Table 3-1 – Summary of Artificial Penetrations Within the AOR

#	Well Name	State / Federal Well ID (API No.)[1]	Well Type	Well Status	Date Drilled	Depth (ft KB)	Latitude, Longitude (NAD 27)	Penetrates UCZ?	Plume (CO_2 or Pressure Front)
1	Carpenter #001	4224530290	Dry Hole	P & A	11/14/1974	7,816	30.05589, -94.42295	Yes	CO_2 Plume
2	P. H. Carpenter #001	4224500004	Dry Hole	P & A	3/16/1958	7,753	30.06002, -94.42207	Yes	CO_2 Plume
3	Frank Carpenter et al #001	4224500005	Oil	P & A	10/18/1957	8,515	30.05893, -94.41876	Yes	CO_2 Plume
4	Wilson et al #001	4224503214	Dry Hole	P & A	4/16/1966	6,395	30.05622, -94.40685	Yes	CO_2 Plume
5	F. S. WILSON #1	4224500006	Dry hole	P & A	11/8/1937	7,012	30.05514, -94.39594	Yes	CO_2 Plume
6	Garth #001	4224531931	Dry hole	P & A	3/8/1988	5,800	30.0646, -94.40914	Yes	CO_2 Plume
7	Broussard Farms #001	4229132614	Dry Hole	P & A	10/16/2005	11,375	30.033768, -94.4881094	Yes	CO_2 Plume
8	Champion International Corp. Etal Gas Unit #001	4224531491	Dry Hole	P & A	7/2/1981	16,260	30.06639, -94.436	Yes	CO_2 Plume
9	B. H. Willis #001	4224500008	Dry Hole	P & A	2/20/1938	6,500	30.04081, -94.40924	Yes	CO_2 Plume
10	A M CARPENTER EST #001	4224503240	Dry Hole	P & A	5/27/1966	5,928	30.04957, -94.42157	Yes	CO_2 Plume
11	E. A. Henderson #001	4229132215	Dry Hole	P & A	7/6/1994	14,002	30.0478163, -94.4678153	Yes	CO_2 Plume
12	Water Well 1	6161701	Water	Unknown	1/1/1956	538	30.029162, -94.481937	No	-
13	Water Well 2	6161807	Water	Unknown	1/1/1906	692	30.044717, -94.425271	No	-
14	Water Well 3	166225	Water	Unknown	5/4/2004	310	30.048606, -94.424993	No	-
15	Water Well 4	166230	Water	Unknown	5/4/2004	125	30.048606, -94.424993	No	-
16	Water Well 5	184051	Water	Unknown	12/7/2005	140	30.033329, -94.470548	No	-
17	Water Well 6	202618	Water	Unknown	2/28/2006	115	30.029439, -94.463327	No	-
18	Water Well 7	211286	Water	Unknown	6/11/2005	122	30.018328, -94.481104	No	-
19	Water Well 8	250951	Water	Unknown	10/7/2005	130	30.033606, -94.488604	No	-
20	Water Well 9	276258	Water	Unknown	11/18/2011	110	30.056940, -94.400549	No	-
21	Water Well 10	370003	Water	Unknown	5/28/2014	280	30.062773, -94.414716	No	-
22	Water Well 11	370064	Water	Unknown	6/4/2014	285	30.062773, -94.417493	No	-
23	Water Well 12	410300	Water	Unknown	9/19/2015	244	30.070212, -94.41831	No	-
24	Water Well 13	410622	Water	Unknown	10/30/2015	240	30.066106, -94.41666	No	-
25	Water Well 14	417832	Water	Unknown	1/5/2016	240	30.070662, -94.417426	No	-
26	Water Well 15	544238	Water	Unknown	3/29/2020	310	30.048200, -94.426718	No	-
27	Water Well 16	650111	Water	Unknown	9/15/2023	110	30.047509, -94.416539	No	-

*Water well datum is below ground level.
**Kelly bushing (KB) not available in historical records.
****NAD 27 – North American Datum of 1927

[1] Readily available well identification numbers provided from public data sources up to November 20, 2025

3.5.1.1 Physical Records Review

The records of artificial penetrations with the AOR were reviewed through digital copies on the TRRC online databases, Enverus Drilling Info, and IHS Energy Portal. These records are included in *Appendix C*.

3.5.1.2 Aeromagnetic Survey

Due to the age of well development in the area, additional data collection is required to improve the accuracy of well locations and details. Magnetic survey methods have been used to fully scan the AOR for magnetic anomalies caused by subsurface features, which could include abandoned wellbores with iron or steel casing. The magnetic surveys were successfully conducted in December of 2025 and the data collected was of sufficient quality to determine that all anomalies within the AOR are accounted for through publicly available databases; no additional corrective action is necessary at this time.

3.5.1.3 Review of Abandoned Well Plugging Records

ExxonMobil conducted an evaluation of the information available for the artificial penetrations listed in Table 3-1. The list of topics reviewed included the following:

- Well depth and completion
- Well drilling date
- Well abandonment date
- Openhole or cased-hole identification
- Location of reported plugs
- Casing and cementing records
- Records of mechanical integrity tests or logs performed
- Well deviations

Wells listed on rows 1 through 11 were identified as penetrating the UCZ and subject to an assessment of plugging records and, potentially, to corrective action for deficiencies.

3.5.1.4 Summary of Artificial Penetrations Tabulation

Wells and boreholes that did not penetrate the UCZ were determined to pose no hypothetical risk to function as a vertical conduit from the injection zone. For those artificial penetrations that were completed below the UCZ, multiple sources of information were reviewed, and the relevant information was analyzed in detail (16 TAC **§5.203(d)(1)(B)**). Table 3-1 presented a summary of the artificial penetrations of interest for developing the Corrective Action Plan. Schematics detailing UCZ penetrating wells and their proposed corrective action plans are presented in *Appendix C*.

3.5.2 Corrective Action Plan for Artificial Penetrations

ExxonMobil developed a Corrective Action Plan for each artificial penetration that was identified to have the potential to act as a vertical conduit, because it was either not plugged or not plugged

in a manner that, as required by 16 TAC **§5.203(d)(1)**, mitigates the movement of CO_2 or other fluids that could potentially endanger USDWs. For the wells identified with plugging deficiencies, the basis for the corrective action strategy is to reenter and install cement barriers to mitigate migration potential.

3.5.2.1 Corrective Action Phasing

Figures 3-2 and 3-4 show the location of the wells identified for corrective action in relation to the 5-year CO_2 plume and pressure front. Table 3-2 lists the expected arrival of the CO_2 plume and pressure front at each artificial penetration, and the schedule for when corrective action is planned. All required corrective action will be executed prior to the CO_2 plume or pressure front contacting the artificial penetration.

As described in *Section 5 – Testing and Monitoring Plan*, direct and indirect monitoring technologies will be used to track the CO_2 plume and pressure front. A planned reevaluation of the AOR will occur after 5 years of injection and at 5-year intervals, at a minimum, throughout the life cycle of the Sunflower Project. If, at any evaluation, the rate of the CO_2 plume or pressure front expansion is predicted to impact additional artificial penetrations that may be found, the Corrective Action Plan will be amended to include the necessary corrective action to address the potential for USDW endangerment, in accordance with 16 TAC **§5.203(d)(2)(B)** and **(C)**.

3.5.2.2 Analysis of Wells Identified for Corrective Action

Table 3-3 summarizes the available information concerning the borehole or well completion features and the P&A activities, as appropriate. ExxonMobil reviewed this information and determined the specific defects that require mitigation under 16 TAC **§5.203(d)(1)**.

Table 3-2 – List of Artificial Penetrations and Schedule for Corrective Action

Well Name	API Number	Latitude, Longitude (NAD 27)	CO_2 Plume Arrival (Yr)	Pressure Front Arrival (Yr)	Schedule
Carpenter #001	4224530290	30.05589, -94.42295	5	5	Pre-Operation
P. H. Carpenter #001	4224500004	30.06002, -94.42207	11	5	Pre-Operation
Frank Carpenter et al #001	4224500005	30.05893, -94.41876	~5	-	Pre-Operation
Wilson et al #001	4224503214	30.05622, -94.40685	5	-	Pre-Operation
B. H. Willis #001	4224500008	30.04081, -94.40924	5	-	Pre-Operation
A M CARPENTER EST #001	4224503240	30.04957, -94.42157	5	5	Pre-Operation
Garth #001	4224531931	30.0646, -94.40914	21	-	Phased
Broussard Farms #001	4229132614	30.033768, -94.4881094	21	-	Phased
F. S. WILSON #1	4224500006	30.05514, -94.39594	31	-	Phased
E.A Henderson #001	4229132215	30.0478163, -94.4678153	31	-	Phased
Champion International Corp. Etal Gas Unit #001	4224531491	30.06639, -94.436	41	-	Phased

Table 3-3 – Summary of P&A Deficiency for Wells Penetrating the UCZ

Well Name	API No.	Apparent Deficiency or Uncertainty Based on Review of Available Information			Summary of Corrective Action
		Casing Records at UCZ	USDW plug(s) installed	UCZ plug(s) installed	
Carpenter #001	4224530290	Open Hole	No	No	Pump open hole with Corrosacem cement plug(s) and Portland cement plug(s)
P. H. Carpenter #001	4224500004	Cased Hole	No	No	Pump inside casing with Corrosacem cement plug(s) and Portland cement plug(s)
Frank Carpenter et al #001	4224500005	Cased Hole	No	No	Pump inside casing with Corrosacem cement plug(s) and Portland cement plug(s)
Wilson et al #001	4224503214	Open Hole	No	No	Pump open hole with Corrosacem cement plug(s) and Portland cement plug(s)
B. H. Willis #001	4224500008	Open Hole	No	No	Pump open hole with Corrosacem cement plug(s) and Portland cement plug(s)
A M CARPENTER EST #001	422450324	Cased Hole	No	No	Pump inside casing with Corrosacem cement plug(s) and Portland cement plug(s)
Garth #001	4224531931	Open Hole	No	No	Pump open hole with Corrosacem cement plug(s) and Portland cement plug(s)
Broussard Farms #001	4229132614	Cased Hole	No	No	Pump inside casing with Corrosacem cement plug(s) and Portland cement plug(s)
F. S. WILSON #1	4224500006	Open Hole	No	No	Pump open hole with Corrosacem cement plug(s) and Portland cement plug(s)
E. A. Henderson #001	4229132215	Cased Hole	Yes	No	Pump inside casing with Corrosacem cement plug(s) and Portland cement plug(s)
Champion International Corp. Etal Gas Unit #001	4224531491	Cased Hole	No	No	Pump inside casing with Corrosacem cement plug(s) and Portland cement plug(s)

3.5.3 Corrective Action Sequence Plan

The planned actions are based on proposed plug deficiencies potentially present in the legacy wells based on the available records (displayed above, in Table 3-3). Each artificial penetration in the CO_2 plume will be reentered, and if sufficient barriers are not present, each well will have the appropriate barriers installed during the corrective action P&A field operations. The barriers will be established at the UCZ, the surface casing shoe (where applicable), the base of usable quality water (BUQW), the base of the lowermost USDW, the base of superior quality water (SQW), and the wellhead surface. While ExxonMobil deems OPC as the fit for purpose technical solution for the Sunflower CCS Project justified and supported by API 5100 and ExxonMobil's own 30-, 60-, and 180-day testing which has been provided to the Texas Railroad Commission, presented and published at industry conference, and both having been summarized in this permit, CorrosaCem – or suitable equivalent - is being proposed for the plug across the UCZ to address regulator feedback on any uncertainty of approval through the permitting process with OPC at the confining zone. *Section 4.4.3* in *Section 4 – Well Construction and Operating Conditions* presents additional discussion on OPC.

A detailed summary of the corrective action sequence for each well is presented further below, in Table 3-4—and in *Appendix C*, as specific well schematics for each well to be reentered.

3.5.3.1 Preparing the Surface Location

Prior to mobilizing at a well location, ExxonMobil will conduct an initial site visit to identify current site access and wellhead conditions. A subsurface survey may be completed utilizing ground-penetrating radar to identify the well location. If legacy equipment remains on the site, the equipment will be removed prior to mobilization. Surface piping and electrical components will be assessed and removed from the site locations. Additionally, access roads to the area surrounding the pad and wellhead-access improvements may be needed to facilitate safe entrance and egress along with rig operations.

If a sign or marker is present, the first step will be to confirm that the API number on the plat corresponds to the well where mobilization is taking place, to complete corrective action operations. After the P&A marker or exposed metal plate is removed, the necessary equipment will be rigged up on the well. The cement surface plug of the well will be drilled out and the hole reentered for corrective action.

ExxonMobil will follow required notification requirements prior to commencing remedial field activities that may take the form of workover or drilling operations. At least 5 days prior to commencement of well plugging operations, ExxonMobil will notify the TRRC via a request for approval of the proposed procedure for plugging the well, using Form W-3A. ExxonMobil will also notify the TRRC at least 48 hours prior to the start of plugging operations.

3.5.3.2 Reentry Activities

The appropriate operational approach will be used during the reentry of each openhole legacy well for re-plugging operations, in an attempt to advance the drill pipe and bottomhole assembly from the well surface to the depth of the base of the UCZ. Based on ExxonMobil's experience with similar P&A efforts, sidetracking from the original borehole is a potential risk. Sidetracking can be caused by wellbore collapse or tagging fill/ledges in the borehole.

To mitigate the risk of sidetracking out of the original legacy wellbores, ExxonMobil will compare the log of parameters—the rate of penetration, torque, and observed cuttings at depth—to local recently drilled wells in the area, to measure the degree of tracking within the original wellbore, as the bottomhole assembly is advanced to target depth for the placement of the cement plugs. Specialized tools, steering, or other procedures will be utilized if reasonable and appropriate to reduce the potential for sidetracking to occur. If wellbore collapse, tagging fill/ledges, or other anomalies are apparent that are judged to prevent the reentry from staying within the original borehole of a legacy well, in consultation with the UIC Director, ExxonMobil will stop the openhole recovery operations at that depth, evaluate available data from the well collected to that point, complete the cement plug at the maximum depth that can be attained as specified for the well, and continue up-borehole with the remainder of the P&A plan for the well.

3.5.3.3 Setting a Plug for the UCZ

Each legacy well requiring corrective action will have a CorrosaCem cement plug set at the base of the UCZ. The cement will be designed to withstand the long-term exposure of temperature, pressure, and chemical environment. The barrier will be tested for estimated hardness and integrity after placement. While ExxonMobil deems OPC as the fit for purpose technical solution for the Sunflower CCS Project justified and supported by API 5100 and ExxonMobil's own 30-, 60-, and 180-day testing which has been provided to the Texas Railroad Commission, presented and published at industry conference, and both having been summarized in this permit, CorrosaCem – or suitable equivalent - is being proposed for the plug across the UCZ to address regulator feedback on any uncertainty of approval through the permitting process with OPC at the confining zone.

3.5.3.4 Setting Plugs at the Casing Shoe, Lowermost USDW, BUQW, SQW, and Surface

A cement plug will be set at the USDW, BUQW, SQW, and casing shoe (when present). The lowermost USDW will be plugged with a minimum 130-foot cement plug that will be set at the base of the lowermost USDW depth, starting from 50 feet beneath that depth and extending 80 feet above the target depth. All cement plugs set in this manner, and for any plug above the UCZ plug, will be OPC.

In accordance with 16 TAC **§3.14(e)**, the BUQW will be plugged with a minimum 130-foot cement plug set at the base of the BUQW, starting 50 feet beneath that depth and extending 80 feet above the target depth. The cement will be lab-tested prior to pumping, and pressure-tested or tagged at each relevant marker. A final 30-foot cement plug will be set at the surface before cutting the casings 5 feet beneath the surface.

3.5.3.5 Corrective Action for Inadequate Cement Isolation or Casing-Cement Bond Deficiencies

Based on the wells identified for corrective action, cement bond logs (CBLs) will only be performed if there is insufficient evidence that cementing has been completed to the surface—and that the lack of primary cement poses a risk to the USDW or corrective action integrity. During reentry, the annulus/casing will be exposed by removing the soil. Visual inspection will be performed to verify cement evidence at the surface. If there is no cement evidence, and primary cement is critical for UCZ and USDW isolation, then a CBL will be considered. If cement is observed, no CBL will be required.

3.5.3.6 Surface Restoration

The wellhead will be cut off at 5 feet below ground level. A metal plate with the API number will be welded to the top of the casing. The area around the well will be backfilled above the casing stub to the surface. The site will then be restored to its previous conditions.

3.5.3.7 Reporting Completion of Corrective Action

After completing the corrective actions and re-plugging a well, a W-3 plugging report will be submitted to the TRRC within 30 days of plugging, including the W-15 cementing report. Records of the corrective actions will be submitted to the UIC Director.

3.5.4 Site-Specific Review of Corrective Actions

Table 3-4 provides the corrective action sequences for the 11 wells. For each legacy well that will be reentered for evaluation and re-plugging, *Appendix C-4* provides the well schematics that have been developed based on both the historical information and the completion of the associated proposed corrective actions. It should be noted that the legacy-well corrective action schematics carry notional plug depths.

ExxonMobil will consult TRRC's Groundwater Advisory Unit, obtain letters for the USDW, BUQW, and SQW, and adjust the plug depths accordingly to meet or exceed TRRC's standards.

Table 3-4 – Summary of Corrective Actions for Wells Penetrating the UCZ

Well Name	Cased or Open Hole at UCZ	API No.	Proposed Corrective Actions
Carpenter #001	Open Hole	4224530290	• Excavate and visually inspect for cement outside surface casing. • Re-head and pressure test as needed. • Wash down open hole to UCZ. • At UCZ, set 130-ft balanced CorrosaCem cement plug. • Across USDW, set 130-ft balanced OPC cement plug. • Across BUQW and surface shoe, set 250-ft balanced OPC cement plug. • At SQW, set 130-ft balanced OPC cement plug. • Set surface cement plug.
P. H. Carpenter #001	Cased Hole	4224500004	• Excavate and visually inspect for cement outside surface casing. • Re-head and pressure test as needed. • Drill out existing plug(s) and wash down cased hole to UCZ. • At UCZ, set 130-ft balanced CorrosaCem cement plug. • Across USDW, set 130-ft balanced OPC cement plug. • Across BUQW, set 130-ft balanced OPC cement plug. • At SQW, set 130-ft balanced OPC cement plug. • At surface shoe, set 130-ft balanced OPC cement plug. • Set surface cement plug.
Frank Carpenter et al #001	Cased Hole	4224500005	• Excavate and visually inspect for cement outside surface casing. • Re-head and pressure-test as needed. • Drill out existing plug(s) and wash down cased hole to UCZ. • At UCZ, set 130-ft balanced CorrosaCem cement plug. • Across USDW, set 130-ft balanced OPC cement plug. • Across BUQW, set 130-ft balanced OPC cement plug. • At SQW, set 130-ft balanced OPC cement plug. • At surface shoe, set 130-ft balanced OPC cement plug. • Set surface cement plug.
Garth #001	Open Hole	4224531931	• Excavate and visually inspect for cement outside surface casing. • Re-head and pressure-test as needed. • Wash down open hole to UCZ. • At UCZ, set 130-ft balanced CorrosaCem cement plug. • Across USDW, set 130-ft balanced OPC cement plug. • Across BUQW, set 130-ft balanced OPC cement plug. • At surface shoe and across SQW, set 335-ft balanced OPC cement plug. • Set surface cement plug.
F.S. Wilson #1	Open Hole	42224500006	• Excavate and visually inspect for cement outside surface casing. • Re-head and pressure-test as needed. • Wash down open hole to UCZ. • At UCZ, set 130-ft balanced CorrosaCem cement plug. • Across USDW, set 130-ft balanced OPC cement plug. • Across BUQW, set 130-ft balanced OPC cement plug. • At surface shoe, set 130-ft balanced OPC cement plug. • Across SQW, set 130-ft balanced OPC cement plug. • Set surface cement plug.
Wilson et al #001	Open Hole	4224503214	• Excavate and visually inspect for cement outside surface casing. • Re-head and pressure-test as needed. • Wash down open hole to UCZ. • At UCZ, set 130-ft balanced CorrosaCem cement plug. • Across USDW, set 130-ft balanced OPC cement plug. • Across BUQW, set 130-ft balanced OPC cement plug. • Across SQW, set 130-ft balanced OPC cement plug. • At surface shoe, set 130-ft balanced OPC cement plug. • Set surface cement plug.
Broussard Farms #001	Cased Hole	4229132614	• Excavate and visually inspect for cement outside surface and visually confirm intermediate casing at surface. • Re-head and pressure-test as needed (mechanical integrity tests). • Drill out existing plug(s) and wash down cased hole to UCZ. • At UCZ, perforate, set retainer, and squeeze 76-ft CorrosaCem cement plug inside 4-1/2” casing and 296-ft CorrosaCem cement in 7-5/8”x10-3/4” annulus • Across USDW, perforate, set retainer, and squeeze 130-ft OPC cement plug. • Across BUQW, perforate, set retainer, and squeeze 130-ft OPC cement plug. • Across SQW, perforate, set retainer, and squeeze 130-ft OPC cement plug. • Set surface cement plug.
Champion International Corp. Etal Gas Unit #001	Cased Hole	4224531491	• Excavate and visually inspect for cement outside surface casing. • Re-head and pressure-test as needed. • Drill out existing plug(s) and wash down cased hole. • Across UCZ, set 130-ft balanced CorrosaCem cement plug. • Across surface shoe, set 130-ft balanced OPC cement plug. • Across USDW, set 130-ft balanced OPC cement plug. • Across BUQW, set 130-ft balanced OPC cement plug. • Across SQW, set 130-ft balanced OPC cement plug. • Set surface cement plug.

Well Name	Cased or Open Hole at UCZ	API No.	Proposed Corrective Actions
A M CARPENTER EST #001	Cased Hole	4224503240	• Excavate and visually inspect for cement outside surface casing. • Re-head and pressure test as needed. • Drill out existing plug(s) and wash down cased hole to UCZ. • At UCZ, set 130-ft balanced CorrosaCem cement plug. • Across USDW, set 130-ft balanced OPC cement plug. • Across BUQW, set 130-ft balanced OPC cement plug. • Across SQW, set 130-ft balanced OPC cement plug. • At surface shoe, set 130-ft balanced OPC cement plug. • Set surface cement plug.
B.H. Willis #001	Open Hole	4224500008	• Excavate and visually inspect for cement outside surface casing. • Re-head and pressure-test as needed. • Wash down open hole to UCZ. • At UCZ, set 130-ft balanced CorrosaCem cement plug. • Across USDW, set 130-ft balanced OPC cement plug. • Across BUQW, set 130-ft balanced OPC cement plug. • At surface shoe and SQW, set 218-ft balanced OPC cement plug. • Set surface cement plug.
E. A. Henderson #001	Cased Hole	4229132215	• Excavate and visually inspect for cement outside surface casing. • Re-head and pressure-test as needed. • Drill out existing plug(s) and wash down cased hole to UCZ. • At UCZ, set 130-ft balanced CorrosaCem cement plug. • Across surface shoe, set 130-ft balanced OPC cement plug. • Across USDW, set 130-ft balanced OPC cement plug. • Across BUQW, set 130-ft balanced OPC cement plug. • Across SQW, set 130-ft balanced OPC cement plug. • Set surface cement plug.

3.5.5 Plan for Site Access

In accordance with 16 TAC **§5.203(d)(1)(C)** and **§5.203(d)(2)(C)**, ExxonMobil is in the process of negotiating land access for each of the artificial penetrations identified for corrective action. Research to identify the well owners via regulatory databases has been completed. Land access has been secured for all but two wells as outlined in Table 3-5. The two wells which land access has not been secured are anticipated to see CO2 31 and 41 years after injection begins and land access will be secured far in advance with an anticipated access date of end of 2027.

Discussions are underway with the owner and operators of record to enter into an access agreement to perform corrective actions. If appropriate and necessary, ExxonMobil will seek plugging orders from the TRRC in accordance with Subchapter C of Chapter 89 of the Texas Natural Resource Code to obtain access for corrective actions.

If the AOR reevaluation conducted at the minimum schedule of once every 5 years (16 TAC **§5.203(d)(2)(B)(i)**) identifies the potential for corrective action requirements at additional wells, ExxonMobil will promptly begin review of the additional wells in accordance with the process described in this Corrective Action Plan. If site access issues are identified for wells identified for corrective action, ExxonMobil will notify the UIC Director.

Table 3-5 – Summary of Access Milestones for Corrective Action

Well Name	API Number	Proposed Actions for Access Rights	Anticipated Date of Final Access Agreement
Carpenter #001	42245302900000	Obtain access agreement from the surface owner.	Completed
P. H. Carpenter #001	42245000040000	Obtain access agreement from the surface owner.	Completed
Frank Carpenter et al #001	42245000050000	Obtain access agreement from the surface owner.	Completed
Wilson et al #001	42245032140000	Obtain access agreement from the surface owner.	Completed
B. H. Willis #001	42245000080000	Obtain access agreement from the surface owner..	Completed
A M CARPENTER EST #001	42245032400000	Obtain access agreement from the surface owner.	Completed
Garth #001	42245319310000	Obtain access agreement from the surface owner.	Completed
Broussard Farms #001	42291326140000	Obtain access agreement from the surface owner.	Completed
F. S. WILSON #1	42245000060000	Obtain access agreement from the surface owner.	Completed
Champion International Corp. Etal Gas Unit #001	42245314910000	Obtain access agreement from the surface owner.	~12/2027
E. A. Henderson #001	42291322150000	Obtain access agreement from the surface owner.	~12/2027

3.6 AOR Reevaluation Plan and Schedule

3.6.1 Frequency of AOR Reevaluation

ExxonMobil adopts the minimum frequency of 5 years for the AOR and Corrective Action Plan reevaluation. Information gathered from implementation of the Testing and Monitoring Plan (*Section 5*) will be used to evaluate whether a more frequent review period is warranted, based on the observed conditions of CO_2 plume and pressure front migration.

If an alteration of the AOR reevaluation frequency of a minimum of every 5 years is recommended, the change in frequency will be aligned with the data evaluation and findings relative to the degree of protectiveness of the USDW. ExxonMobil acknowledges that any amendments to the AOR and Corrective Action Plan must be approved by the UIC Director, must be incorporated into the permit, and are subject to the permit modification requirements at 16

TAC **§5.202(d)(2)**, as appropriate. ExxonMobil also acknowledges the requirement in 16 TAC **§5.203(d)(2)(B)(i)** of the "minimum fixed frequency, not to exceed five years, at which the owner or operator proposes to reevaluate the area of review."

3.6.2 Content of the AOR Reevaluation

The requirements for AOR reevaluation are specified in 16 TAC **§5.206(g)** and include the following considerations:

- Reevaluate the AOR in the same manner specified in 16 TAC **§5.203(d)(1)(A)(i)-(ii)**.
- Identify all wells in the reevaluated AOR that require corrective action in the same manner specified in 16 TAC **§5.203(d)(1)**.
- Perform corrective action on wells requiring it in the reevaluated AOR, in the same manner specified in 16 TAC **§5.203(d)(1)(C)**.
- Submit an amended AOR and Corrective Action Plan or demonstrate to the UIC Director through monitoring data and modeling results that no amendment to the plan is needed. Any amendments to the AOR and Corrective Action Plan must be approved by the UIC Director, must be incorporated into the permit, and are subject to the permit modification requirements at 16 TAC **§5.202(d)(2)**, as appropriate.

3.6.3 Conditions Warranting AOR Reevaluation

The monitoring and operational conditions that would warrant a reevaluation of the AOR prior to the next scheduled reevaluation (i.e., the minimum fixed frequency established in 16 TAC **§5.203(d)(2)(B)(i)**) are outlined in Table 3-6—which provides a list of the potential triggers for an AOR reevaluation consistent with the requirements of 16 TAC **§5.203(d)(2)(B)(iii)**. These triggering events are based on a review of the hydrogeological site characteristics, the AOR and plume model results, and the pre-operational and operational plans for the Sunflower Project.

For each potential triggering event, Table 3-6 provides a summary of how the monitoring and operational data will be used to inform an AOR reevaluation, and how corrective action will be conducted to reduce the potential for threats to the USDW, if any arise. If an AOR reevaluation were to occur, corrective actions will be reevaluated.

Table 3-6 – Potential Triggers for AOR Reevaluation

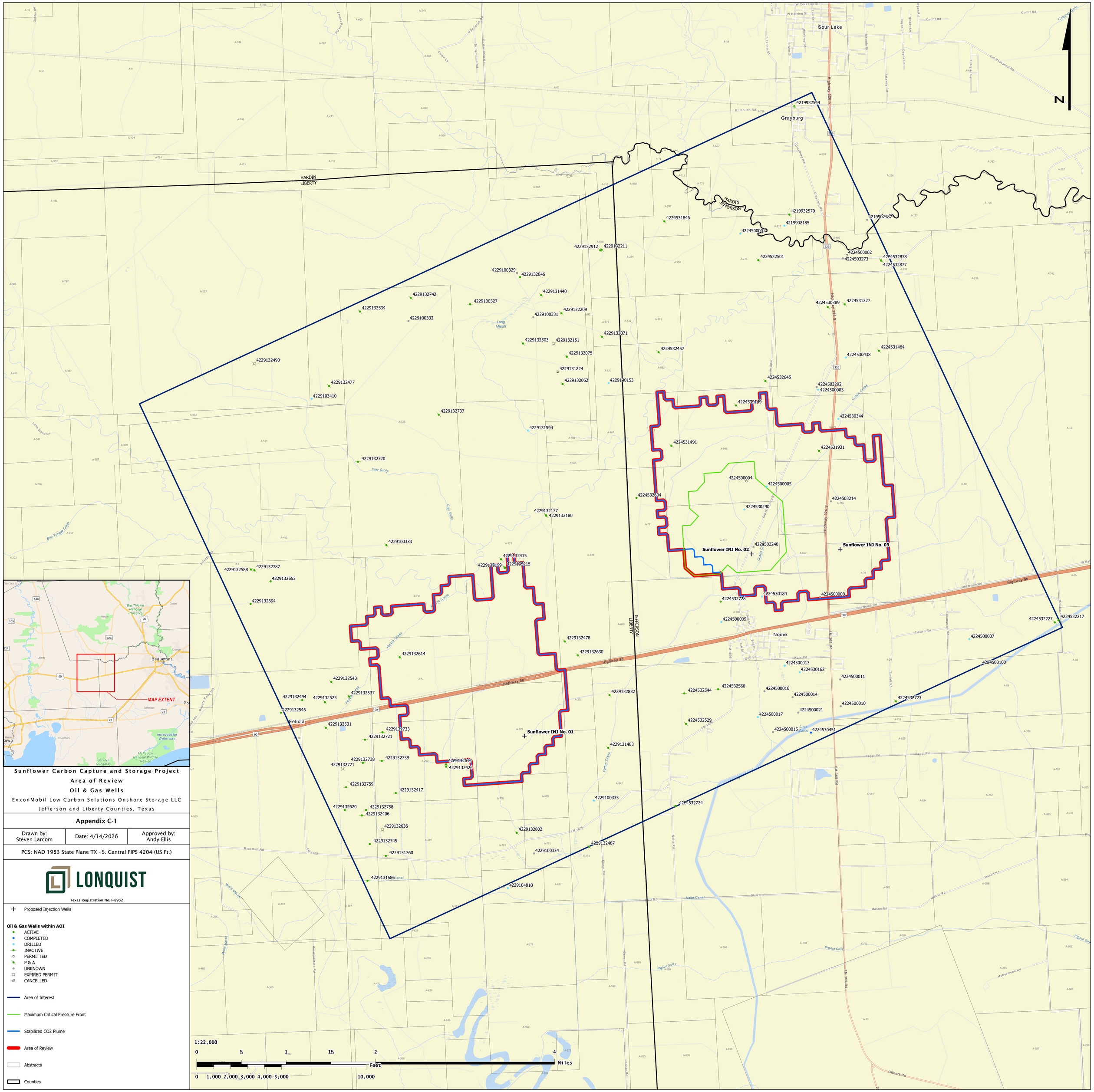
Monitoring and Operational Conditions that May Warrant AOR Reevaluation	How Monitoring and Testing Data Will Inform the AOR Reevaluation	How Corrective Action Will Be Conducted to Reduce the Potential for Threats to USDW
Significant changes in operations that mandate AOR reevaluation under 16 TAC **§5.203(d)(2)** as outlined below	The AOR reevaluation will be informed by both planned changes to operations and by testing and obtaining monitoring data that signal potential unexpected CO_2 plume migration impacting the extent of the AOR. Examples may include identification of a new offset well installation by third parties. Certain short-term operational changes, such as temporary well shut-ins, are not expected to warrant AOR reevaluation.	ExxonMobil will notify and coordinate with the UIC director to determine appropriate next steps
New offset operations are established that could affect the injection intervals.	Rerun the reservoir plume model with new data. If the plume increases in shape or extents to an unexpected level beyond the AOR, reevaluate the AOR.	ExxonMobil will notify and coordinate with the UIC director to determine appropriate next steps
An injection well exhibits a significant anomalous change in surface pressure for a sustained period of time.	Incorporate new pressure information and rerun the reservoir plume model with new data. Investigate if the monitoring wells' pressure gauges show a similar anomalous change at any depth and incorporate the monitoring well pressure information in the reservoir plume model. If the plume increases in shape or extents to an unexpected level beyond the AOR, reevaluate the AOR.	ExxonMobil will notify and coordinate with the UIC director to determine appropriate next steps
A casing or tubing leak is detected by casing integrity logging.	Investigate possible tubing leak and trigger contingency monitoring to reevaluate the AOR.	ExxonMobil will notify and coordinate with the UIC director to determine appropriate next steps.
Results from site monitoring differ from model predictions (16 TAC **§5.203(d)(2)(B)(iii)**) as outlined below.	An evaluation of monitoring data (required under 16 TAC **§5.203(j)**) indicates that CO_2 and/or pressure front migration is significantly different than that predicted by the current AOR delineation model and, therefore, warrants an AOR reevaluation. The following examples provide specific criteria for differences in monitoring data and model predictions that may trigger an AOR reevaluation (16 TAC **§5.203(d)(2)(B)(iii)**).	ExxonMobil will notify and coordinate with the UIC director to determine appropriate next steps
Seismic event greater than a 3.0 magnitude occurs within a 5.6-mile radius of an injection well.	Evaluate pressure and temperature data relative to operating limits and pressures in the in-zone monitoring wells. Evaluate the need to enhance the monitoring program to confirm the extent of the CO_2 plume.	ExxonMobil will notify and coordinate with the UIC director to determine appropriate next steps
Indication of concentrations above the baseline for USDW samples of TDS, major cations and anions, CO_2 concentration, isotopic values, or pH increase in a statistically significant way.	Resample the fluid that contained the elevated concentrations and compare the resample results with numerical criteria for trends and/or exceedances of target concentrations.	ExxonMobil will notify and coordinate with the UIC director to determine appropriate next steps
The presence of separate-phase CO_2 is detected in the sampled fluids above the confining zone, but below the lowermost USDW, resulting from CO_2/fluid migration out of the injection zone.	Investigate possible migration pathways and trigger contingency monitoring to reevaluate the AOR.	ExxonMobil will notify and coordinate with the UIC director to determine appropriate next steps

Appendix C – AOR Maps and Corrective Action Well Schematics:

Appendix C-1: Overview Map
Appendix C-2: Freshwater Well Map
Appendix C-3: Freshwater Well List
Appendix C-4: Corrective Action Schematics for the 11 Corrective Action Wells
Appendix C-5: Site Review Map

Appendix C – Area of Review and Corrective Actions

Appendix C1 – Oil & Gas Wells Map



Sunflower Carbon Capture and Storage Project

Area of Review

Oil & Gas Wells

ExxonMobil Low Carbon Solutions Onshore Storage LLC

Jefferson and Liberty Counties, Texas

Appendix C-1

Drawn by: Steven Larcom	Date: 4/14/2026	Approved by: Andy Ellis

PCS: NAD 1983 State Plane TX - S. Central FIPS 4204 (US Ft.)

