POST-INJECTION SITE CARE AND SITE CLOSURE PLAN
40 CFR 146.93(a)

Facility Information

Facility Name: Capio [redacted] Sequestration, LLC

Well Name: Capio [redacted] CCS Well No. 1

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Well location: [redacted]
Pointe Coupee Parish, Louisiana
[redacted]

This Post-Injection Site Care (PISC) and Site Closure plan describes the activities that Capio Sequestration, LLC will perform to meet the requirements of 40 CFR 146.93. Following the cessation of injection, Capio will monitor ground water quality and track the position of the carbon dioxide plume and pressure front for either the default PISC time frame of 50 years or an alternative time frame approved by the appropriate regulatory body, until the site has been approved for closure. Capio will not cease post-injection monitoring until a demonstration of non-endangerment of USDWs has been approved by the UIC Program Director pursuant to 40 CFR 146.93(b)(3). Following approval for site closure, Capio will plug all monitoring wells, restore the site to its original condition, and submit a site closure report and associated documentation.

Capio [redacted] CCS Well No. 1 will be developed for injection in multiple phases over a multi-decade period of time. The current expectation is that the well will be utilized for injection for a [redacted]. This version of the PISC plan is based on the initial AOR delineation and modeling results discussed in **Section 3** for Operational Phase I. This phase will consist of an [redacted] Upon the acquisition of site-specific data, the model will be calibrated and validated as there is currently no site-specific historical data available with which to match the future injection location. At the time that Capio [redacted] CCS Well No. 1 is drilled and installed, Capio will collect additional data specific to the modeled intervals. In particular, Capio will conduct injectivity tests to obtain permeability data specific to the modeled intervals. Prior to the commencement of Operational Phase I, the model will be calibrated with site-specific data, and the AOR, Testing and Monitoring Plan, and PISC Plan will subsequently be refined.

Pre- and Post-Injection Pressure Differential [40 CFR 146.93(a)(2)(i)]

Based on the modeling of the pressure front as part of the AOR delineation, pressure at the injection well is expected to decrease to pre-injection levels [redacted], as described below. Additional

information on the projected post-injection pressure declines and differentials is presented in the permit application and the AOR and Corrective Action Plan.

Predicted Position of the CO_2 Plume and Associated Pressure Front [40 CFR 146.93(a)(2)(ii)]

Figure 10-1 shows the predicted extent of the plume as modeled for Operational Phase I, representing the maximum extent of the plume. The maximum pressures are centered on the injection well, [redacted]. These model results show that the extent of the AOR will be governed by the extent of the supercritical carbon dioxide plume, and not by the extent of the pressure front. At no time in the model was the pressure sufficient to drive brine in a hypothetical artificial penetration outside of the storage complex. The delineated AOR was calculated as the union of all of the supercritical extent maps calculated at yearly intervals. This map is based on the final AOR delineation modeling results submitted pursuant to 40 CFR 146.84.

Legend

- CO_2 Sequestration Well
- Oil and Gas Well
- CO_2 Plume
- [redacted]

FIGURE 10-1
DELINEATED AREA OF REVIEW
CAPIO FIDELIS
POINTE COUPEE PARISH, LA

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0 3,000 Feet
N

Post-Injection Monitoring Plan [40 CFR 146.93(b)(1)]

Performing the planned monitoring methods as described in the following sections during the post-injection phase will meet the requirements of 40 CFR 146.93(b)(1). The results of all post-injection phase testing and monitoring will be submitted annually, within 60 days of the anniversary date of the cessation of injection, as described under "Schedule for Submitting Post-Injection Monitoring Results," below.

A Quality Assurance and Surveillance Plan (QASP) is provided as **Appendix A** to the Testing and Monitoring Plan. This QASP covers all testing and monitoring activities for both the Operational and Post-Operational phases.

Monitoring Above the Confining Zone

Groundwater monitoring well locations within the currently delineated AOR for Operational Phase I are shown on **Figure 10-2**. All monitoring wells utilized during Operational Phase I will continue to be utilized through the PISC period, as well as any additional monitoring wells to be determined (TBD) during AOR updates related to future Operational Phases.

Target monitoring zones, monitoring well locations, parameters, and frequencies were carefully selected based on the delineated AOR for Operational Phase I. Refer to the Testing and Monitoring Plan (**Section 8**) for details on the rationale for these selections. Groundwater monitoring details will be refined as more site-specific data become available, the model is calibrated and validated, and the AOR is updated. Capio will determine monitoring frequencies for the PISC period at a subsequent time when the appropriate modeling results become available.

