Testimony of Lily R. Barkau, P.G., Groundwater Section Manager
Water Quality Division
Wyoming Department of Environmental Quality

Before

U.S. Senate Committee on Energy and Natural Resources

Hearing to receive testimony on

"Full Committee Hearing to Examine Opportunities and Challenges in Deploying CCUS and DAC Technologies on Federal and Non-Federal Lands"

November 2, 2023 at 10:00 AM
Room 366 Dirksen Senate Office Building

Contents

Regulatory Background

Since 2008, the State of Wyoming has passed comprehensive legislation to allow and promote carbon dioxide (CO_2) sequestration, also referred to as CO_2 storage. Within Wyoming's regulatory framework, prospective CO_2 storage operators can pursue carbon capture and storage (CCS) in an environment with well-defined risks and liabilities. Wyoming statutes and regulations (1) localize and streamline the storage process by authorizing the Wyoming Department of Environmental Quality (WDEQ) to oversee CCS injection permitting in Wyoming; (2) provide clarity for the ownership and leasing of pore space by establishing a regime for the ownership and conveyance of pore space rights; (3) create efficiencies by authorizing multiple pore space interests to be combined for development as a single unit (unitization); and (4) allocate responsibility for long-term stewardship of and liability for geologic storage facilities.

Section 1421 of the Safe Drinking Water Act (SDWA) requires the US Environmental Protection Agency (USEPA) to develop Underground Injection Control (UIC) program requirements that protect underground sources of drinking water (USDW). Primary enforcement authority, often called primacy, refers to a state, territory, or tribal responsibility that has been authorized to implement USEPA-approved UIC programs. Primacy programs are established under Sections 1422 and 1425 of the SDWA. Wyoming received primacy over Class I through V UIC wells in 1983. The WDEQ received primacy over Class VI wells for the geologic sequestration of CO_2 on September 3, 2020. Wyoming is one of two states to have received primacy for implementing the UIC Class VI program; the other is North Dakota.

The WDEQ implements the UIC Class I, III, V, and VI well programs. The Wyoming Oil and Gas Conservation Commission (WOGCC) implements the UIC Class II program (disposal of hydrocarbons, brines, or other fluids produced in conjunction with oil and gas production). Class IV wells (injection of hazardous waste into or above a usable aquifer) are prohibited in Wyoming. The WDEQ's Class I program currently has 93 permitted wells that inject hazardous and non-hazardous fluids (industrial and municipal wastes) into deep, isolated rock formations below the lowest USDW. The WDEQ has issued over 3,000 permits (rule authorized, general, or individual permits) for Class V wells that inject non-hazardous fluids into or above a USDW. The WDEQ's long history of permitting and enforcing the Class I and V UIC Programs has supported WDEQ's primacy of the UIC Class VI program and represents four decades of expertise and experience that are easily transferable to the UIC Class VI program.

Wyoming's Underground Injection Control Class VI Program

Carbon Capture, Utilization, and Storage (CCUS) refers to the utilization of the captured CO_2 either directly or indirectly in various products or for enhanced oil recovery projects, whereas CCS focuses on permanent storage (i.e., sequestration) (Figure 1). The UIC Class VI program permits storage and will be the focus of this testimony (Item Number 4 of Figure 1).

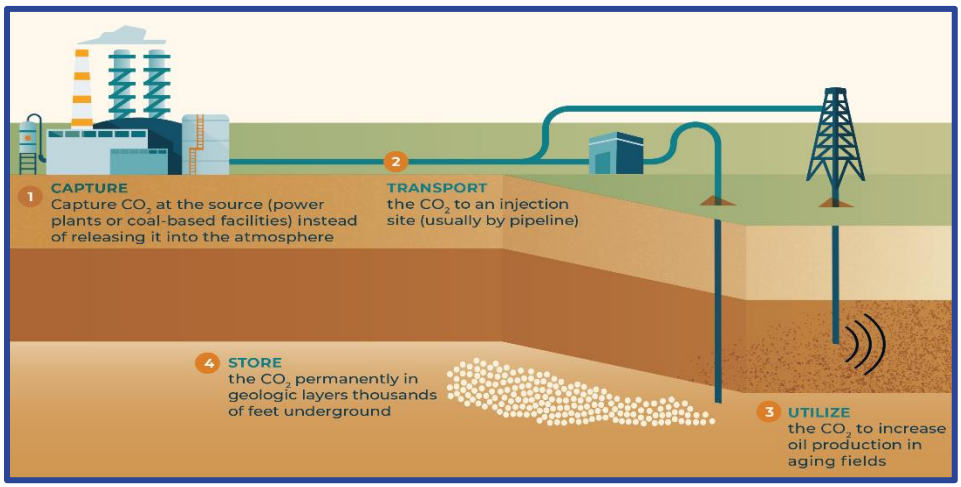


Figure 1. CCUS, Energy & Environmental Research Center, 2021

Wyoming is well suited for CCS due to its number of high-storage potential sedimentary basins (Figure 2).