LONQUIST

Texas Registration No. F-8952

+ Proposed Injection Wells

Oil & Gas Wells within AOI

- ACTIVE
- COMPLETED
- DRILLED
- INACTIVE
- PERMITTED
- P & A
- UNKNOWN
- EXPIRED PERMIT
- CANCELLED

Area of Interest

Maximum Critical Pressure Front

Stabilized CO2 Plume

Area of Review

Abstracts

Counties

Appendix C2 - Freshwater □ ells Map



Sunflower Carbon Capture and Storage Project

Area of Review

Freshwater Wells

ExxonMobil Low Carbon Solutions Onshore Storage LLC

Jefferson and Liberty Counties, Texas

Appendix C-2

Drawn by: Steven Larcom	Date: 5/29/2026	Approved by: Andy Ellis

PCS: NAD 1983 State Plane TX - S. Central FIPS 4204 (US Ft.)

LONQUIST

Texas Registration No. F-8952

- Proposed Injection Wells
- Maximum Critical Pressure Front
- Stabilized CO2 Plume
- Area of Review

TWDB Groundwater Wells
- Domestic
- Industrial
- Irrigation
- Stock
- Unused
- Plugged or Destroyed

SDRDB Groundwater Wells
- Domestic
- Public Supply
- Industrial
- Irrigation
- Monitor
- Rig Supply
- Stock

- Distance Call (Closest Freshwater and Drinking Water Wells to Project Sunflower Injection Well)
- Counties

1:15,000

0 ½ 1 1½ 2 4 Miles

0 1,000 2,000 3,000 4,000 5,000 10,000 Feet

Appendix C3 - Freshwater Wells List

Appendix C-3

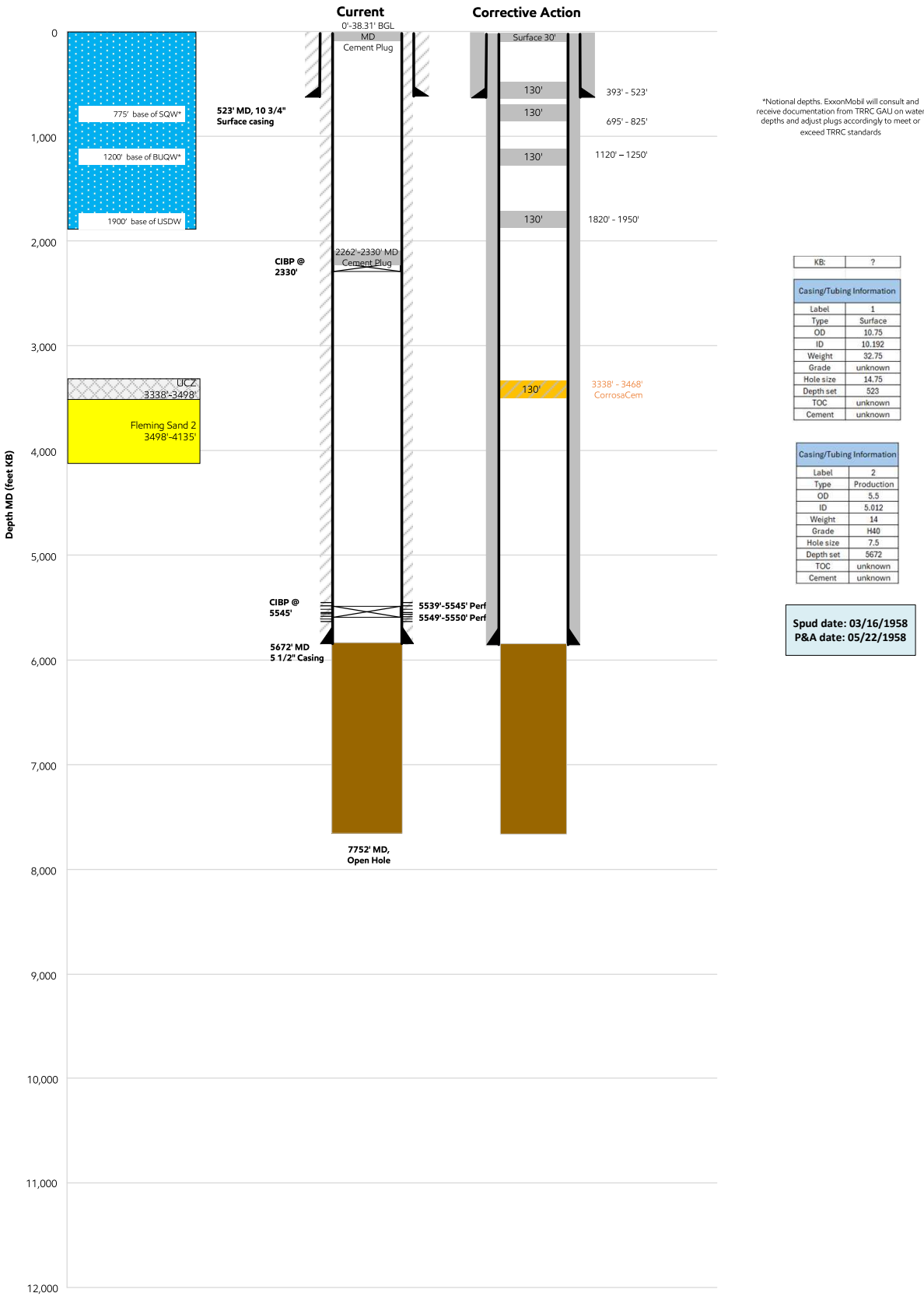
Area of Review: Freshwater Wells List

WELL REPORT NO.	OWNER'S NAME	OWNER ADDRESS	CITY/STATE/ZIP	LAT. NAD 83	LONG. NAD83	WELL USE	WATER LEVEL (FT.)	TOTAL DEPTH (FT.)	DATE DRILLED
6161701	A. L. Banke	Box 155	Nome, TX 77629	30.029162	-94.481937	Irrigation	18.9	538	1958
6161807	Southern Pacific Co.	*Illegible*	Nome, TX 77629	30.044717	-94.425271	Plugged or Destroyed	2.0	692	1906
166225	Kevin Robbins	1783 Old Grayburg	Nome, TX 77629	30.048606	-94.424993	Domestic	25.0	310	5/4/2004
166230	Robbins	4783 Old Grayburg	Nome, TX 77629	30.048606	-94.424993	Domestic	25.0	125	5/4/2004
184051	Ballard Exploration, Inc.	1021 Main St. Ste 2310	Houston, TX 77002	30.033329	-94.470548	Rig Supply	15.0	140	12/7/2005
202618	Transit Mix Concrete	850 Pine	Beaumont, TX 77701	30.029439	-94.463327	Industrial	15.0	115	2/28/2006
211286	Westport O&G/KerrMcGee O&G	16666 North Chase BM 2114	Houston, TX 77070	30.018328	-94.481104	Rig Supply	12.0	122	6/11/2005
250951	Cimarex Energy Co.	707 17th Street Ste 3300	Denver, CO 80202	30.033606	-94.488604	Rig Supply	15.0	130	10/7/2005
276258	Mike Doguet	2400 Hwy 326	Nome, TX 77629	30.056940	-94.400549	Stock	20.0	110	11/18/2011
370003	Matt Willey	PO Box J	Nome, TX 77629	30.062773	-94.414716	Domestic	18.0	280	5/28/2014
370064	Greg Devillier	PO Box 694	Nome, TX 77629	30.062773	-94.417493	Domestic	23.0	285	6/4/2014
410300	Charles Daniels	PO Box 46	Nome, TX 77629	30.070212	-94.418310	Domestic	24.0	244	9/19/2015
410622	Katie Spencer	2225 N Major	Beaumont, TX 77701	30.066106	-94.416660	Domestic	38.0	240	10/30/2015
417832	Billy G Daniels	2764 Nome	Nome, TX 77629	30.070662	-94.417426	Domestic	24.0	240	1/5/2016

Sunflower Carbon Capture and Storage Project

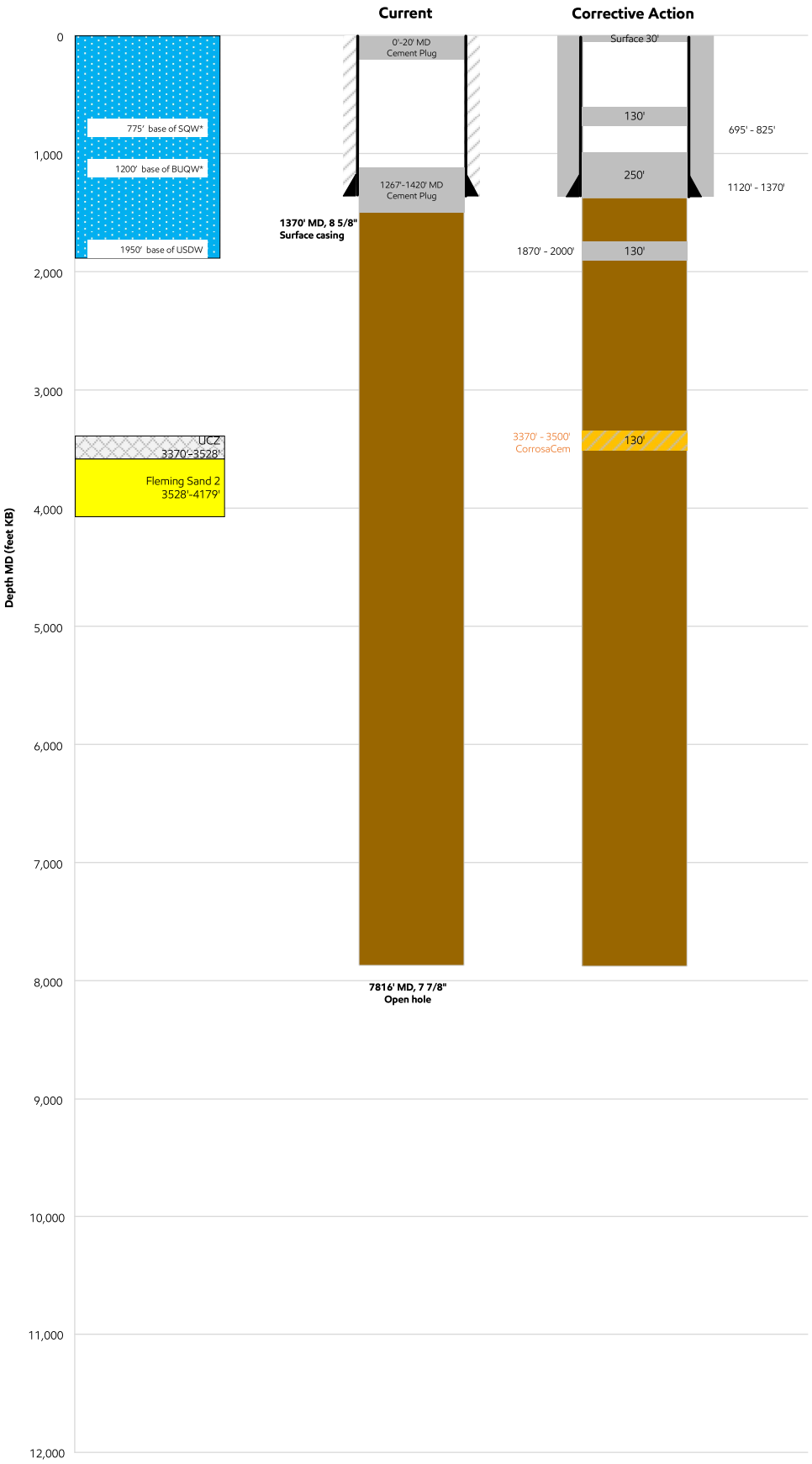
544238	Kevin Robins	4628 Old Grayburg Rd	Nome, TX 77629	30.048200	-94.426718	Domestic	20.0	310	3/29/2020
650111	Mike Doguet	2400 Hwy 326	Nome, TX 77629	30.047509	-94.416539	Irrigation	15.0	110	9/15/2023

Appendix C4 - Correcti e Action ell ore Schematics



Appendix C-4
P. H. Carpenter #001 (1958) Well Corrective Action Schematic
API 4224500004
Sunflower Carbon Storage Project
ExxonMobil Low Carbon Solutions Onshore Storage LLC
Newton, Texas

Carpenter #001 (1974) Well Schematic (API 4224530290)
30.0558900 -94.4229500 (NAD 27)



*Notional depths. ExxonMobil will consult and receive documentation from TRRC GAU on water depths and adjust plugs accordingly to meet or exceed TRRC standards

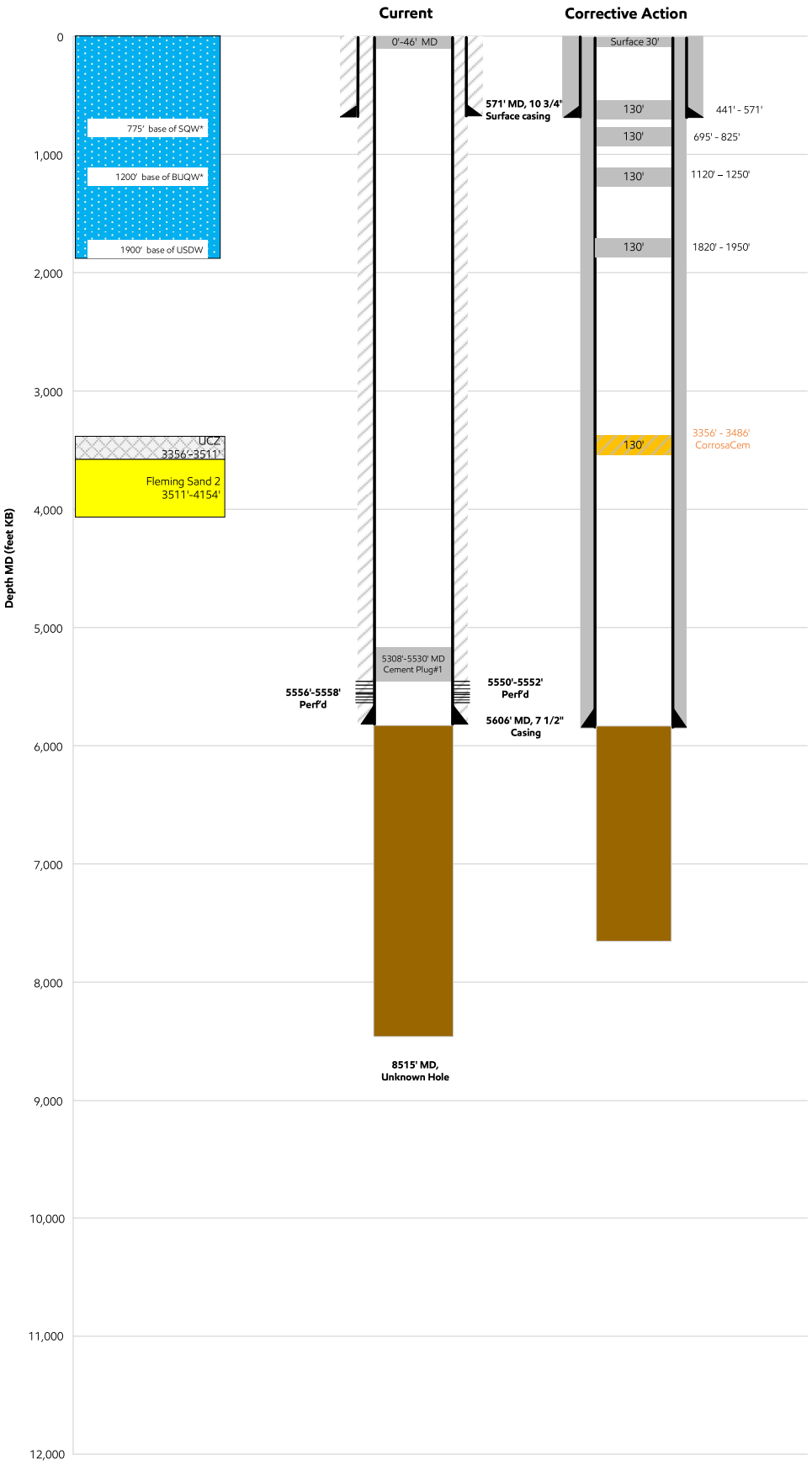
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Casing/Tubing Information	
Label	1
Type	Surface
OD	8.625
ID	8.097
Weight	24
Grade	unknown
Hole size	12.25
Depth set	1370
TOC	unknown
Cement	unknown

Spud date: 11/12/1974
P&A date: 11/20/1974

Appendix C-4
Carpenter #001 (1974) Well Corrective Action Schematic
API 4224530290
Sunflower Carbon Storage Project
ExxonMobil Low Carbon Solutions Onshore Storage LLC
Newton, Texas

Frank Carpenter et al #001 (1957) Well Schematic (API 4224500005)
30.0589300 -94.4187600 (NAD 27)



*Notional depths. ExxonMobil will consult and receive documentation from TRRC GAU on water depths and adjust plugs accordingly to meet or exceed TRRC standards

KB:	?

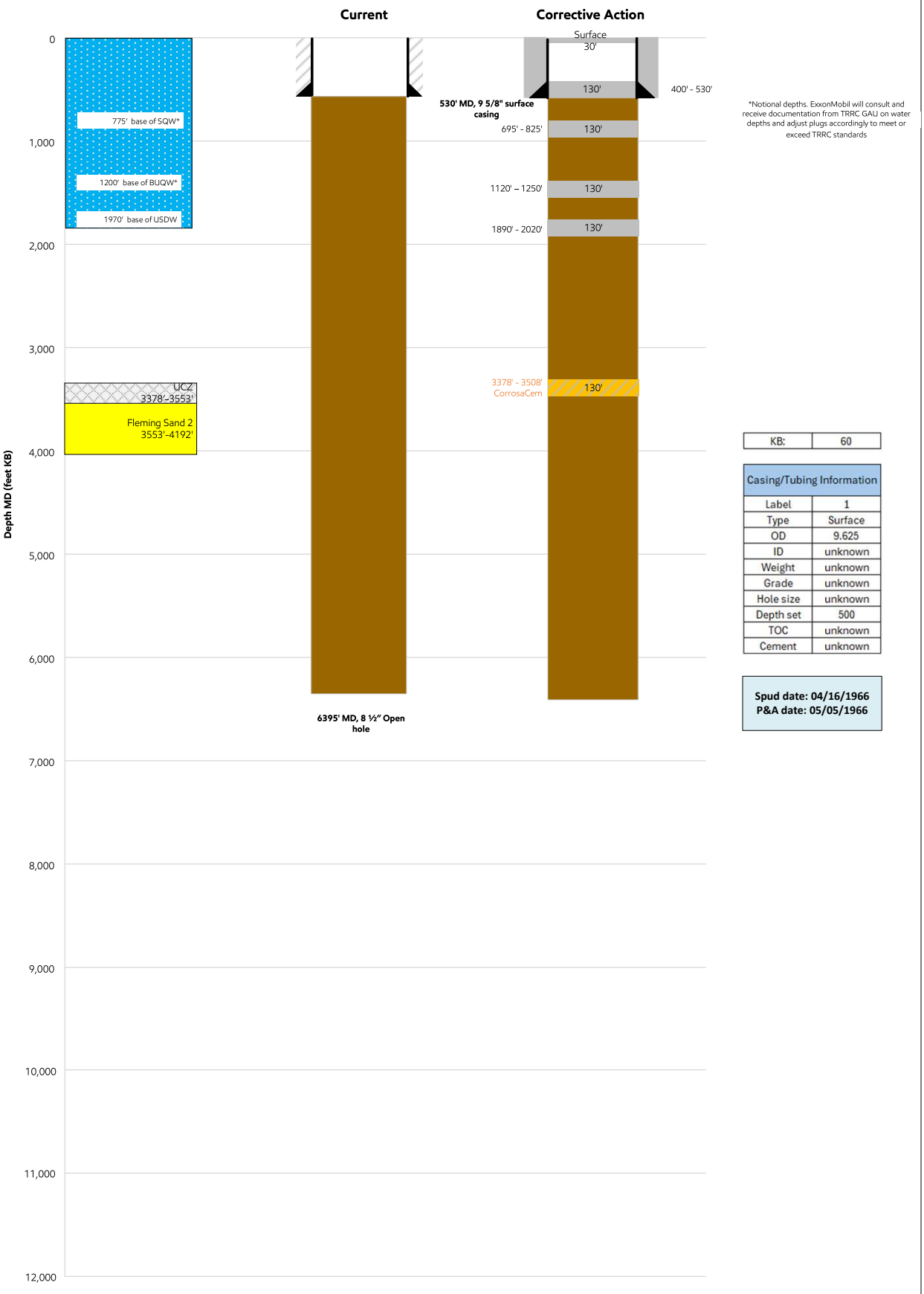
Casing/Tubing Information	
Label	1
Type	Surface
OD	10.75
ID	10.192
Weight	32.75
Grade	unknown
Hole size	14.75
Depth set	572
TOC	unknown
Cement	unknown

Casing/Tubing Information	
Label	2
Type	Production
OD	5.5
ID	5.012
Weight	14
Grade	unknown
Hole size	7.5
Depth set	5606
TOC	unknown
Cement	unknown

Spud date: 11/14/1974
P&A date: 11/20/1974

Appendix C-4
Frank Carpenter et al #001 (1957) Well Corrective Action Schematic
API 4224500005
Sunflower Carbon Storage Project
ExxonMobil Low Carbon Solutions Onshore Storage LLC
Newton, Texas

Wilson et al #001 Well Schematic (API 4224503214)
30.05622 -94.40685 (NAD 27)



*Notional depths. ExxonMobil will consult and receive documentation from TRRC GAU on water depths and adjust plugs accordingly to meet or exceed TRRC standards

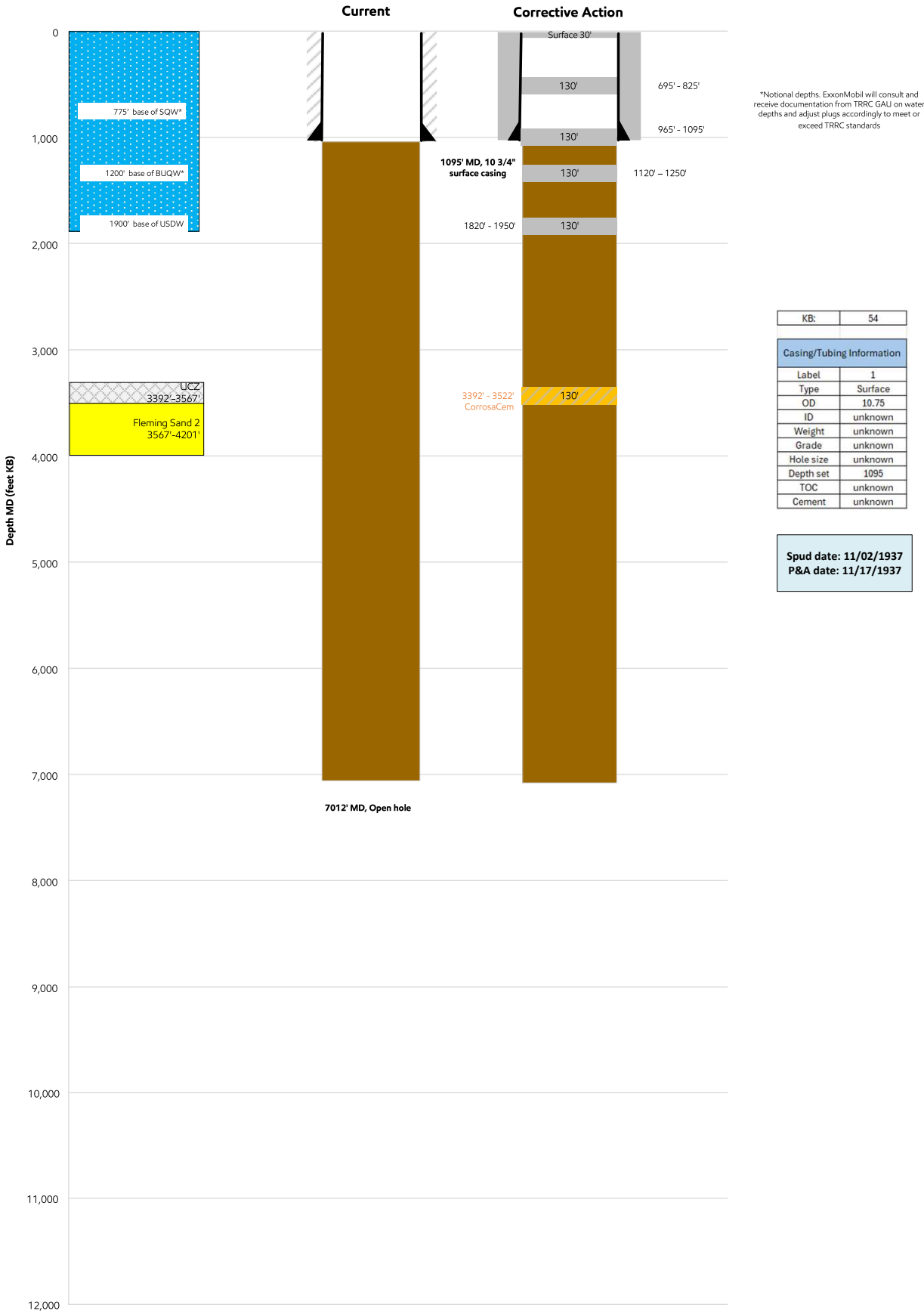
KB:	60

Casing/Tubing Information	
Label	1
Type	Surface
OD	9.625
ID	unknown
Weight	unknown
Grade	unknown
Hole size	unknown
Depth set	500
TOC	unknown
Cement	unknown

Spud date: 04/16/1966
P&A date: 05/05/1966

Appendix C-4
Wilson et al #001 Well Corrective Action Schematic
API 4224503214
Sunflower Carbon Storage Project
ExxonMobil Low Carbon Solutions Onshore Storage LLC
Newton, Texas

F. S. WILSON #1 Well Schematic (API 4224500006)
30.05514 -94.39594 (NAD 27)



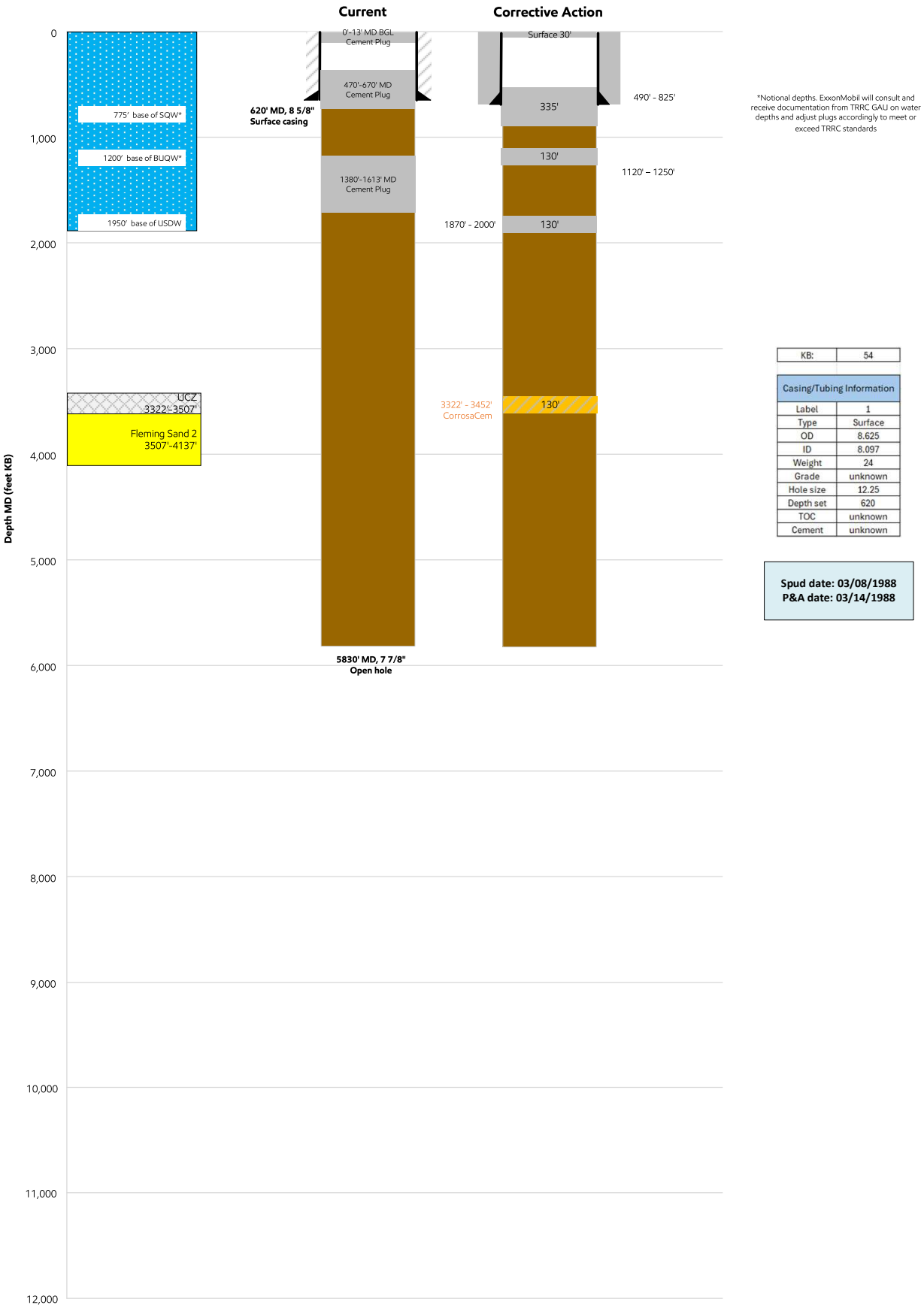
*Notional depths. ExxonMobil will consult and receive documentation from TRRC GAU on water depths and adjust plugs accordingly to meet or exceed TRRC standards

KB:	54

Casing/Tubing Information	
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Type	Surface
OD	10.75
ID	unknown
Weight	unknown
Grade	unknown
Hole size	unknown
Depth set	1095
TOC	unknown
Cement	unknown

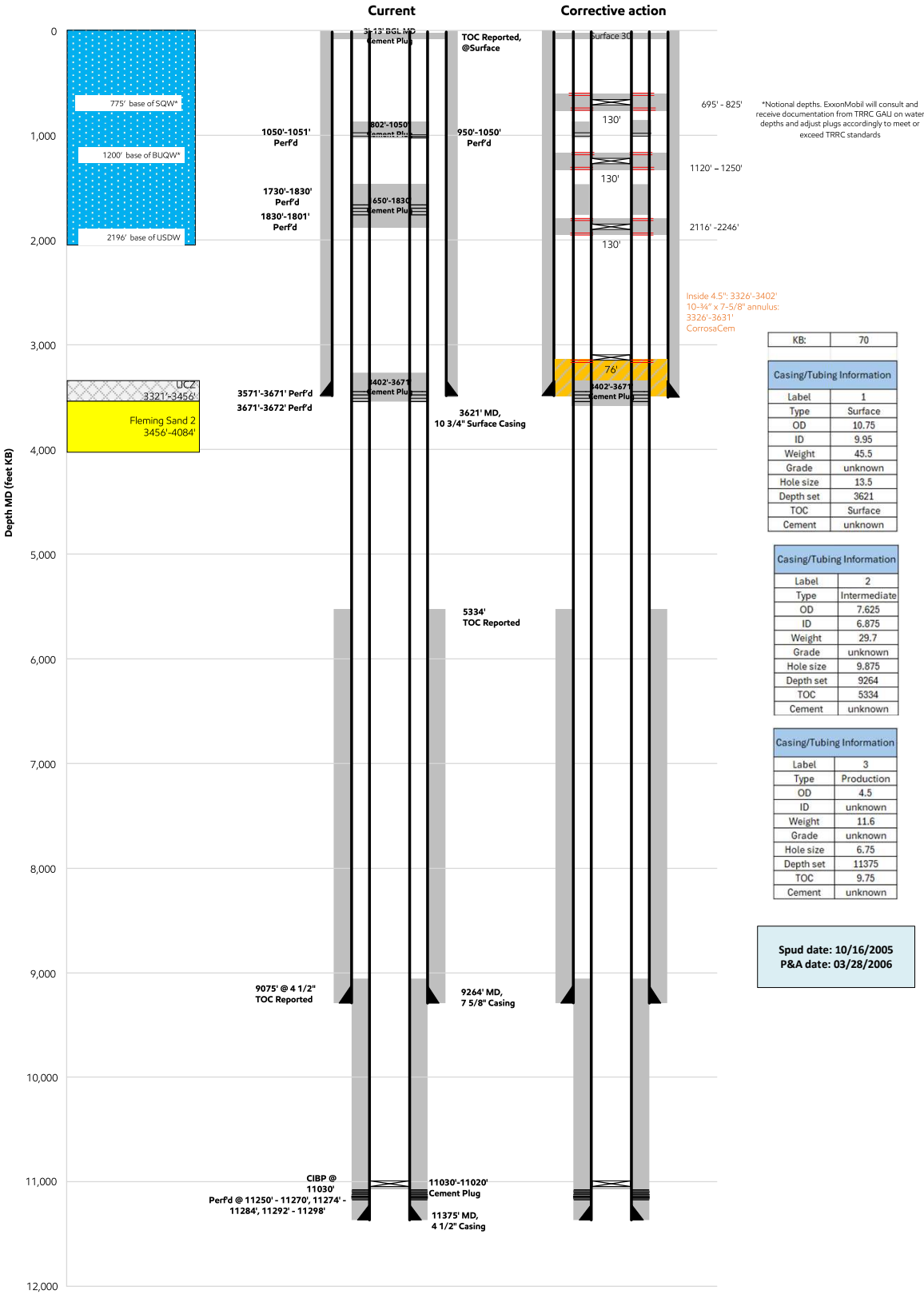
Spud date: 11/02/1937
P&A date: 11/17/1937

Appendix C-4
F. S. WILSON #1 Well Corrective Action Schematic
API 4224500006
Sunflower Carbon Storage Project
ExxonMobil Low Carbon Solutions Onshore Storage LLC
Newton, Texas



Appendix C-4
Garth #001 (1988) Well Schematic Well Corrective Action Schematic
API 4224531931
Sunflower Carbon Storage Project
ExxonMobil Low Carbon Solutions Onshore Storage LLC
Newton, Texas