Table 10-1 presents the monitoring methods, locations, and frequencies for monitoring above the confining zone. **Table 10-2** identifies the parameters to be monitored and the analytical methods Capio will employ.

Table 10-1. Monitoring of ground water quality and geochemical changes above the confining zone.

Target Formation	Monitoring Activity	Monitoring Location(s)	Estimated Total Depth (ft)	Frequency
Lowermost Sand Interval Above Confining Zone (Miocene)	Groundwater Sampling	GMW-1D	[redacted]	TBD
	Groundwater Sampling	GMW-2D	[redacted]	TBD
Lowermost USDW (Upper Miocene)	Groundwater Sampling	GMW-1M	[redacted]	TBD
	Groundwater Sampling	GMW-2M	[redacted]	TBD

Target Formation	Monitoring Activity	Monitoring Location(s)	Estimated Total Depth (ft)	Frequency
Mississippi River Alluvial Aquifer	Groundwater Sampling	GMW-1S	[redacted]	TBD
	Groundwater Sampling	GMW-2S	[redacted]	TBD

Notes:

1. *See **Figure 10-2** for monitoring locations.*
2. *Post-Operational Period will include all Operational Period well clusters, plus any additional TBD during AOR updates.*

Table 10-2. Summary of analytical and field parameters for ground water samples.

Parameters	Analytical Methods
Lowermost Sand Interval Above Confining Zone	
Analytical: Calcium, Magnesium, Sodium, Potassium, Chloride, Sulfate, Total Dissolved Solids, Dissolved CO_2, Alkalinity (as bicarbonate), Arsenic, Iron, Magnesium	Analytical: Per EPA SW-846 guidance
Field: pH, Specific Conductance, Temperature, Pressure	Field: Continuous pH/SC/T/P monitoring via downhole sensors
Lowermost USDW (Upper Miocene)	
Analytical: Calcium, Magnesium, Sodium, Potassium, Chloride, Sulfate, Total Dissolved Solids, Dissolved CO_2, Alkalinity (as bicarbonate), Arsenic, Iron, Magnesium	Analytical: Per EPA SW-846 guidance
Field: pH, Specific Conductance, Temperature, Pressure	Field: Continuous pH/SC/T/P monitoring via downhole sensors
Local USDW (Alluvial Aquifer)	
Analytical: Calcium, Magnesium, Sodium, Potassium, Chloride, Sulfate, Total Dissolved Solids, Dissolved CO_2, Alkalinity (as bicarbonate), Arsenic, Iron, Magnesium	Analytical: Per EPA SW-846 guidance
Field: pH, Specific Conductance, Temperature, Pressure	Field: Continuous pH/SC/T/P monitoring via downhole sensors

Carbon Dioxide Plume and Pressure Front Tracking [40 CFR 146.93(a)(2)(iii)]

Capio will employ direct and indirect methods to track the extent of the carbon dioxide plume and the presence or absence of elevated pressure throughout the PISC period.

Table 10-3 presents the direct and indirect methods that Capio will use to monitor the CO_2 plume and pressure front throughout the PISC period, including the activities, locations, and frequencies Capio will employ.

Direct pressure-front monitoring details

Capio will utilize Distributed Fiber Optic Sensing at Capio [redacted] CCS Well No. 1 along the outside of the long string casing. Capio will use Distributed Temperature Sensing (DTS)/ Distributed Strain Sensing (DSS) for direct, continuous, real-time monitoring of temperature and the pressure front within the injection zone. Sensors are equipped with variable density clips to enable detection prior to casing perforation. Additional DFOS may be deployed in one or more monitoring wells, depending on future revisions to AOR.

Indirect plume and pressure-front monitoring details

Indirect geophysical monitoring of the plume and pressure front is required to supplement the direct pressure front monitoring.

The DFOS network at Capio [redacted] CCS Well No. 1 will also be utilized for the indirect monitoring activities. Time-lapse 3D vertical seismic profiles (VSPs) will indirectly monitor the CO_2 plume movement and development. VSPs use distributed acoustic sensing (DAS) and offer higher resolution images of the subsurface than surface seismic, as well as better repeatability (El-kaseeh et al., 2018). These surveys will be conducted on an annual basis during the Post-Operational period, up to 45 days before the anniversary date of authorization of injection each year. Additionally, DAS will be used to monitor microseismicity. DAS continuously detects and reports seismic events as small as magnitude -1.4 in real-time. This information will be compared to the multi-phase fluid flow model (Section 3.0) and if warranted the model will be re-calibrated. Additionally, the routinely calibrated every five years.