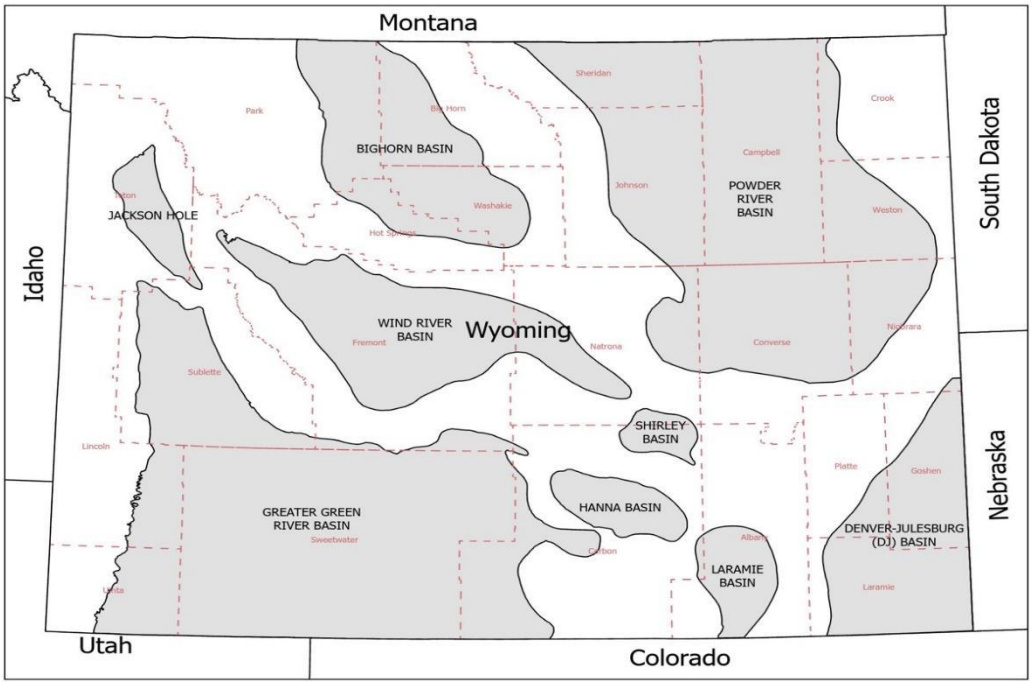


Figure 2. Sedimentary basins in Wyoming[1] 2023

At this time, the WDEQ is aware of four geologic sequestration projects consisting of 12 proposed UIC Class VI wells in Wyoming. Permitting of these UIC Class VI wells are in various stages, ranging from the pre-application stage to the permit issuance stage. Currently the WDEQ is reviewing submitted applications for a total of five UIC Class VI wells. WDEQ anticipates issuing the first three UIC Class VI permits (permits to construct the wells) by the end of the calendar year for a project in the southwest corner of the State. Each UIC Class VI permit represents one Class VI well; multiple wells cannot be authorized under the same permit.

Figure 3. Wyoming CCS Project Locations, 2023 (See Attachment A)

[1] Data Sources: Esri, BLM, BoR, DoD, NPS, USFWS, USFS, USGS, Wyoming State Geological Survey.

Program Successes

As noted above, WDEQ received primacy of the UIC Class VI program in September 2020. WDEQ estimates that obtaining primacy, from primacy application submittal to receipt of primacy, took 33 months. In 2008, the Wyoming Legislature drafted bills specifying ownership of subsurface pore space and creating a regulatory scheme for geologic storage by directing WDEQ to develop standards for regulating long-term, geologic storage of CO_2 in Wyoming under the existing UIC Program. In addition, a workgroup consisting of state agencies, industry, and academia was convened to assess the risks of geologic storage and recommend financial assurance requirements and duration of post-closure care. Wyoming's long-term efforts to build a regulatory framework for CCS provided a foundation for Wyoming to obtain UIC Class VI primacy, and Wyoming was discussing and establishing CCS regulations before EPA promulgated Class VI federal regulations in 2011. WDEQ's experience with permitting UIC Class I wells, which are also technically complex, is easily transferable to the Class VI program.

As part of obtaining primacy, WDEQ established rules to regulate Class VI wells in Wyoming such that USDWs are protected. These rules are established in Water Quality Rules Chapter 24, and Wyoming's rules are as stringent as federal regulations.

Wyoming's Class VI rules are robust and cover the siting, permitting, operation, testing and monitoring, financial assurance, post-injection site care, and closure of Class VI wells. Below are a few of the key requirements an applicant must meet:

- Operators seeking a UIC Class VI permit for injection operations as part of CCS must demonstrate the ability of the subsurface formations to safely contain the CO_2 and adhere to a stringent well construction standard.

- The operator must conduct a monitoring program and carry financial assurance throughout the life of the project.

- All UIC Class VI wells must:
    - Be sited in areas with a suitable geologic system comprised of an injection zone of sufficient areal extent, thickness, porosity, and permeability to receive the total anticipated volume of the CO_2 stream, and
    - Have confining zones that are free of transmissive faults or fractures and of sufficient areal extent and integrity to contain the injected carbon dioxide stream and displaced formation fluids and allow injection at proposed maximum pressures and volumes without initiating or propagating fractures in the confining zones or causing non-transmissive faults to become transmissive.

In order to help applicants meet WDEQ's rules and to expedite the permitting of UIC Class VI wells in Wyoming, the WDEQ has developed and is implementing a streamlined permitting process (Figure 4) that encourages operators to meet with regulatory agencies early in the process. A detailed breakdown of the permitting process is available in Attachment B.

