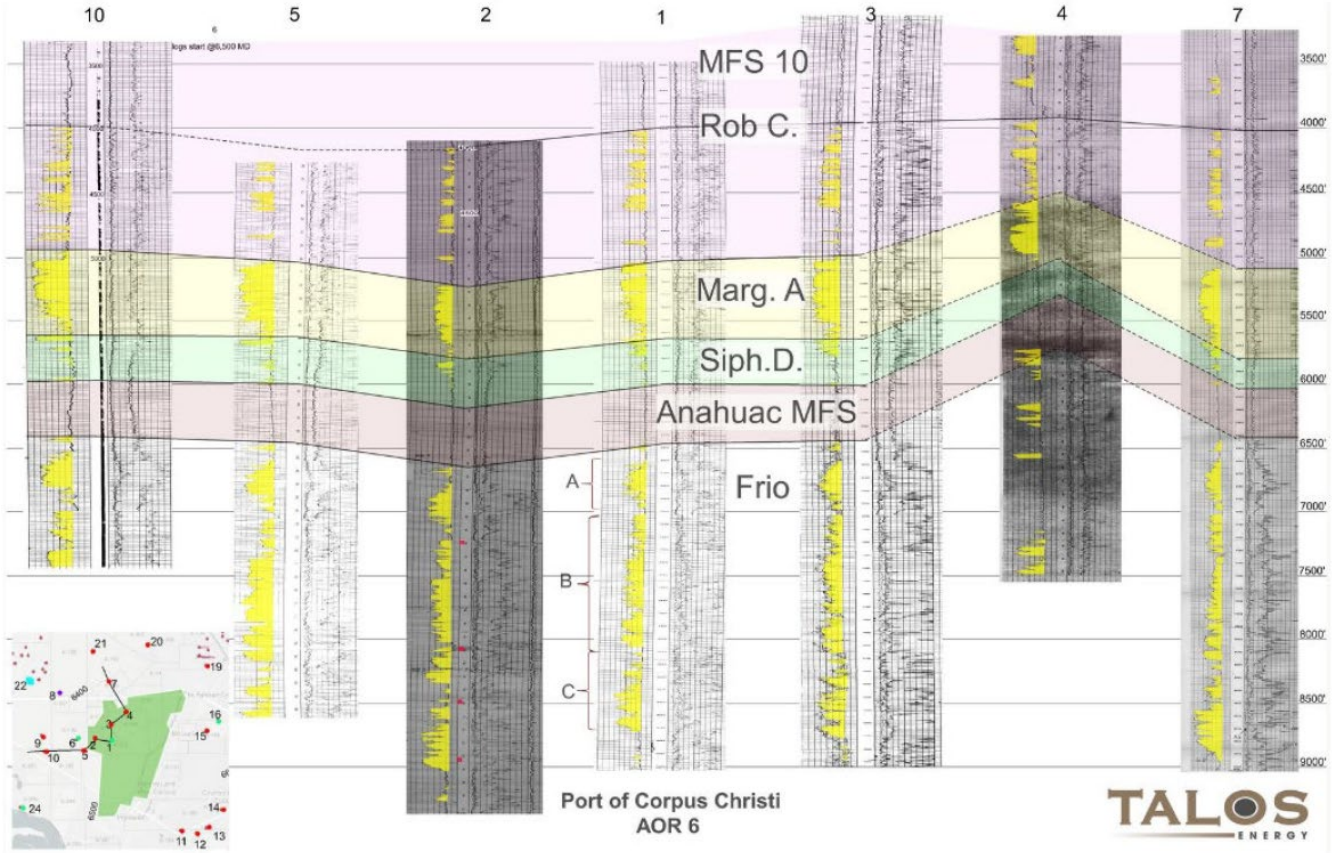
Task 7.0 – UIC Class VI Permitting:

- 7.1 Site Selection/Permitting
- 7.2 Stratigraphic Well/Data Collection
- 7.3 Permit Application

Task 8.0 – Feasibility:

- 8.1 CO_2 Source and Composition
- 8.2 Hub Infrastructure Development
- 8.3 Regional Infrastructure Assessment
- 8.4 Technical Economic Viability
- 8.5 Commercial Development Plan
- 8.6 CO_2 Measurement and Accounting

Example of Stratigraphic Cross-Section in AoR-6



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Technical Approach — Project Schedule and Key Milestones