Refer to **Appendix 8-D** of the Testing and Monitoring Plan (**Section 8**) for additional details on the DFOS technology and applications for CO_2 plume and pressure front monitoring.

Table 10-3. Post-injection phase plume and pressure front monitoring.

Target Formation	Monitoring Activity	Monitoring Location(s)	Spatial Coverage	Frequency
DIRECT PRESSURE-FRONT MONITORING				
Injection Zones [redacted]	DTS/DSS	CCS Well No. 1	Distributed measurements from surface to base of storage interval	Continuous
INDIRECT PLUME AND PRESSURE FRONT MONITORING				
	Time-Lapse VSP Survey	CCS Well No. 1	Full coverage of approximately [redacted]	Annual

Target Formation	Monitoring Activity	Monitoring Location(s)	Spatial Coverage	Frequency
Injection Zones [redacted]	DAS Passive Seismicity	CCS Well No. 1	Vertical: distributed measurements from surface to base of storage interval Lateral: [redacted]	Continuous

Wetland Monitoring

As noted in the Testing and Monitoring Plan, the development, construction, and operation of the surface infrastructure will take place near wetlands (See **Figure 10-5, Section 10**). In the event there are impacts to wetlands, Capio will mitigate those impacts and conduct testing and monitoring of the wetland mitigation in accordance with all State of Louisiana and Federal requirements as necessary during the post-injection period.

Schedule for Submitting Post-Injection Monitoring Results [40 CFR 146.93(a)(2)(iv)]

All post-injection site care monitoring data and monitoring results collected using the methods described above will be submitted to EPA in annual reports submitted within 60 days of the anniversary date of the cessation of injection, or on an alternatively with prior approval from the UIC Program Director. The reports will contain information and data generated during the reporting period; i.e. well-based *monitoring data, sample analysis, and the results from updated site models.*

Alternative Post-Injection Site Care Timeframe [40 CFR 146.93(c)]

Following the cessation of injection operations, Capio will conduct post-injection monitoring for either the default 50-year time frame or an alternative PISC time frame as approved by the appropriate regulatory agency. Should future modeling results and AOR updates suggest an alternative PISC time frame is necessary, justification will be provided in this section in future revisions to this Plan. Regardless of the alternative PISC timeframe, monitoring and reporting as described in the sections above will continue until Capio demonstrates, based on monitoring and other site-specific data, that no additional monitoring is needed to ensure that the project does not pose an endangerment to any USDWs, per the requirements at 40 CFR 146.93(b)(2) or (3).

Non-Endangerment Demonstration Criteria

Prior to approval of the end of the post-injection phase, Capio will submit a demonstration of non-endangerment of USDWs to the UIC Program Director, per 40 CFR 146.93(b)(2) and (3). This report will make a demonstration of USDW non-endangerment based on the evaluation of the site monitoring data used in conjunction with the project's computational model. The report will detail how the non-endangerment demonstration evaluation uses site-specific conditions to confirm and demonstrate non-endangerment. The report will include all relevant monitoring data and interpretations upon which the non-endangerment demonstration is based, model documentation and all supporting data, and any other information necessary for the UIC

Program Director to review the analysis. The report will include the following sections:

Introduction and Overview

A summary of relevant background information will be provided, including the operational history of the injection project, the date of the non-endangerment demonstration relative to the post-injection period outlined in this PISC and Site Closure Plan, and a general overview of how monitoring and modeling results will be used together to support a demonstration of USDW non-endangerment.

Summary of Existing Monitoring Data

A summary of all previous monitoring data collected at the site, pursuant to the Testing and Monitoring Plan of this permit and this PISC and Site Closure Plan, including data collected during the injection and post-injection phases of the project, will be submitted to help demonstrate non-endangerment. Data submittals will be in a format acceptable to the UIC Program Director [40 CFR 146.91(e)], and will include a narrative explanation of monitoring activities, including the dates of all monitoring events, changes to the monitoring program over time, and an explanation of all monitoring infrastructure that has existed at the site. Data will be compared with baseline data collected during site characterization [40 CFR 146.82(a)(6) and 146.87(d)(3)].

Site Closure Plan

Capio will conduct site closure activities to meet the requirements of 40 CFR 146.93(e) as described below. Capio will submit a final Site Closure Plan and notify the permitting agency at least 120 days prior of its intent to close the site. Once the permitting agency has approved closure of the site, Capio will plug the monitoring wells and submit a site closure report to EPA. The activities, as described below, represent the planned activities based on information provided to EPA. The actual site closure plan may employ different methods and procedures. A final Site Closure Plan will be submitted to the UIC Program Director for approval with the notification of the intent to close the site.