Figure 4. Wyoming UIC Class VI Permitting Process, 2023

Key steps in the permitting process include the following:

- The process begins with an **Informational Meeting:** Operators are encouraged to meet with WDEQ early, as soon as they work through screening and feasibility evaluations of the sequestration site. Discussions regarding site characterization activities to date, the scope of the project, the location of the project including property ownership and mineral estates, and the anticipated timeframe to submit a UIC Class VI permit will assist WDEQ in expediting permit application reviews. In addition, the WDEQ provides information to help and encourage the operator to meet with other state and federal regulatory agencies, such as:

    - Wyoming Oil and Gas Conservation Commission
    - Wyoming Office of State Lands and Investments
    - Wyoming Department of Environmental Quality – Industrial Siting, Air Quality, and Land Quality Divisions
    - Wyoming Game and Fish Department
    - County Commissioners
    - Bureau of Land Management

- An operator who determines that they do not have the information to demonstrate appropriate site characterization for the sequestration site may choose to drill a **stratigraphic test well** to collect additional site information prior to completing a UIC Class VI permit application.

- A **pre-application meeting** is held with the operator 45 days prior to the application being submitted, at which time the applicant and WDEQ will continue discussing Class VI application requirements, and the applicant will meet with other WDEQ divisions to discuss potential permitting requirements in those divisions (e.g., Air Quality Division permits).

- The operator submits the application, and WDEQ then conducts the UIC Class VI permit **application review**. The WDEQ must review the application for completeness within 60 days of receipt of the application. If the WDEQ determines an application to be incomplete, it will prepare comments for the operator to provide the additional information needed. The application is reviewed for:

    - The protection of USDWs to include the presence/absence of faults or fractures, and cap and bottom rock seal integrity
    - Geologic exhibits for site characterization
    - Geologic model construction and numerical simulation of carbon dioxide injection
    - Area of review
    - Testing and monitoring plan
    - Post-injection site care and facility closure plan

- Emergency and remedial response plan
- Well casing and cementing program
- Plugging plan
- Injection operations
- Financial Assurance

If the WDEQ finds technical deficiencies, it will work with the operator to address them through the comment/response process.

- Once the WDEQ determines an application to be complete and all regulations are met, the WDEQ drafts a **Permit to Construct** and holds a 60-day public comment period. The WDEQ then issues the Permit to Construct, provided no new information was received during the public comment period that indicates additional information is needed for the well to meet regulations.

- The operator **drills the injection well and associated monitoring wells** and completes **pre-injection testing**. The operator submits data acquired from these construction and testing activities to the WDEQ in a permit modification application to finalize site characterization information and other items as identified above.

- The WDEQ reviews the permit modification application to ensure regulations are met. If regulations are met and once unitization of pore space has been demonstrated through an Order issued by the Wyoming Oil and Gas Conservation Commission (WOGCC), the WDEQ drafts a permit modification to **authorize injection**. The permit modification is available for another 60-day public comment period. Following the public comment period and provided no new information has been submitted indicating that regulations aren't met, the WDEQ will issue the modified permit to authorize injection.

- WDEQ provides oversight for the life of the project during the injection phase, including compliance and inspection activities. Under Water Quality Rules Chapter 29, the operator is charged a 7 cents/ton fee during the injection period. Funds are placed into a special revenue account to support the monitoring and management of the site during the long-term stewardship phase.

- Once injections are complete, the operator is required to conduct **post-injection site care and closure** requirements. In order to achieve closure, Wyoming statutes require the operator to provide a minimum of three years' data indicating the CO2 plume is stable without the use of control equipment.[2]

- After closure requirements have been met, the permit is terminated and the project moves into the **long-term stewardship phase**. Wyoming passed legislation in 2022 that transfers the title and liability for the CO_2 to the state after site closure. The transfer of title and liability cannot occur until: all UIC Class VI permit conditions and regulations have been met; financial assurance is returned; and the permit is terminated. The transfer cannot occur until at least 20 years after injections cease.

Given WDEQ's efforts to streamline the permitting process and encourage early and often communication with applicants, the WDEQ anticipates it will be able to issue a Class VI permit authorizing injection within 1 ½ to 2 years from the date it receives the application (this includes the entire permitting process from when an application is received, issuance of a Permit to Construct,

[2] WY Stat § 35-11-313(f)(vi)(F)

injection well construction, submission of additional information, and issuance of the modified permit authorizing injection). However, the permitting timeline ultimately depends on the condition of the submitted permit application and the responsiveness of the applicant.

A robust outreach program for the UIC Class VI wells has also been implemented. Wyoming Statute requires applicants to publish a notice of the application being submitted in a newspaper of general circulation, in each county the proposed operation will occur, weekly for four consecutive weeks.[3] In addition, notice is sent to surface owners, mineral claimants, mineral owners, lessees and other owners of record of subsurface interest located within one mile of the proposed boundary of the geologic sequestration site. Water Quality Rules Chapter 24, Section 27 outlines the public notice requirements of WDEQ's intent to issue or deny a permit, which includes a 60-day public comment period. For recent draft permits, WDEQ held stakeholder meetings with county commissioners and citizen organizations once the application was received and conducted a hearing at the conclusion of the public comment period to ensure all comments were received.