Broussard Farms #001 (2005) Well Schematic (API 4229132614)
30.033768, -94.4881094 (NAD 27)



*Notional depths. ExxonMobil will consult and receive documentation from TRRC GAU on water depths and adjust plugs accordingly to meet or exceed TRRC standards

KB:	70

Casing/Tubing Information	
Label	1
Type	Surface
OD	10.75
ID	9.95
Weight	45.5
Grade	unknown
Hole size	13.5
Depth set	3621
TOC	Surface
Cement	unknown

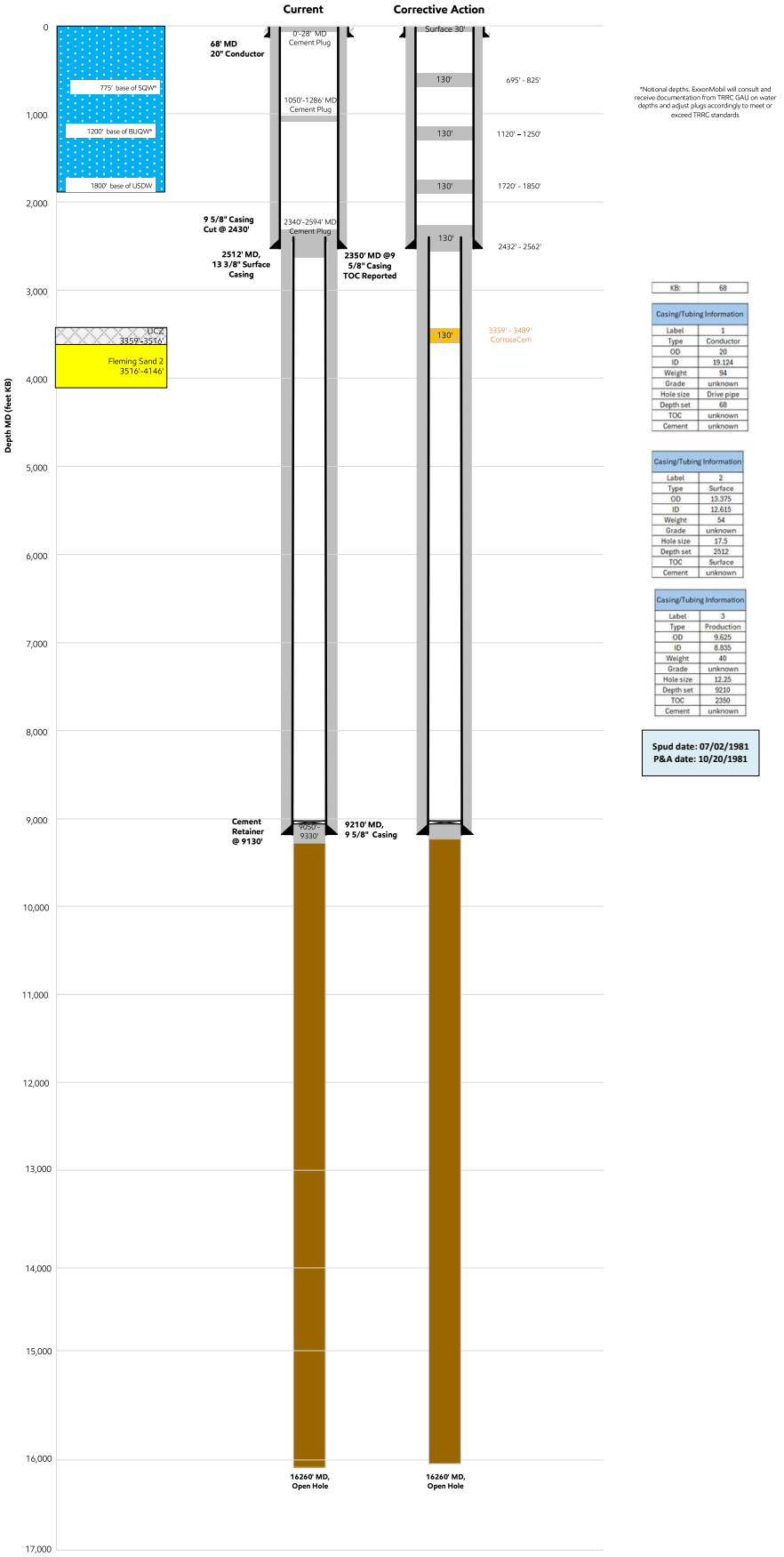
Casing/Tubing Information	
Label	2
Type	Intermediate
OD	7.625
ID	6.875
Weight	29.7
Grade	unknown
Hole size	9.875
Depth set	9264
TOC	5334
Cement	unknown

Casing/Tubing Information	
Label	3
Type	Production
OD	4.5
ID	unknown
Weight	11.6
Grade	unknown
Hole size	6.75
Depth set	11375
TOC	9.75
Cement	unknown

Spud date: 10/16/2005
P&A date: 03/28/2006

Appendix C-4
Broussard Farms #001 (2005) Well Corrective Action Schematic
API 4229132614
Sunflower Carbon Storage Project
ExxonMobil Low Carbon Solutions Onshore Storage LLC
Newton, Texas

Champion International Corp. Etal Gas Unit #001 (1981) Well Schematic (API 4224531491)
30.0663900 -94.4360000 (NAD 27)



*Notional depths. ExxonMobil will consult and receive documentation from TRRC GAU on water depths and adjust plugs accordingly to meet or exceed TRRC standards

KB:	68

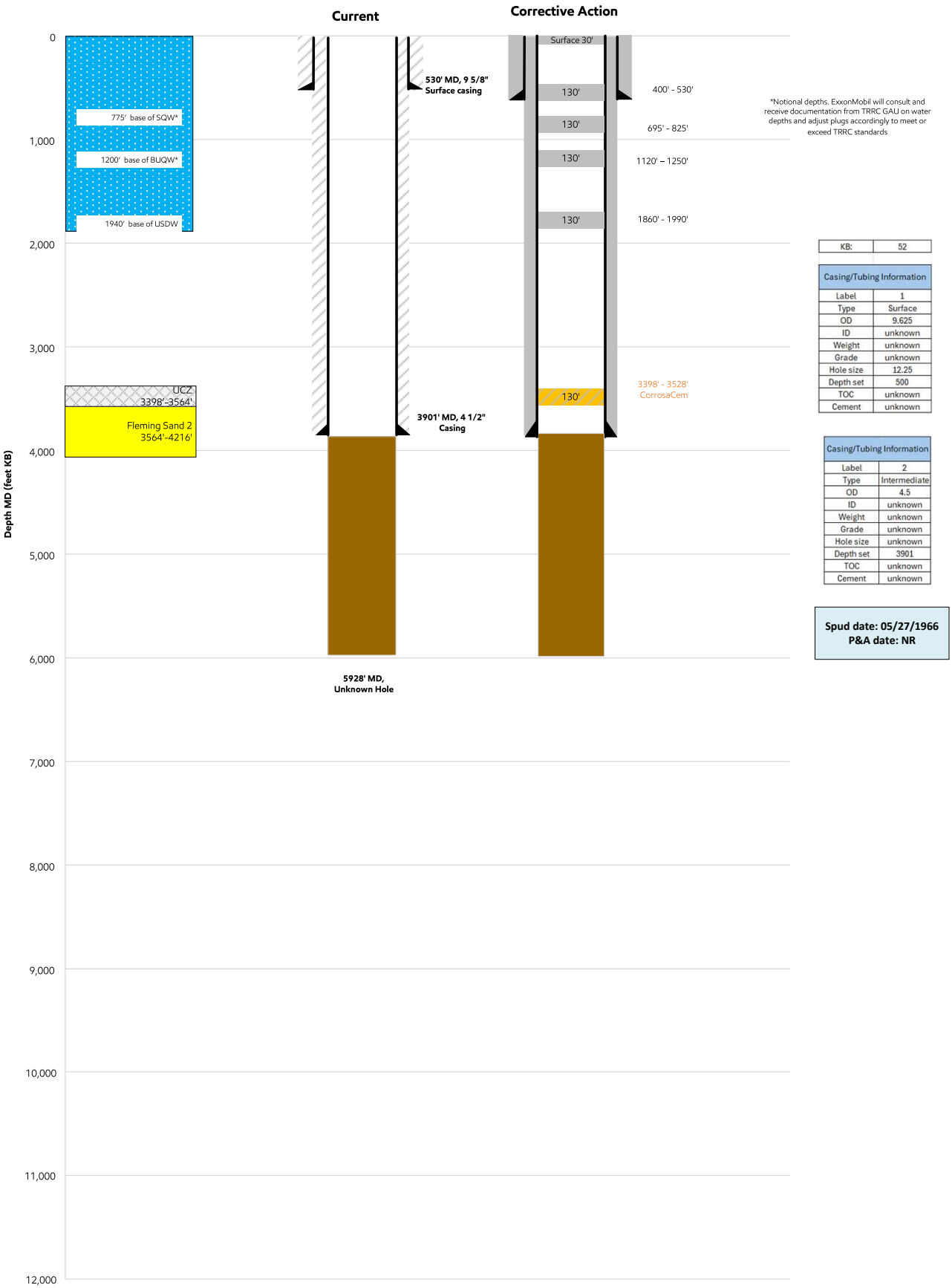
Casing/Tubing Information	
Label	1
Type	Conductor
OD	20
ID	19.124
Weight	94
Grade	unknown
Hole size	Drive pipe
Depth set	68
TOC	unknown
Cement	unknown

Casing/Tubing Information	
Label	2
Type	Surface
OD	13.375
ID	12.615
Weight	54
Grade	unknown
Hole size	17.5
Depth set	2512
TOC	Surface
Cement	unknown

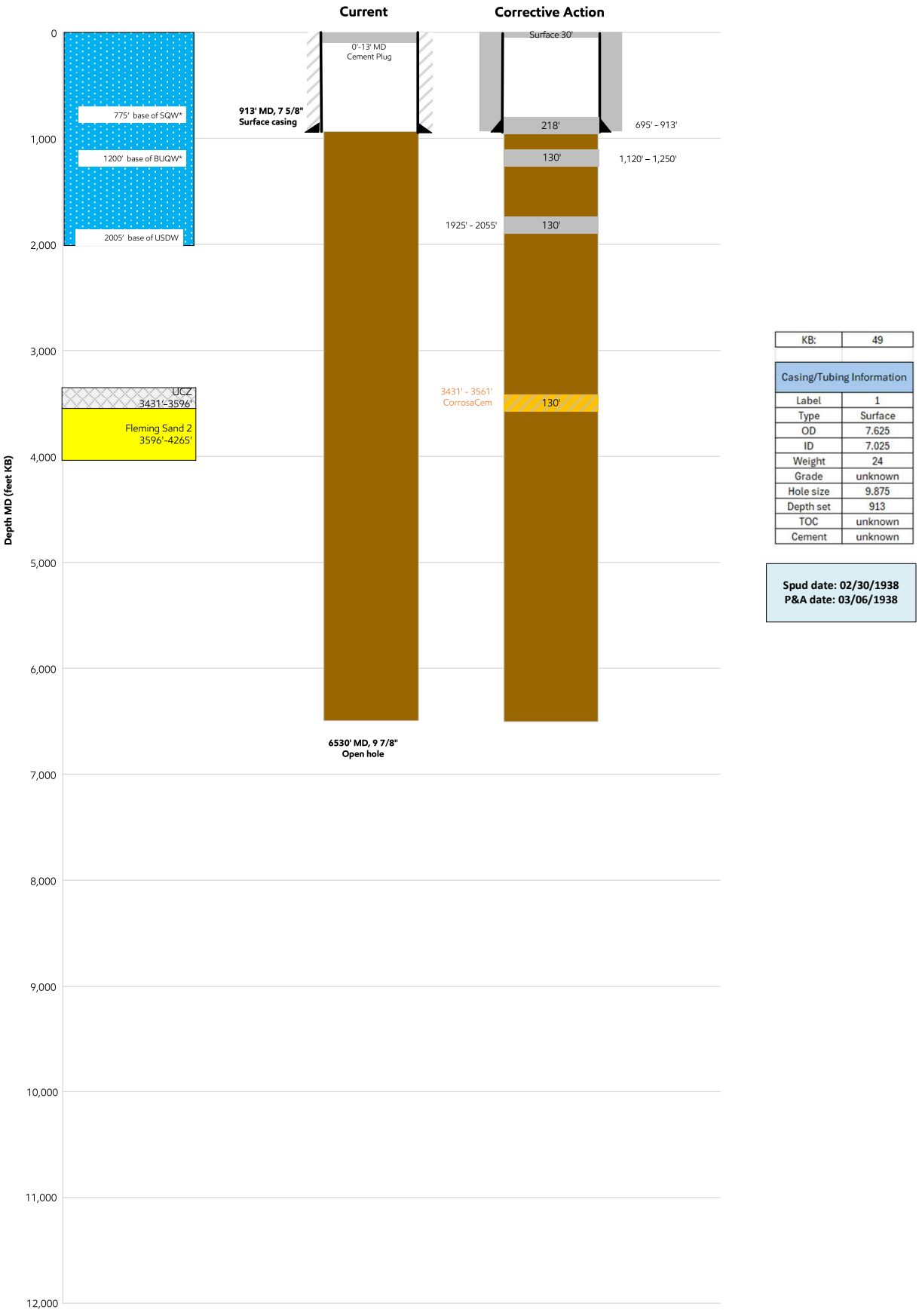
Casing/Tubing Information	
Label	3
Type	Production
OD	9.625
ID	8.835
Weight	40
Grade	unknown
Hole size	12.25
Depth set	9210
TOC	2350
Cement	unknown

Spud date: 07/02/1981
P&A date: 10/20/1981

Appendix C-4
Champion International Corp. Etal Gas Unit #001 (1981) Well Corrective Action Schematic
API 4224531491
Sunflower Carbon Storage Project
ExxonMobil Low Carbon Solutions Onshore Storage LLC
Newton, Texas



Appendix C-4
A M CARPENTER EST #001 (1967) Well Corrective Action Schematic
API 4224503240
Sunflower Carbon Storage Project
ExxonMobil Low Carbon Solutions Onshore Storage LLC
Newton, Texas



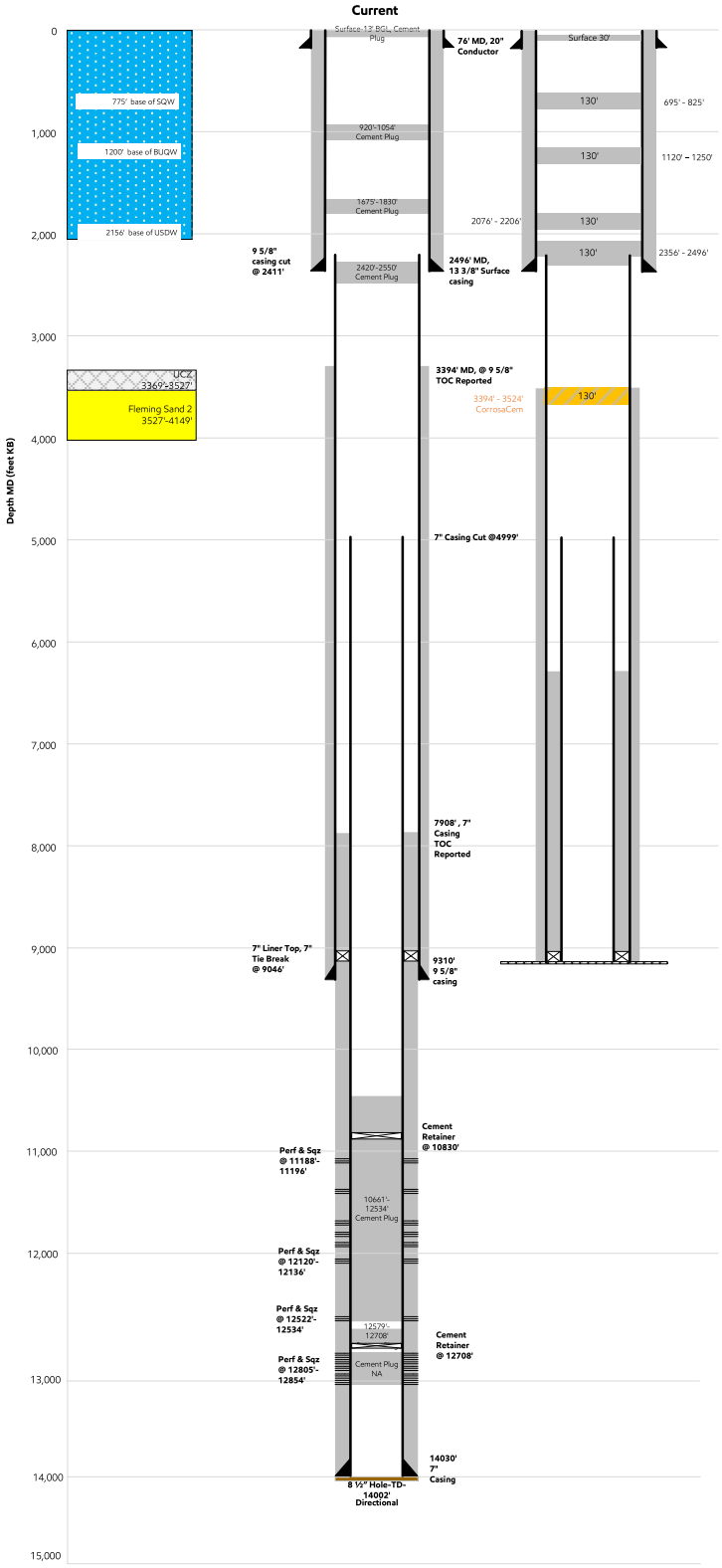
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Casing/Tubing Information	
Label	1
Type	Surface
OD	7.625
ID	7.025
Weight	24
Grade	unknown
Hole size	9.875
Depth set	913
TOC	unknown
Cement	unknown

Spud date: 02/30/1938
P&A date: 03/06/1938

Appendix C-4
B.H. Willis #001 (1938) Well Schematic Well Corrective Action Schematic
API 4224500008
Sunflower Carbon Storage Project
ExxonMobil Low Carbon Solutions Onshore Storage LLC
Newton, Texas

E. A. Henderson #001 (1994) Well Schematic (API 4229132215)
30.0478163 -94.4678153 (NAD 27)



KB:	65

Casing/Tubing Information	
Label	1
Type	Conductor
OD	20
ID	unknown
Weight	unknown
Grade	unknown
Hole size	Drive Pipe
Depth set	76
TOC	unknown
Cement	unknown

Casing/Tubing Information	
Label	2
Type	Surface
OD	13.375
ID	12.515
Weight	61
Grade	J-55
Hole size	17.5
Depth set	2496
TOC	Surface
Cement	unknown

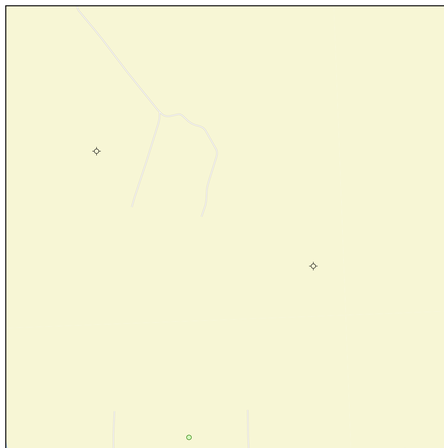
Casing/Tubing Information	
Label	3
Type	Intermediate
OD	9.625
ID	8.535
Weight	53.5
Grade	L-80
Hole size	12.25
Depth set	9310
TOC	3394
Cement	unknown

Casing/Tubing Information	
Label	3
Type	Production
OD	7
ID	6.094
Weight	32
Grade	P-110
Hole size	8.5
Depth set	14000
TOC	7908
Cement	unknown

Spud date: 07/06/1994
P&A date: 03/14/1996

Appendix C-4
E. A. Henderson #001 (1994) Well Corrective Action Schematic
API 4229132215
Sunflower Carbon Storage Project
ExxonMobil Low Carbon Solutions Onshore Storage LLC
Newton, Texas

Appendix C5 – Site Review Map



Sunflower Carbon Capture and Storage Project

Area of Review

Site Review

ExxonMobil Low Carbon Solutions Onshore Storage LLC

Jefferson and Liberty Counties, Texas

Appendix C-4

Drawn by: Steven Larcom	Date: 5/29/2026	Approved by: Andy Ellis

PCS: NAD 1983 State Plane TX - S. Central FIPS 4204 (US Ft.)

LONQUIST

Texas Registration No. F-8952

- Proposed Injection Wells
- Proposed Monitoring Wells

Oil & Gas Well SHLs

- <Null>
- DISPOSAL
- DRY HOLE
- GAS
- OIL
- OIL & GAS
- OTHER
- <all other values>

Permanent Structures

- Residential
- Commercial
- Government
- Education
- Other
- RCRA Hazardous Waste Site (Active)
- Cleanups in my Community
- Area of Review
- Sunflower Geologic Storage Facility
- Counties

*Note: Extensive research was performed to check the project area for the presence of artificial penetrators, cleanup sites, mines and quarries, and any other infrastructure of note. The absence of any of these features on this map means that data sources indicate that they are not present within the project area. Data sources used for research include the United States Environmental Protection Agency (Superfund Sites, Active and Inactive RCRA Hazardous Waste Sites, Cleanups-in-my-Community); United States Geological Survey (mines and quarries); United States Fish & Wildlife Service (endangered species critical habitats); Texas Parks and Wildlife Department (wildlife management areas); Texas Water Development Board (springs); Enverus, TGS, RRC (artificial penetrators).

Sunflower USDW No. 01
Sunflower INJ No. 01
Sunflower AZM No. 01
Sunflower USDW No. 02
Sunflower INJ No. 02
Sunflower AZM/IZM No. 01
Sunflower AZM No. 02
Sunflower USDW No. 03
Sunflower INJ No. 03
110006131408
BRIGGS MOTOR CO
Nome
HARDIN
JEFFERSON
LIBERTY
Highway 326 S
Highway 90
Old Nome Rd
Old Graytown Rd
Nome Spur
Cotton Creek
Fancia Creek
Long Marsh
Mermentau Slough
Clay Gully
Private 103
Private Road 107
Nolte Canal
Lnva Canal
Pignut Gully
Willis Ln
Elmer Rd
Nolte Rd
Bonner Rd
Rodeo Dr
Paggi Rd
Blair Rd
Mason Rd
Tindall Rd
Florida St
Louisiana St
Gulf St
Market Dr
Kotz Rd
Avenue E
Avenue D
Avenue C
Avenue B
Avenue A
FM 1009
FM 365 Rd
1:15,000
0 ½ 1 1½ 2 4 Miles
0 1,000 2,000 3,000 4,000 5,000 10,000 Feet
N

Underground Injection Control – Class VI Permit Application for Sunflower Carbon Capture and Storage Project Injection Wells No. 01, No. 02, and No. 03

SECTION 4 – WELL CONSTRUCTION PLAN AND OPERATING CONDITIONS

Sunflower Carbon Capture and Storage Project
Jefferson and Liberty Counties, Texas
ExxonMobil Low Carbon Solutions Onshore Storage, LLC
Amendment 3: August 2026

SECTION 4 – WELL CONSTRUCTION PLAN AND OPERATING CONDITIONS

TABLE OF CONTENTS

4.1 Well Construction Plan and Operating Conditions 4
4.2 Objectives 4
4.3 CO_2 Stream 5
4.4 Material Selection 5
4.4.1 Corrosion-Resistance Testing 5
4.4.2 Production Casing and Tubing Material Selection 7
4.4.3 Ordinary Portland Cement 8
4.5 Well Design and Construction 11
4.5.1 Surface Conductor Pipe Design 11
4.5.2 Surface Casing Design 11
4.5.3 Production Casing Design 14
4.6 Completion Design and Equipment 18
4.6.1 Injection Tubing Design 18
4.6.2 Safety and Continuous Monitoring Device Design 19
4.6.3 Injection Packer Design 19
4.6.4 Wellhead and Tree Equipment Design 19
4.7 Well Drilling and Completion Design 22
4.7.1 Drilling and Completion Procedure for the Injection Wells 22
4.8 Pre-Operational Testing Plan 23
4.8.1 Injection and Confining Zone Core Sampling 23
4.8.2 Pre-Operation Logging Program 23
4.8.3 Injection Zone Characterization 24
4.8.4 Fluid Characteristics and Downhole Conditions 25
4.8.5 Injection and Confining Zone Formation Testing 25
4.9 Injection Well Operating Strategy 25
4.9.1 Overview of Injection Well Perforation and Completion Strategy 26
4.9.2 Injection Rate and Pressure 28
4.9.3 Well Stimulation Procedures 31
4.10 Operational Reporting Plan 32

Figures

Figure 4-1 – Typical Wellhead Configuration for the Injection Wells 21
Figure 4-2 – Operational Completion Strategy for the Injection Wells 28

Tables

Table 4-1 – Major CO_2 Stream Constituents 5
Table 4-2 – Simulation of Corrosive Environment 6
Table 4-3 – Corrosion Testing Results at USGC Reservoir Conditions with 100,000 mg/L Chlorides..... 6
Table 4-4 – Potential Injection-Well Tubular Failures Due to Corrosion and Associated Details 8
Table 4-5 – Summary of Design for Surface Casing Specifications for the Sunflower Project Injection Wells 12
Table 4-6 – Surface Casing Design Calculations for the Injection Wells* 13
Table 4-7 – Surface Casing Cement-Volume Calculations for the Injection Wells 13
Table 4-8 – Summary of Design for Surface Casing Centralizers 14
Table 4-9 – Production Casing Specifications 15
Table 4-10 – Production Casing Design Calculations* 16
Table 4-11 – Production Casing Cement-Volume Calculations for Injection Well No. 01 16
Table 4-12 – Production Casing Cement-Volume Calculations for Injection Well No. 02 17
Table 4-13 – Production Casing Cement-Volume Calculations for Injection Well No. 03 17
Table 4-14 – Production Casing Centralizer Program 17
Table 4-15 – Tubing Specifications 18
Table 4-16 – Engineering Design Calculations for Tubing 18
Table 4-17 – Summary of Preliminary Coring Operations 23
Table 4-18 – Open hole Logging Plan for the Injection Wells 24
Table 4-19 – Cased-Hole Logging Plan for the Injection Wells 24
Table 4-20 – Sampling and Analysis Plan for the above UCZ Water Samples 25
Table 4-21 – Injection Sequencing Strategy for Injection Well No. 01 26
Table 4-22 – Injection Sequencing Strategy for Injection Well No. 02 26
Table 4-23 – Injection Sequencing Strategy for Injection Well No. 03 27
Table 4-24 – Summary of Injection Parameters for the Injection Wells 29
Table 4-25 – Injection Zone Depths 31

4.1 Well Construction Plan and Operating Conditions

ExxonMobil Low Carbon Solutions Onshore Storage, LLC (ExxonMobil) is undertaking the Sunflower Carbon Capture and Storage (CCS) Project (Sunflower Project) in Jefferson and Liberty Counties, Texas, to sequester CO_2 using three injection wells, Sunflower CCS Project Injection Wells No. 01, No. 02, and No. 03. This section contains information on the well construction and operating conditions in compliance with the requirements of Title 16, Texas Administrative Code (16 TAC), Part 1, Chapter 5A.

This section provides a narrative document with associated schematics and data summary tables that describe how ExxonMobil will construct the injection wells to meet the goals of 16 TAC **§5.203**—specifically, to do the following:

1. Prevent the movement of fluids into or between underground sources of drinking water (USDWs) or into unauthorized zones (16 TAC **§5.203(e)(1)(A)(i)**).
2. Permit the use of appropriate testing devices and workover tools (16 TAC **§5.203(e)(1)(A)(ii)**).
3. Permit continuous monitoring of the annulus space between the injection tubing and long string casing (16 TAC **§5.203(e)(1)(A)(iii)**).

The engineering design is based on the collection of as much site-specific data as possible. This level of effort was undertaken to facilitate the permit writing process, between conducting the pre-construction activities required at 16 TAC **§5.203(a)(2)** and the pre-operation phase activities required at 16 TAC **§5.203(g)**. ExxonMobil will install well signs pursuant to 16 TAC **§5.206(n)**.

In the event that ExxonMobil utilizes contractors for work at the storage facility, ExxonMobil will hold a pre-job safety meeting and explain emergency measures specific to such work prior to the work beginning (16 TAC **§5.206(h)(2)(B)**.

4.2 Objectives

ExxonMobil developed the engineering design, pre-operational testing plan, and operating strategy for the proposed injection wells to meet the following objectives:

- The injection well construction design, material specifications, and construction will be compatible with the composition of the CO_2 stream over the duration of the Sunflower Project to protect USDWs (16 TAC **§5.203(A)(i)**).

- The injection wells will undergo logging and testing prior to operation, to assess injection well and formation performance and update the operating strategy as necessary before the injection of CO_2 (16 TAC **§5.203(c)(2)(F**) and **§5.206**).

- The injection well operating strategy provides continuous injection and annulus monitoring systems for each injection well, to control injection pressure and trigger automatic shutoff devices, consistent with safe operating procedures (16 TAC **§5.203(i)(1)**, **§5.203(e)(4)**, and **§5.203(i)(1)**; also **§5.206(d)(2)(F)**). ExxonMobil intends to always maintain mechanical integrity of the injection wells other than during periods of well workovers as outlined by 16 TAC **§5.203(h)(1)(A)** and will not injection between the outermost casing and wellbore as outlined by 16 TAC **§5.206(d)(2)(A).**

4.3 CO_2 Stream

The CO_2 stream injected into the reservoir will be 100% sourced from ExxonMobil's USGC CO2 pipeline. The stream is considered to be dehydrated. The majority of the full CO_2 stream constituents for the Sunflower Project are outlined in Table 4-1. Constituents with de minimis amounts are not reflected.

Table 4-1 – Major CO_2 Stream Constituents

Major Constituents	Mole Percent
Carbon dioxide (CO_2)	>97%
Hydrogen (H_2)	<1.5%
Methane (CH_4)	<3%
Ethane to Pentane (C_2 to C_5)	< 1.0%
Combined Nitrogen and Argon (N_2 and Ar)	<0.5%

The above stream components are in mole percentage, which is equal to volume percentage of the stream.

4.4 Material Selection

ExxonMobil assessed the corrosion-resistance properties of various metal alloys under the operating conditions expected on the proposed injection wells. The corrosion-resistance test results were used to select a reasonable and appropriate metal alloy for production casing and tubing compliant with the requirements of 16 TAC **§5.203(e)(1)(B)(ii)**.

4.4.1 Corrosion-Resistance Testing

ExxonMobil conducted a series of rigorous corrosion tests that simulated the worst-case potential well operations and downhole conditions of CO_2 within reservoir saline water. Specimens of metal alloys were placed in an autoclave test cell representing the corrosive environment that tubing and lower completion components will be subject to during the shut-in conditions, when CO_2 and reservoir connate water are present. Corrosion of the production tree and injection tubing is not expected during normal CO_2 injection operations, as the CO_2 stream is

dehydrated. Table 4-2 reflects the testing conditions to simulate the corrosive environment, to demonstrate the corrosion-resistant capabilities of the selected material.

Table 4-2 – Simulation of Corrosive Environment

Test Objective	Test Conditions	Sunflower Project Expected Site Conditions	Material
Simulate corrosive United States Gulf Coast (USGC) environment	Propietary [redacted]	[redacted]	13Cr

[redacted]

The specimen was subjected to the anticipated downhole conditions for 30 days at reservoir temperature, pressure, and expected fluid interfaces. Post-test specimens were evaluated for general and localized corrosion. The specimen demonstrated corrosion-resistance capabilities.

The testing protocol is in line with the American Society for Testing and Materials (ASTM) guidelines.

The results for the USGC corrosion tests are summarized in Table 4-3. Reservoir temperature, pressure, and gas mixture were maintained per the specific test conditions, and the chloride content of the brine was varied. The corrosion rates from the 30-day test results are linearly extrapolated (worst-case scenario) to predict a maximum corrosion rate in mil/year (or 0.001 inch/year). As we inject CO_2 downhole, CO_2 saturation will increase in the near wellbore region and the reservoir temperature will decrease, both of which will continue to inhibit rate of corrosion.

Table 4-3 – Corrosion Testing Results at USGC Reservoir Conditions with 100,000 mg/L Chlorides

Chlorides (mg/L)	100,000
USGC Conditions – Averaged weight-loss corrosion rate (mil/year)	P [redacted]
USGC Conditions – Maximum localized corrosion rate (mil/year)	Pr [redacted]

4.4.2 Production Casing and Tubing Material Selection

Based on the extensive USGC corrosion-resistance testing, ExxonMobil deems 13Cr production casing and tubing sufficient in providing well integrity at the downhole conditions anticipated for both operating and later abandonment of the injection wells.

The metallurgy selection for the Sunflower Project is intended to be fit for purpose. Injection wells will be initially perforated in the planned injection stage, and injection will commence into this stage for approximately Propietar depending on the injection stage duration outlined in *Section 4.9.1*. After that period, the deepest injection interval will be plugged back, and the well will be recompleted uphole at the next injection interval, where a similar period of injection will occur. This interval will also be subsequently plugged back and uphole recompleted after the injection duration is reached. This process will continue until all the injection stages have been filled with CO_2 and the well can be permanently abandoned. During the anticipated maximum injection interval of about two years, it is expected that there may be approximately Propie of shut-in for routine well maintenance. During these periods, the casing below the injection packer, the injection packer, and the tubing could be exposed to CO_2 gas, associated gas impurities, and saline water. The casing above the packer will be isolated from formation fluids and constantly monitored during this period. During active CO_2 injection, the tubing, injection packer, and casing below the injection packer will be exposed to dense phase CO_2—but will not see potential corrosion like the carbon steel pipeline that is delivering CO_2 to the injection wells (i.e., absence of free water or formation fluids).

In the worst-case scenario, USGC conditions with formation fluids of Propietary chlorides, the maximum localized corrosion rate is expected to be Propietary This would require approximately Propietar of continuous shut-in exposure to CO_2 and formation fluids, to potentially lead to enough pitting to result in a through-wall leak in 13Cr casing.

Note that the average weight-loss corrosion rate assumes that all the weight loss is due to reduction in sample wall thickness for reporting purposes. No wall loss was seen in the samples, so it is just an indication of test-sample weight loss due to pitting. The maximum localized corrosion rate indicates the maximum pitting depth discovered in a batch of test specimens under the same conditions. It gives an indication on how long it could take for the wall of well tubulars to be penetrated, assuming the injection well was in a shut-in condition and exposed to both brine and CO_2 at the same time.

Although no significant corrosion or pitting leading to leaks is anticipated based on the operating conditions of these wells, any such occurrence would be addressed as discussed in Table 4-4—an injection well tubular-failure analysis table, showing potential failures and the remedial actions required. The failure analysis table utilizes a Propietary corrosion rate, which is the worst-case maximum localized corrosion rate (pitting) from all the testing data (detailed in Table 4-3).