Project Schedule and Key Milestones

Task	Description of Tasks	23’	24’				25’		
		Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3
1	Project Management Plan		Implemented during Project						
2	Outreach & Environmental Justice								
3	Permitting & Site-Access Agreements								
4	Site Characterization & Geologic Data Analysis								
5	Subsurface Modeling & Flow Simulation								
6	Risk Assessment, Mitigation, & Monitoring Plan								
7	Plan for UIC Class VI Permitting								
8	Infrastructure & Techno-Economic Feasibility								

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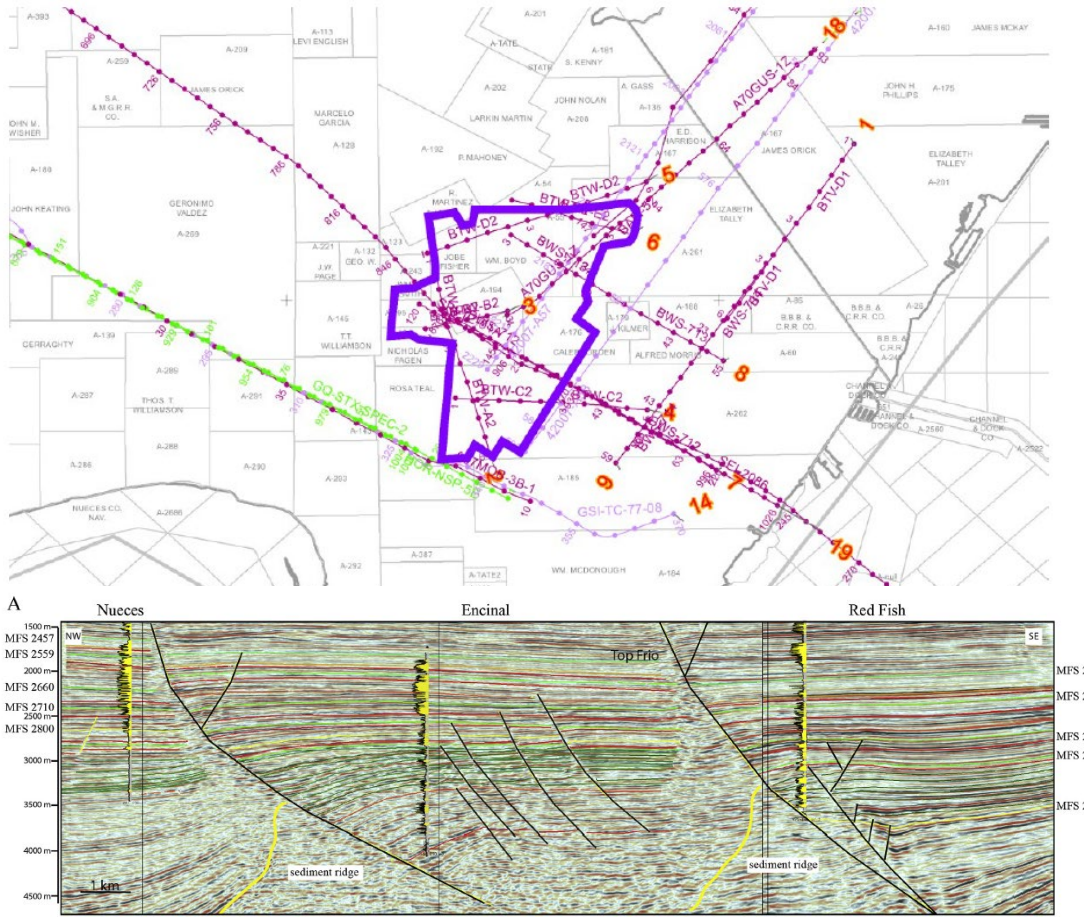
Technical Approach — Project Success Criteria (1/2)

Year 1 — Go/No-Go:

- Successful acquisition and interpretation of existing 2D seismic data.
- Building a 3D geological model of the Project Pore Space (AoR-6) area and begin flow simulation model to estimate the plume migration and injectivity.
- Stakeholder engagement to identify potential risks (NRAP).
- SMART criteria preliminary report for community outreach, environmental justice, and economic growth.
- Successfully drill a "stratigraphic" appraisal well and analyze the results for injectivity, reservoir potential and seal capacity.