Federal Lands for CCS Projects

Given the high concentration of federal lands located in Wyoming (Figure 5), large-scale CCS projects are almost certain to implicate federal holdings, generating questions about how federal land agencies, such as the BLM, will approach CCS. In particular, how BLM or other federal agencies will approach access to pore space needs further clarification.

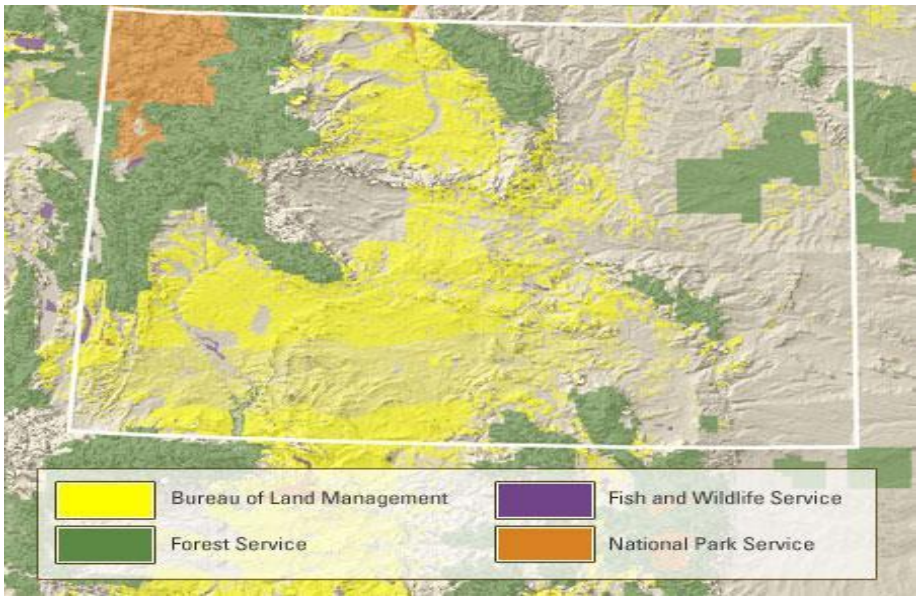


Figure 5. Public Lands, 2023

Wyoming Statute, Title 34, Article 1, Section 34-1-152 identifies that the ownership of all pore space in all strata below the surface lands and waters of the state is declared to be vested in the several owners of the surface above the strata. [4] In other words, the surface owner also owns the pore space. Furthermore, the statutes define pore space to mean subsurface space which can be used as storage space for carbon dioxide or other substances. Prior to WDEQ authorizing injection under the UIC Class VI permit, WOGCC must have issued an Order for the unitization of the pore space within the geologic storage site.

[3] WY Stat § 35-11-313(f)(ii)(N)

[4] WY Stat § 34-1-152 (2022)

Current federal law does not provide a legal definition of pore space, much less clarify the ownership of pore space in estates owned in less than fee simple (aka, in split estates, where the surface rights are privately owned, but the mineral rights are federally owned). Due to the private/federal split estate, there is particular uncertainty surrounding the ownership of pore space under approximately 70 million acres of land in the United States patented under the Stock Raising & Homestead Act of 1916, which granted land to settlers for the grazing and farming of livestock.[5]

Obstacles in Implementing CCS Projects

The WDEQ, based on its experience with CCS projects to date, has identified the following obstacles to issuing UIC Class VI permits in a timely and effective manner:

1. Clarification on federal pore space and unitization of that pore space is needed to support timely permitting of CCS projects. The federal UIC Class VI Program is silent on pore space and injection activities as the purpose of the program and a Class VI permit is to protect USDWs. However, as noted previously, the WDEQ cannot authorize injection under a Class VI permit until a pore space unitization order has been issued. Given the extent of federal lands and mineral estates in Wyoming, clarity on where federal pore space exists, particularly on split-estate lands, and how federal pore space will be unitized will help ensure that CCS operators can plan projects, communicate with landowners, and obtain unitization orders such that WDEQ can issue Class VI permits in a timely manner.

2. Improve coordination between WDEQ and Wyoming BLM to ensure that
    a. WDEQ Class VI permits issuance and BLM Right-of-Way (ROW) authorizations are issued at the appropriate times: A CCS operator is not required to have the Class VI permit before applying for the BLM ROW, but the operator must have the BLM ROW before WDEQ can issue the Class VI permit. However, an operator with a potential CCS project that obtains a BLM ROW may never apply for a Class VI permit. The first operator obtaining a BLM ROW should not exclude a second operator from also obtaining the BLM ROW so that the second operator can submit a Class VI application. The WDEQ and Wyoming BLM Office have discussed this timing issue and have agreed that a CCS operator should obtain the BLM ROW first but that the issuance of the BLM ROW is not exclusive. Other operators can also obtain a ROW in the same area, and the ability of an operator to inject in that area is dependent on obtaining the Class VI permit.

    b. WDEQ Class VI permit issuance and BLM Right-of-Way (ROW) authorizations are issued such that each agency (WDEQ and BLM) has the information it needs to make decisions and such that each agency is staying within its regulatory authority: Under the Class VI permit, the WDEQ authorizes injection of the CO2 such that USDWs are protected. Under the BLM ROW, the BLM is charged with ensuring access to federal pore space and that federal mineral estates are not damaged. It is important to keep these two roles and authorities distinct.