Table 4-4 – Potential Injection-Well Tubular Failures Due to Corrosion and Associated Details

Type of Failure	Result of Failure	(Brine + Gas) Minimum Exposure Time Required for Failure	Probability of Failure (e.g., Leak Through Tubular)	Remedial Action if Leak Occurs
Leak in casing below injection packer	Inconsequential—the casing is already perforated below injection packer.	• Propiet	Unanticipated down to lowest perforation taking CO_2	None required
Leak in wall casing above injection packer	Leak would be immediately identified due to pressure monitoring and remedial action initiated.	• Propiet	Unanticipated as casing would be protected by cement and packer and packer fluid in annulus	Pull tubing and patch casing or plug back above leak depth. No impact to USDW.
Leak in tubing	Leak would be immediately identified, and remedial action initiated.	• Propiet	Unanticipated — exposure to brine + gas is expected to be approximately 18 days	Pull tubing and replace as needed.

4.4.3 Ordinary Portland Cement

The compilation of published research, experimental data, and industry experience highlighted in American Petroleum Institute (API) Bulletin 5100 provides technical clarity on the suitability of ordinary Portland cement (OPC) as a well construction material for CCS applications and other environments where it may be exposed to CO_2. While chemical and physical alterations do occur in the presence of carbonic acid—a product of the reaction between CO_2 and water—the rate and depth of alteration are negligible for long-term storage objectives. The preponderance of literature referenced in the bulletin concludes that, when sound well construction and cement placement techniques are followed and operationally induced wellbore stresses are considered, the alteration of OPC by CO_2 does not compromise well integrity—making OPC a barrier material that is sound in environments with highly saturated CO_2. Additionally, the literature referenced in the bulletin states that where minor defects of mechanical damage are present, the reaction products of CO_2 and OPC can exhibit self-healing properties.

Beyond this overall conclusion, API Bulletin 5100 (2025) also states that, "*While current literature and experimental data support the use of OPC in CO_2-exposed applications, this conclusion does not eliminate the need to account for site-specific well conditions when designing and optimizing OPC barrier systems. Factors that can affect performance include temperature exposure; post-set well stresses; formation lithologies; formation fluid compositions; and CO_2 stream composition*" (Wu, Stiles and Gupta 2025). These factors are addressed below.

Regarding temperature exposure, the maximum anticipated bottom hole temperature expected for the Sunflower wells is ~170˚ F API Bulletin 5100 Table 1 – Summary of Experimental Results

of Alteration Rates of OPC Under Influence of CO2, shows a test case at ~170˚ F run on Class H cement. Based on the experiment, a penetration depth of 0.79m after 10,000 years (0.079 mm/yr.) was predicted.

Furthermore, ExxonMobil conducted internal testing of the impact of CO_2 on cement at 30- and 90- day durations and presented results supporting the conclusions of API Bulletin 5100 (2025) at a March 2025 CCUS SPE conference. ExxonMobil's experiment-based prediction of the carbonation rate results in less penetration than the noted API 5100 example.

To further evaluate long term effects, ExxonMobil repeated internal testing on cement samples at 180 days. The 180-day testing reaffirmed the findings of the 30- and 90-day tests and further supported the conclustions presented in API Bulletin 5100. In fact, the longer term 180-day testing indicates that carbonization occurs more slowly than predicted by extrapolation of short term data, as there was no significant increase in carbonization depth between test intervals. Additionally, all tested speciemens maintained sufficient compressive strength to qualify as a barrier under API cement barrier requirements.

Importantly, alteration (penetration) should not be interpreted as degradation. Rather, it indicates the depth to which the cement and carbonic acid have reacted, or the depth to which carbonation of the cement has occurred. The reaction forms $CaCO_3$ (limestone) which is harder and less permeable than the original cement. Internal cement testing performed at 200^0F showed that the gas permeability of a Class H cement dropped from 0.016mD to 0.0015mD after 30 days of brine and CO_2 exposure. As per API Bulletin 5100 (2025), "*In practical terms, when OPC is used for zonal isolation in the annulus, the cement column is long enough that the extrapolated time required for CO_2 to migrate through the entire length of the cement sheath exceeds long-term storage objectives*."

Regarding stress, the primary stress will be from the original pressure test of the casing up to a maximum of 5000psi. Subsequent tests will be done to 200psi above injection pressure. The cement will be fully set at the time of pressure test with a minimum of eight hours waiting time. Note that while damage to the cement is not expected, cement bond logs will be run to verify cement quality and yearly mechanical integrity tests will be run to identify any potential behind pipe fluid migration.

Formation lithology across the injection interval consists of sand and shale intervals that will not impact the cement. Formation fluid is high salinity brine (100mg/L chlorides). The cement will not be exposed to the formation fluid during setting due to overbalance, mud filter cake, and cement fluid loss additive which aids in development of a filter cake for the cement. Once the well is perforated and cement is exposed to the brine, the chlorides in the brine will not react with the cement after it has been set.

Finally, the worst-case injection gas composition is CO_2: >97.0%, O_2: <50ppm, H_2S: <50ppm, SO_x: <15ppm | NO_x: <15ppm. API Bulletin 5100 (2025) addresses the interaction between the CO_2 and cement where a protective carbonated layer will develop which has lower permeability than the

original cement. Cement is fully oxidized and O_2 will not react with it. To address H_2S and SO_x content in the injection gas, a high sulfate resistant Class H cement will be used to prevent post-set degradation due to sulfate alteration. Both H_2S and SO_x can react with the cement to form calcium sulfate (gypsum). Calcium sulfate then reacts with tricalcium aluminate in the cement to form a crystal that has potential to expand and impact cement quality. High sulfate resistant Class H cement limits the amount of allowable tricalcium aluminate in the cement to prevent significant sulfate damage. SO_x and NO_x mixed with water can lower the pH; however, the small amount available (<15ppm each) does not have a meaningful effect on the pH already altered by the CO_2.

Overall, both API Bulletin 5100 (2025) and ExxonMobil's internal testing support the conclusion that OPC-based cement systems remain suitable barrier materials for CO_2 service. The anticipated temperature, stress conditions, formation lithology, formation fluid composition, and injection gas composition for the Sunflower Facility fall within conditions for which OPC performance has been demonstrated to maintain long-term well integrity.

ExxonMobil proposes single stage cementing for both the surface casing and production casing for all three injection wells.

A list of common cement additives is provided below for the blended Portland cement. The additives are used to improve setting time, reduce porosity, and improve overall strength if needed. Not all additives listed will be utilized. ExxonMobil will provide specifics in required regulatory reports based on final cement slurry blends which will be determined by laboratory testing using the mix water available at the rig site.

Fluid-loss additives such as:

- Cellulosic polymer, polyamines, sulfonated aromatic polymers, polyvinyl pyrrolidone, polyvinyl alcohol, acrylamide methyl propane sulfonate copolymers and terpolymers, bentonite, latexes, and crosslinked polyvinyl pyrrolidone

Dispersants such as:

- Polynapthalene sulfonate and polymelamine sulfonate

Retardants such as:

- Lignosulfonates, hydroxycarboxylic acids, cellulose derivatives, organophosphonates, and certain inorganic compounds

Accelerators such as:

- Calcium chloride, sodium chloride, and sodium silicates

Antifoam agents such as:

- Polyglycol ethers and silicones

While ExxonMobil deems OPC as the fit for purpose technical solution for the Sunflower CCS Project justified and supported by API 5100 and ExxonMobil's own 30-, 60-, and 180-day testing which has been provided to the Texas Railroad Commission, presented and published at industry

conference, and both having been summarized in this permit, CorrosaCem – or suitable equivalent - is being proposed for the tail cement from total depth to the UCZ to address regulator feedback on any uncertainty of approval through the permitting process with OPC .

4.5 Well Design and Construction

The engineering design parameters for the three proposed injection wells are based on the planned injection rates, injection volumes, fluid properties, and chemical properties of the injectate fluid. Injection well design is a two-string design. The casing and cement were designed to have sufficient strength and material properties to withstand the pressure, temperature, and corrosive forces to which they will be exposed (16 TAC **§5.203(e)(1)(B)(ii**)). Well design schematics are included in *Appendix D* (16 TAC **§5.203(e)(2)(K**)).

4.5.1 Surface Conductor Pipe Design

The unconsolidated nature of the sediments in the upper subsurface soil requires the installation of a conductor pipe to establish and maintain borehole integrity. A cellar will be installed, a 26-inch hole will be drilled with an auger-style rig to depth, and a 20-inch casing will then be run and cemented conventionally. A 17 1/2-inch bit will be used to drill the next section of the well through the conductor pipe.

4.5.2 Surface Casing Design

The surface hole will be drilled to below the USDW (16 TAC **§5.203(e)(1)(B)(iii)**) with a 17 1/2-inch bit, with surface casing set below the USDW by approximately 200 feet for each of the injection wells. A string of 13 3/8-inch casing will be run and cemented to the surface, with the casing centered in the open hole with centralizers. Please note, ExxonMobil will log each injection well and consult with TRRC's GAU for a USDW determination prior to setting the surface casing. As such, the well design may be slightly amended based on as-drilled conditions. In any case, the surface casing will extend below the lowermost USDW for proper isolation of all protected water strata.

A summary of the surface casing design parameters is presented in Tables 4-5 through 4-8.

Table 4-5 – Summary of Design for Surface Casing Specifications for the Sunflower Project Injection Wells

Section	OD (in.)	ID (in.)	Drift (in.)	Weight (lb/ft)	Burst (psi)	Collapse (psi)	Tensile (kips)	Intervals (ft)		
								INJ No. 01	INJ No. 02	INJ No. 03
13 3/8-in. J-55	13.375	12.415	12.259	68.0	3,450	1,950	1,069	0–~2,900	0–~2,220	0–~2,150

*OD – outer diameter
ID – inner diameter
lb/ft – pounds per foot
kips – thousand pounds

Table 4-6 – Surface Casing Design Calculations for the Injection Wells*

13 3/8-in. Casing: 68 ppf J-55 BTC, 0–2,900 ft					
	Load Type – Working Stress Design	**Load (lb)**	**Depth (ft)**	**Min SF**	**Depth (ft)**
Burst	Kick	1,218(psi)	0	2.6	0
	Pressure Test – 2,500 psi with 10 ppg OBM	2,685 (psi)	2,900	1.14	2,900
Tension	Green Cement – 2,500 psi with 10 ppg OBM	408 (kips)	0	2.61	0
	Running with Overpull – 100 kips	269 (kips)	0	3.97	0
	Buckling Check – cement to surface, maximum MW 11.0 ppg	105 (kips)	0	10.1	0
Collapse	Cementing Collapse	441 (psi)	2,900	4.36	2,900
	Future Drilling – minimum MW 8.5 ppg	667 (psi)	2,900	2.88	2,900
BTC = buttress-thread and coupled; MW = mud weight; OBM = oil-based mud; ppf = pounds per foot; ppg = pounds per gallon; SF = safety factor *Note: Based on Injection Well No. 01					

Table 4-7 – Surface Casing Cement-Volume Calculations for the Injection Wells

Section	**Footage (ft)**	**Type**	**Weight (ppg)**	**Total Sacks**	**Excess (%)**	**Cement Height (ft)**	**Cement Volume (ft^3)**
INJ No. 01	~2,900	ASTM Type I-II equivalent to API Class A or B	12 (lead); 15 (tail)	914 (lead); 405 (tail)	20	To Surface	2,523
INJ No. 02	~2,220	ASTM Type I-II equivalent to API Class A or B	12 (lead); 15 (tail)	622 (lead); 404 (tail)	20	To Surface	1,872
INJ No. 03	~2,150	ASTM Type I-II equivalent to API Class A or B	12 (lead); 15 (tail)	622 (lead); 404 (tail)	20	To Surface	1,872
ft^3 = cubic feet *Note: possible additives listed in section 4.4.3 Depths and volumes to be updated based on post-drill conditions.							

Table 4-8 – Summary of Design for Surface Casing Centralizers

Centralizer Type	Centralizer Frequency	Depth (ft)	Quantity
Bow Spring	One every joint	2,820 – 2,900	2
Bow Spring	One every third joint	0 – 2,039	23
		Total:	25
*Note: Based on Injection Well No. 01, frequency is consistent across all injector wells.			

4.5.3 Production Casing Design

The production hole will be drilled to below the surface casing with a 12 1/4-inch bit. A long string of 9 5/8-inch casing will be run and cemented to the surface, with the casing centered in the open hole with centralizers (16 TAC **§5.203(e)(1)(B)(v)**). The key design criteria for the long string includes use of the following:

- L80 carbon steel material used from the surface to the top of the permitted upper confining zone (UCZ)
- 13Cr material used from the top of the permitted UCZ to the bottom of the permitted injection zone
    - Tail cement: 13.5 ppg CorrosaCem – or suitable equivalent - cement from TD to above the UCZ (16 TAC **§5.203(e)(1)(B)(vi)**)
    - Lead cement: 12.5 ppg OPC cement above the UCZ to the surface

- Fiber optic line to TD (INJ No. 03) or to 50’ below the Top Anahuac (INJ No. 01)

Through the life of the proposed injection wells, the project will have a continuous temperature monitoring system in place—designed to record downhole temperature as discussed in *Section 5 – Testing and Monitoring Plan*. The monitoring system will include a fiber optic cable with distributed temperature sensing outside the 9 5/8-inch production casing on Injectors 1 and 3. The fiber optic cable will be installed from TD to 50’ below the Top Anahuac in Injector 01 and from TD to surface in Injector 03 and cemented in place when the cementing job for the 9 5/8-inch casing is performed. The Sunflower AZM/IZM No. 01 will also have fiber to TD.

The engineering and design parameters for the production casing are summarized in Tables 4-9 and 4-10. These depths will be updated based on the final logging of the injection wells.

Table 4-9 – Production Casing Specifications

Section	OD (in.)	ID (in.)	Drift (in.)	Weight (lb/ft)	Burst (psi)	Collapse (psi)	Tensile (kips)	Intervals (ft TVD KB)		
								INJ No. 01	INJ No. 02	INJ No. 03
9 5/8-in. L80	9.625	8.681	8.525	47	6,870	4,760	1,086	0–3,400 7,865–7,945 (shoe track)	0–3,350 7,831-7,911 (shoe track)	0–3,350 7,912–7,992 (shoe track)
9 5/8-in. 13Cr-80	9.625	8.681	8.525	47	6,870	4,760	1,086	3,400–7,865	3,350–7,831	3,350–7,912

TVD = true vertical depth; KB = kelly bushing
13Cr-80 = 13 chrome with 80,000 psi yield strength
Note: Depths based on pre-drill model; actual depths will be subject to as-drilled conditions.

Table 4-10 – Production Casing Design Calculations*

9 5/8-in. Production Casing: 47 ppf 80 ksi Yield Strength with Premium Connections					
	Load Type – Working Stress Design	**Load (lb)**	**Depth (ft)**	**Min SF**	**Depth (ft)**
Burst	Injection – 2,750 psi injection pressure, 7.0 ppg packer fluid	2,946 (psi)	0	2.3	0
	Pressure Test – 5,000 psi with 8.33 ppg displacement fluid	5,000 (psi)	0	1.4	0
Tension	Green Cement – 5,000 psi with 8.33 ppg displacement fluid	480 (kips)	0	2.26	0
	Running with Overpull – 100 kips	418 (kips)	0	2.6	0
	Buckling Check – cement to surface, injection temperature	185 (kips)	0	5.7	0
Collapse	Evacuated Collapse – full evacuation	4,148 (psi)	7,992	1.13	7,992
NADF = non-aqueous drilling fluid *Note: Based on Injection Well No. 03.					

Tables 4-11 to 4-14 provide the production casing cement-volume calculations for each injection well.

Table 4-11 – Production Casing Cement-Volume Calculations for Injection Well No. 01

Section	**Footage (ft)**	**Type**	**Weight (ppg)**	**Total Sacks**	**Excess (%)**	**Cement Height (ft)**	**Cement Volume (ft^3)**
Lead Cement	3,405	API Class H	12.5	742	20	0 – 3,405	1,357
Tail Cement	4,540	CorrosaCem	13.5	1,105	20	3,405 – 7,945	1,706
						Total Volume: ft^3 (bbl)	3,063 (546)
bbl = barrel Note: Depths and excess cement to be adjusted on as-drilled conditions.							

Table 4-12 – Production Casing Cement-Volume Calculations for Injection Well No. 02

Section	Footage (ft)	Type	Weight (ppg)	Total Sacks	Excess (%)	Cement Height (ft)	Cement Volume (ft^3)
Lead Cement	3,396	API Class H	12.5	730	20	0 – 3,396	1,334
Tail Cement	4,515	CorrosaCem	13.5	1,099	20	3,396 – 7,911	1,670
						Total Volume: ft^3 (bbl)	3,031 (540)
bbl = barrel Note: Depths and excess cement to be adjusted on as-drilled conditions.							

Table 4-13 – Production Casing Cement-Volume Calculations for Injection Well No. 03

Section	Footage (ft)	Type	Weight (ppg)	Total Sacks	Excess (%)	Cement Height (ft)	Cement Volume (ft^3)
Lead Cement	3,425	API Class H	12.5	735	20	0 – 3,350	1,345
Tail Cement	4,567	CorrosaCem	13.5	1,112	20	3,350 – 7,911	1,716
						Total Volume: ft^3 (bbl)	3,061 (545)
bbl = barrel Note: Depths and excess cement to be adjusted on as-drilled conditions.							

Centralizer placement for the 9 5/8-in. production casing is designed to accommodate the installation of fiber optic cable and to promote a continuous, uniform column of cement throughout the production casing (16 TAC **§5.203(e)(1)(B)(v)**). The proposed placement of centralizers through the production casing is shown in Table 4-14.

Table 4-14 – Production Casing Centralizer Program

Centralizer Type	Centralizer Frequency	Injection Well No. 01		Injection Well No. 02		Injection Well No. 03	
		Depth (ft)	Qty	Depth (ft)	Qty	Depth (ft)	Qty
Centralizers	One every other joint	0–7,945	99	0–7,911	99	0–7,992	100

4.6 Completion Design and Equipment

The engineering design parameters for the three proposed injection wells are based on the planned injection rates, injection volumes, fluid properties, and chemical properties of the injectate fluid. Injection well design is a cased and perforated natural completion. The tubing, packer, instrumentation, and wellhead equipment were selected to have sufficient strength and material properties to withstand the pressure, temperature, and corrosive forces to which they will be exposed (16 TAC **§5.203(e)(1)(B)(ii)**).

Completion schematics are included in *Appendix D*.

4.6.1 Injection Tubing Design

The production tubing will be 7-inch 13Cr-80 with premium connections, installed with an injection packer. This design uses 13Cr material or its equivalent in all sections where the CO_2 will contact the tubulars. A tubing design analysis was conducted that considered calculated pipe-friction losses, exit velocities, and compression requirements. Tables 4-15 (16 TAC **§5.203(e)(2)(C)**) and 4-16 provide the tubing design parameters and evaluation (16 TAC **§5.203(e)(1)(B)(ii)**).

Table 4-15 – Tubing Specifications

Section	OD (in.)	ID (in.)	Drift (in.)	Weight (lb/ft)	Burst (psi)	Collapse (psi)	Tensile (kips)	Intervals (ft MD)		
								Injection Well No. 01	Injection Well No. 02	Injection Well No. 03
7-in. 13Cr-80	7.000	6.276	6.151	26.0	7,240	5,410	604	0–7,338	0–7,147	0–7,167
MD = measured depth Note: Depths listed represent each well's maximum setting depth for all completions stages. Depths to be adjusted based on injection well logs.										

Table 4-16 – Engineering Design Calculations for Tubing

7-in. Production Tubing: 26 ppf 13Cr 80 ksi Yield Strength with Premium Connections				
Load Type	**Triaxial SF**	**Axial SF**	**Burst SF**	**Collapse**
Buoyed Weight with Overpull – 100 kips	2.24	2.24	100+	2.24
CO2 Injection – 2,000 psi injection pressure and 2,750 A-annulus pressure	2.91	3.98	100+	2.99
Shut-in	2.91	3.98	100+	2.99
Tubing Evacuation – 2,750 psi A-annulus pressure	1.80	4.11	100+	1.67
Tubing Leak	4.33	4.73	100+	4.33
Injection Test – 30 bpm fresh water	2.45	3.34	2.54	100+
Annulus Pressure Test – 2,750 psi	2.08	5.47	100+	1.80

bpm = barrels per minute
*Note: Based off Injection Well No. 03

4.6.2 Safety and Continuous Monitoring Device Design

The following safety and continuous monitoring devices were designed for installation in the injection wells (16 TAC **§5.203(j)(2)(B)**).

4.6.2.1 Downhole Pressure and Temperature Gauge Design

A single pressure and temperature gauge will be run above the injection packer in each injection well to provide real-time bottomhole monitoring data. Pressure and temperature measurements will be fed to the surface using the installed tubing encapsulated conductor (TEC) line.

4.6.2.2 Fiber Optic Design and Completion

Fiber optic cable will be run on wells to monitor temperature.

4.6.3 Injection Packer Design

An injection packer will be installed with the 7-inch injection tubing. The planned type of packer is the Halliburton Perma Series or suitable equivalent packer with hydrogenated nitrile butadiene rubber (HNBR) element and flow-wetted material components will be 13Cr or a suitable equivalent. Differential pressure ratings of the packer will be selected to withstand all expected injection and shut-in load cases. Prior to setting the packer, the tubing annulus will be filled with diesel. Diesel is non-corrosive because it is a nonpolar hydrocarbon that contains no water, ions, or acidity needed to support electrochemical corrosion.

4.6.4 Wellhead and Tree Equipment Design

The wellhead and tree are designed to manage working pressures and provide mechanical and pressure integrity for each injection well. The equipment will be manufactured to the requirements of API 6A. The wellhead and tree equipment in contact with injection fluids will be manufactured with stainless-steel or corrosion-resistant alloy (CRA) components. The following is a detailed list of the wellhead components:

- Landing base: transfers casing loads from casing head to the 20-inch conductor
- Casing head assembly: 13 3/8-inch bottom connection x 13 5/8-inch 5,000 psi flange top, with one 2 1/16-inch 5,000 psi outlet valve on one side
- Mandrel casing hanger: 9 5/8-inch 47# premium thread box bottom, with dual elastomer premium annulus seals
- Double-studded adapter (DSA): 13 5/8-inch 5,000 psi x 13 5/8-inch 5,000 psi, optional
- Tubing head spool assembly: 13 5/8-inch 5,000 psi x 13 5/8-inch 5,000 psi, with two 2 1/16-inch 5,000 psi outlets and two outlet valves on one side, and premium elastomer casing pack-off

- Tubing hanger: 7-inch 26# premium thread box bottom, with control line ports and metal-to-metal hanger neck seal, API material class FF
- Production tree: 7 1/16-inch 5,000 psi API material class FF or EE with API monograms; configuration as follows:
    - Lower master valve – manual
    - Upper master valve – manual
    - Flow tee
    - Crown valve – manual
    - Tree cap
    - Inner wing valve manual
    - Instrumentation flange
    - Outer wing valve – actuated fail closed

The wellhead will be configured as illustrated in Figure 4-1. Suitable equivalents for the specific manufacturers or equipment models indicated in the figure may be substituted as appropriate, based on vendors used and equipment availability.

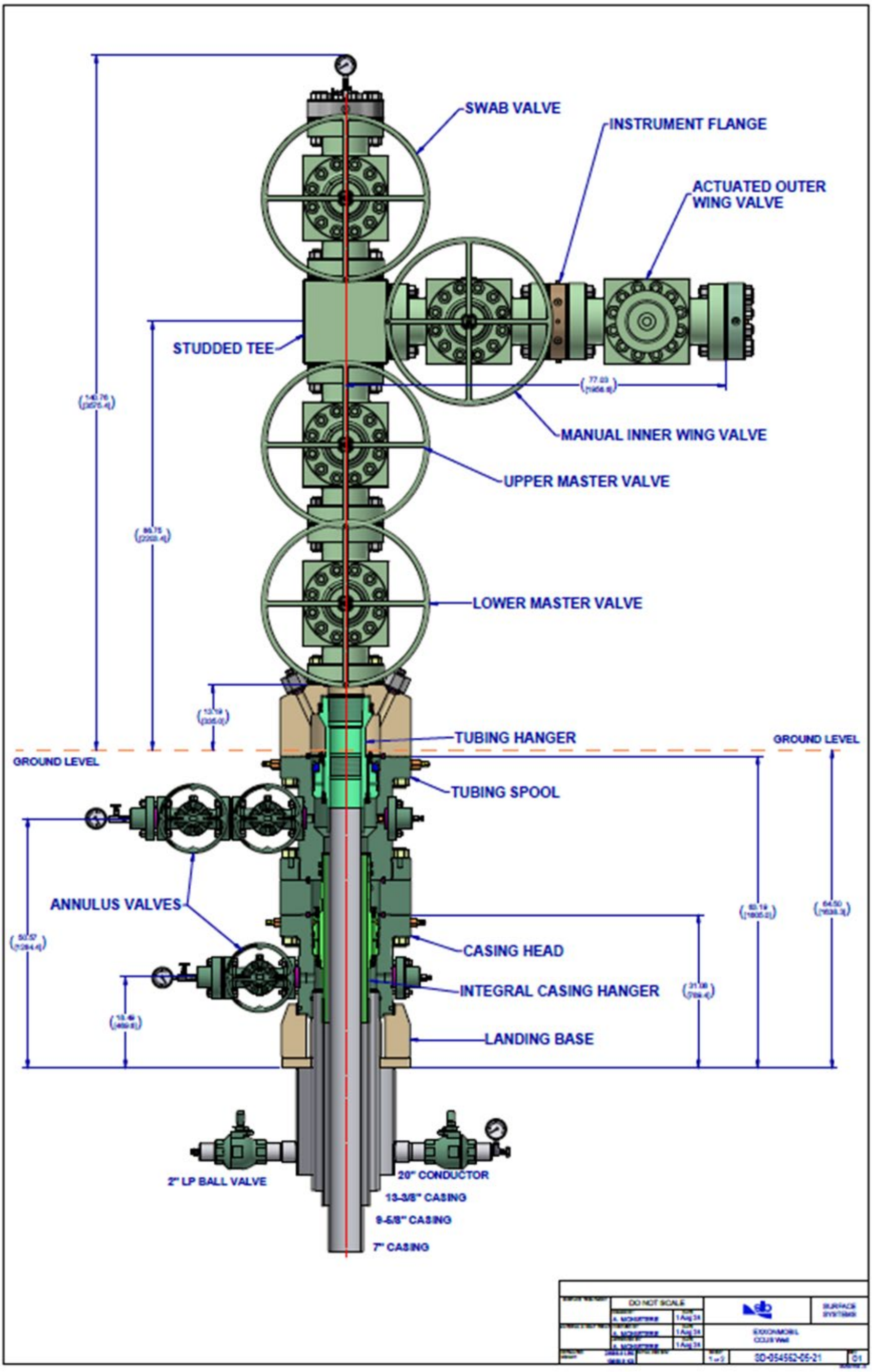


Figure 4-1 – Typical Wellhead Configuration for the Injection Wells

4.7 Well Drilling and Completion Design

4.7.1 Drilling and Completion Procedure for the Injection Wells

The proposed design summary and procedure for the proposed injection wells are described below. The tables presented here and in *Appendix D* provide the well design and completion details for each injection well. The final completion depths and specifications listed in those tables and the *Appendix D* schematics may be modified based on actual formation depths and/or conditions encountered during drilling.

- Preset the conductor.
  - 20 inches to 120 feet
- Drill 17 1/2-inch surface hole to TD and log.
  - Casing to be set below the base of the lowermost USDW.
    - The USDW will be confirmed by means of logging during the drilling of the well.
    - The planned surface TD is approximately 2,215 feet TVD KB + rathole.
- Run and cement the 13 3/8-inch surface casing.
  - Cemented to surface using blended OPC.
- Drill 12 1/4-inch production hole to TD and conduct pre-operation formation evaluation.
  - Planned production hole TD is specified by schematics in *Appendix D*.
- Run and cement the 9 5/8-inch production casing.
  - 9 5/8-inch casing is composed of L80 and 13Cr material.
    - L80 casing will cover shallow formations from the surface to the top of the upper confining zone (UCZ).
    - 13Cr-80 casing will cover the sealing and injection zones.
    - L80 casing will make up the shoe track.
    - The planned shoe depth for each well is specified by the schematics in *Appendix D*.
  - Cemented back to surface
    - Cement to be comprised of:
      - Tail cement: 13.5 ppg CorrosaCem – or suitable equivalent - cement from TD to above the UCZ
      - Lead cement: 12.5 ppg OPC cement above the UCZ to the surface
- Perforate and install the injection tubing and completion equipment.
  - 7-inch tubing set above top perforation.
    - Downhole pressure and temperature gauge set above the packer.
    - Landing nipple is set below the packer.
  - 13Cr tubulars will be used.
  - Tubing annulus will be filled with a noncorrosive fluid.

Within 30 days after completing each well, ExxonMobil will file with the division a complete record of the well on the appropriate form showing the current completion (16 TAC **§5.206(c)(2)**). A detailed drilling and completion prognosis for each injection well is included in *Appendix D*.

4.8 Pre-Operational Testing Plan

A variety of geophysical well logs, core, and injection tests were collected during the construction of a nearby stratigraphic test well to verify and evaluate the depth, thickness, porosity, permeability, lithology, and formation fluid salinity in the relevant geologic formations. *Appendix D.3* details the actual core and injection test data taken in the nearby stratigraphic test well. Additional core, well log, and injection test data will be taken in the construction of the proposed injection wells as outlined below to satisfy 16 TAC **§5.203(f)**.

4.8.1 Injection and Confining Zone Core Sampling

The following preliminary coring operations are planned during the construction of the injection wells. Table 4-17 details the potential core intervals and operations per formation interval.

Table 4-17 – Summary of Preliminary Coring Operations

Interval	Injector No. 01	AZM/IZM No. 01
UCZ		RSWC
Injection Zones	CC in Frio	RSWC
LCZ		RSWC

RSWC = rotary sidewall core, taken via wireline during drilling operations; LCZ = lower confining zone; CC = conventional core
Note: Preliminary coring plans subject to change based on as-drilled conditions.

4.8.2 Pre-Operation Logging Program

The following geophysical logs are planned to characterize the site. The openhole logging plan is detailed in Table 4-18. The cased-hole logging plan is detailed in Table 4-19.

Table 4-18 – Open hole Logging Plan for the Project

Section	Open hole Logs
17 1/2-in. hole	• Gamma Ray and Resistivity logs will be collected while drilling via logging while drilling (LWD) tools
12 1/4-in. hole	• Gamma Ray – All Injectors – LWD on Injector No. 02 • Resistivity – All Injectors – LWD on Injector No. 02 • Density – All Injectors – LWD on Injector No. 02 • Neutron – All Injectors – LWD on Injector No. 02 • Magnetic Resonance – Injectors No. 01 & 03 • Sonic – All Injectors – LWD on Injector No. 02 • Caliper – Injectors No. 01 & 03 • Borehole Imaging – AZM/IZM No. 01 only • Formation Pressure – AZM/IZM No. 01 only • Fluid Samples – AZM/IZM No. 01 only • RSWC – AZM/IZM No. 01 only

Table 4-19 – Cased-Hole Logging Plan for the Injection Wells

Section	Cased-Hole Logs
13 3/8-in. surface casing	• CBL, VDL, Temperature
9 5/8-in. production casing	• CBL, VDL, Temperature
7-in. production tubing and 9 5/8-in. casing	• Temperature • Through-Tubing Casing Inspection • Oxygen Activation or Pulsed Neutron

*CBL – cement bond log
VDL – variable density log

4.8.3 Injection Zone Characterization

ExxonMobil will collect characterization data for the permitted injection zone of the injection wells, including formation fluid temperature, pH, specific conductivity, and formation pressure (16 TAC **§5.203(f)(3)(A)**).

4.8.4 Fluid Characteristics and Downhole Conditions

During the construction of the injection wells, ExxonMobil will collect formation fluid samples in the injection zone and the formation above the UCZ. Injection zone samples will be evaluated for the compatibility of the injectate with the formation fluids (16 TAC **§5.203(f)(2)**). Samples collected above the UCZ during the pre-operation phase will form the baseline data for comparison with water quality data representing the operating and post-operating phases of the Sunflower Project. The analysis plan for water samples collected in the injection zones and above the UCZ formation is specified in Table 4-20.

Table 4-20 – Sampling and Analysis Plan for the above UCZ Water Samples

Parameter/Analyte	Analytical Method
Total dissolved solids, alkalinity, electrical conductivity, temperature, pH	Standard lab analyses
Gas composition (CO_2, CH_4, O_2, N_2)	Gas chromatography
Dissolved cations (i.e., As, Ba, Ca, Fe, Mg, Mn, Na, K, Pb, Zn)	Ion chromatography
Dissolved anions (i.e., HCO_3, Br, Cl, NO_3 SO_4)	Ion chromatography
As = arsenic; Ba = barium; Br = bromine; Ca = calcium; CH_4 = methane; Cl = chlorine; Fe = iron; HCO_3 = bicarbonate; K = potassium; Mg = magnesium; Mn = manganese; N_2 = nitrogen; NO_3 = Nitrate; O_2 = oxygen; Pb = lead; SO_4 = sulfate; Zn = Zinc	

4.8.5 Injection and Confining Zone Formation Testing

Pressure transient well testing (e.g., a pressure falloff test) will be conducted on one injection well as a part of completion activities (16 TAC **§5.203(f)(2)(B)**). These tests are intended to confirm reservoir and operational parameters used in the permitting process and provide needed data on the geologic and hydrogeologic properties of subsurface formations. The following pressure falloff test procedures are proposed:

- A nonhazardous test fluid will be used during the injection test.
- The purpose of this test is to evaluate the injectivity index, skin, and permeability-thickness of the injection zone.
- For the permitted injection zone, an injectivity test will be performed prior to injection.
- The well will be shut in and the pressure falloff recorded with downhole gauges over sufficient time for proper analysis.

4.9 Injection Well Operating Strategy

4.9.1 Overview of Injection Well Perforation and Completion Strategy

Upon permit approval, injection will start based on the stages and injection schedules referenced in Tables 4-21 through 4-23. Please note that the following perforation depths are notional and may be revised based on as-drilled conditions of the wells themselves.