Example of Existing 2D Seismic Data (near AoR-6)



Olariu, M.I., Hammes, U., Ambrose, W.A., 2013, Depositional architecture of growth-fault related wave-dominated shelf edge deltas of the Oligocene Frio Formation in Corpus Christi Bay, Texas, Marine and Petroleum Geology, v. 48, p. 423-440. http://dx.doi.org/10.1016/j.marpetgeo.2013.09.009

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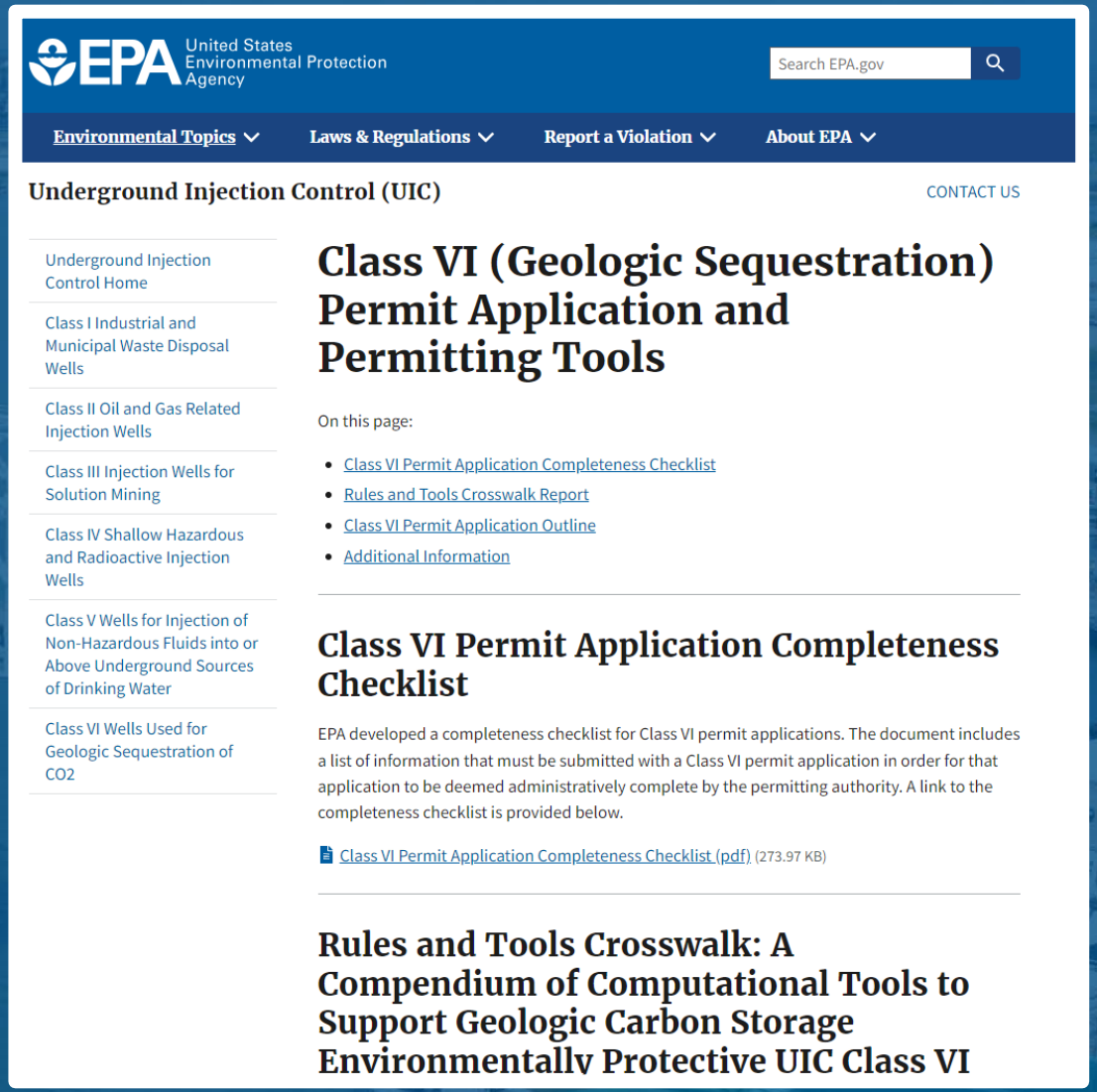
Technical Approach — Project Success Criteria (2/2)

Year 2:

- Estimate Storage Resource Management System (SRMS) Contingent Resource volume based on technical work and project status.
- Prepare data and interpretations and be ready to apply for CarbonSafe Phase III program and begin engagement with EPA regarding the required UIC Class VI permit.
- SMART criteria final report for community outreach, environmental justice, and economic growth.