       The WDEQ and Wyoming BLM continue to discuss the information-sharing necessary to achieve this coordination and the best ways for one agency to communicate questions and concerns to the other agency. Some of the information WDEQ needs for a Class VI permit may be the same information that BLM needs for a ROW authorization. As each agency reviews this information, it is important that WDEQ's review relates to the

[5] Kevin Doran and Angela M. Cifor, *Does the Federal Government Own the Pore Space Under Private Lands in the West? Implications of the Stock-Raising Homestead Act of 1916 for Geologic Storage of Carbon Dioxide*, 42 LEWIS & CLARK ENV'T L. REV. 527, 531 (2012); Righetti, et al., *supra* note 27, at 194.

issuance of the Class VI permit, that BLM's review relates to the issuance of the ROW authorization, and that the concurrent reviews are conducted in such a way to avoid creating delays.

Additionally, the scope of BLM's ROW review for different pore space/mineral estate scenarios could be clarified. For example, is the scope of BLM's ROW review the same if it is solely ensuring protection of a federal mineral estate (e.g., if surface ownership is private and thus pore space ownership is private but a federal mineral estate exists above the injection zone) vs. if BLM is providing access to federal pore space (e.g., federal surface ownership and federal pore space)?

c. WDEQ and BLM are not requiring duplicative financial assurance through bonds. Clarification is needed to identify what portions of the geologic sequestration site require bonding through WDEQ vs. what portions require bonding through BLM. Currently, the WDEQ and Wyoming BLM are in discussions to establish procedures to coordinate financial assurance for CCS projects and ensure that duplicative bonding does not occur, particularly for CCS projects with minimal use of federal pore space.

3. Interstate pore space: As shown on Figure 2, Wyoming's sedimentary storage basins traverse or are situated near state borders, including the Greater Green River Basin extending into Colorado and Utah, the Bighorn and Powder River Basins extending into Montana, and the Denver Basin (variously referred to as the Denver-Julesburg Basin) extending into Nebraska and Colorado. The Area of Review (AoR) for a geologic storage site is defined as the CO_2 plume, pressure front, and any displaced fluids. The federal UIC Class VI Program regulations do not consider pore space in the issuance of the permit and only require public notification to local, tribal, or neighboring state jurisdictions in the AoR. Therefore, in Wyoming, the WDEQ as the primacy agency would be required to notify local, tribal, or neighboring state jurisdictions where the AoR occurs. For example, if the AoR crosses into Colorado, the WDEQ would need to notify Colorado. However, a process for acquisition and storage in a neighboring state's pore space has not been identified, especially if a neighboring state does not have current regulations regarding pore space. Because the WDEQ cannot issue the Class VI permit until the pore space unitization order has been issued, the use of interstate pore space calls into question how unitization will occur, thus impacting the WDEQ's ability to issue the Class VI permit. Further discussions need to be held to identify processes for interstate pore space.

4. Aquifer Exemptions: As identified in Figure 2, Wyoming has significant storage potential within its saline sedimentary basins. UIC Class VI regulations require that CO_2 injection occur below the lowest-most USDW. Wyoming has deep freshwater aquifers that under UIC Class I federal regulations, would be allowed to obtain an aquifer exemption. However, UIC Class VI federal regulations do not allow for new aquifer exemptions for CCS projects other than aquifer exemption expansions associated with already issued UIC Class II aquifer exemptions.

5. Federal funding for state primacy programs. At this time, no federal funding is being provided to states to implement UIC Class VI primacy programs. Thus, Wyoming is using state general funds and permit fees to support the program. While under the Infrastructure Investments and Jobs Act (IIJA), EPA is offering one-time grant funding to support states either with or seeking UIC Class VI primacy, it is unclear when that funding will be available and what requirements EPA will apply to that funding. That funding will also only support state programs for a limited time.

WDEQ CONTACTS

Todd Parfitt, Director
307-777-7937
todd.parfitt@wyo.gov

Jennifer Zygmunt, Water Quality Division Administrator
307-777-5985
Jennifer.zygmunt@wyo.gov