Table 4-21 – Injection Sequencing Strategy for Injection Well No. 01

Stage	Sand Interval	Top Perf (ft MD)	Bottom Perf (ft MD)	Gross Thickness (ft)	Net Reservoir (ft)	Duration (years)	Completion Years after Startup
1	Frio Sand 3	7,378	7,638	415	205	2	0
2	Frio Sand 2 Lower	6,768	7,272	546	276	2	2
3	Frio Sand 2 Upper	6,590	6,710	236	180	2	4
4	Frio Sand 1	5,962	6,409	857	469	2	6
5	Fleming Sand 3 Lower	4,841	5,271	484	299	2	8
6	Fleming Sand 3 Upper	4,398	4,759	549	251	1	9

*MD – Measured Depth

Table 4-22 – Injection Sequencing Strategy for Injection Well No. 02

Stage	Sand Interval	Top Perf (ft MD)	Bottom Perf (ft MD)	Gross Thickness (ft)	Net Reservoir (ft)	Duration (years)	Completion Years after Startup
1	Frio Sand 3	7,187	7,707	538	222	1	0
2	Frio Sand 2 Lower	6,974	7,143	237	103	1	1
3	Frio Sand 2 Upper	6,506	6,900	430	237	1	2
4	Frio Sand 1	5,651	6,420	859	378	1	3
5	Fleming Sand 3 Lower	4,816	5,267	491	349	1	4
6	Fleming Sand 3 Upper	4,254	4,768	541	255	1	5

Table 4-23 – Injection Sequencing Strategy for Injection Well No. 03

Stage	Sand Interval	Top Perf (ft MD)	Bottom Perf (ft MD)	Gross Thickness (ft)	Net Reservoir (ft)	Duration (years)	Completion Years after Startup
1	Frio Sand 3	7,207	7,756	603	242	2	0
2&3	Frio Sand 2	6,650	7,146	606	283	2	2
4	Frio Sand 1	5,989	6,448	836	296	2	4
5	Fleming Sand 3 Lower	4,868	5,309	451	262	2	6
6	Fleming Sand 3 Upper	4,587	4,851	618	270	1	7

ExxonMobil plans to use a staged approach injection strategy as shown in Figure 4-2. Once ExxonMobil ceases injection into a stage, that stage will be plugged back before perforating and injecting into a subsequent stage. The perforation depths that were provided in Tables 4-21 to 4-23 are based on the current geologic model described in *Section 1 – Site Characterization* and subject to change based on as-drilled conditions.

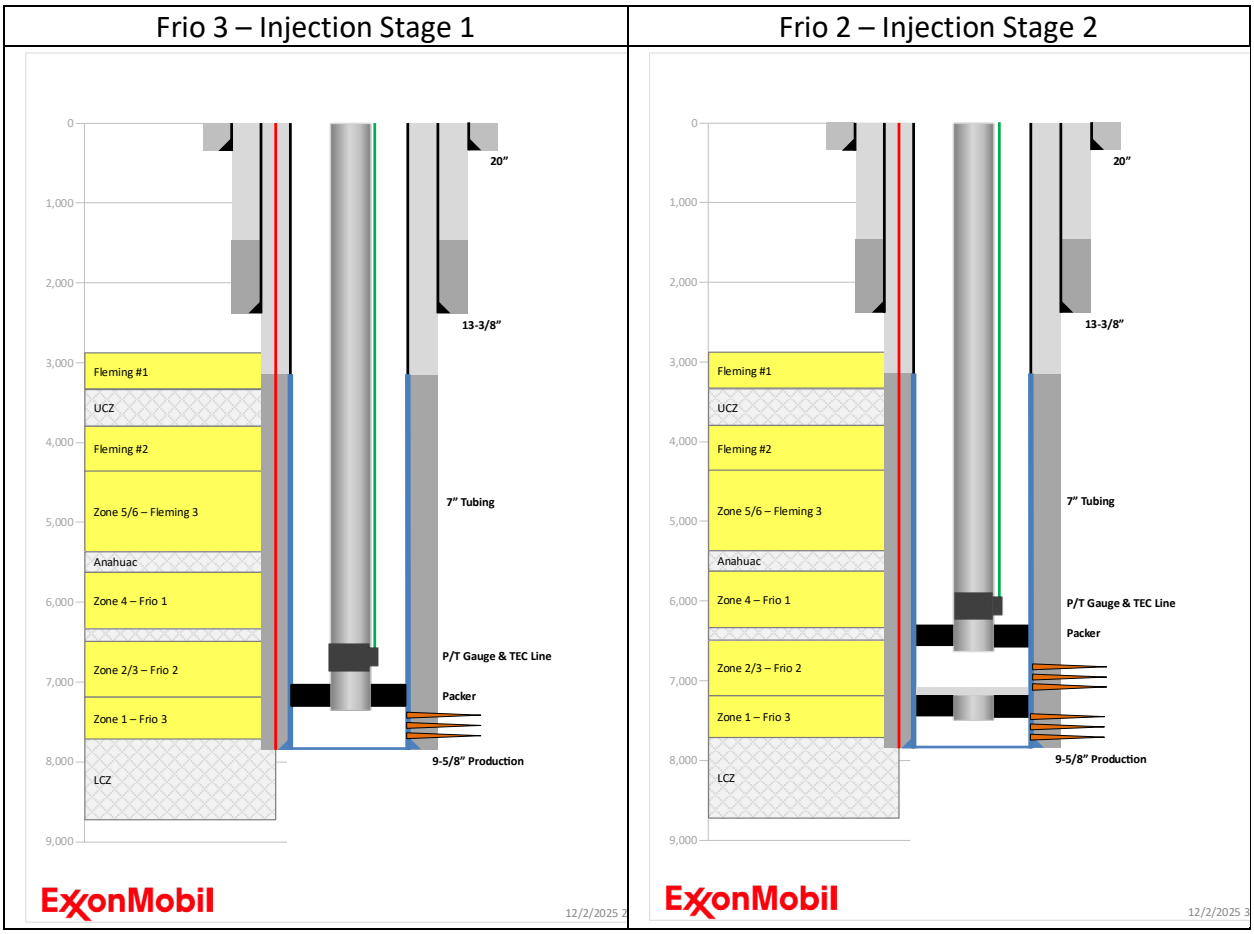


Figure 4-2 – Operational Completion Strategy for the Injection Wells

4.9.2 Injection Rate and Pressure

Table 4-24 provides the proposed operations for the injection wells, including injection rate and pressure by well. Average injection rates for each well's injection stages range from 0.5 to 1.2 MMTPA, with a maximum injection zone rate of 2.5 MMTPA. While each well will remain within its total annual injectivity allowance, temporary increases up to 2.5 MMTPA may occur. Both the maximum and average injection rates are predicted to result in reservoir pressure rises that are below 90% of the critical fracture pressure, shown in Table 4-24. Both the injection rates and pressures are within the operating window of the injection wells. In developing the injection strategy, ExxonMobil incorporated geomechanical studies of site-specific data.

Table 4-24 – Summary of Injection Parameters for the Injection Wells

Stage	Sand Interval	Parameter	Injection Well No. 01	Injection Well No. 02	Injection Well No. 03
1	Frio 3	Maximum Injection Zone Rate (MMTPA)	2.5	2.5	2.5
		Average Injection Zone Rate (MMTPA)	1.2	1.0	0.8
		Maximum Allowed Surface Pressure (psi)	2,000	2,000	2,000
		Average Modeled Surface Injection Pressure (psi)	1088	1066	1067
		Maximum Modeled Surface Injection Pressure (psi)	1112	1070	1073
		Fracture Pressure (psi)	5,175	5,175	5,175
		Maximum Allowed BHP (psi)	4,500	4,500	4,500
		Maximum Modeled BHP (psi)	3,537	3,490	3,503
2	Frio 2 Lower	Maximum Injection Zone Rate (MMTPA)	2.5	2.5	2.5
		Average Injection Zone Rate (MMTPA)	1.0	1.2	1.2
		Maximum Injection Zone Surface Pressure (psi)	2,000	2,000	2,000
		Average Modeled Surface Injection Pressure (psi)	1029	1048	1034
		Maximum Modeled Surface Injection Pressure (psi)	1083	1069	1066
		Fracture Pressure (psi)	4,830	4,830	4,830
		Maximum Allowed BHP (psi)	4,200	4,200	4,200
		Maximum Modeled BHP (psi)	3,489	3,488	3,491
3	Frio 2 Upper	Maximum Injection Zone Rate (MMTPA)	2.5	2.5	**
		Average Injection Zone Rate (MMTPA)	0.5	1.2	
		Maximum Injection Zone Surface Pressure (psi)	2,000	2,000	
		Average Modeled Surface Injection Pressure (psi)	960	1016	
		Maximum Modeled Surface Injection Pressure (psi)	1022	1043	
		Fracture Pressure (psi)	4,554	4,554	

Stage	Sand Interval	Parameter	Injection Well No. 01	Injection Well No. 02	Injection Well No. 03
		Maximum Allowed BHP (psi)	3,960	3,960	
		Maximum Modeled BHP (psi)	3,164	3,197	
4	Frio 1	Maximum Injection Zone Rate (MMTPA)	2.5	2.5	2.5
		Average Injection Zone Rate (MMTPA)	1.0	1.0	1.0
		Maximum Injection Zone Surface Pressure (psi)	2,000	2,000	2,000
		Average Modeled Surface Injection Pressure (psi)	941	935	939
		Maximum Modeled Surface Injection Pressure (psi)	955	1013	1026
		Fracture Pressure (psi)	4,313	4,313	4,313
		Maximum Allowed BHP (psi)	3,750	3,750	3,750
		Maximum Modeled BHP (psi)	3,085	3,128	3,148
5	Fleming 3 Lower	Maximum Injection Zone Rate (MMTPA)	2.5	2.5	2.5
		Average Injection Zone Rate (MMTPA)	1.0	1.0	1.0
		Maximum Injection Zone Surface Pressure (psi)	2,000	2,000	2,000
		Average Modeled Surface Injection Pressure (psi)	836	830	842
		Maximum Modeled Surface Injection Pressure (psi)	940	929	936
		Fracture Pressure (psi)	3,450	3,450	3,450
		Maximum Allowed BHP (psi)	3,000	3,000	3,000
		Maximum Modeled BHP (psi)	2,855	2,840	2,849
6	Fleming 3 Upper	Maximum Injection Zone Rate (MMTPA)	2.5	2.5	2.5
		Average Injection Zone Rate (MMTPA)	1.0	1.0	0.5
		Maximum Injection Zone Surface Pressure (psi)	2,000	2,000	2,000
		Average Modeled Surface Injection Pressure (psi)	776	762	769
		Maximum Modeled Surface Injection Pressure (psi)	830	823	835
		Fracture Pressure (psi)	3,174	3,174	3,174

Stage	Sand Interval	Parameter	Injection Well No. 01	Injection Well No. 02	Injection Well No. 03
		Maximum Allowed BHP (psi)	2,760	2,760	2,760
		Maximum Modeled BHP (psi)	2,280	2,270	2,288

*BHP – bottomhole pressure

** For Sunflower INJ No.3 stages 2 & 3 (Frio 2 Lower & Upper) are combined

Table 4-255 – Injection Zone Depths

Injection Well	Top of Injection Zone (TVD, ft)	Bottom of Injection Zone (TVD, ft)
Sunflower INJ No. 01	3,572	7,720
Sunflower INJ No. 2	3,588	7,723
Sunflower INJ No. 03	3,595	7,775

The proposed injection zone depths are provided in Table 4-25 based on the work outlined in *Section 1 – Site Characterization*. ExxonMobil proposes an injection zone of 3,572 ft TVD - 7,775 ft TVD. ExxonMobil may slightly revise these depths based on the as-drilled conditions of the wells.

4.9.3 Well Stimulation Procedures

ExxonMobil may stimulate the injection zone for the Sunflower CCS Project in the event it is necessary, to achieve desired injectivity (*Appendix D.4*). Stimulation may be conducted if injection impairment is observed during the life of the wells. Additional details on the stimulation plan can be found in *Appendix D.4*. Some of the potential causes for injection reduction are as follows:

- Formation damage (e.g., fines migration, scaling, debris in injection stream)
- Geochemical reactions due to fluid/reservoir incompatibility
- Salt precipitation due to in situ brine vaporization
- Reservoir compartmentalization or facies variation
- Shale swelling

ExxonMobil will provide advance notice of the proposed stimulation to the UIC Program director (UIC Director) in writing at least 30 days prior to injection and provide at least a 48-hour advanced notice in accordance with 16 TAC **§5.206(j)**. The detailed stimulation plan is provided in *Appendix D.4* and incorporates the following:

- Stimulation design to ensure the treatment will not interfere with containment
- Stimulation fluids detail (e.g., volumes, concentrations, additives)
- Stimulation fluid/ well material compatibility analysis

- Well integrity analysis (e.g., casing/tubing stress analysis)
- Stimulation procedure

The stimulation fluids will be an acid, most likely hydrochloric acid (HCl), or a water-based fluid treated as needed with the necessary chemicals and/or additives to achieve the desired results. Any stimulation would not interfere with the containment of the project. A high-level procedure is as follows and, as mentioned above, a case-specific stimulation plan procedure along with a detailed description of fluids to be used will be provided to the UIC Director should stimulation become necessary:

1. Determine the compatibility of stimulation chemicals with well materials, reservoir rock, and fluids.
2. Develop the stimulation plan based on the injection impairment cause.
3. Provide the work procedure and stimulation program to the UIC Director in writing at least 30 days prior to the planned date for start of the work (16 TAC **§5.206(j)**).
4. Prepare the wellsite and mobilize equipment.
5. Shut in and isolate the well from the CO_2 injection system. Allow the pressures to stabilize.
6. Rig up the stimulation equipment.
7. Prepare the well for stimulation.
8. Perform the stimulation treatment per approved plan.
9. Flush the wellbore with treated water and prepare the well to return to normal operation.
10. Rig down and return the well back to injection.

4.10 Operational Reporting Plan

During the operational phase of the Sunflower Project, ExxonMobil will, within 24 hours, report to the UIC Director a confirmed noncompliance, pursuant to the requirements in 16 TAC **§5.206(d)(2)(F)(ii)(III)**, **§5.207(a)(2)(A**), and **§5.206(h)(3)**—including the following:

- Evidence that the CO_2 plume or pressure front may endanger one or more USDWs
- The noncompliance situation as it relates to a permit condition
- Apparent malfunction of the injection system
- Triggering of a shutoff system
- Loss of mechanical integrity
- A release of CO_2 to the atmosphere or biosphere

ExxonMobil will cease injection and take all steps reasonably necessary to determine whether there may have been a release of CO_2 to an unauthorized zone, in the event that there is a loss of mechanical integrity (16 TAC **§5.206(d)(2)(F)(ii)(II)**).

Appendix D – Well Construction Schematics and Procedures:

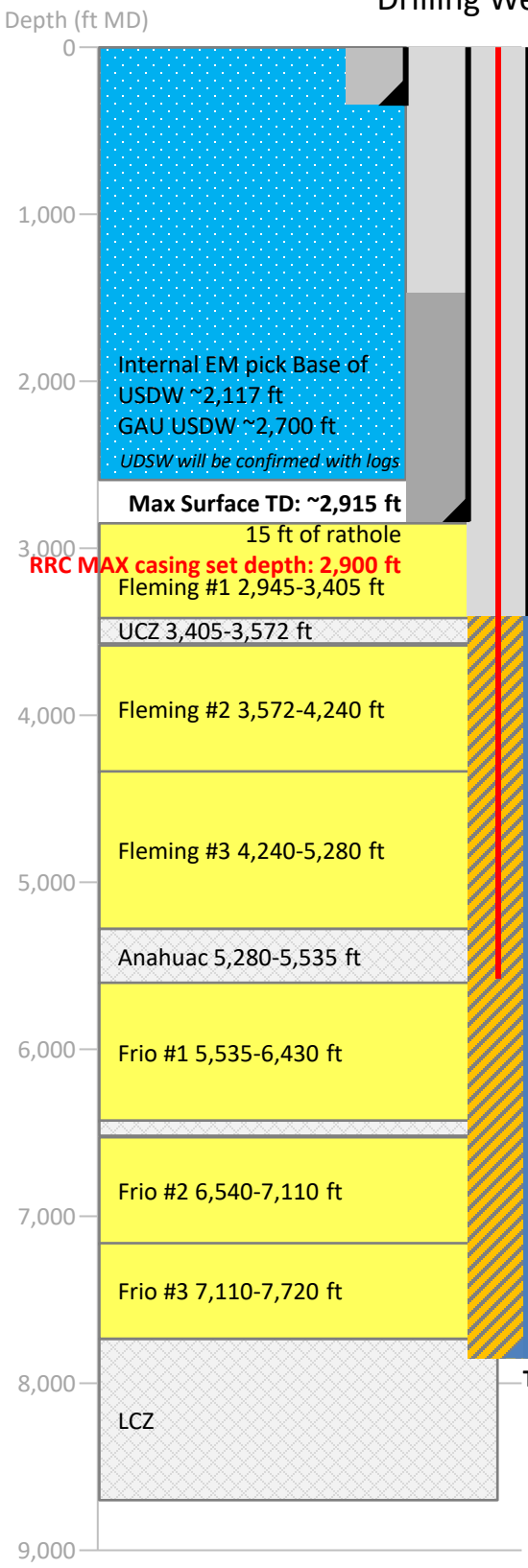
- Appendix D-1: Well Design and Completion Schematics for Injection Wells
- Appendix D-2: Drilling and Completion Prognosis for Injection Wells
- Appendix D-3: Nearby Stratigraphic Test Well Core and Injection Test Data
- Appendix D-4: Sunflower Stimulation Program

Appendix D: □ ell Construction Schematics and □rocedures

Appendix D1: ell esign Completion Schematics for In ection ells

Sunflower CCS Project Injection Well No. 01

Drilling Wellbore Schematic (Pre-Drill)



20" Conductor:
78.6 ppf, line pipe, Welded
0.375" WT, 19.25" ID

17.5" Hole Section:
Water based mud
Planned MW ~9.5 ppg

13-3/8" Surface Casing:
0 – 2,900 ft 13-3/8" 68 ppf, J55, BTC
0.480" WT, 12.259" drift ID
Burst 3450, Collapse 1950, Tensile 1069

12.25" Hole Section:
Oil based mud
Planned MW ~10.0 ppg

Production Cement:
0 – 3,405 ft Lead (12.5 ppg)
3,405 – 7,930 ft Tail (13.5 ppg)
CorrosaCem

9-5/8" Production Casing:
0 – 3,400 ft 9-5/8" 47ppf L80 TSH Blue/A
0.472" WT, 8.525" drift ID
Burst 6870, Collapse 4750, Tensile 1086
3,400 – 7,930 ft 47ppf 13Cr80 JFE Lion
0.472" WT, 8.525" drift ID
Burst 6870, Collapse 4750, Tensile 1086

Casing mounted fiber optic (DAS/DTS)
0 – 5330 ft MD
2x CDC (one above & below) each coupling

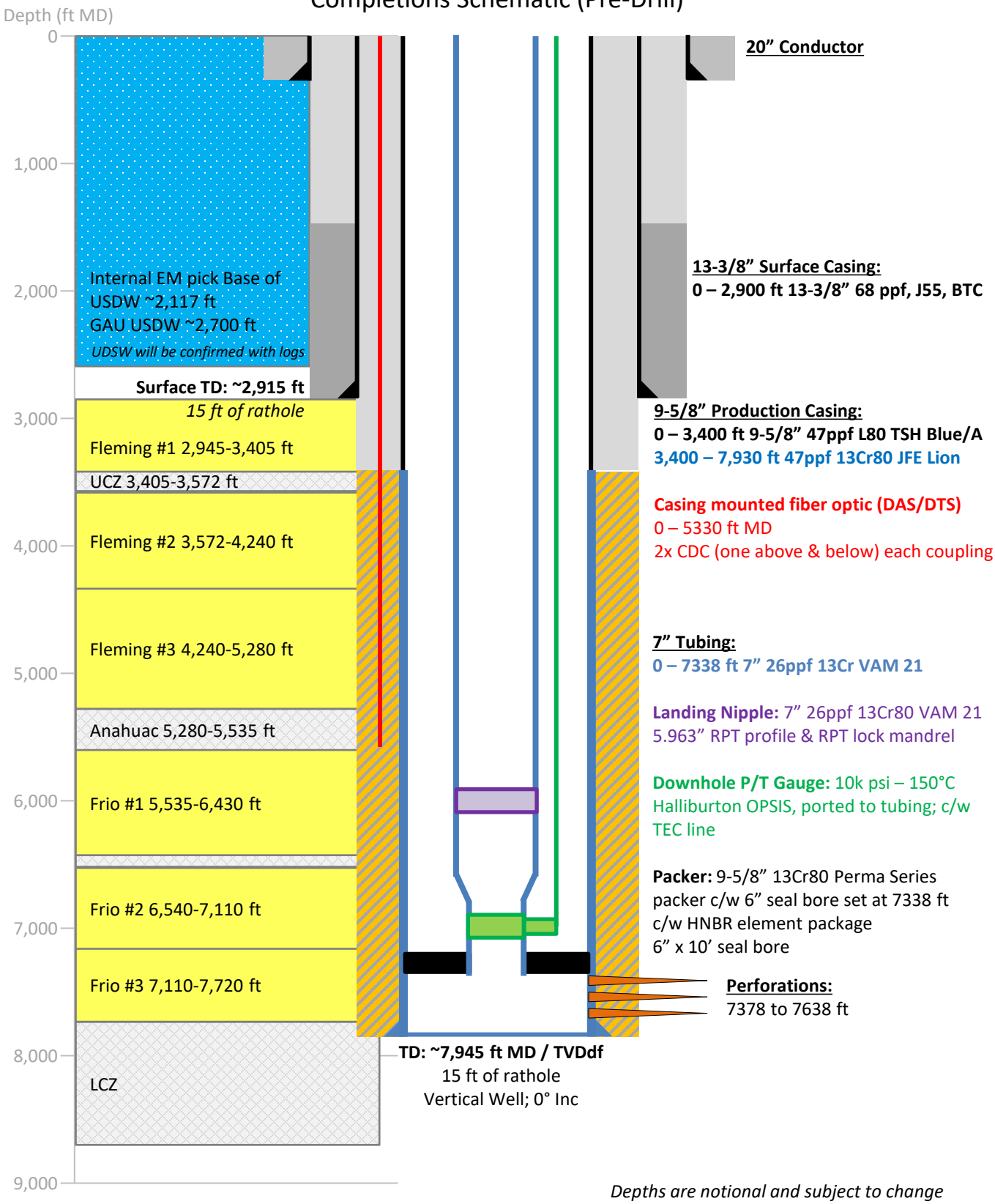
Depths are notional and subject to change based on as-drilled conditions

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Sunflower CCS Project Injection Well No. 01

Completions Schematic (Pre-Drill)



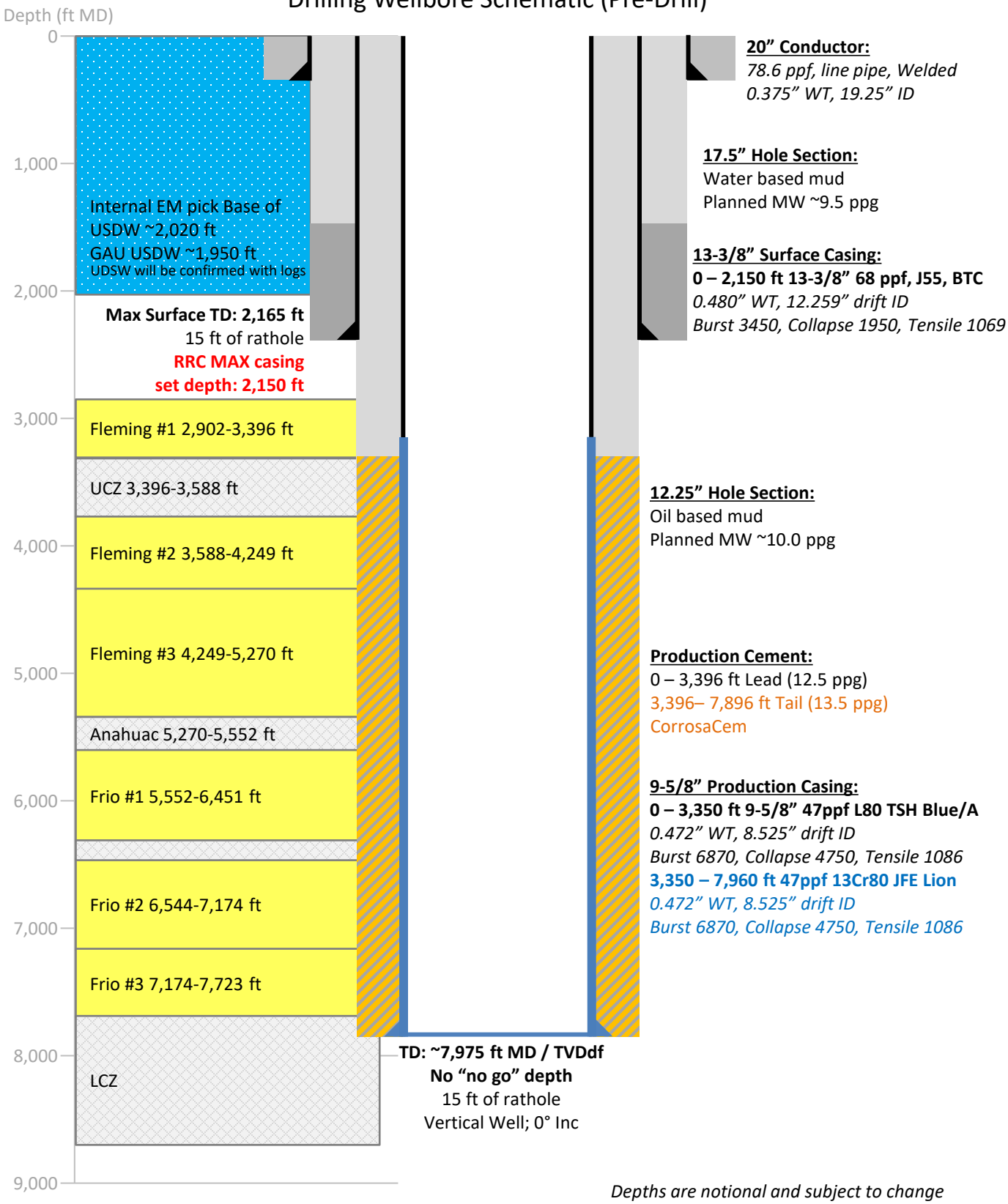
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Sunflower CCS Project Injection Well No. 02

Drilling Wellbore Schematic (Pre-Drill)



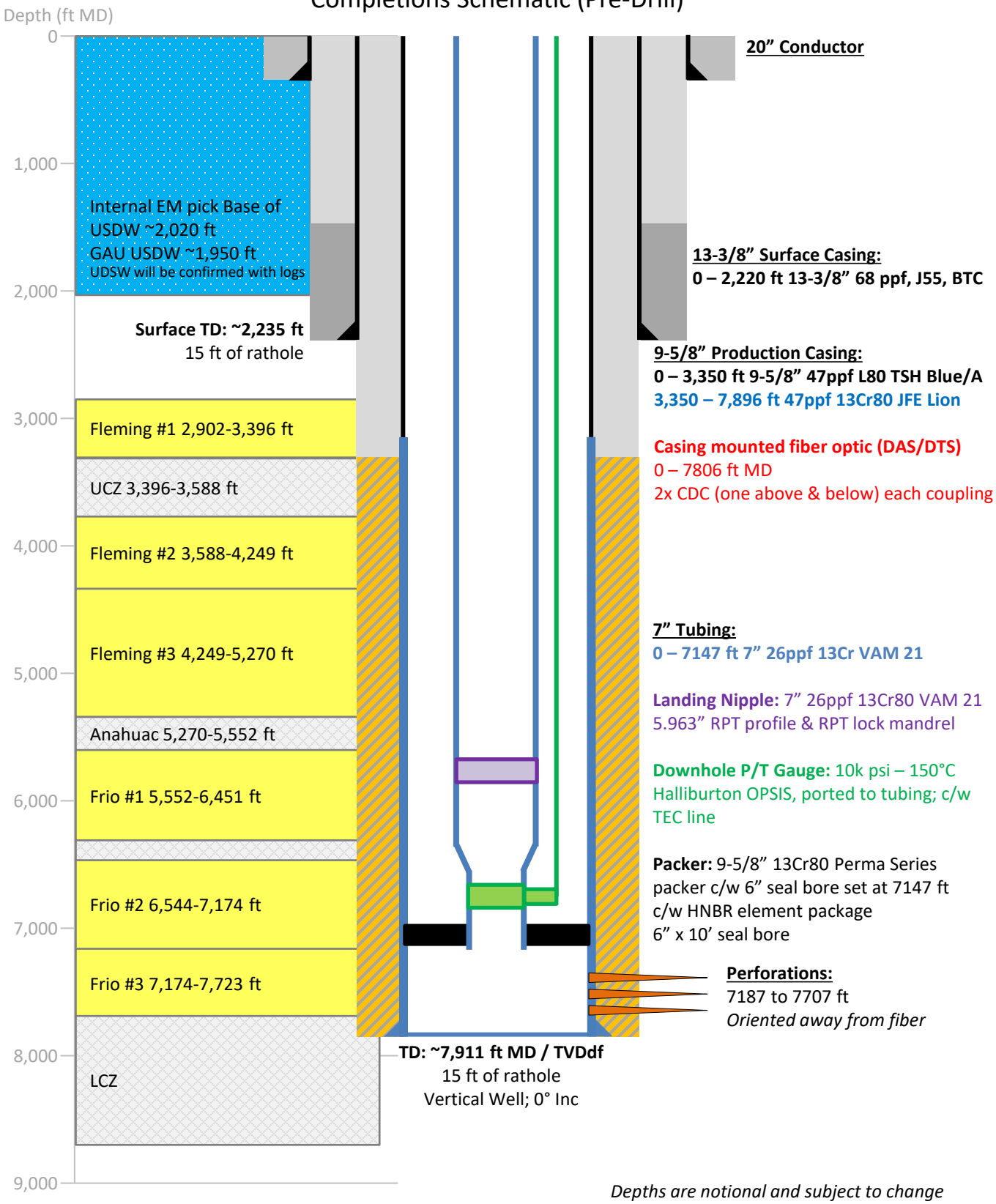
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Sunflower CCS Project Injection Well No. 02

Completions Schematic (Pre-Drill)



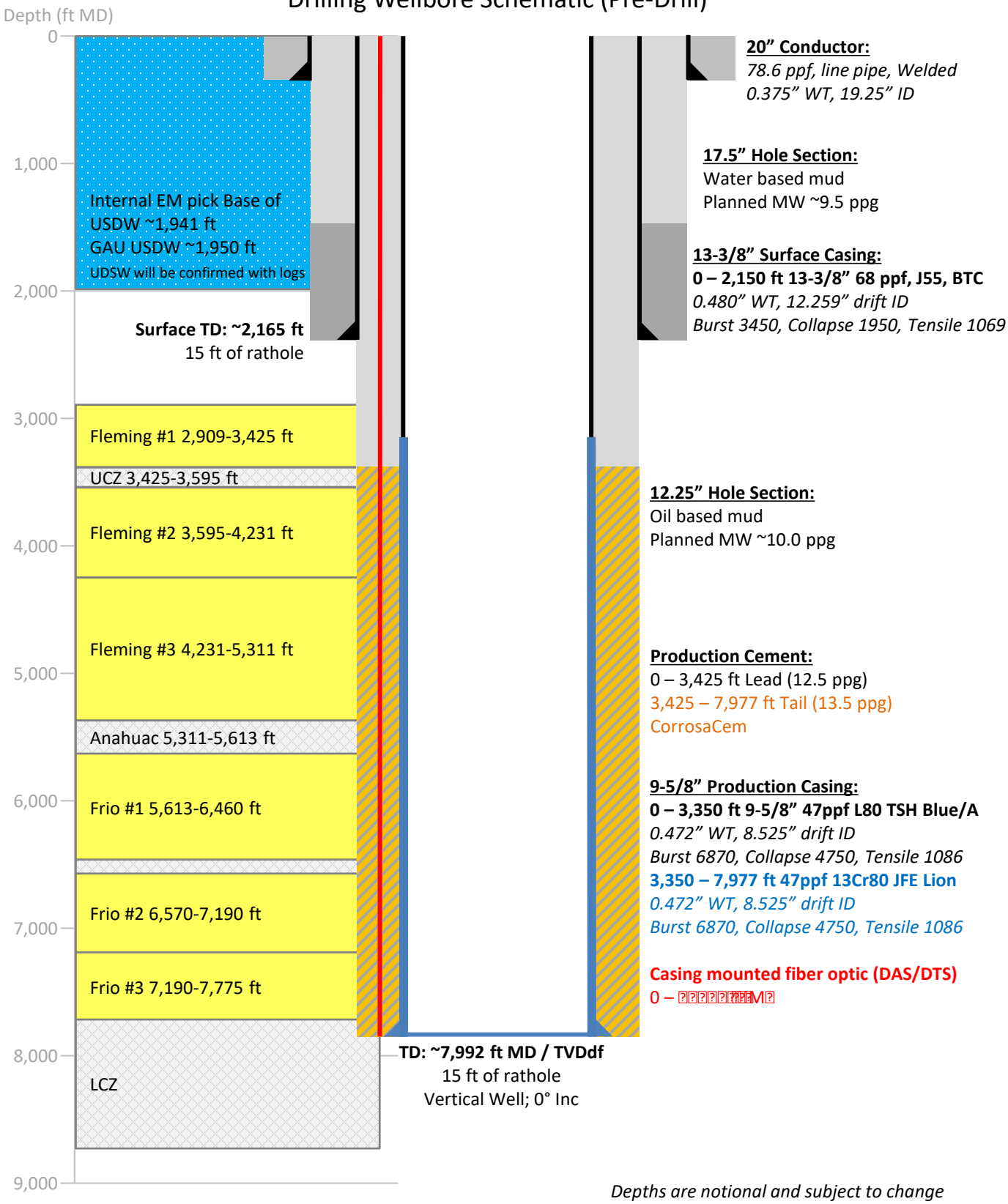
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Sunflower CCS Project Injection Well No. 03

Drilling Wellbore Schematic (Pre-Drill)