EPA United States Environmental Protection Agency

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Underground Injection Control (UIC) CONTACT US

- Underground Injection Control Home
- Class I Industrial and Municipal Waste Disposal Wells
- Class II Oil and Gas Related Injection Wells
- Class III Injection Wells for Solution Mining
- Class IV Shallow Hazardous and Radioactive Injection Wells
- Class V Wells for Injection of Non-Hazardous Fluids into or Above Underground Sources of Drinking Water
- Class VI Wells Used for Geologic Sequestration of CO2

Class VI (Geologic Sequestration) Permit Application and Permitting Tools

On this page:

- Class VI Permit Application Completeness Checklist
- Rules and Tools Crosswalk Report
- Class VI Permit Application Outline
- Additional Information

Class VI Permit Application Completeness Checklist

EPA developed a completeness checklist for Class VI permit applications. The document includes a list of information that must be submitted with a Class VI permit application in order for that application to be deemed administratively complete by the permitting authority. A link to the completeness checklist is provided below.

Class VI Permit Application Completeness Checklist (pdf) (273.97 KB)

Rules and Tools Crosswalk: A Compendium of Computational Tools to Support Geologic Carbon Storage Environmentally Protective UIC Class VI

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Technical Approach — Project Risks

Perceived Risk	Risk Rating (Low, Med, High)			Mitigation/Response Strategy
	Probability	Impact	Overall	
Cost/Schedule Risks:				
Stratigraphic test well delayed due to permitting and/or availability of long lead items	Low	Med	Low	Consider incurring pre-award costs in order to begin permit preparation and pre-well costs.
Stratigraphic test well cost increase due to inflation	Med	Med	Med	Ensure competitive bids on all significant goods and services.
Surface permitting for pipeline	Med	High	High	Robust communication with landowners and regulatory stakeholders. Diligence during permitting
Project budget is underestimated	Med	Med	Med	Quarterly review of budget versus expenditures and assess risk of going off budget.

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Technical Approach — Project Risks

Perceived Risk	Risk Rating (Low, Med, High)			Mitigation/Response Strategy
	Probability	Impact	Overall	
Technical/Scope Risks:				
Delay in seismic data acquisition	Low	Med	Med	Initiate seismic acquisition from vendor.
Complexity in plume modeling	Med	Med	Med	Running multiple scenarios and sensitivity analyses.
Lack of lease extension	Low	Med	Low	Have begun acquisition of additional land.
Communication and integration of work scope and results	Low	Med	Low	Ensure frequent communication and establish quarterly meetings amongst all teams.

Current Status of Project and Accomplishments

Project Intended Start Date: October 2023

Status of Project Objectives and Tasks:

Task 1 – Update Project Management Plan	(*All*)
Task 2 – Outreach & Environmental Justice	(*POCCA*)
Task 3 – Permitting & Site Access Agreement	(*Talos/Howard*)
Task 4 – Site Characterization & Geologic Data	(*Texas A&M/Talos*)
Task 5 – Subsurface Modeling & Flow Simulation	(*Texas A&M/Talos*)
Task 6 – Risk Assessment, Mitigation, Monitoring	(*Texas A&M/Talos*)
Task 7 – Plan for UIC Class VI Permitting	(*Talos*)
Task 8 – Infrastructure & Techno-Economic Feasibility	(*POCCA/Howard*)

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Current Status of Project and Accomplishments