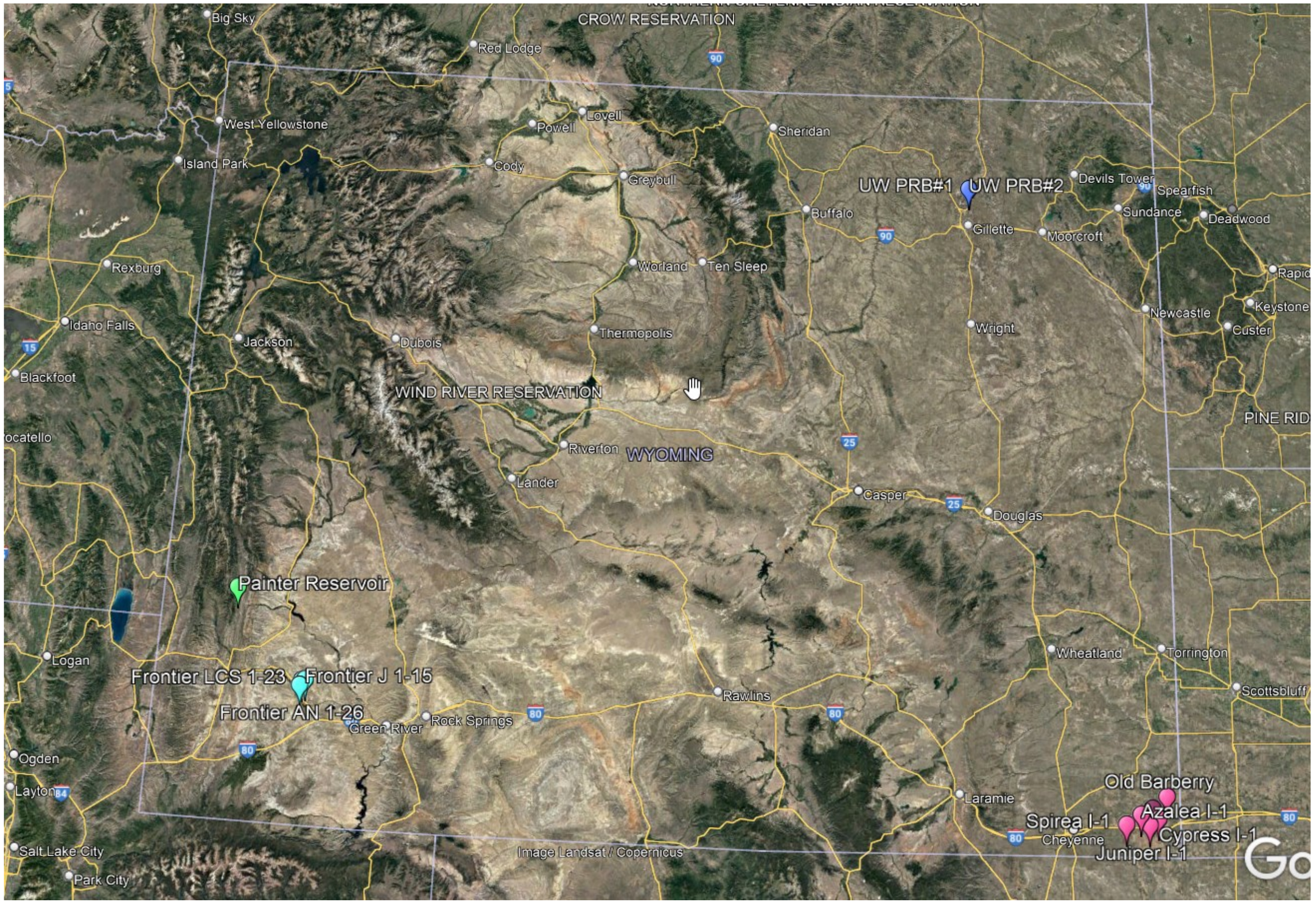
Lily R. Barkau, P.G., Groundwater Section Manager
307-777-7072
Lily.barkau@wyo.gov

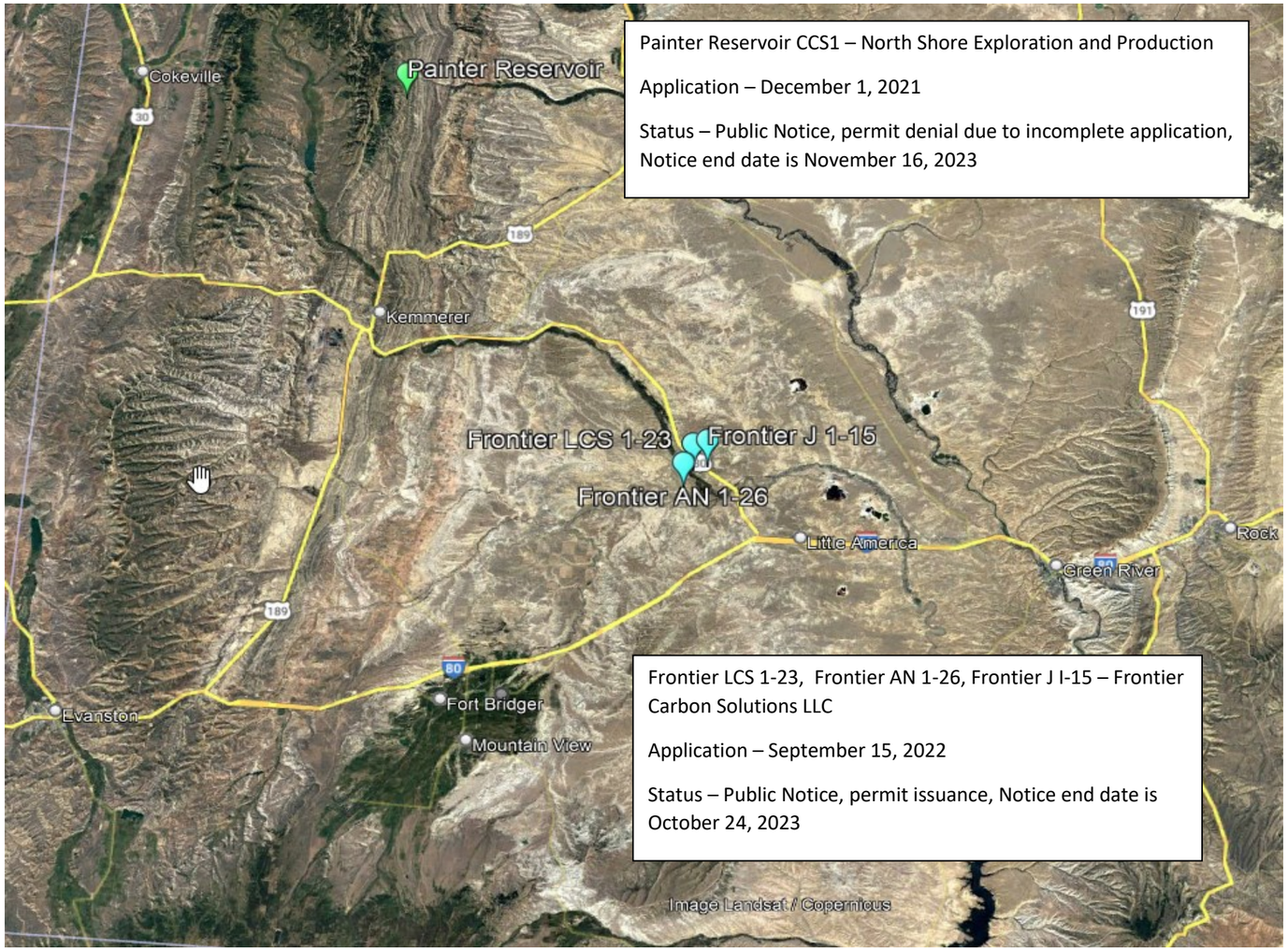
Wyoming Department of Environmental Quality, Water Quality Division Class VI Website
https://deq.wyoming.gov/water-quality/groundwater/uic/class-vi/