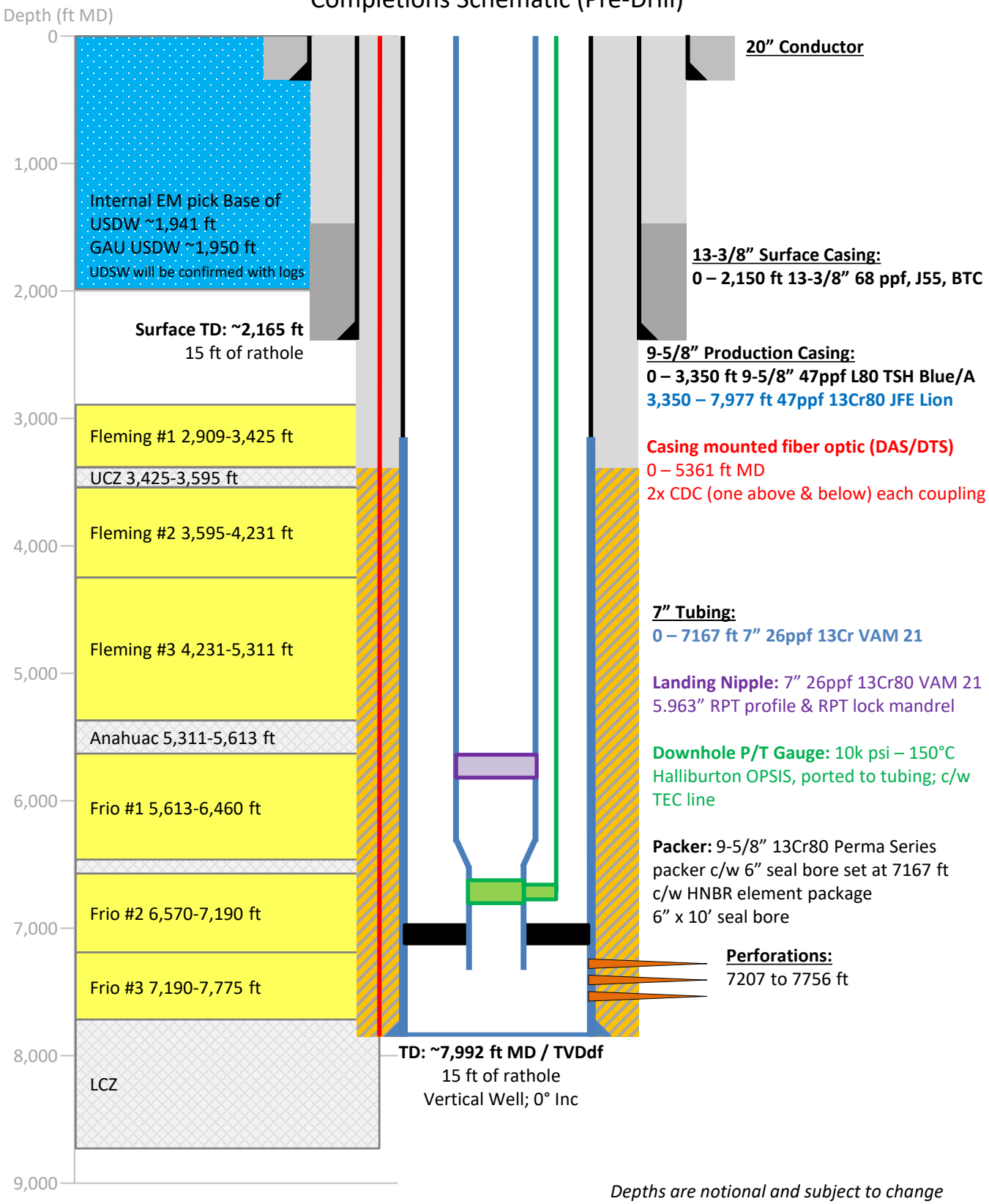
Depths are notional and subject to change based on as-drilled conditions

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Sunflower CCS Project Injection Well No. 03

Completions Schematic (Pre-Drill)



Depths are notional and subject to change based on as-drilled conditions

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Appendix D2 - Drilling and Completion Prognosis for Injection Wells

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Appendix D.2: Drilling and Completion Prognosis for Injection Wells

Drilling Operations:

20-in. Conductor

1. Mobilize spud rig and equipment to drilling pad
2. Position rig on marked well center
3. Rig up spudder rig
4. Drill 26-in. hole with auger to ~150 ft MD
5. Run and cement 20-in. casing to surface
6. Demobilize spud rig as needed

13-3/8-in. Surface Casing

1. Mobilize drilling rig and equipment to drilling pad
2. Rig up drilling rig and auxiliary equipment
3. Pick up 17-1/2-in. bit/bottom hole assembly (BHA)
4. Clean-out conductor as needed
5. Drill 17-1/2-in. hole to total depth (TD) at ~2,215ft with water-based mud (WBM)
6. Run 13-3/8-in. surface casing with centralizers to TD
7. Cement surface casing to surface displacing with oil-based mud (OBM)
8. Check for cementer returns to surface and pump top-off cement job as required
9. Wait on cement

9-5/8-in. Production Casing

1. Install blowout preventer (BOP) and pressure test to required test pressure
2. Pick up 12-1/4-in. BHA and tag cement
3. Circulate bottoms up with OBM
4. Pressure test 13-3/8-in. casing to 2,750 psi over OBM
5. Drill out shoe track
6. Perform formation integrity test (FIT)
7. Drill 12-1/4-in. hole to TD with OBM.
8. Perform pre-operational testing required well logs
9. Run 9-5/8-in. production casing with centralizers and fiber optic cable to TD
10. Cement 9-5/8-in. production casing to surface
11. Wait on cement
12. Pressure test 9-5/8-in. casing

Completion Operations:

Install Completion

1. Mobilize / rig up workover rig
2. Install and pressure test BOP
3. Perforate injection stage 1
4. Set packer assembly

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5. Rig up tubing running equipment including cable management system
6. Pick up completion equipment
    1. Gauge mandrel and TEC line – pressure and temperature gauge
    2. Landing nipple
7. Run completion equipment on 7-in. tubing
8. Displace packer fluid
9. String in tubing in the injection packer and land tubing hanger
10. Terminate TEC
11. Test tubing and packer to required pressure
12. Rig up surface flowlines
13. Set back-pressure valve in tubing hanger
14. Install tree
15. Remove back-pressure valve from tubing hanger
16. Perform pre-operational wireline logs
17. Rig down and demobilize the rig and equipment

Appendix D3 - Near-by Stratigraphic Well Core and Injection Test Data

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Appendix D4 - Stimulation Plan

Appendix D.4: Stimulation Plan

Stimulation to enhance the injectivity potential of the injection zone may be necessary. Stimulation may involve but is not limited to flowing fluids into or out of the well, increasing or connecting pore spaces in the injection formation, or other activities that are intended to allow the injectate to move more readily into the injection formation. Advance notice of all proposed stimulation activities must be provided to the Director, as detailed below, prior to conducting the stimulation. In no circumstance will the stimulation interfere with containment. ExxonMobil will submit proposed schedule and procedures for all stimulation activities to the Director at least 30 days in advance, and submit notice at least 48 hours in advance, to provide the Commission opportunity to witness per 16 TAC **§5.206(h)(4)(i)**.

1. Introduction and Purpose

ExxonMobil may stimulate the injection zones for the Sunflower CCS Project to enhance the injectivity potential of CO2 injection wells. Stimulation may involve, but is not limited to, flowing fluids into or out of the well, increasing or connecting pore spaces in the injection formation, or other activities that are intended to allow CO2 to move more readily into the injection zone.

ExxonMobil will adhere to all applicable regulatory requirements for any stimulation treatment that may be required. Specifically, and without limitation, ExxonMobil will comply with the following:

- 16 TAC **§5.203(e)(4)**: ExxonMobil will submit the proposed stimulation program, a description of stimulation fluids to be used and a determination that stimulation will not interfere with containment.
- 16 TAC **§5.206(h)(4)(i)**: ExxonMobil will notify the Director 30 days in advance of any planned stimulation activities and provide notice at least 48 hours before operations.
- 16 TAC **§5.207** ExxonMobil shall submit all required reports, submittals, and notifications to the Director. Additionally, per both 16 TAC **§5.207(b)(2)** and 40 CFR **146.91(e)**, ExxonMobil will also submit these reports, submittals, and notifications to EPA in an electronic format approved by EPA.

The information provided in this section specifically addresses the stimulation fluids, additives, and proposed stimulation procedures ExxonMobil may implement. This plan includes multiple stimulation methodologies that may be selected based on site-specific technical and operational conditions that may impact future well performance. The methods provided below may also be used to remediate scaling or perforation occlusion in the well.

1.1 Purpose of the Stimulation

Perforated intervals in the proposed injection zones may require stimulation periodically throughout the project life to enhance performance with the aim of restoring it to initial or optimum conditions. For example, stimulation may be needed to remediate injectivity loss resulting from mineral scales, clay fragments, metallic sulfide, or oxide particulates. Stimulation may also be necessary to remove any near-wellbore damage resulting from drilling and completion operations. Following well construction, remedial stimulation may be conducted before the commencement of CO2 injection..

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2. Stimulation Fluids

ExxonMobil will use acid blends for matrix stimulation that are typical for the industry. These include, but are limited to, mixture of acetic, hydrochloric, hydrofluoric, and/or other organic acids. These blends have been historically proven to remove near-wellbore damage caused by mineral scales, drilling muds, completion fluids, and clay fines while minimizing negative impacts to permeability. There is also potential for near-wellbore halite precipitation in the CO2 injectors, which may require remediation by periodic flushes with less saline water.

All chemical treatments will be evaluated and selected for compatibility with the treatment method. For example, mineral acids will be treated with chemical inhibitors to prevent corrosion damage to the tubing string. In addition, chemical will be evaluated and selected to avoid damage to the downhole packer sealing elements, casing, and other seals within the injection system that might be exposed to chemicals.

2.1 Additives

Additives may be utilized with the stimulation fluids to aid matrix stimulation while mitigating corrosion of tubulars and potential damage to the sequestration zone. These additives include, but are not limited to, corrosion or acid inhibitors, scale inhibitors, clay stabilizers, biocides, emulsifiers, chelating agents, mutual solvents, iron sequestrants, retarders, and/or surfactants. Compatibility of these additives with the stimulation fluids, tubulars and the reservoir will be confirmed prior to their use in any stimulation activities.

2.2 Diverters

Nitrogen, crosslink polymers, viscoelastic surfactants, solid particulates and/or fiber diverters may be added to stimulation fluids to achieve improved diversion and effective treatment for the target zone by diverting the stimulation fluids to the most impaired (i.e, low injectivity) perforations. Depending on the well-specific requirements and stimulation design, organic or polymeric diverting agents may also be selected. These diverters provide temporary restrictions during stimulation operations and degrade or break-down with time due to water solubility and temperature. The most suitable diverting agent will be selected based on one or more factors, including, anticipated pump rates, the length of the perforated interval, perforation density, and the selected technique for conveying acid to the injection zone (e.g., pumping through regular tubing or pumping down coiled tubing)

3. Mechanical Stimulation

In addition to chemical stimulation, mechanical stimulation of the well may be required independently, or in conjunction with chemical stimulation. Mechanical stimulation may be required if there is deposition that cannot be easily remediated with chemicals, or if mechanical means may be more effective. These mechanical options include, but are not limited to, backflow, adding perforations, or re-perforating. Perforating operations may be further enhanced with the use of propellants. Propellant stimulations will be designed for nominal height growth, and to remain within the injection zone and avoid fracture growth into the confining layer.

4. Ensuring Containment

Except during stimulation, injection pressure will not exceed 90% of the established fracture pressure for the injection zone. Injection pressure at the downhole tubing pressure gauge and tubing/annulus surface gauges will be continuously monitored during the stimulation operation. Stimulation of the injection interval will be conducted to avoid affecting the confining layers.

5. Stimulation Procedures

A standard stimulation procedure is outlined below. This procedure may be modified depending on site-specific operational and technical conditions and the specific treatment requirements. The conveyance methods may include coil tubing, tubing-conveyed retrievable straddle packer assembly, snubbing unit, tubing flush, or bullheading.

1. Determine compatibility of stimulation chemicals with well materials, reservoir rock, and fluids.
2. Develop stimulation plan based on the injection impairment cause
3. Provide work procedure and stimulation program to the UIC Program Director at least 30-days prior to the planned date for start of the work and provide notice at least 48 hours in advance (16 TAC **§5.206(h)(4)(i)**).
4. Prepare wellsite and mobilize equipment
5. Shut-in and isolate the well from the CO2 injection system. Allow the pressures to stabilize
6. Rig up the stimulation equipment
7. Prepare the well for stimulation
8. Perform the stimulation treatments as per approved plan
9. Flush the wellbore with treated water and prepare the well to return to normal operations
10. Rig down and return the well back to injection

Underground Injection Control – Class VI Permit Application for Sunflower Carbon Capture and Storage Project Injection Wells No. 01, No. 02, and No. 03

SECTION 5 – TESTING AND MONITORING PLAN

Sunflower Carbon Capture and Storage Project
Jefferson and Liberty Counties, Texas
ExxonMobil Low Carbon Solutions Onshore Storage, LLC
Amendment 3: August 2026

SECTION 5 – TESTING AND MONITORING PLAN

TABLE OF CONTENTS

5.1 Introduction 3
5.2 Reporting Requirements 4
5.3 Testing Plan Review and Updates 7
5.4 Overall Strategy and Approach for the Testing and Monitoring Plan 9
5.4.1 Use of Phased and/or Triggered Approach 14
5.4.2 Mechanical Integrity Testing 18
5.4.3 Pressure Falloff Testing 19
5.4.4 Monitoring of CO_2 Stream 20
5.5 Monitoring Programs 21
5.5.1 Continuous injection Stream Physical Monitoring 21
5.5.2 Corrosion Monitoring 23
5.5.3 Groundwater/USDW Quality Monitoring 25
5.5.4 Upper Confining Zone/Above-Zone Monitoring 28
5.5.5 Plume and Critical Pressure Front Monitoring 30

Figures

Figure 5-1 – Summary of the Risk Assessment Process for the Life Cycle of the Sunflower Project 10
Figure 5-2 – TRLs for Selection of Monitoring Technologies 12
Figure 5-3 – Staged-Injection Approach to Optimize CO_2 Storage 15
Figure 5-4 – Location of Injection Wells, Above-Zone Monitoring Wells, In-Zone/Above-Zone Monitoring Well, and USDW Monitoring Wells 17

Tables

Table 5-1 – Summary of Triggering Events for Notification and Reporting Schedule 6
Table 5-2 – Testing and Monitoring Plan Measurements and Frequency 8
Table 5-3 – Summary of Monitoring Technologies for Direct and Indirect CO_2 Plume and Pressure Front Tracking 13
Table 5-4 – Summary of CO_2 Sampling and Analysis Plan 21
Table 5-5 – Sampling Devices, Locations, and Data Frequencies for Continuous Monitoring 22
Table 5-6 – Summary of USDW Monitoring Well Construction Details 26
Table 5-7 – USDW and Above-UCZ Monitoring Sampling Program 27
Table 5-8 – General Completion Details for Sunflower AZM/IZM No. 01 29
Table 5-9 – General Completion Details for Sunflower AZM No. 01 and No. 02 29

5.1 Introduction

Consistent with the requirements of Title 16, Texas Administrative Code (16 TAC), Part 1, Chapter 5, ExxonMobil Low Carbon Solutions Onshore Storage, LLC (ExxonMobil) developed a comprehensive Testing and Monitoring Plan for the Sunflower Carbon Capture and Storage (CCS) Project (Sunflower Project) using a risk-based approach. The data collection included injectate monitoring; corrosion monitoring of the well tubulars, mechanical, and cement components; pressure falloff testing; obtaining seismic surveys; well logging; continuous monitoring of injection rate, pressure, and temperature; groundwater quality monitoring; and CO_2 plume and pressure front tracking. The data generated from implementation of the plan provides the basis to verify the confinement of the injectate in the permitted injection zones during the active injection phase of the project.

The post-injection phase of monitoring is provided in *Section 7 – Post-Injection Site Care (PISC) and Site Closure*, consistent with the structure of the Underground Injection Control (UIC) Class VI permit application for this project. In conjunction with careful site selection and area of review (AOR) delineation, this plan will be a critical component of the successful operation, PISC, and eventual closure of the Sunflower Project.

A key feature of the Testing and Monitoring Plan is that the location and frequency of monitoring and surveillance data acquisition and analysis are designed to align with the injection operation plan and the identified site-risk elements that impact and determine CO_2 plume and pressure front migration. This plan presents a data collection program to confirm that the injection is consistent with the permit requirements. The plan also includes a phased/triggered approach for the incremental implementation of testing and monitoring technology, consistent with the EPA's presentation of phased/triggered monitoring in their 2013 *UIC Program Class VI Well Testing and Monitoring Guidance*.[1] Overall, the risk of underground source of drinking water (USDW) endangerment is mitigated (1) by balancing the increase in CO_2 plume and pressure front size and location with the collection and analysis of data to track migration in the subsurface; and (2) by implementing robust risk management processes to assess the potential for leaks through the upper confining zone (UCZ) throughout the life of the project.

ExxonMobil intends for the Testing and Monitoring Plan and subsequent iterations to continue throughout the life of the Sunflower Project. An adaptive approach will be employed with respect to the monitoring frequency of select parameters, whereby the application of selected monitoring technologies may be decreased based on improved subsurface understanding and subsequent reduction of reservoir uncertainties. Monitoring results will be presented in semi-annual reports, wherein data will be evaluated and any proposed monitoring frequency modification within the Testing and Monitoring plan justified. Baseline data will be collected prior to injection start-up, and time-lapse comparisons to the baseline data will be made during the operational period of the project. The adaptive approach will be applied if the data collected

[1] UIC Program Class VI Well Testing and Monitoring Guidance, EPA 816-R-13-001 (March 2013). https://www.epa.gov/sites/default/files/2015-07/documents/epa816r13001.pdf)

during the injection period shows results within the expected CO_2 behavior range. Should ExxonMobil anticipate any noncompliance of a permit condition or planned physical additions to the permit facility, the UIC Program Director (UIC Director) will be notified.

An ongoing dialogue between ExxonMobil and the UIC Program director is envisioned, marked by tying the monitoring plan reviews and proposed modifications to the AOR reevaluation frequency. Consistent with the discussion of AOR reevaluation in *Section 3 – Area of Review and Corrective Action Plan*, a minimum frequency of 5 years is planned to reevaluate the AOR and Corrective Action Plan. More frequent evaluations of the AOR and updates to the Corrective Action Plan may also be triggered if other unexpected changes in testing and monitoring data are detected as discussed in *Section 3*, Table 3-8. Key to this is the efficient review process that is proposed, particularly where the AOR reevaluation confirms that the plan is appropriate as written. If ExxonMobil determines that monitoring data suggests that potential corrective actions are needed and mitigation measures should be employed, then the Emergency and Remedial Response Plan (*Section 8*) will be implemented as appropriate.

The following objectives were developed for the Testing and Monitoring Plan in alignment with 16 TAC **§5.203(j)**:

- Use site characterization data, the site geologic conceptual model, and the results of computational modeling to identify areas or risk elements of potential concern for the project.
- Consider how possible migration pathways and subsurface uncertainties in confining zone and injection zone properties could affect the AOR boundaries and include this uncertainty in the testing and monitoring strategy.
- Select testing and monitoring strategies and a cadence of technologies' implementation that are tailored to the site-specific risk profile in conformance with the requirements.
- Identify project-specific factors to consider or incorporate in evaluating the data collected from the Testing and Monitoring Plan, which may indicate the potential risk to or endangerment of the USDW, as well as deviations from permitted conditions.

5.2 Reporting Requirements

The Testing and Monitoring Plan was developed to achieve two reporting objectives:

- Provide the necessary data to verify predictions of CO_2 plume and pressure front movement (16 TAC **§5.203(j)(2)(E)**).
- Provide the basis for evaluating the model inputs, making necessary changes, and reevaluating the AOR (16 TAC **§5.203(d)(2)(B)(ii)**).

In compliance with 16 TAC **§5.206** and **§5.207**, ExxonMobil will provide reports to the UIC Director at a semiannual frequency that document both the performance of the system and the CO_2 plume and pressure front tracking data. Relevant records pertaining to the Class VI testing and

monitoring program will be submitted to the TRRC. Pursuant to 16 TAC **§5.206(b)(1),** ExxonMobil will report the results of the injection pressure and injection rate monitoring for each injection well on Form H-10 and the results of the internal mechanical integrity tests on Form H-5. In addition, ExxonMobil will follow the prescribed notification requirements for deviation from permit conditions, in the event of an operational malfunction that may allow CO_2 or brine to migrate into or between USDWs, or for other evidence of USDW endangerment.

The semiannual reports will include the data collected during each reporting period and a list of notifications triggered during a semiannual period, if any. Pursuant to 16 TAC **§5.203(a)(4)**, reports will be prepared by a qualified and knowledgeable person and logs, surveys, sampling, and tests required under Chapter 5 will include an interpretation. The following information is proposed for the routine performance reporting:

- Monthly average, maximum, and minimum values of injection pressure, flow rate and volume, and annular pressure
- Monthly volume and/or mass of the CO_2 stream injected over the reporting period, and the volume injected cumulatively over the life of the Sunflower Project
- Monthly annulus fluid volume added
- Results of CO_2 plume and pressure front tracking data analysis as described herein
- Any significant changes to the physical, chemical, and other relevant characteristics of the CO_2 stream from the proposed operating data that could impact plume migration or protection of USDWs
- A description of any event that triggered a shutoff device required according to 16 TAC **§5.206(d)(2)(F)**, and the response taken
- A description of any event that exceeded operating parameters for annulus pressure or injection pressure specified in the permit

The semiannual reports will be submitted 30 days after the completion of the quality control and quality review of the data for each reporting period. Table 5-1 describes the non-routine reporting triggers, contents, and schedule.

Additionally, pursuant to 16 TAC **§5.207(A)(2)(D)),** ExxonMobil will submit an annual report detailing any corrective action performed, new wells installed, re-calculated AOR or a statement that the current delineation is appropriate, and the updated area for which ExxonMobil has a good faith claim.

ExxonMobil will apply methods and standards generally accepted in industry and submit a description of tests and methods used for reports pertaining to mechanical integrity (16 TAC **§5.207 (a)(1)**).

Table 5-1 – Summary of Triggering Events for Notification and Reporting Schedule

Triggering Event	Reporting Schedule
Planned well workover, stimulation activities, or other planned test of an injection well	Notification and proposed schedule to the UIC Director, in writing, 30 days in advance of planned activity for opportunity to witness. 48-hour notification in advance of such activity, other than stimulation for formation testing, to the TRRC.
Completion of well workover	30 days after completion of well workover
Any test of the injection well(s) conducted, if required by the UIC Director	30 days after completion of any testing required by the UIC Director filed in duplicate
Evidence of potential non-compliance with a permit condition, or potential malfunction of the injection system that may cause fluid migration into or between USDWs	Verbal notification – reported within 24 hours of verification of non-compliance or malfunction
Primary evidence that the injected CO_2 stream or associated pressure front may cause an endangerment to a USDW	Verbal notification – reported within 24 hours of verification of endangerment
A failure to maintain mechanical integrity	Verbal notification – reported within 24 hours of verification of mechanical integrity failure
A statistically significant change to the physical, chemical, or other relevant characteristics of the CO_2 stream from the composition described in the proposed operating plan (e.g., if the CO_2 stream becomes <90% of CO_2, where %=mol%=volume %)	Written notification – reported within 72 hours of verification of composition change
An operational condition that exceeds operating parameters for annulus pressure or injection pressure as specified in the permit	• Verbal notification – reported within 24 hours of verification of non-compliance with permit conditions • Written notification – reported within 72 hours of verification of non-compliance with permit conditions
A shutoff device that is activated anywhere in the injection well system	• Verbal notification – reported within 24 hours of event • Written notification – reported within 72 hours of event
Recorded seismic event with magnitude greater than 2.0	• Table 8-2 in *Section 8 – Emergency and Remedial Response Plan* details the response actions

ExxonMobil will adhere to the monitoring and record retention requirements outlined in 16 TAC **§5.206(e)(5)**. Additionally, ExxonMobil will provide all reports, submittals, and notifications to both the EPA and the Railroad Commission of Texas (TRRC) and retain records in accordance with 16 TAC **§5.207(e)** for a 10-year period after site closure. Injected-fluid data, including nature and composition, will be retained for the 10-year period following site closure. Monitoring data will be retained for a minimum of 10 years post-collection, while well plugging reports, PISC data, and the site closure report will be retained for 10 years after site closure.

5.3 Testing Plan Review and Updates

In accordance with 16 TAC **§5.203(j)**, the Testing and Monitoring Plan will be reviewed and revised at least every 5 years to:

- Identify Sunflower Project-specific factors that may warrant revision to the plan.
- Incorporate information and changes necessary to monitor an increase in risk to endangerment of USDWs.
- Account for any deviations from permitted conditions that require plan modifications.

ExxonMobil will incorporate the collected monitoring data that characterize the project-specific factors and the changes needed, if any, to monitor both increased potential risk to the USDW and overall plan compliance with the UIC Director's requirements. Plan amendments will be submitted within 1 year of an AOR reevaluation, following significant facility changes (such as the development of offset monitoring wells or newly permitted injection wells within the AOR), or as the UIC Director requires.

Table 5-2 summarizes the various measurements discussed in the Testing and Monitoring Plan and the frequency of measurements for data collection and reporting purposes.

Table 5-2 – Testing and Monitoring Plan Measurements and Frequency

Equipment / Measurement	16 TAC Regulation	Objective	Frequency
Coriolis flow meter	**§5.203(j)(2)(B)**	Measure mass flow rate	Continuously
Corrosion coupon	**§5.203(j)(2)(C)**	Measure corrosion levels on the types of metal used in the project	Quarterly
Injection stream sampling	**§5.203(j)(2)(A)**	Provide a more detailed analysis via periodic lab analysis of injection stream	Quarterly for first 2 years then semiannually
Central pad temperature gauge	**§5.203(j)(2)(A)**	Measure the temperature of the total injection stream at the pad before partitioning to injections	Continuously
Injection wellhead tubing pressure gauge	**§5.203(j)(2)(B)**	Measure downstream of choke	Continuously
Injection wellhead annulus pressure gauge	**§5.203(j)(2)(B)**	Verify that the annulus pressure is maintained	Continuously
Injection well downhole pressure and temperature gauge for active/open injection interval	**§5.203(j)(2)(B)**	Measure downhole pressure and temperature (injection mass-to-volume conversion, verifying that it is not exceeding maximum pressure)	Continuously
	§5.203(j)(2)(G)	Measure falloff pressure	At least once every 5 years
	Not required	Direct measurement of downhole pressure open to active injection zone	Continuously
Time-lapse seismic survey	**§5.203(j)(2)(E)**	Monitoring of CO_2 plume growth in the subsurface over time	Frequency from the start of operations: • Baseline survey: completed • Monitor Survey No. 01: 1–3 years • Monitor Survey No. 02: 6–8 years • Monitor Survey No. 03: 11 years
Injection well external mechanical integrity	**§5.203(j)(2)(F)**	To assess changes in the temperature profile due to migration of injected fluids	Annually
Injection annulus pressure test	**§5.203(h)(1)(C)**	Verify the absence of a leak in the annulus	Once every 5 years
Injection well casing inspection	**§5.203(j)(2)(F)**	Use through-tubing log to detect loss of metal mass in casing due to corrosion	Baseline only; repeat survey is triggered if risk of leakage is apparent
Sunflower AZM/IZM No. 01 downhole pressure / temperature gauge	**§5.203(j)(2)(D)(i) and §5.203(j)(2)(D)(ii)**	Detect pressure anomaly above the UCZ in case of unexpected vertical migration; will require careful analysis due to false-positive potential from sensor drift, geomechanical effects, and preexisting pressure trends due to potential far-field activities	Continuously
Sunflower AZM No. 01, No. 02	**§5.203(j)(2)(D)(i) and §5.203(j)(2)(D)(ii)**	Collect above-UCZ fluid as recommended by guidelines.	Quarterly for 2 years followed by annually
Sunflower AZM No. 01, No. 02 pressure gauge	**§5.203(j)(2)(D)(i) and §5.203(j)(2)(D)(ii)**	Detect pressure anomaly above the UCZ in case of unexpected vertical migration;	Continuously
USDW fluid sampling	**§5.203(j)(2)(D)(ii)**	Sample fluids from the Chicot aquifer, which is the most prolific USDW aquifer within the AOR, as recommended by guidelines, and analyze the composition.	Quarterly for pre-injection and first 2 years after start of injection, then annually

5.4 Overall Strategy and Approach for the Testing and Monitoring Plan

The Class VI Permit regulations (16 TAC **§5.203** and **§5.206**) require various testing and monitoring activities to identify potential risks to, and the potential for endangerment of, USDWs during the injection phase of the Sunflower Project. ExxonMobil consulted with TRRC staff in pre-application discussions to identify the testing and monitoring activities that were best suited for the project. The site features that affect the degree of risk and potential for endangerment of a USDW include the following:

- The integrity of the UCZ to contain the CO_2 plume and pressure front
- The potential for vertical migration of CO_2 and/or brine along faults
- The occurrence of legacy well penetrations (i.e., artificial penetrations) through the UCZ
- The potential geomechanical stress induced by the modeled injection pressure
- The engineering design considerations for wellbore cement and casing/tubing materials of construction and completion
- Conformance to the modeled operational targets

Of these features, the key risk factor that is most critical for the design of this plan is the potential for artificial penetrations to create migration pathways through the UCZ. ExxonMobil completed a variety of technical tasks, discussed in *Section 3 – Area of Review and Corrective Action Plan*, to identify and evaluate the potential for legacy wells to exist in circumstances where CO_2/brine could potentially migrate up through a partially plugged wellbore (e.g., one with an open borehole)—or one that is inadequately plugged for CO_2 sequestration sites. Other potential risks associated with the project were deemed to be of a lower probability and consequence.

Therefore, a focused testing and monitoring approach was considered reasonable and appropriate to address the following risk scenarios:

- Migration of CO_2/brine along a fault/fault material or natural fracture impacting the USDW
- Migration of CO_2/brine along a fault/fault material or natural fracture impacting the USDW due to fault reactivation
- Migration of CO_2/brine up an unknown wellbore or one inadequately remediated
- Induced seismicity as a result of pressure increase during injection activities
- Loss of external mechanical integrity that leads to a release of CO_2 from injection well(s)
- Migration of CO_2/brine through seal(s) due to lack of seal continuity/presence
- Unanticipated structural or stratigraphic baffling creates unexpected preferential CO_2 plume migration pathways
- CO_2 composition changes and creates excess injection corrosion or unexpected chemical reactions in the injection zone

Figure 5-1 presents a summary of the risk assessment process for the life cycle of the project.

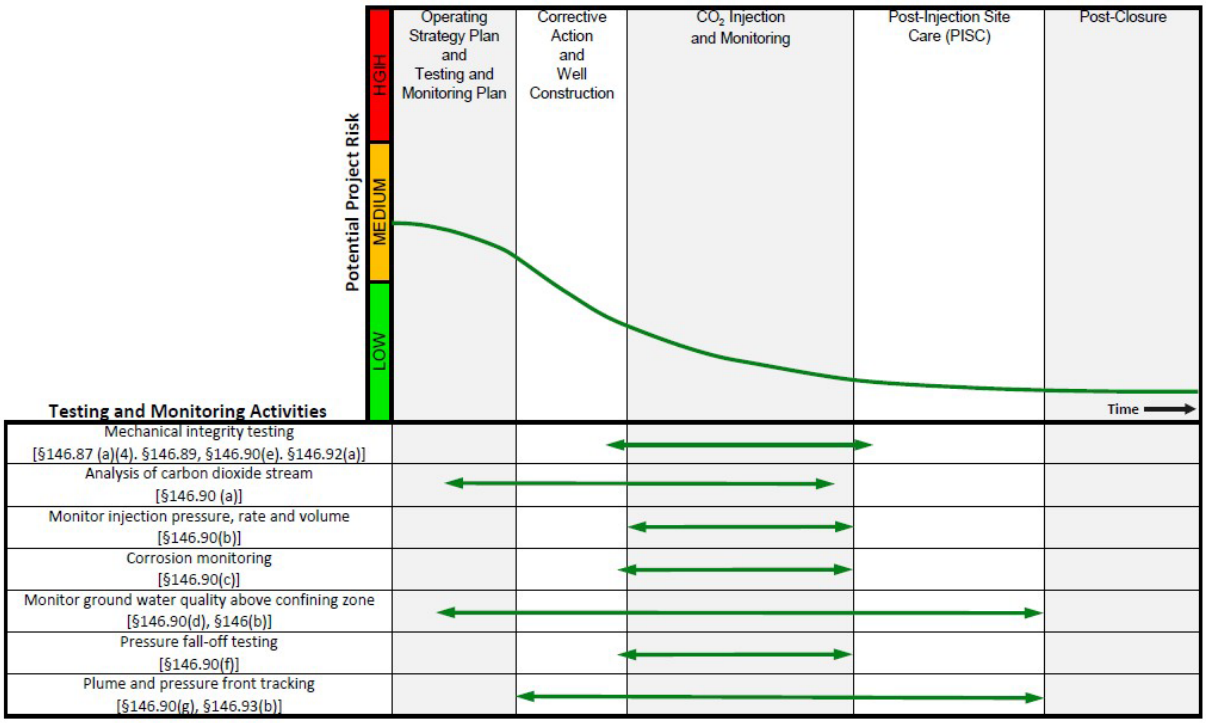


Figure 5-1 – Summary of the Risk Assessment Process for the Life Cycle of the Sunflower Project

As shown in Figure 5-1, the anticipated risk level is low at Project startup due to the implementation of best-practice mitigation measures—including injection well placement, injection interval selection, operational limitations, and corrective action for artificial penetrations. The injection well locations and injection intervals were selected to provide separation from geologic features (e.g., faults) that could potentially contribute to CO_2 or brine crossflow between the injection zone and USDW. The maximum injection pressure will be maintained below the potential hydraulic fracturing or activation pressure of a natural fault, to mitigate the potential for CO_2/brine migration through one or more seals due to mechanical fracturing or migration of CO_2/brine along faults.

State-of-the-art construction and mechanical integrity testing will be employed to reduce the potential for the loss of external mechanical integrity, to prevent potential release of CO_2. The composition of the injectate stream will be managed and monitored so that unexpected reactions with the potential to impact containment are mitigated. Monitoring and predictive reservoir modeling are being used to limit the potential for CO_2 plume and pressure front migration, to encounter artificial penetrations that have the potential for CO_2 or brine crossflow from the injection intervals to the lowermost USDW.

The Class VI Permit testing and monitoring requirements (16 TAC **§5.203** and **§5.206**) address the potential risk scenarios identified by ExxonMobil as warranting monitoring and testing. Scenarios that were found to have elevated risk will be the subject of corrective action prior to operations. Six artificial penetrations are located within or near the 5-year CO_2 plume and pressure front as

shown in *Section 3 – Area of Review and Corrective Action Plan*, Figure 3-5 and Table 3-4. Corrective action will be performed on these wells prior to injection, mitigating the need for deployment of monitoring technologies near these locations. Five additional artificial penetrations are located within the final CO_2 plume and pressure front. A phased approach will be utilized for corrective action for these artificial penetrations as summarized in Table 3-4 of *Section 3*.

An array of data collection technologies was screened to identify the most reasonable and appropriate methods for the Testing and Monitoring Plan. The screening criteria included: (1) selection of appropriate direct and indirect mix of mature or commercially demonstrated monitoring technologies linked to identified risk scenarios; (2) cost benefit analysis of each technology to mitigate unexpected CO_2/brine migration potential; and (3) a mix between continuous and periodic technology implementation schedules. ExxonMobil recognizes mature technologies based on their Technology Readiness Levels (TRLs), as defined by the International Energy Agency in their report *Energy Technology Perspectives, 2020; Special Report on Carbon Capture Utilisation and Storage.* This scheme is applicable to any technology, including those described in Table 5-3 for implementation in the Sunflower Project. As described in Figure 5-2, ExxonMobil considers mature technologies to be those at TRL 8 (i.e., first-of-a-kind commercial demonstration with full-scale deployment in final form) and higher.

The selected mature monitoring technologies for the Sunflower Project are designed to track the CO_2 and pressure plume growth in each of the four injection intervals, in this order from bottom to top: Upper Frio (Oligocene) Sands 3, 2, and 1, and Fleming (Miocene) Sand 3 (Figure 5-3).