Plugging Monitoring Wells

At the conclusion of the post-injection site care period, all monitoring wells will be plugged and capped below grade according to state and local regulations and standards. The UIC Program Director and the Louisiana Department of Natural Resources (LDNR) will be notified in writing of the intent to plug and abandon wells a minimum of 60 days in advance. The purpose of deep

monitoring well plugging is to ensure these wells do not become conduits for CO_2 or formation fluid movement into USDWs following cessation of injection and site closure.

Capio will adopt the following plugging procedures at each monitoring well:

1. Lower the hydrostatic head in the monitoring zone with a brine solution as needed to control artesian flow.

2. Conduct a final external MIT in accordance with the Capio Sequestration, LLC Testing and Monitoring Plan and QASP, if the monitoring well penetrates the confining zone [redacted] or injection zone [redacted]

3. Remove all components of the surface completion including wellhead, surface casing, and any downhole appurtenances and dedicated monitoring equipment. All casing strings will be cut off a minimum of 3-5 feet below land surface (below plow depth).

4. Place ASTM C150 Type I/II neat cement in the monitoring zone through a tremie grout pipe to prevent bridging, along the entire length of the well, from the base of the monitoring zone to the land surface. The volume of neat cement will be calculated for each specific monitoring well based on required plug diameter and length and quantity of materials will be determined accordingly. Neat cement will be prepared according to manufacturer's instructions.

5. Cap the cut casing and inscribe the cap with the monitoring well identification number and date of plugging/abandonment.

6. Backfill the area surrounding the well with native soils to restore the area to pre-installation grade (see Site Restoration Activities below for additional detail).

Upon completion of plugging activities, a plugging and abandonment report will be submitted to the UIC Program Director within 60 days fully describing the methods used and tests performed on the monitoring wells during plugging. Additionally, per state requirements, plugging and abandonment forms will be submitted to the LDNR within 30 days of completion of the plugging activities.

Plugging Geophysical Wells

At the conclusion of the post-injection site care period, all geophysical wells will be plugged and capped below grade according to according to state and local regulations and standards, and following the same general procedures outlined above for monitoring wells.

Upon completion of plugging activities, a plugging and abandonment report will be submitted to the UIC Program Director within 60 days fully describing the methods used and tests performed on the monitoring wells during plugging. Additionally, per state requirements, plugging and

abandonment forms will be submitted to the LDNR within 30 days of completion of the plugging activities.

Site Restoration Activities

At the end of the PISC period, Capio will reclaim the injection and monitoring sites and return them to pre-development conditions per the requirements of 40 CFR 146.93(e) and any additional state and local requirements.

The first phase of surface equipment decommissioning will occur when the injection phase ends and the post-injection phase begins. All surface facilities and equipment related to the injection well and its pumping (if applicable) and control equipment will be removed when the injection well is plugged. These sites will be reclaimed and returned to their pre-development conditions. The second phase of decommissioning occurs when the PISC period ends. Any surface facilities remaining at the end of the PISC period will be removed and the sites will be reclaimed and returned to pre-development conditions. All well pads and access roads developed for monitoring locations will also be removed and these areas will be reclaimed for beneficial use such as citizen access [redacted] unless otherwise requested by the landowner, [redacted] Native soils will be used to backfill the areas around all plugged wells to restore those areas to pre-installation grades.

Site Closure Report

A site closure report will be prepared and submitted within 90 days following site closure, documenting the following:

- Plugging of the verification and geophysical wells (and the injection well if it has not previously been plugged),
- Location of sealed injection well on a plat of survey that has been submitted to the local zoning authority,
- Notifications to state and local authorities as required at 40 CFR 146.93(f)(2),
- Records regarding the nature, composition, and volume of the injected CO_2, and
- Post-injection monitoring records.