ATTACHMENTS

Attachment A: UIC Class VI Well Locations
Attachment B: UIC Class VI Permitting Process

Attachment A - **Wyoming UIC Class VI Well Locations**





Painter Reservoir CCS1 – North Shore Exploration and Production

Application – December 1, 2021

Status – Public Notice, permit denial due to incomplete application, Notice end date is November 16, 2023

Frontier LCS 1-23, Frontier AN 1-26, Frontier J I-15 – Frontier Carbon Solutions LLC

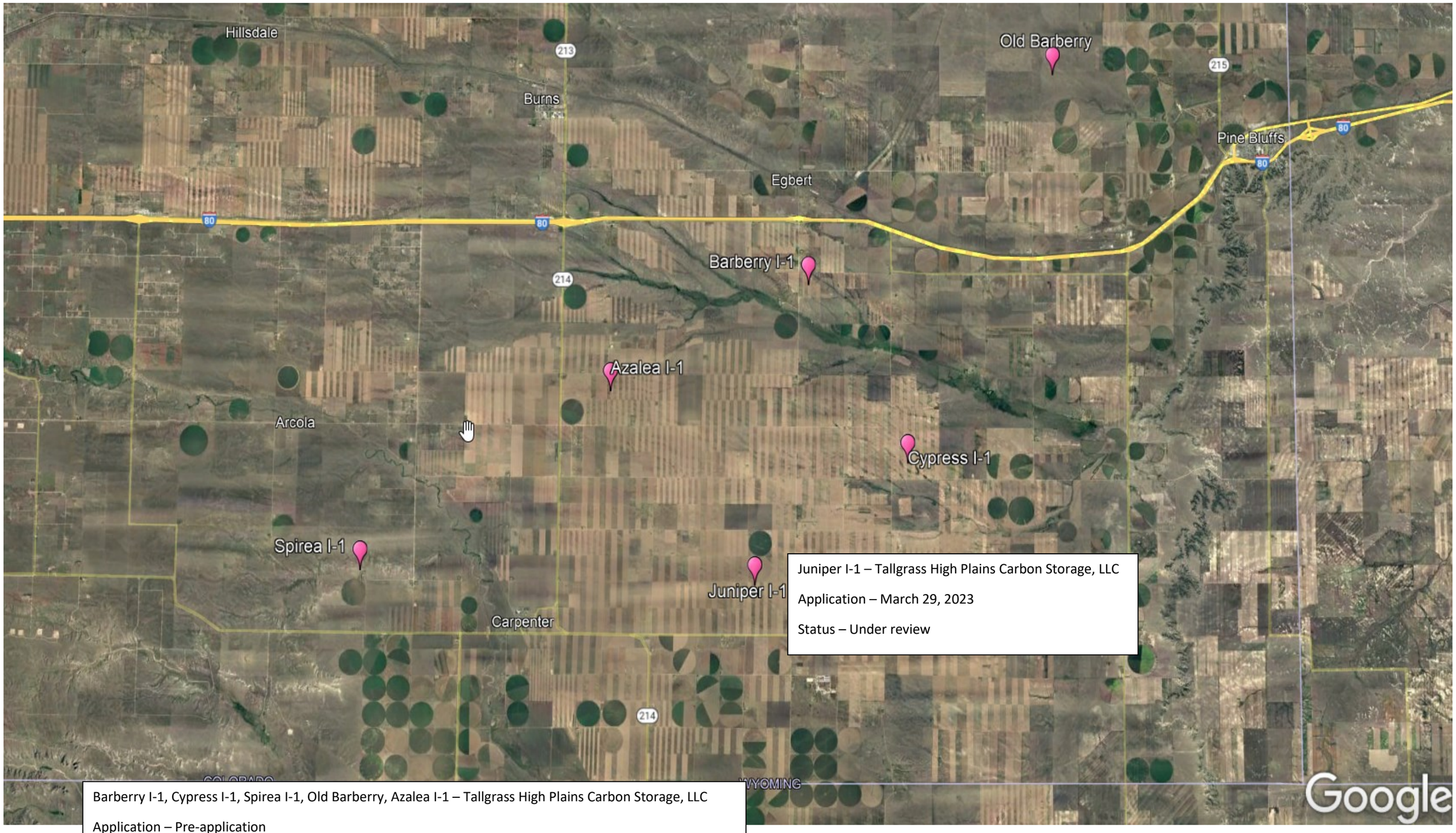
Application – September 15, 2022

Status – Public Notice, permit issuance, Notice end date is October 24, 2023

UW PRB #1 and UW PRB#2 – University of Wyoming Carbon Safe Project

Application – NA