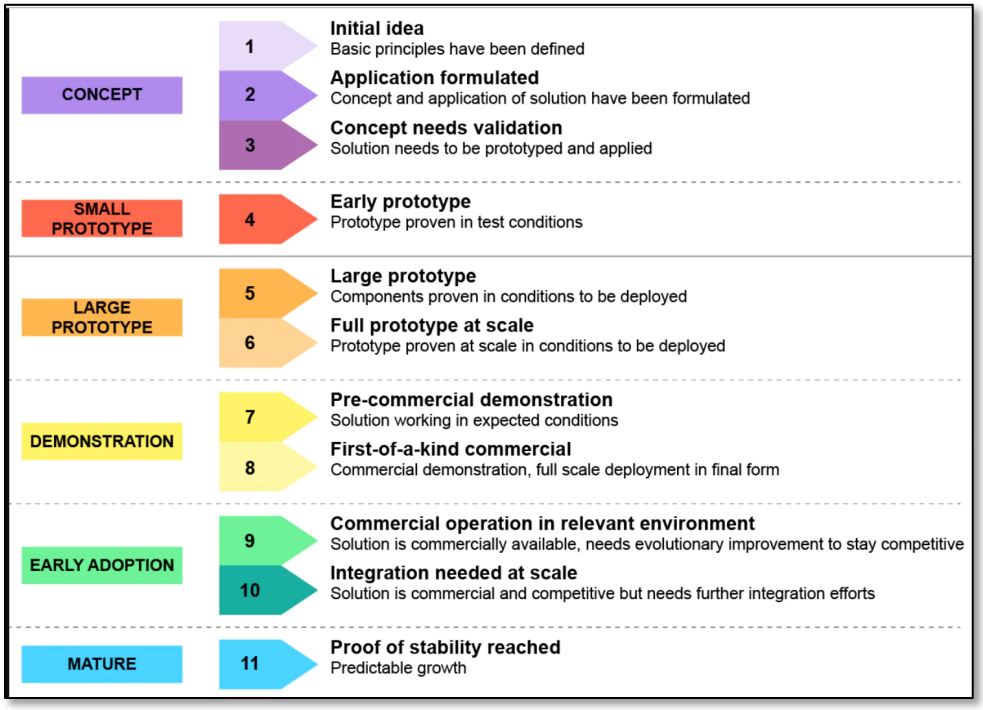


Figure 5-2 – TRLs for Selection of Monitoring Technologies

Table 5-3 provides a summary of mature technologies selected for tracking the CO_2 plume and pressure front. The Testing and Monitoring Plan is intended to be a flexible approach using appropriate technologies and techniques that are refined and adapted based on site-specific information over time. ExxonMobil will continue to assess the feasibility of emerging technologies and conduct performance evaluations to continue to investigate large-scale applications and improve the efficiency of the testing and monitoring surveillance system.

ExxonMobil will communicate with the UIC Director on plans and the potential for modifications and updates to the Testing and Monitoring Plan in the case that emergent technologies are deemed ready for adoption. Through the combination of proven and emerging technology implementation, an efficient testing and monitoring strategy will be maintained for the Sunflower Project to ensure effective monitoring of CO_2 plume and pressure front migration paths in the subsurface, and to provide reliable data for risk management, mitigation strategies, and a potential reevaluation of the AOR model.

Table 5-3 – Summary of Monitoring Technologies for Direct and Indirect CO_2 Plume and Pressure Front Tracking

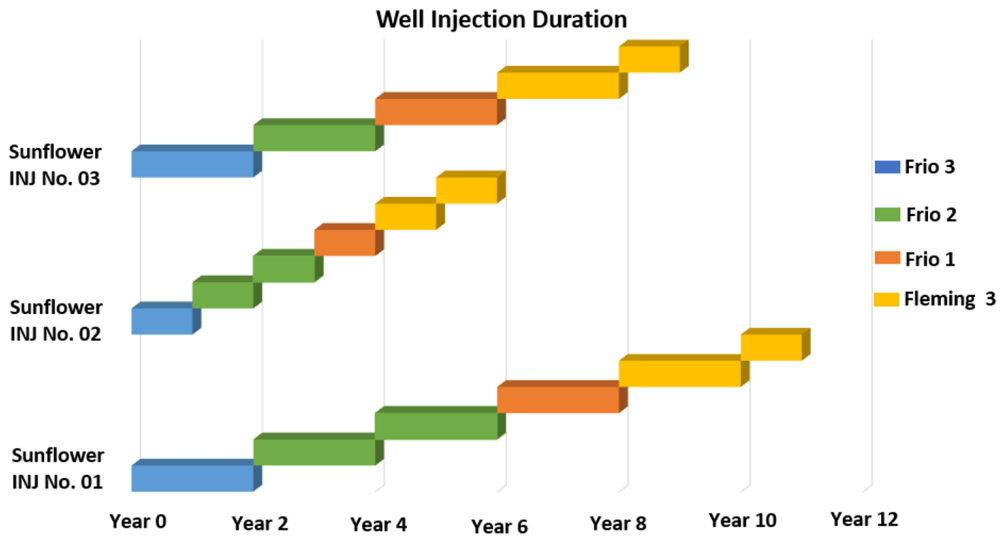
Target Zone	Requirement	Technology	Placement Location	Target Depths	Phased/Triggered Approach	Monitoring Frequency	Data Evaluation Objectives
Injection Zone	Direct per 16 TAC **§5.203(j)(2)(D)(i)**	Downhole tubing-mounted pressure and temperature gauge	Sunflower INJ No. 01, No. 02, and No. 03	Four injection intervals in Fleming and Upper Frio Formations	No	Continuous monitoring during injection operations for each injection interval	Identification of pressure differential and location of pressure front for the four injection intervals
		Tubing encapsulated conductor cable with in-line pressure and temperature gauges	Sunflower AZM/IZM No. 01	Four injection intervals, first laterally continuous water-bearing zone above UCZ	No	Continuous monitoring	Pressure front tracking
	Indirect, geophysical techniques per 16 TAC **§5.203(j)(2)(E)**	Time-lapse seismic surveys, or equivalent technologies	AOR	Four injection intervals in Fleming and Upper Frio Formations	No	Seismic baseline survey conducted prior to injection. Monitor Survey No. 01 will be performed within the first 3 years after injection, Monitor Survey No. 02 within 6 to 8 years after injection, Monitor Survey No. 03 in Year 11 at cessation of injection.	Monitoring of CO_2 plume growth in the subsurface over time
		Passive seismicity monitor station array	Selected locations within and/or around the AOR	Surface	No	Continuous monitoring	AOR-specific seismicity data collection and event analyses
Above UCZ	Direct per 16 TAC **§5.203(j)(2)(D)(i)**	Fluid sampling protocol using wireline sampling or U-tube sampling protocols as appropriate	Sunflower AZM/IZM No. 01	First water above UCZ	No	One collection of sample from wireline sampling	Baseline geochemical data
			Sunflower AZM No. 01, No. 02		No	Quarterly samples for 2 years, then annual sampling for remainder of operational phase	Detection monitoring for CO_2 plume and/or brine crossflow from injection zones to top of UCZ
	Indirect, geophysical techniques per 16 TAC **§5.203(j)(2)(E)**	Time-lapse seismic surveys, or equivalent technologies	AOR	From surface to base of Upper Frio Sand interval	No	Seismic baseline survey conducted prior to injection. Monitor Survey No. 01 will be performed within the first 3 years after injection, Monitor Survey No. 02 within 6 to 8 years after injection, Monitor Survey No. 03 in Year 11 at cessation of injection.	Detection monitoring for presence of CO_2 plume above UCZ
USDW	Direct per 16 TAC **§5.203(j)(2)(D)(ii)**	Fluid sampling	Sunflower USDW No. 01, No. 02, No. 03	USDW Groundwater samples collected just below the typical total depth of water wells completed in the area	Yes, three USDW monitoring wells prior to start of injection and additional USDW monitoring wells depending on the results of CO_2 plume and pressure front tracking as discussed in AOR reevaluations.	Pre-Operational Phase – Quarterly Operational Phase – Quarterly for 2 years, then annually for remainder of injection phase	Detection monitoring and evaluation of trends in water quality and geotechnical parameters
Soil-Gas Monitoring	Not Required	Soil-gas samples collected from the unsaturated zone	Contingent on confirmed release to USDW				
Air Monitoring	Not Required	Portable and/or stationary CO_2 detectors monitoring and recording ambient CO_2 concentrations	Contingent on confirmed release to USDW				

5.4.1 Use of Phased and/or Triggered Approach

The testing and monitoring plan for tracking the CO_2 plume and brine pressure front uses the phased and/or triggered approach. The goal of the approach is to provide the monitoring and surveillance data necessary to demonstrate that USDWs are protected from the potential migration of CO_2 or brine. The proposed testing and monitoring plan is aligned with the multi-staged injection approach outlined in *Section 2 – Plume Model*. A multi-stage CO_2 injection strategy, which leverages the vertical profile of the injection zone, optimizes storage capacity while minimizing plume migration and pressure buildup. Compared to a single-stage approach, multi-stage injection results in significantly smaller CO_2 plume expansion and a more controlled pressure front over time.

The initial monitoring plan is based on the model-predicted 5-year AOR and deemed appropriate to track the CO_2 plume and brine pressure front growth during that time period. Beyond that point, the AOR reevaluation process will be used to assess the adequacy of the testing and monitoring program to detect potential unexpected CO_2 or brine migration—should it occur—and make recommendations for changes and implementation of corrective measures, if necessary, to demonstrate the protection of USDWs.

Figure 5-3 provides an illustration of the staged-injection approach for the Sunflower Project. The CO_2 will be injected at up to six separate stages into four injection intervals in the Fleming and Upper Frio sands, at depths thousands of feet below the lowermost USDW. Sunflower INJ Wells No. 01, No. 02, and No. 03 will start injecting into the Upper Frio and then move to the Fleming. Multiple confining layers are present, including the Anahuac Shale and the UCZ. Additional intraformational shale layers are present within the Fleming and Upper Frio formations. *Section 4 – Well Construction Plan and Operating Conditions* provides a detailed discussion of the injection rates and schedules for each injection well and injection interval.



Stage	Injection Formation	Maximum Injection Rate Constraint (MMTPA)			Total Per Zone (MMT)
		Sunflower INJ No. 01	Sunflower INJ No. 02	Sunflower INJ No. 03	
1	Frio 3	1.2	1.0	0.8	5.0
2	Frio 2 Lower	1.0	1.2	1.2 *	7.8
3	Frio 2 Upper	0.5	1.2		
4	Frio 1	1.0	1.0	1.0	5.0
5	Fleming 3 Lower	1.0	1.0	1.0	7.5
6	Fleming 3 Upper	1.0	1.0	0.5	
Total Per Well (MMT)		10.4	6.4	8.5	**Site Total (25.3)**

* For Sunflower INJ No.3 stages 2 & 3 are combined.

Propietary Business Information

Figure 5-3 – Staged-Injection Approach to Optimize CO_2 Storage

As the CO_2 plume and pressure front expand over time, so does the deployment of monitoring technologies to gather data and assess the potential for USDW endangerment. This phased and/or triggered monitoring strategy was adopted for the Testing and Monitoring Plan based on the timing and depth of each injection interval described in Figure 5-3. This strategic approach is protective of the USDW because of the availability of mature, reliable, and accurate technologies for tracking the CO_2 plume and pressure front growth within the injection zones while minimizing the number of well penetrations through the UCZ.

The monitoring program was also constructed to align with the three operational phases of the Sunflower Project: (1) pre-operational baseline data collection phase (cross-referenced in *Section 4 – Well Construction Plan and Operating Conditions*); (2) the operational phase for the three injection wells discussed in this section; and (3) the PISC phase (discussed in *Section 7 – Post-Injection Site Care and Site Closure Plan*). Phasing will be used for the installation of the in-zone, above-zone, and USDW monitoring wells. During the pre- and early-operational phases, a selection of mature monitoring technologies will be used to not only establish the baseline seismic and pressure, and certain geochemical parameters needed to monitor the CO_2 plume and pressure front—but also to confirm the predictive reservoir modeling results, refine the model as necessary, and optimize the position of the monitoring wells. A semiannual report will be provided to the TRRC that presents the collected monitoring data and plume migration evaluations.

Surface-air and soil-gas monitoring are proposed as a triggered monitoring condition. The additional use of these technologies will be based on monitoring results obtained from the above-UCZ groundwater and USDW monitoring data.

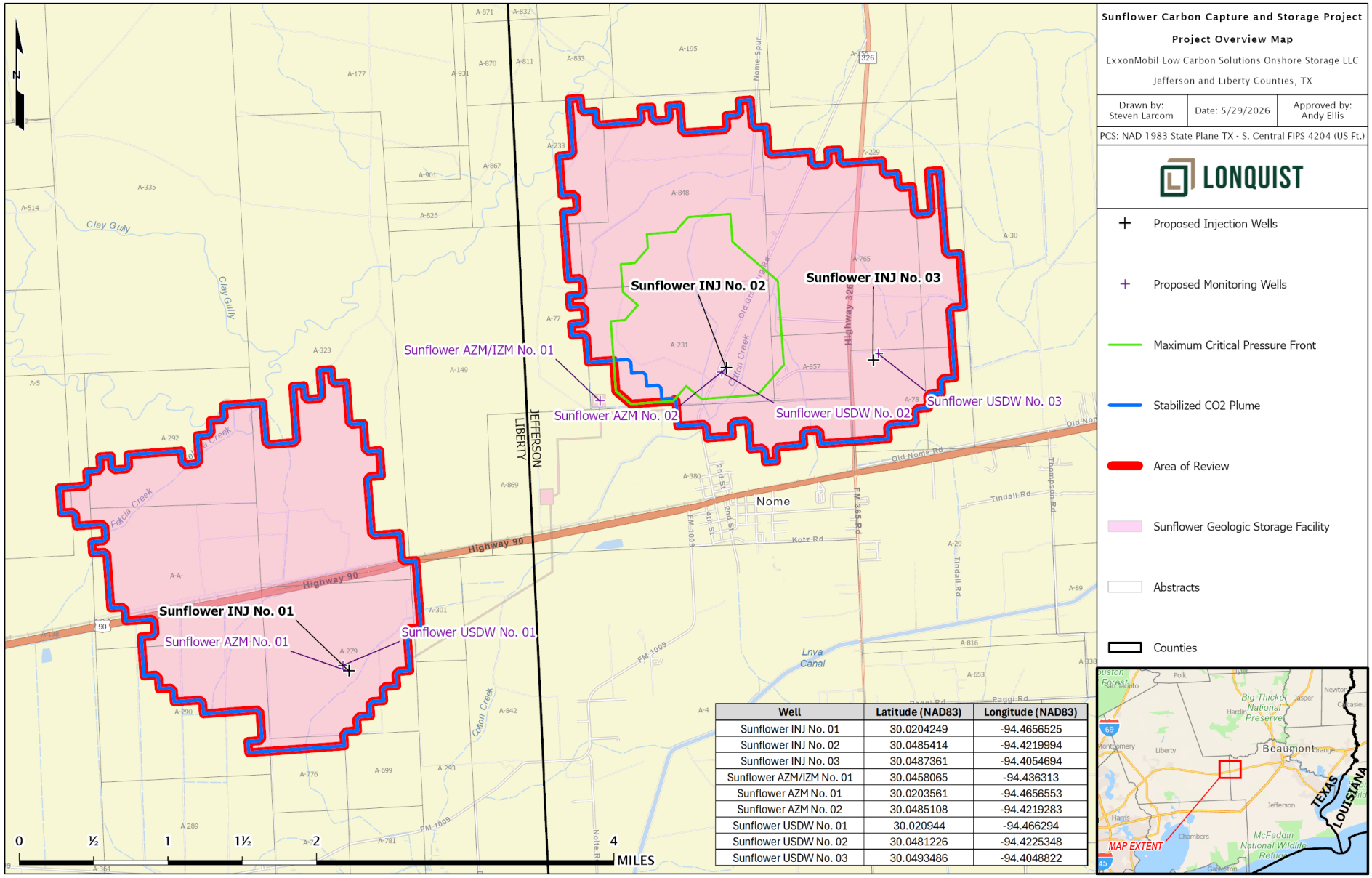


Figure 5-4 – Location of Injection Wells, Above-Zone Monitoring Wells, In-Zone/Above-Zone Monitoring Well, and USDW Monitoring Wells

5.4.2 Mechanical Integrity Testing

5.4.2.1 Internal Mechanical Integrity Testing – Annulus Pressure Test

In accordance with 16 TAC **§5.203(h)(1)(C)**, ExxonMobil will assess the internal mechanical integrity of each injection well by performing annulus pressure tests after the wells have been completed, prior to injection, and at least once every 5 years thereafter. During well construction and prior to the installation of the injection tubing and packer, the casing will also be pressure-tested to the maximum anticipated annulus-surface pressure to verify its integrity. Pursuant to 16 TAC **§5.203(h)(1)(E)**, ExxonMobil will perform mechanical integrity pressure tests after workovers.

The annular pressure tests are designed to demonstrate the mechanical integrity of the casing, tubing, and packer. These tests will be conducted by pressuring the annulus to a minimum of the planned surface-injection pressure described in *Section 4 – Well Construction Plan and Operating Conditions*.

The injection tubing annulus pressure will be continuously monitored at the wellhead during all other times (16 TAC **§5.203(h)(1)(C)**). The tubing annulus pressure will be recorded and reported to the regulatory permitting authority in semiannual reports to demonstrate compliance with casing integrity requirements.

5.4.2.2 External Mechanical Integrity Testing

Following the requirements of 16 TAC **§5.203(h)(1)(D)**, ExxonMobil will use a wireline-deployed temperature log or distributed temperature sensing (DTS) as a means of complying with the external mechanical integrity test (MIT) requirements on an annual basis. The UIC Director will be notified a minimum of 30 days in advance of field activities, per 16 TAC **§5.206(i)**.

The procedures for acquiring a temperature log are as follows:

- A temperature log with gamma ray and casing collar locator will be obtained prior to injection activities, to establish baseline conditions and to identify any potential local temperature anomalies that may exist.
- Shut in the well for a minimum of 24 hours, targeting 36 hours of shut-in time, if possible, based on operational needs.
- Rig up wireline and perform a temperature log from surface to total depth.
- Pull the temperature tool out of hole. If anomalies are present, re-log the well at least 8 hours after the initial pass to reestablish sufficient conditions. If none are identified, rig down wireline.

Per EPA *Geologic Sequestration of Carbon Dioxide: Underground Injection Control (UIC) Program Class VI Well Testing and Monitoring Guidance (March 2013)*, any temperature logs will be evaluated by comparing the relative differences of the log to a baseline log. If the log is comparable to the baseline log, it is considered a successful demonstration of mechanical

integrity. If log data is inconclusive or anomalies are detected, additional logs such as an oxygen activation or pulsed neutron may be run to further investigate mechanical integrity.

5.4.2.3 Reporting Results of MIT

Annulus pressure test (internal MIT) results will be submitted to the appropriate regulatory permitting authority within 30 days of completion. The logs recorded during the external MIT will be submitted to the appropriate regulatory permitting authority, such as the UIC Director, within 30 days of the verification that the logging results are representative and acceptable.

5.4.3 Pressure Falloff Testing

Required pressure-transient falloff testing will be conducted at least once every 5 years to meet the requirements of 16 TAC **§5.203(j)(2)(G)**. The objective of periodic testing is to monitor for any changes in the near-wellbore environment that may impact permeability and reservoir pressures during active injection. A report containing the pressure falloff data and interpretation of the reservoir pressure will be submitted to the TRRC within 30 days of the conclusion of the test. Although test procedures or methods may be changed based on the request of the permittee and approval by the UIC Director, the following procedure is expected to be typical for such periodic monitoring.

5.4.3.1 Testing Method

The procedures to conduct a pressure falloff test are as follows:

- Record data regarding the test well injection at typical operating conditions (constant rate plus or minus 10%). Rate vs. time data will be recorded during the injection period. Cumulative injection volume will also be recorded. Continue the injection for a time equivalent to the projected duration of the falloff necessary to observe analyzable radial flow. Note that significant rate variations may require more complicated analysis techniques.
- Verify the operation of the permanent monitoring equipment or rig up downhole the memory pressure gauge and run in the well to a datum depth approved by the regulators.
- For pressure transient falloff, obtain the final stabilized injection rate and pressure for a minimum of 1 hour. Ensure that the injectate temperature has stabilized.
- Cease injection and monitor the pressure falloff. Continue monitoring pressure for a time sufficient to observe reservoir behavior. Wellbore pressure gradients will be obtained to establish the fluid gradient.
- Stop the test-data acquisition, rig down, and release the equipment.

5.4.3.2 Analytical Methods

Near-wellbore conditions, such as the prevailing flow regimes, well skin, reservoir properties, and boundary conditions, will be assessed using standard pressure-transient diagnostic plotting and well test simulators, as required. This assessment will be accomplished from analysis of observed pressure changes and pressure derivatives on standard diagnostic log-log and semi-log plots. Significant changes in the well or reservoir conditions will be identified by comparing pressure falloff tests performed prior to initial injection with later tests. These well parameters resulting

from falloff testing will be compared against those used in AOR determination and site computational modeling. Notable changes in reservoir properties may dictate that an AOR reevaluation is necessary.

The pressure falloff test results will be submitted to the UIC Director within 30 days of completion of the quality assurance/quality control verification of the pressure data.

5.4.3.3 Quality Assurance/Quality Control

The surface field equipment will undergo inspection and testing prior to operation. The pressure gauges will be calibrated prior to installation per manufacturer instructions. Documentation certifying proper calibration will also be enclosed with the test results.

5.4.4 Monitoring of CO_2 Stream

Consistent with 16 TAC **§5.203(j)(2)(A)**, ExxonMobil will install and use measurement devices to analyze the chemical composition of the injection stream, to assess the potential for interactions between CO_2 and other injectate components—and compatibility with the well-completion materials. Temperature and pressure will also be measured at the sample collection point.

5.4.4.1 Sampling Frequency

Quarterly sampling of the CO_2 stream is proposed for the first 2 years of operation, after which the frequency may be reduced to twice per year in consultation with the UIC Director if the results of the CO_2 stream analyses are consistent. If a new source is introduced after transition to semiannual sampling, quarterly sampling would be reinitiated from the time the new source is included in the CO_2 stream for a period of 1 year. If a consistent stream composition is observed for a period of 1 year, sampling would be reduced to twice per year.

5.4.4.2 Sampling Methods

The quarterly measurements will be obtained by collecting representative samples of CO_2 at a sample port on the Sunflower Project's central pad, beyond the last stage of compression in the compression build or similar point. Sufficient mixing and residence time in the system will have occurred at this sampling point for the sample to be representative of the injected CO_2 stream. The sampling station will be equipped with the ability to purge and collect a gas sample into a sealed container.

The central pad is the connection point between the CO_2 pipeline and the sequestration field's distribution system.

Sampling activities will be conducted at the direction of site representatives, in accordance with the certified or accredited analytical laboratory procedures. A sample will be collected by depressurizing the stream and sampling the CO_2 as a gas in either a Tedlar® bag, a Summa cannister, or a laboratory-approved alternate. The grab sample will be sent to an independent contract laboratory for analysis.

5.4.4.3 Analytical Plan

Table 5-4 presents the test parameters, analytical methods, and sample frequency for each test parameter.

Table 5-4 – Summary of CO_2 Sampling and Analysis Plan

Parameter/Constituents	Analytical Method(s)[1]	Frequency[2]
CO_2 Purity	GC/DID or Method 3A (Subtraction)	Quarterly
Water	GC/FTIR, Method 320, or EPA Method 4	Quarterly
Oxygen	GC/DID or Method 3A	Quarterly
Nitrogen	GC/DID or by difference	Quarterly
Sulfur Dioxide	GC	Quarterly
Hydrogen Sulfide	GC	Quarterly
Oxides of Nitrogen	GC/DT	Quarterly
Total Hydrocarbons	GC/FID	Quarterly
Carbon Monoxide	GC	Quarterly
Methane	GC/DID	Quarterly
GC = gas chromatography; DID = discharge ionization detector; FTIR = Fourier transform infrared DT = drager tube, FID = flame ionization detector [1] A suitable alternate analytical method may be used/identified by accredited third-party lab. [2] Proposed quarterly sampling is for the first 2 years of operation with the option to reduce frequency to twice a year after 2 years if the CO_2 stream analytical results are consistent. The addition of a new source would require a return to quarterly sampling for 1 year.		

5.5 Monitoring Programs

5.5.1 Continuous injection Stream Physical Monitoring

ExxonMobil will install and use continuous measurement devices to monitor the injection pressure, rate, and mass injected; the pressure on the annulus between the tubing and the production casing; and the temperature of the CO_2 stream, as required under 16 TAC **§5.206(d)(2)(F)(i)**, **§5.206(h)(1)(C)**, and **§5.206(j)(2)(B)**. Data will also be collected to document the addition or removal of any fluid from the annulus system. Data interfaces will be created for equipment that is not linked directly to a data management system or suitable equivalent, and it will be integrated into a unique surveillance platform. In the monitoring program, the sensors, transducers, and controllers will be connected in a central platform to monitor the operating conditions, set alarms for alerting operations of malfunction, and establish safety protocols in case of abnormal conditions. Alarms will additionally be set for pressures outside of described tolerances (generally 90% of the fracture gradient and prescribed wellhead pressures), and changes in annular pressure and fluid.

Instrument calibration standards, precision, and tolerances will be determined based on manufacturer recommendations. The automated control system data will be visually monitored

for anomalies on a regular basis. Average values will be compared to baseline and predicted values to determine if there are any significant deviations relevant to integrity or containment. The operating parameters, monitoring values, laboratory results, reports, and surveillance documents for the Sunflower Project will be stored in a database to support AOR reviews, quality assurance/quality control review programs, and routine reporting. Table 5-5 provides a summary of the typical sampling devices, locations, and data storage frequencies for the continuous monitoring program. As may become necessary, paper records may be substituted for digital records at the discretion of the operator. Suitable equivalent devices may be used as technology availability and maintenance dictate.

Table 5-5 – Sampling Devices, Locations, and Data Frequencies for Continuous Monitoring

Parameter	Device(s)	Location	Estimated Min. Sampling Frequency	Estimated Min. Recording Frequency
Surface injection pressure	Wellhead pressure logger	Surface, injection well piping	5 seconds	5 minutes
Downhole pressure gauge	Pressure gauges	Injection unit	5 seconds	5 minutes
Injection rate	Coriolis flow meter	Central pad piping	5 seconds	5 minutes
Total mass injected	Coriolis flow meter	Central pad piping	5 seconds	5 minutes
Annular pressure	Pressure gauge	Wellhead	5 seconds	5 minutes
Annulus fluid volume	Pressure gauge	Annulus system tank	5 seconds	5 minutes
CO_2 stream temperature	Temperature gauge	Wellhead, injection well flowing	5 seconds	5 minutes

5.5.1.1 Continuous Monitoring of Injection Rate and Volume

ExxonMobil will collect continuous measurements necessary to calculate and report the injection mass flow rate and volume in compliance with 16 TAC **§5.206(j)(2)(B)**. A data management system or suitable equivalent will be used to facilitate the continuous collection of intake pressure at the central pad transfer point, the distribution system to each injection well, and the wellhead of the proposed injection wells.

A Coriolis flow meter will be used to measure the flow rate at the central pad and compute flow rates for each injection well. The meter directly measures the mass flow rate of the injected fluid. Analytical methods will be conducted at a periodic interval to determine the mass percentage concentration of CO_2 and carbon monoxide (CO). The mass percentage concentration of CO_2 and CO are multiplied by the total mass flow reading from the Coriolis flow meter to estimate the total mass of captured CO_2 and CO for a given period. The meter will be calibrated to manufacturer specifications.

ExxonMobil will review and interpret the continuously monitored parameters to validate that they are within permitted limits. The data review will also include an examination of trends to help assess the need for equipment maintenance or calibration. Semiannual reports of the monitoring data will be submitted to the regulatory permitting authority.

5.5.1.2 Continuous Monitoring of Injection Temperature and Pressure at the Injection Wells

ExxonMobil will perform continuous monitoring of the injection pressure, temperature, mass flow rate, and injection annulus pressure in compliance with 16 TAC **§5.206(j)(2)(B)**. The injected CO_2 stream pressure will be continuously monitored in the CO_2 flowline near the wellhead interface. The annulus pressure will also be continuously recorded. The combined wellhead and downhole monitoring data will be used to continuously characterize the injection stream in detail.

ExxonMobil will review and interpret the monitoring data to confirm compliance with the operational limits of the injection permit for each injection well. The data review will include an analysis of trends for operational performance evaluation and routine maintenance. Periodic reports of the monitoring data will be submitted to the UIC Director on a semi-annual basis.

5.5.1.3 Continuous Monitoring of Injection Temperature and Pressure in the Reservoir

Reservoir temperatures and pressures will be measured using a downhole gauge that will be installed in the tubing above the production packer. The temperature gauge will also continuously measure the temperature.

5.5.1.4 Continuous Monitoring of Annular Pressure and Volume (Tank Level)

The annular pressure between the tubing and the injection casing string will be monitored on a continuous basis. The pressure gauge on the annulus will be tied into the data management system or a suitable equivalent system and set to alarm if pressure or volumes move outside set tolerances. The annulus tanks in the well systems will be maintained with sufficient volumetric capacity to accommodate the anticipated volume fluctuations due to temperature and pressure variations. The annulus tanks will be equipped with a level transducer or an armored reflex sight glass and an independent liquid-fill nozzle. If any annulus fluid is added or removed, it will be recorded. An annulus tank level is to be recorded on any day when injection occurs.

5.5.1.5 Positive Annular Pressure

Per 16 TAC **§5.206(d)(2)(F)**, pressure will be maintained in the annulus at a value greater than the injection pressure. ExxonMobil will fill the annulus with a noncorrosive fluid approved by the UIC Director. A system will be set up to maintain pressure in the annulus using noncorrosive fluid or gas, and it will be tied into the alarms or a suitable equivalent system designed to signal pressure drops below set points.

5.5.2 Corrosion Monitoring

To meet the requirements of 16 TAC **§5.206(j)(2)(C),** the tubing and casing materials will be monitored during the operational period for loss of mass, thickness, cracking, pitting, and other

signs of corrosion, to demonstrate that the well components continue to meet the minimum standards for material strength and performance.

5.5.2.1 Monitoring Location and Frequency

Corrosion coupons will be placed in continuous contact with the CO_2 stream in a selected location deemed representative of the three proposed injection wells. The samples will be exposed to the process stream conditions immediately prior to injection, using a recycle loop or sample retriever. Exposure is to be representative of conditions at the top of the tubing. Coupons will be tested quarterly.

Casing inspection logs (CILs) will be conducted on the long string casing at a minimum frequency of once every 5 years pursuant to 16 TAC **§5.305(1)(C)**.

5.5.2.2 Monitoring of Corrosion Coupon

Monitoring of well tubing and casing material corrosion will initially be conducted on a quarterly basis to evaluate the corrosion coupon monitoring system. A corrosion coupon station or rack will be provided as part of well-materials integrity monitoring. Any coupon in active use will be exposed to the stream composition to provide ongoing evaluation of material compatibility with the CO_2 stream. The results will be reported semiannually to the regulatory permitting authority, such as the UIC Director.

The coupons will be assessed for corrosion using American Society for Testing and Materials (ASTM) and Association for Materials Protection and Performance (AMPP) standards for evaluating corrosion tests (e.g., ASTM G1-03 (2017), Standard Practice for Preparing, Cleaning, and Evaluating Corrosion Test Specimens), or a suitable equivalent. When the coupons are removed, they will be inspected visually for signs of corrosion or pitting. The weight and size of the coupons will be measured each time they are removed. The rate of corrosion will be calculated using a weight loss method where the rate equals the weight loss during the exposure period divided by the duration of the period.

The initial baseline measurements of the coupons will follow the recommendations of AMPP National Association of Corrosion Engineers (NACE) SP0775-2023. Coupons will be prepared from the material used to construct the injection wells. A method of coupon preparation will be chosen that does not alter the properties of the metal.

5.5.2.3 Cement Evaluation and Casing Inspection Logs

As discussed in *Section 4 – Well Construction Plan and Operating Conditions*, a cement bond log will be run after the casing has been run and cemented, and sufficient cement curing has taken place. Logging will be conducted to assess the quality of the cement. A baseline CIL will establish the initial dimensions of the wall thickness of the production casing after it is cemented. Following the installation of the completion equipment, including the tubing and packer assembly, an initial CIL will be run. The CIL will serve as the baseline survey for potential future repeat surveys with the objective of enabling the detection of possible loss of metal mass.

Repeat CILs will only be performed if other monitoring measurements create concern about the integrity of the casing of the wells, and the technical determination is made that a repeat CIL is most suitable to address those concerns. Examples include a loss of annulus pressure and temperature measurements using the gauges installed in the wells. Changes in the recorded electromagnetic response will be analyzed to identify and localize casing corrosion.

5.5.3 Groundwater/USDW Quality Monitoring

To meet the requirements of 16 TAC **§5.203(j)(2)(D)**, ExxonMobil will monitor groundwater quality and geochemical changes above the confining zone during the period of operation. ExxonMobil's intended strategy is to monitor the first laterally continuous permeable and porous sand above the UCZ via the Sunflower AZM No. 01, Sunflower AZM No. 02, and Sunflower AZM/IZM No. 01. This would be the first location to monitor for any potential leaks before they reach the USDW. Additionally, the USDW monitor wells are located within the AOR. The depth of these USDW monitoring wells is ~350 - 500 feet to be consistent with active water wells in use within the AOR. Given the low salinity of this zone, fluctuations in composition (salinity, dissolved CO_2 concentration, etc.) will be more readily apparent compared to a fluctuation of the same magnitude in the higher salinity zone found at deeper depths within the USDW. This would reduce the uncertainty of identifying a potential leak and improve the overall effectiveness of USDW testing and monitoring.

5.5.3.1 Design of the Monitoring Well Network

The monitoring well network includes the proposed monitoring wells that will be used to support compliance with the testing and monitoring requirements under the 16 TAC 5. Combined with the monitoring of pressure buildup at each proposed injection well, the design of the monitoring well network was selected to provide a high degree of confidence in detecting vertical CO_2 migration through the confining zone, that could endanger the USDW without corrective action. The relevant site data considered for the design of the monitoring well network included the phased injection depths, rate, and volume; the geology; and the presence of the legacy wells as required by 16 TAC **§5.203(j)(2)(D)(iii)** and **(iv)**.

5.5.3.2 USDW Monitoring Well Construction

To comply with 16 TAC **§5.203(j)(2)(D)(ii)**, three USDW monitoring wells are proposed. Prior to startup, three USDW monitoring wells (Sunflower USDW No. 01, No. 02 & No. 03) will be completed at the locations shown in Figure 5-4. These locations were selected to provide baseline geochemical data in the vicinity of the three injection wells within the AOR.

The Chicot aquifer is the primary USDW aquifer within the AOR, and its relatively shallow water-bearing zones are a target for the completion of freshwater wells, typically at depths ranging from approximately 100–550 feet below ground level (BGL) in the AOR, as reported in *Appendix C-3* of *Section 3 – AOR and Corrective Action Plan*. The depth ranges of the planned Sunflower USDW No. 01, No. 02 and No. 03 were selected to be consistent with the total depths of freshwater wells in the area and will provide data to assess whether significant changes in water quality are occurring at the depth of most water wells. These three USDW monitoring wells will

provide an initial baseline of USDW quality prior to injection and then will be used to monitor for changes in USDW quality during injection and PISC.