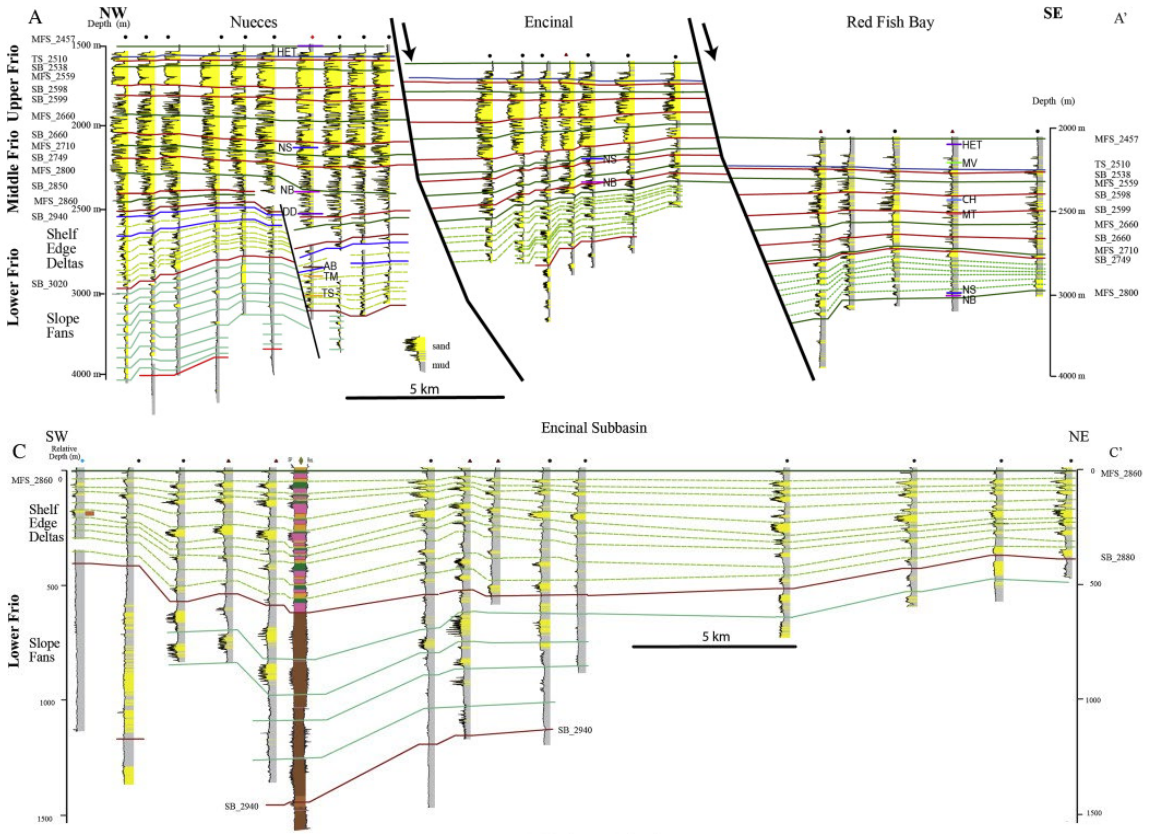
Key Findings and Their Impact:

- Geologically, the Frio Formation is more heterogenous than initially anticipated.
- Injection will require complex scheduling.

Challenges and Mitigations:

- Absence of seismic and core data for pre-feasibility study — acquisition of data during Phase II.
- No information on fault geometry and transmissibility — use structure mapping to assess displacement.
- Homogeneous reservoir properties — reduce injection rates to limit plume migration.
- Heterogeneous reservoir properties — reduce cell height to reduce averaging effects of interbedded sandstones and shales.

Example of Existing Stratigraphic Cross-Section (near AoR-6)