Status – Permitted as UIC Class I Wells for research purposes. Wells constructed and testing completed. Will submit applications for conversion to Class VI wells in late 2023/early 2024.



Juniper I-1 – Tallgrass High Plains Carbon Storage, LLC

Application – March 29, 2023

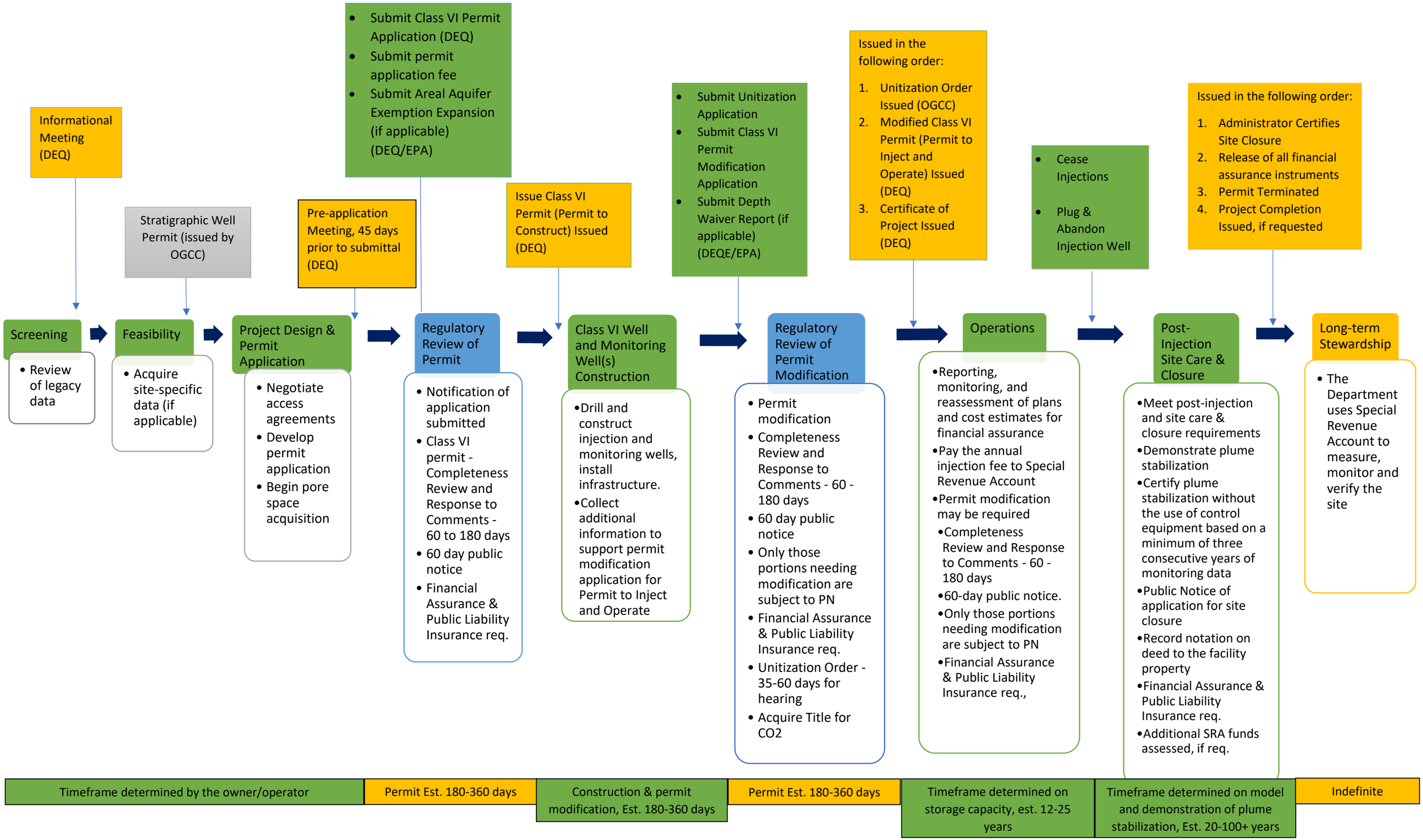
Status – Under review

Barberry I-1, Cypress I-1, Spirea I-1, Old Barberry, Azalea I-1 – Tallgrass High Plains Carbon Storage, LLC

Application – Pre-application

Status – Applications to be submitted late 2023

Wyoming **UIC Class VI Permitting Process**



Note: Other items are required for permit and site closure per Wyo. Stat. § 35-11-313 and Water Quality Rules Chapter 24.