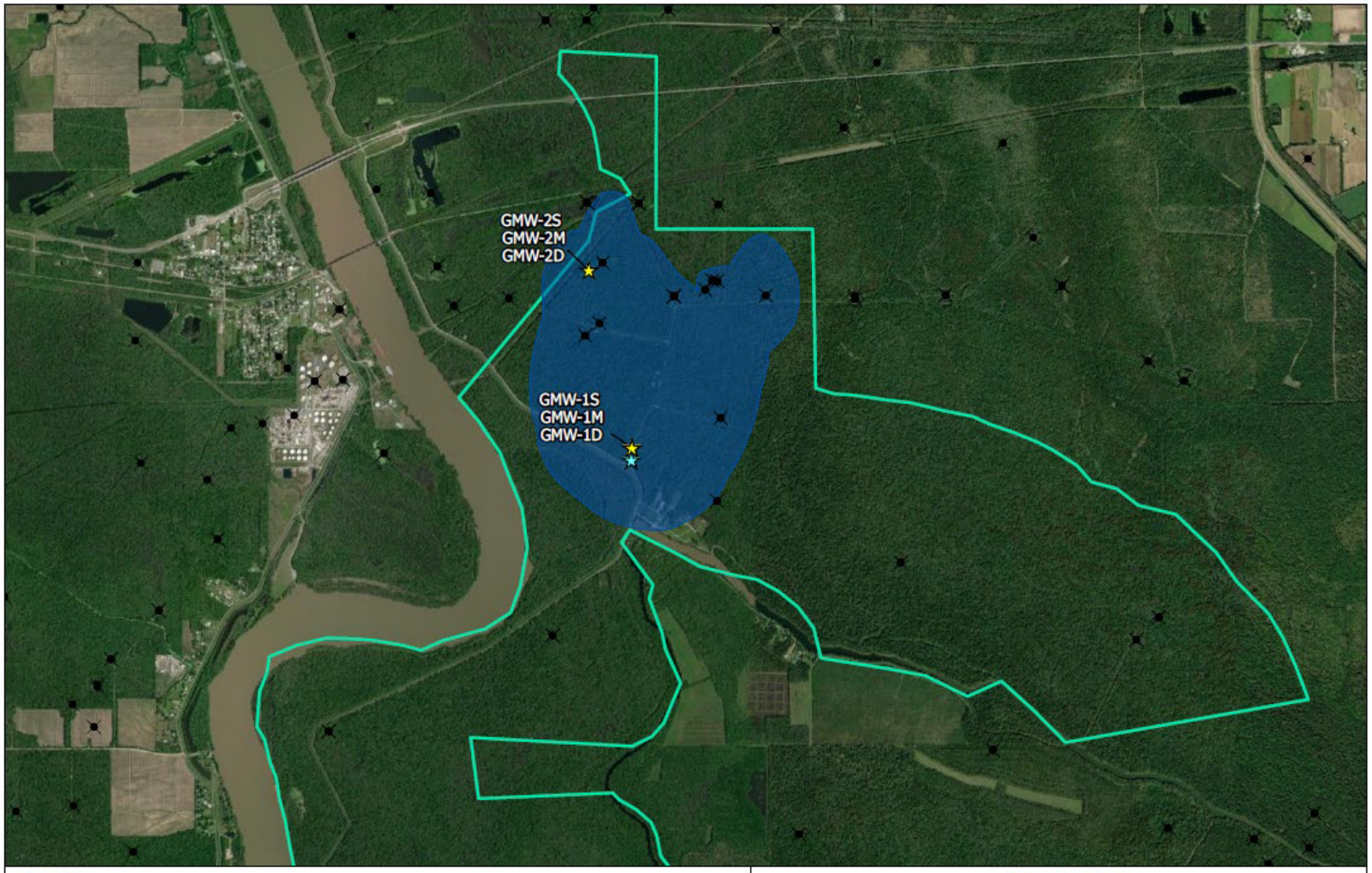
Capio will record a notation to the property's deed on which the injection well was located that will indicate the following:

- That the property was used for carbon dioxide sequestration,
- The name of the local agency to which a plat of survey with injection well location was submitted,
- The volume of fluid injected,
- The formation into which the fluid was injected, and
- The period over which the injection occurred.

The site closure report will be submitted to the permitting agency and maintained by the owner or operator for a period of 10 years following site closure. Additionally, the owner or operator will maintain the records collected during the post-injection period for a period of 10 years after which these records will be delivered to the UIC Program Director.

References

El-kaseeh, G., Czoski, P., Will, R., Balch, R., Ampomah, W., and Li, X., 2018. Time-lapse vertical seismic profile for CO2 monitoring in carbon capture, utilization, and sequestration/EOR, Farnsworth project. SEG Technical Program Expanded Abstracts, August, 2018. https://doi.org/10.1190/segam2018-2995747.1.



Legend

- Proposed Monitoring Well Cluster
- CO_2 Sequestration Well
- Oil and Gas Wells
- Area of Review
- [redacted]

Note: [redacted]

FIGURE 10-2
OVERVIEW OF THE MONITORING NETWORK WITHIN THE AOR
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POINTE COUPEE PARISH, LA

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0 4,000 Feet
N