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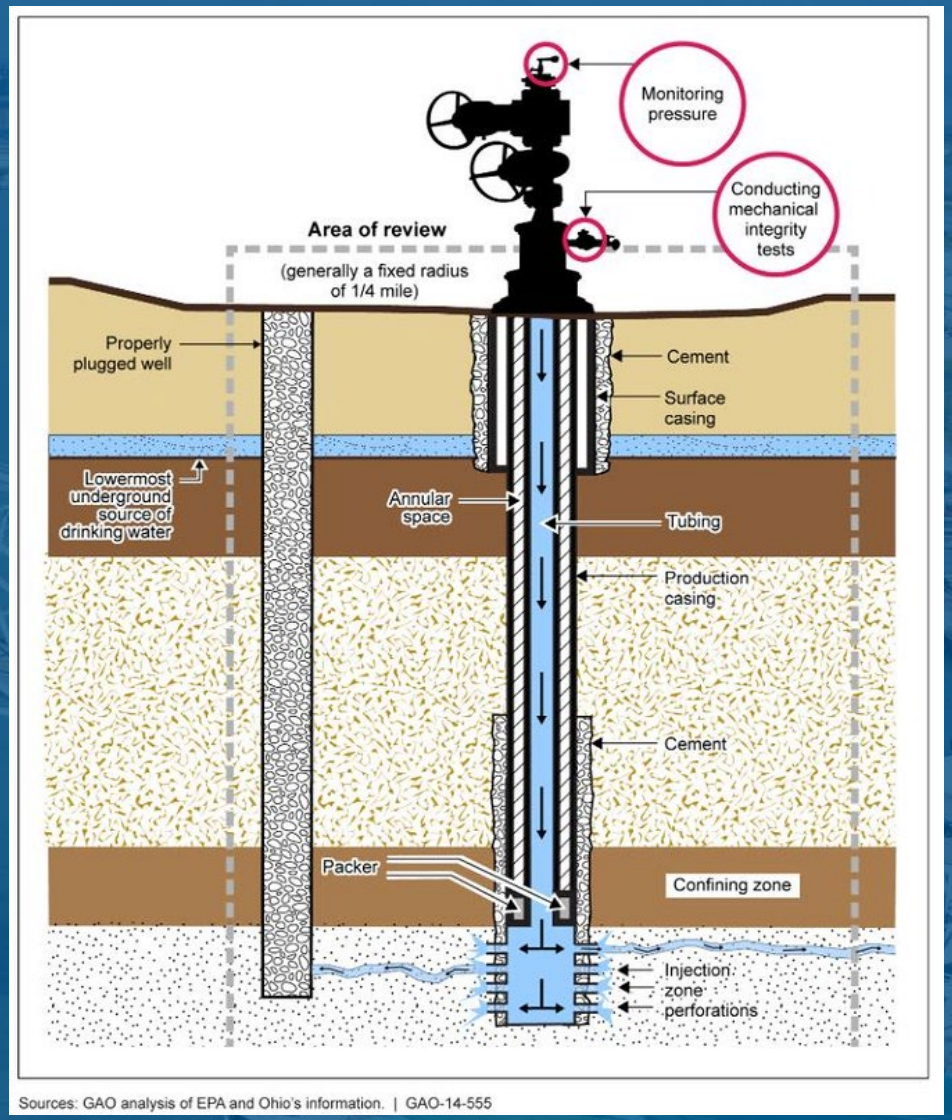
Current Status of Project and Accomplishments

National Environmental Policy Act: (NEPA)

- Agency Kickoff Meetings
- Project Site Visits
- Wetland Delineations
- Cultural Resource Phase/Archaeological Intensive Survey & Report
  - — Historical Resource Consultation
  - — Community/Stakeholder Engagement
  - — Environmental Assessment

Class VI Well Permitting:

- Agency Consultation
- Emergency Response Planning
- Contractor Safety Management
- Process Safety Management
- Data Management



Sources: GAO analysis of EPA and Ohio's information. | GAO-14-555

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Community Benefits / Societal Considerations (CB/SCI)

Community & Labor Engagement

- Business opportunities/local workforce
- Encourage local entrepreneurs

Job Quality & Skilled Workforce

- Internships
- College Training Programs & Partnerships

Diversity, Equity, Inclusion, Accessibility

- Women-Owned-Businesses
- Learning Lab (see photo)

Justice 40

- Access to Jobs

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Next Steps/Lessons-Learned

Scope of Work:

- Integrate geological, geophysical, fluid, and engineering data to characterize the Frio Formation and the Marg. A Sandstone unit in the storage complex.
- Model storage resources, flow behavior, plume migration, and pressure propagation.
- Identify all commercial, transportation and subsurface risks using the NRAP methodology and maintain a comprehensive risk register for the creation of a detailed Mitigation Plan.
- Develop a Monitoring Plan using all geological, and geophysical methods required to ensure safe and permanent storage in AoR-6.
- Develop a detailed Site Characterization, Technical and Regulatory Plan that addresses all regulatory requirements required for a UIC Class VI permit.
- Conduct a comprehensive techno-economic analysis of the Project, including socio-economic costs and benefits as well as various financing options.
- Ensure sustained engagement with a diversity of stakeholders with an emphasis on maximizing project benefits in historically underserved and disadvantaged communities.

Thank you.

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