Potential vertical migration points were considered for the USDW monitoring wells, but the available evidence and evaluation indicated that no significant risk was apparent. For example, results from reservoir and geomechanics models showed that increased pressures near fault and/or fracture planes were found to be well below levels deemed necessary to cause transmissivity that might result in the potential for CO_2 and/or brine to migrate from the injection zones to the USDW. Therefore, no USDW monitoring wells were proposed near fault or fracture planes within the first years of project operations. The time-lapse seismic data collected during operations will be used to validate the model predictions.

5.5.3.3 Summary of Water Well Data for the AOR

Table 5-6 provides a summary of the planned USDW monitoring well construction details for Sunflower USDW No. 01, No. 02 and No. 03. The well construction details for additional USDW monitoring wells (if needed) will be consistent with the construction details in Table 5-6.

A total of 16 freshwater wells were identified in and near the AOR as listed in *Appendix C-3* of *Section 3 – AOR and Corrective Action Plan* from the Texas Water Development Board well registration list and the Submitted Drillers Report Database. *Appendix C-2* of *Section 3* illustrates the location of the water wells, each of which is completed in the Chicot aquifer with a maximum depth of approximately 538 feet BGL. For planning purposes, the extent of the CO_2 plume and pressure front relative to the water wells will be reviewed after sufficient data have been collected to assess whether additional USDW groundwater monitoring is needed for situations of potential USDW endangerment.

Table 5-6 – Summary of USDW Monitoring Well Construction Details

USDW Monitoring Well	Latitude (NAD 83)	Longitude (NAD 83)	Total Depth (ft BGL)
No. 01	30.0209444	-94.4662944	350–500
No. 02	30.0481226	-94.4225348	350–500
No. 03	30.0493486	-94.4048822	350–500

*NAD 83 – North American Datum of 1983
BGL – below ground level

Groundwater samples will be collected, and the fluid sampling parameters and frequencies for the above-zone and USDW monitoring wells are shown in Table 5-7. Additional USDW monitoring wells will be added to assess the potential for USDW endangerment, if necessary. The Sunflower USDW No. 01 – 03 monitoring wells will be completed to collect groundwater samples for the Chicot aquifer at depths from approximately 350–500 feet BGL. .

5.5.3.4 Collection and Analysis of Groundwater Samples

Fluid samples will be taken periodically from the USDW monitoring wells and the Sunflower AZM No. 01 and No. 02. Three USDW monitoring wells target the Chicot aquifer, which is the most used aquifer in the AOR for potable and non-potable purposes. The AZM monitoring wells will target the first laterally continuous water-bearing zone above the UCZ. The initial sampling frequency for the USDW monitoring wells is quarterly. This sampling frequency is for both the pre-injection phase and the first 2 years of injection. This quarterly sampling characterizes the potential seasonal fluctuation in this USDW. After the initial phase, the sampling becomes annual, with the optimal season of data collection determined by analysis of the first years of quarterly samples.

Table 5-7 summarizes the parameters analyzed and the planned sampling frequency, which apply to the USDW and above-zone monitoring wells. Anomalous measurements will trigger resampling and additional data analysis, including a more detailed evaluation of data using statistical comparisons approved by the TRRC for detection monitoring programs. This analysis could also include geochemical modeling to compare the compositions of groundwater from before and during operations.

If warranted, other tests may be added to the evaluation if resampling and detailed analysis of the fluid samples do not satisfactorily rule out an undesired migration scenario.

Table 5-7 – USDW and Above-UCZ Monitoring Sampling Program

Parameter/Analyte	USDW Monitoring Well Frequency	Monitoring Frequency Above the UCZ
TDS, alkalinity, electrical conductivity, temperature, pH	Quarterly for first 2 years, then annually thereafter for the remainder of the injection phase of the project	Quarterly for first 2 years, then annually thereafter for the remainder of the injection phase of the project
Gas composition (CO_2, CH_4, O_2, N_2)		
Dissolved cations (i.e., As, Ba, Ca, Fe, Mg, Mn, Na, K, Pb, Zn)		
Dissolved anions (i.e., HCO_3, Br, Cl, NO_3 SO_4)		
As = arsenic; Ba = barium; Br = bromine; Ca = calcium; CH_4 = methane; Cl = chlorine; Fe = iron; HCO_3 = bicarbonate; K = potassium; Mg = magnesium; Mn = manganese; N_2 = nitrogen; NO3 = Nitrate; O_2 = oxygen; Pb = lead; SO_4 = sulfate; Zn = Zinc		

ExxonMobil will test the fluid samples and maintain results for the parameters listed in Table 5-7. If results indicate the existence of impurities in the injection stream, the significance of these constituents relative to the protection of USDW will be assessed to determine if they should be included in the analysis of the water samples. Testing results will be stored in an electronic database.

Fluid chemistry data will be monitored for deviations from baseline, predicted, and average values. If a significant variance occurs, the numerical model will be reevaluated. Potential

geochemical signs that fluid may be unexpectedly migrating from the injection intervals may be detected upon observation of the following trends:

- Change in total dissolved solids (TDS)
- Change in signature of major cations and anions
- Increase in CO_2 concentration
- Decrease in pH
- Increase in concentration of injectate impurities

5.5.3.5 Laboratory to Be Used/Chain of Custody Procedures

The analysis of the fluid samples will be transported to an accredited and state-approved laboratory. ExxonMobil will observe standard chain of custody (COC) procedures and maintain records to allow full reconstruction of the sampling procedure, storage, and transportation, including any problems encountered.

5.5.3.6 Quality Assurance and Surveillance Measures

ExxonMobil will collect replicate samples and sample blanks for quality assurance/quality control purposes. The samples will be used to validate test results, if needed.

5.5.3.7 Plan for Guaranteeing Access to All Monitoring Locations

The placement of the well locations is optimized to be accessible from roads.

5.5.4 Upper Confining Zone/Above-Zone Monitoring

5.5.4.1 Construction of In-Zone and Above-Zone Monitoring Wells

The Sunflower AZM/IZM No. 01 will be constructed to collect pressure and temperature measurements from the four injection intervals as well as the first laterally continuous permeable and porous formation above the UCZ. The Sunflower AZM No. 01 and No. 02 will be completed with a fluid sampling capability at a depth corresponding to the first laterally continuous water-bearing formation above the UCZ and will also monitor pressure in that zone. Table 5-8 provides the completion details for Sunflower AZM/IZM No. 01, which will be equipped with a tubing encapsulated conductor (TEC) cable with in-line pressure/temperature gauges to collect continuous pressure and temperature measurements for evaluating the rate of CO_2 plume and pressure front movement. Table 5-9 provides completion details for the Sunflower AZM Nos. 01 and 02, which will monitor for pressure and geochemical changes above the UCZ. Schematics of the wells are provided in *Appendix E-2*.

The Sunflower AZM/IZM No. 01 will be completed centrally with respect to the three injection wells (Figure 5-4) for direct measurements of pressure and temperature in the injection zone.

The Sunflower AZM No. 01 and No. 02 will be equipped with a tubing-equipped U-tube fluid sampling device or similar sampling device. The above-zone reservoir will be accessed through perforations. The U-tube enables the collection of fluid samples from the above-zone monitoring interval, including any dissolved gases present under original reservoir pressure and temperature

conditions. The U-tube samples will be collected in a pressurized cylinder to maintain gas pressure in the fluid sample for analysis. The samples will be depressurized in a controlled laboratory environment and the gas samples collected and analyzed for chemical composition.

Once operations commence, groundwater samples will be collected from the first laterally continuous water-bearing zone above the UCZ via Sunflower AZM No. 01 and No. 02 for analysis of geochemical concentrations—on a quarterly frequency for the first 2 years and annually thereafter for the remainder of the operational period.

Continuous pressure and temperature measurements will be recorded for semiannual reporting using a downhole pressure gauge in the Sunflower AZM/IZM No. 01 (illustrated in *Appendix E-2* as a TEC cable and gauges mounted behind the casing). Pressure measurements will be recorded for semiannual reporting in the Sunflower AZM No. 01 and 02.

No additional monitoring wells were deemed necessary at this time based on the model-predicted CO_2 plume movement and proposed monitoring program, the significant porosity/permeability thickness and layering present in the injection zones, and the extensive UCZ present at the site. In the event of unexpected CO_2 plume migration, the location of additional monitoring wells will be proposed through a revision to this Testing and Monitoring Plan as part of a corrective measures plan.

Table 5-8 – General Completion Details for Sunflower AZM/IZM No. 01

Monitoring Well Location Info	Sunflower AZM/IZM No. 01
NAD 83 (2011) Latitude	30.0458065
NAD 83 (2011) Longitude	-94.436313
Total Depth	7,951 ft MD

*MD – measured depth

Table 5-9 – General Completion Details for Sunflower AZM No. 01 and No. 02

Monitoring Well Location Info	Sunflower AZM No. 01	Sunflower AZM No. 02
NAD 83 (2011) Latitude	30.0203561	-94.4656553
NAD 83 (2011) Longitude	30.0485108	-94.4219283
Total Depth	3,365 ft MD	~3,365 ft MD

Monitoring Well Location Info	Sunflower AZM No. 01	Sunflower AZM No. 02
Screened interval	~3,000 ft MD	~3,000 ft MD

*MD – measured depth

Two injection wells will also be equipped with fiber which provides temperature monitoring capability. This will allow ExxonMobil to monitor for anomalous changes in temperature which could be indicative of potential loss of containment.

5.5.5 Plume and Critical Pressure Front Monitoring

ExxonMobil plans a two-phased strategy for meeting the requirement for plume tracking consistent with 16 TAC **§5.206(j)(2)(E)**. For the initial period of operation, the rate and direction of CO_2 plume migration will be based on a combination of continuously recorded temperatures and pressures at a combination of the three injection wells and the one in-zone/above-zone monitoring well. Indirect monitoring will be performed using periodic time-lapse seismic imaging. Additionally, ExxonMobil will be exploring the adoption of emergent technologies to support plume monitoring. The Sunflower AZM No. 01 and No. 02 will be equipped with fluid sampling capabilities for above-zone fluid collection. Table 5-3 provided a summary of direct and indirect plume and pressure front monitoring technologies.

5.5.5.1 Direct Monitoring

The proposed Sunflower Project Injection Wells No. 01 through No. 03 will be equipped to continuously monitor the pressure in the active completed injection intervals as shown in *Appendix D-1* of *Section 4 – Well Construction Plan and Operating Conditions*. The continuous pressure and temperature measurements will be used to characterize injection well pressure at that location, as well as the cumulative pressure response from the other wells completed in the injection zone.

Any periods of shut-in for an injection well may be observed and treated as a falloff test by recording the shut-in wellhead pressure, bottomhole pressure, and temperature readings. This information, together with the continuous measurements obtained during regular operating conditions, will aid in updating the CO_2 plume reservoir models and plume growth forecasts.

5.5.5.2 Indirect Monitoring: Time-Lapse Seismic Surveys

ExxonMobil considers time-lapse seismic analysis to be a proven method for imaging subsurface changes from oil and gas production and enhanced oil recovery (EOR). This methodology has been applied previously by Denbury Inc. in the Frio Formation at a Gulf Coast EOR field (Holmes et al., 2023) to monitor the movement of injected CO_2 through time.

ExxonMobil will use periodic seismic data acquisitions and time-lapse data analysis as the primary indirect method for tracking the CO_2 plume migration for the Sunflower Project, consistent with the operation monitoring requirements specified in 16 TAC **§5.206(j)(2)(E)**. Existing 3D-seismic

data represents the pre-injection subsurface conditions and will serve as the reference point for time-lapse data analysis. *Section 1.5.1* presents a description of the existing 3D-seismic data (baseline survey). Monitor surveys will be acquired during the injection stages at a frequency discussed below that will demonstrate conformance between the reservoir model simulation and site performance. An adaptive approach will be applied to monitor survey acquisition timing if the data collected during the injection period shows results within the expected range. An ongoing dialogue between ExxonMobil and the UIC Director is envisioned, marked by tying the monitoring plan potential revisions to the AoR reevaluation frequency, in adherence to reporting requirements.

For the Sunflower Project, the timing of Monitor Survey No. 01 will occur within the first 1–3 years of operation. Should at any time the acquisition of indirect monitoring data suggest deviation from expected behavior for compliance with the permits, ExxonMobil will discuss with the UIC Director and take appropriate action.

Monitor Survey No. 02 will occur approximately 6–8 years after Stage 1 start-up.

Monitor Survey No. 03 will occur at the end of injection after approximately 11 years of operations. Monitor Survey No. 03 will yield the indirect measurement of the extent of the CO_2 plume at the start of the PISC period.

A significant amount of direct and indirect monitoring data will be available by the end of the active injection period and conclusions will have been made regarding the predictive capabilities of the CO_2 plume and pressure front subsurface dynamic model for both the Upper Frio Sand and the Fleming Sand injection intervals. ExxonMobil expects the model will be a reliable predictor of the growth rate and extent of CO_2 saturation and pressure plumes. If additional seismic surveys are necessary during the PISC period to improve the model's predictive capability or show CO_2 plume stability, ExxonMobil will communicate with the UIC Director on the nature and timing of such contingent surveys.

In summary, ExxonMobil proposes the following seismic survey schedule:

- Baseline Survey: data already obtained and reprocessed leveraging EM high standards for site characterization and to represent pre-injection subsurface conditions
- Monitor Survey No. 01: to be acquired 1–3 years from the start of injection operations
- Monitor Survey No. 02: to be acquired 6–8 years from the start of injection operations
- Monitor Survey No. 03: to be acquired at the end of injection operations, 11 years from commencement of injection operations
- Contingent Additional Monitor Surveys During Operational and PISC Phases: to be determined based on the results from direct and indirect monitoring and model prediction.

The time-lapse seismic data collected will also be used to monitor for CO_2 in the groundwater formation directly above the storage reservoir, utilizing data from the injection wells and the in-zone monitoring well, as an assurance-monitoring technique.

The timing of these monitor surveys will be refined in future updates of the monitoring plan. Over time, monitoring methods and data collection may be supplemented or replaced as advanced techniques are developed.

5.5.5.3 Seismicity Monitoring (Induced Seismicity)

Based on the projected operating conditions and regional and local geologic conditions, injection operations are not expected to result in an induced seismicity event mandating a response action. However, ExxonMobil has installed a permanent seismicity monitoring system onsite, which is being monitored by a third party to detect seismic activity prior to and during injection operations. This array has been recording baseline data since July 2026. The design of the array consists of a near-surface network of seismometers with continuous data sampling, incorporation of publicly available data, and telemetry to cloud-based storage. Near-real-time,high-resolution signal processing and quality assurance will be implemented for event detection, magnitude, and location accuracy. ExxonMobil will additionally receive notifications from USGS of recorded seismicity events for the site and surrounding area, should an event occur. If a review of the data indicates that the event was within a 5.6 mi radius of an injector ExxonMobil will notify the UIC Director to jointly determine if the events are likely to be associated with the operations, and, if so implement response actions for seismicity events contained in Table 8-2 of *Section 8 – Emergency and Remedial Response Plan*.

Appendix E:

Appendix E-1: QASP

Appendix E-2: Sunflower AZM/IZM No. 01 and Sunflower AZM Nos. 01 and 02 Monitoring Well Schematics

References:

Holmes, G., Bongiovanni, N., Wulf, T. et al. April 2023. Time Lapse Seismic in a CO2 EOR Flood and Implications for CCS Reservoir Monitoring, GeoGulf 23 Conference, Abstract, Houston, TX, Award: Thomas A. Philpott Excellence of Oral Presentation

Appendix E – Testing and Monitoring

Appendix E – AS

Underground Injection Control – Class VI Permit Application for Sunflower Carbon Capture and Storage Project Injection Wells No. 01, No. 02, and No. 03

APPENDIX E – QUALITY ASSURANCE SURVEILLANCE PLAN

Sunflower Carbon Capture and Storage Project
Jefferson and Liberty Counties, Texas
ExxonMobil Low Carbon Solutions Onshore Storage, LLC
Amendment 2: May 2026

APPENDIX E – QUALITY ASSURANCE SURVEILLANCE PLAN

TABLE OF CONTENTS

E.1 Introduction 4
E.2 Scope and Objective for the QASP 4
E.3 Overview of ExxonMobil's Operations Control System 4
E.4 Alignment of Testing and Monitoring Plan with QASP 7
E.5 Criteria for Data Evaluation 7
E.5.1 Precision 8
E.5.2 Bias 8
E.5.3 Representativeness 11
E.5.4 Completeness 11
E.5.5 Comparability 11
E.6 Standards for Calibration of Instrument and Equipment 11
E.7 Data Management System and Acquisition 12
E.7.1 Acquisition of CO_2 Stream Monitoring Data 13
E.7.2 Acquisition of Corrosion Monitoring Data 14
E.7.3 Acquisition of Injection Well Performance Data 15
E.7.4 Acquisition of Groundwater Monitoring Data 17
E.7.4.1 USDW Monitoring 17
E.7.5 Sample Custody for CO_2 and Groundwater Samples 21
E.7.6 Acquisition of CO_2 Plume and Brine Pressure Front Tracking Data 21
E.8 Data Validation and Usability 22
E.9 Self-Assessment of QASP 23
E.10 References 25

Figures

Figure E-1 – Sunflower Project Location Map 6

Tables

Table E-1 – Summary of Testing and Monitoring Plan 9
Table E-3 – Representative Logging Tool Specifications 13
Table E-4 – Pressure Field Gauge – Central Injection Pad 13
Table E-5 – Typical Summary of Sample Containers, Preservation Treatments, and Holding Times for CO_2 Gas Stream Analysis 14
Table E-6 – Summary of Analytical Parameters for CO_2 Stream 14
Table E-7 – Summary of Analytical Parameters for Corrosion Coupons 15
Table E-8 – Summary of Measurement Parameters for Field Gauges 16
Table E-9 – Field Stabilization Criteria for USDW Well Sampling 17
Table E-10 – Summary of Sample Containers, Preservation Treatments, and Holding Times for Groundwater Samples 18

Table E-11 – Summary of Analytical and Field Parameters for Fluid Samples in USDW and Above the UCZ 20
Table E-12 – Downhole Pressure and Temperature Gauge Specifications 21
Table E-13 – DTS Cable Specifications 22

Distribution Sheet

This Quality Assurance and Surveillance Plan (QASP) was prepared and approved by ExxonMobil for use in collecting information for the operation and compliance of the Sunflower Carbon Capture and Storage Project. ExxonMobil will incorporate the quality assurance and surveillance actions described in this document into the standard ExxonMobil operating program, as appropriate, for the control of work associated with the scope of data quality and detection monitoring for the project.

E.1 Introduction

ExxonMobil Low Carbon Solutions Onshore Storage, LLC (ExxonMobil) is proposing a Sunflower Carbon Capture and Storage (CCS) Project (Sunflower Project) in Jefferson and Liberty Counties, Texas. ExxonMobil proposes to inject approximately 25.3 million metric tons of CO_2 into the Fleming and Frio formations for geological storage of CO_2 using three injection wells over an 11-year period. Figure E-1 provides the location and layout of the project and the key features within and near the area of review (AOR).

Section 5 – Testing and Monitoring Plan of this Class VI permit application was developed for collecting data for tracking the CO_2 plume and brine pressure front within the AOR. The Testing and Monitoring Plan provided the strategy and details of the data collection program in compliance with the requirements of Title 16, Texas Administrative Code (16 TAC), Part 1, Chapter 5. The Quality Assurance and Surveillance Plan (QASP) is required pursuant to 16 TAC **§5.203(a)(4)** for the purpose of establishing data collection objectives and procedures related to data quality and consistency throughout the project life cycle: the pre-operational phase, the injection operations phase, and the post-injection site care and site closure phase. Some data collection activities were also referenced in *Section 4 – Well Construction Plan and Operating Conditions* and *Section 7 – Post-Injection Site Care and Site Closure Plan*. The QASP also established data quality protocols for those sections.

E.2 Scope and Objective for the QASP

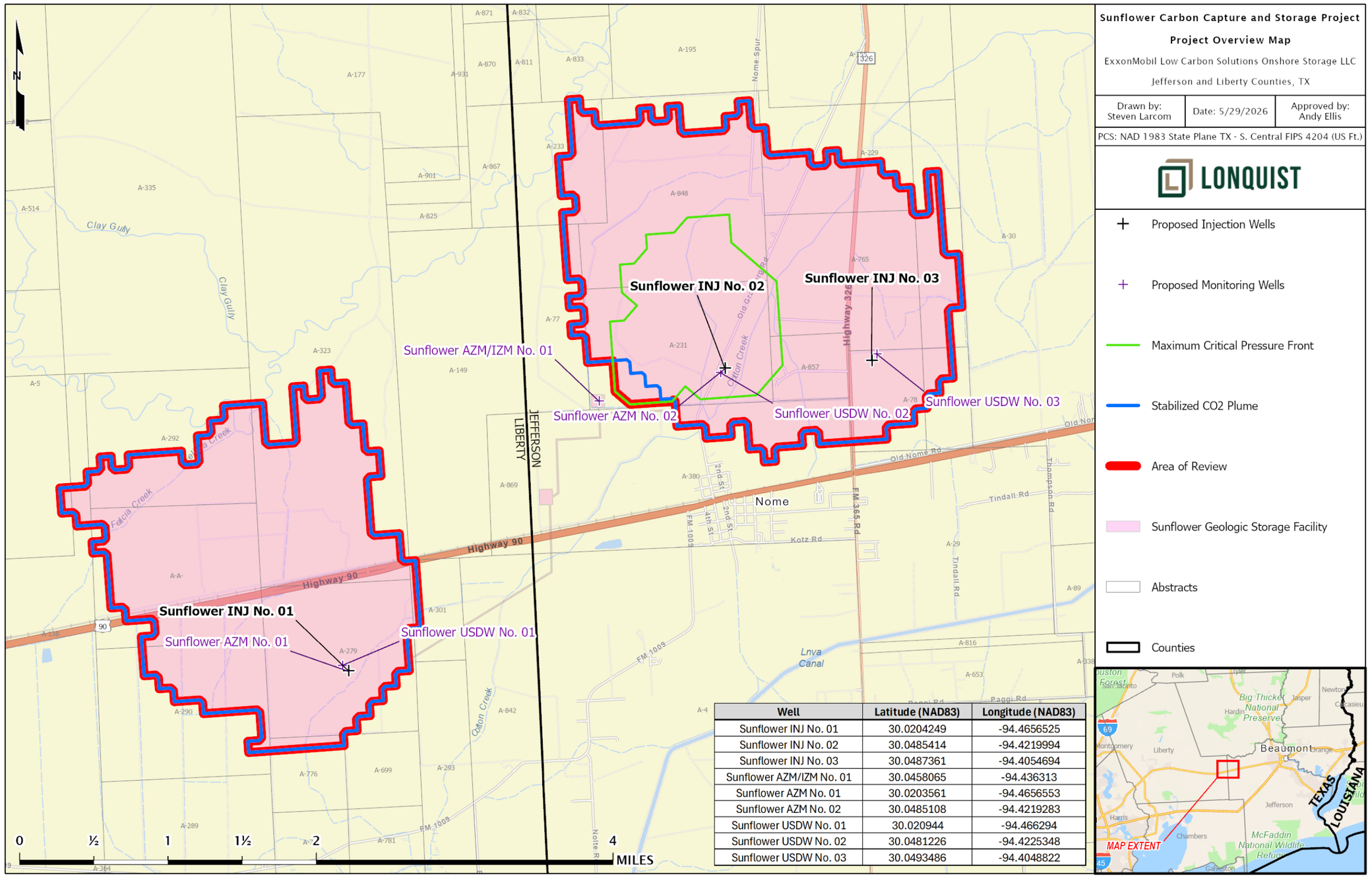
The scope of the QASP is based on the Testing and Monitoring Plan data collection activities for injectate monitoring; corrosion monitoring of the well's tubular, mechanical, and cement components; pressure falloff testing; groundwater quality monitoring; and CO_2 plume and pressure front tracking. The objective of the QASP is to provide standard procedures and practices that will be employed for collecting information and data related to the scope of activities. Quality assurance objectives were established for data management, sample collection and laboratory analysis, and reporting results as appropriate for ongoing monitoring for the Sunflower Project.

E.3 Overview of ExxonMobil's Operations Control System

The Sunflower Project will be operated remotely by ExxonMobil's Operations Control Center (OCC). Operating philosophies have been developed that will be incorporated into operating instructions for OCC operators. The OCC is also stewarded by a robust Control Room Management Program per 16 TAC **§8.1(b)(2)**. The OCC operates and monitors the facility through a Supervisory Control and Data Acquisition (SCADA) system. Additionally, Field Operations will make periodic visits to perform surveillance, maintenance, and integrity objectives. ExxonMobil will properly operate and maintain all facilities and systems to achieve compliance with permit conditions (16 TAC **§5.206 (o)(2)(D)**).

In alignment with the requirements for the QASP, the following testing and monitoring activities will be included in the operations control program:

- Mechanical integrity test methods
- Continuous recording of operational parameters during injection
- Corrosion monitoring
- Pressure falloff testing
- Monitoring of CO_2 stream
- CO_2 plume and pressure front tracking
    - Direct pressure front tracking
    - Plume tracking using indirect geophysical techniques
- CO_2 plume tracking using groundwater monitoring data
    - USDW monitoring wells
    - In-Zone and Above-Zone monitoring wells



Well	Latitude (NAD83)	Longitude (NAD83)
Sunflower INJ No. 01	30.0204249	-94.4656525
Sunflower INJ No. 02	30.0485414	-94.4219994
Sunflower INJ No. 03	30.0487361	-94.4054694
Sunflower AZM/IZM No. 01	30.0458065	-94.436313
Sunflower AZM No. 01	30.0203561	-94.4656553
Sunflower AZM No. 02	30.0485108	-94.4219283
Sunflower USDW No. 01	30.020944	-94.466294
Sunflower USDW No. 02	30.0481226	-94.4225348
Sunflower USDW No. 03	30.0493486	-94.4048822

Figure E-1 – Sunflower Project Location Map

As part of the operations control plan for the project, an appropriate organizational structure, roles and responsibility matrix, and communications plan will be developed that comply with the requirements of the Class VI UIC permit, in coordination with the UIC Program director (UIC Director), for review and approval of the QASP.

E.4 Alignment of Testing and Monitoring Plan with QASP

The QASP identifies a comprehensive list of quality assurance procedures that align with the data collection and testing requirements identified in the Testing and Monitoring Plan. Table E-1 provides a summary of each test and monitoring activity in the Testing and Monitoring Plan and the associated feature described in the QASP—including the source of the data or measurement, method of data acquisition, and use of an accredited third-party laboratory for analysis, as appropriate. ExxonMobil intends for proper use, maintenance, and installation of monitoring equipment and/or methods.

Many of the measurements rely upon the use of field instrumentation. Table E-2 summarizes a list of the instruments planned for use and the data acquisition objectives for each instrument. The indirect monitoring technique for tracking the CO_2 plume is time-lapse seismic monitoring. As outlined in *Section 5 – Testing and Monitoring Plan*, a series of seismic surveys are planned to acquire seismic data for analysis. The seismic surveys will be acquired and processed by a qualified third-party contractor, and the resultant seismic data will be provided to ExxonMobil for analysis.

E.5 Criteria for Data Evaluation

Groundwater monitoring and sampling is subject to potential sources of variability, such as the following:

- Natural heterogeneity in fluid geochemical composition, total dissolved solids, and formation pressure and temperature
- Instrument variability due to calibration and drift during sampling or analytical activity
- Alternating staff/accredited labs responsible for collecting/analyzing samples
- Changes in environmental conditions during field sampling activities including temperature, rainfall, dust, nearby agricultural activities
- Typographic errors related to data input

The following criteria are provided to help identify instances when variability has been introduced during the sampling and analysis phase and is not related to actual changes in groundwater quality conditions. These criteria and/or others will be considered not only when evaluating the data usability for data qualification (if warranted) and reporting data quality, but also for decision-making purposes.

E.5.1 Precision

Precision for physical and analytical measurement parameters is detailed within the individual laboratory's test methodology and within established detection limits. Laboratory equipment calibration and maintenance are described by the individual laboratory in a typical analytical quality assurance manual or its equivalent. Following laboratory selection, the laboratory's analytical quality assurance manual can be provided upon request. Laboratory assessment of analytical precision will be the responsibility of the individual laboratories per their standard operating procedures and the analytical methods being used.

E.5.2 Bias

An assessment of bias is applicable to laboratory analyses where a difference between the reference value and the average of measurements made on the same sample can be quantitatively measured. The potential for bias is not applicable in direct measurements including logging, temperature, and pressure. Evaluation of analytical bias will be the responsibility of the individual laboratories per their analytical quality assurance manual or equivalent. Analytical results received from individual laboratories will be reviewed to evaluate the potential for analytical bias.

Table E-1 – Summary of Testing and Monitoring Plan

Measurement	Purpose	Location(s)	Project Phase and Frequency			Descriptive Features in QASP		
			Pre-Injection	Operation	Post-Injection Site Care	Data Source Type	Method of Data Acquisition	Lab/Custody Procedures
CO_2 stream analysis	CO_2 stream composition	Central pad	Baseline	Quarterly for first two years then semiannually	NA	One sample	Chemical analysis	Accredited laboratory receiving samples under chain of custody
CO_2 stream temperature	Monitor injection temperature	Central pad	Baseline	Continuous	NA	Temperature gauges	Direct measurement	None
Injection rate, density, and mass	Rate and volume monitoring	Central pad	NA	Continuous	NA	Coriolis flow meter	Direct measurement	None
Injection pressure	Compliance with operating permit	Surface, injection well piping	NA	Continuous	NA	Pressure gauge	Direct measurement	None
Annular pressure	Pressure monitoring and well integrity	Sunflower INJ No. 01, No. 02, and No. 03	NA	Continuous	NA	Pressure gauge	Direct measurement	None
Corrosion monitoring	Well integrity	Central pad downstream of metering skid	NA	Quarterly	NA	Corrosion coupon	Physical analysis	Accredited laboratory receiving samples under chain of custody
Internal mechanical integrity	Well integrity	Sunflower INJ No. 01, No. 02, and No. 03	Baseline	Once every 5 years	Prior to P&A	Pressure gauge	Direct measurement	None
External mechanical integrity	Well integrity	Sunflower INJ No. 01, No. 02, and No. 03	Baseline	Continuous and Annually with logs	Prior to P&A	DTS or Temperature surveys or Pulsed neutron log /OA log	Direct measurement	None
Containment and control	Assess CO_2 plume and brine pressure-front containment by monitoring above UCZ	Sunflower USDW No. 01, No. 02, and No. 03, and Sunflower AZM No. 01 and No. 02;	Baseline	Quarterly for first 2 years then annually	Annual	One sample per well	Direct measurement	Accredited laboratory receiving samples under chain of custody
Direct CO_2 plume/pressure front tracking	Demonstrate compliance with permit and calibrate plume model	Sunflower INJ No. 01, No. 02, and No. 03; Sunflower AZM/IZM Well No. 01	Baseline	Continuous	Continuous for Sunflower AZM/IZM Well No. 01	Downhole tubing-mounted pressure and temperature gauge Downhole casing-mounted pressure and temperature gauge	Direct measurement	None
Indirect CO_2 plume tracking	Demonstrate compliance with permit and calibrate plume model	Time-lapse seismic surveys	Baseline survey	Three monitor surveys	Contingent	Time-lapse seismic monitoring	Indirect measurement	None
Seismic event monitoring	Determine if CO_2 injection is inducing any seismic events to occur	Seismometers in and around the AOR	Continuous	Continuous	Continuous	Passive seismicity monitoring	Continuous	None
Pressure falloff testing	Assess injection well performance and formation permeability	Sunflower INJ No. 01, No. 02, and No. 03	NA	At least once every 5 years	None	Downhole tubing-mounted pressure and temperature gauge	Direct measurement	None

DTS = distributed temperature sensing; NA= not applicable; OA = wireline-deployed oxygen activation (OA) log; P&A = plugging and abandonment; UCZ = upper confining zone

Table E-2 – Summary of Field Instrumentation

Monitoring Location	Instrument Type	Compliance Objective
Central pad before distribution system	Pressure and temperature gauge	Monitor the pressure and temperature of the CO_2 stream at the point of intake prior to distribution.
	Coriolis flow meter	Measure the mass flow rate of the CO_2 stream at the point of intake prior to distribution to the wellheads.
	Corrosion coupons	Measure corrosion rates for well-completion materials downstream of metering skid.
Sunflower INJ No. 01, No. 02, and No. 03	Downhole tubing-mounted pressure/temperature gauge	Measure pressure and temperature in the four injection intervals during operation and prior to injection-stage changes and for CO_2 plume and pressure front tracking
	Annular pressure testing	Measure tubing casing pressure to assess internal mechanical integrity.
	Fiber optic cable for DTS measurements	Measure temperature both in and above the injection zone to assess the potential for loss of containment. Fiber optic line will be installed from surface to approximately 150 feet from TD for INJ No. 2, and from surface to 50 feet below the Top Anahuac for INJ Nos. 1 and 3.
	Wellhead pressure gauge	Measure pressure inside the tubing at the wellhead.
	Coriolis flow meter	Measure the mass of the CO_2 stream at each injection well pad prior to injection tubing.
Sunflower USDW No. 01, No. 02, and No. 03,	Portable field meters for measuring groundwater stabilization parameters such as specific conductance, temperature, dissolved oxygen, turbidity, and pH	Measure field parameters prior to collecting groundwater samples to assess the stabilization of groundwater conditions in the screened interval prior to sample collection.
Sunflower AZM No. 01 and No. 02	Wellhead pressure gauge	Measure pressure in the first laterally continuous permeable and porous formation above the UCZ
	Wireline, U-tube assembly or portable field meters for measuring groundwater stabilization parameters such as specific conductance, temperature, dissolved oxygen, turbidity, and pH	Detection monitoring for presence of CO_2 in the first laterally continuous permeable and porous formation above the UCZ
Sunflower AZM/IZM No. 01	Tubing encapsulated conductor cable with in-line pressure/temperature gauges	Measure temperature and pressure in the four injection intervals and the first laterally continuous permeable and porous formation above the UCZ for CO_2 plume and pressure front tracking.
	DTS Interrogator and fiber cables	Measure temperature from the top of the UCZ to the bottom of the injection zone.
DTS = distributed temperature sensing; UCZ = upper confining zone		

E.5.3 Representativeness

Representativeness is the degree to which data expresses a characteristic of a population, parameter variation at a point, or an environmental condition. Representativeness for analytical results of groundwater samples will be estimated by ion and mass balances. Ion balances with ±10% error or less will be considered valid. Mass balance assessment will be used in cases where the ion balance is greater than ±10% to help assess the source of error. For a sample and its duplicate, if the relative percent difference is greater than 10%, the sample may be considered non-representative.

To assess sample representativeness, sample collection will be performed in accordance with EPA-recommended procedures for collection and preservation, as well as EPA-recommended holding times specified within a given method.

E.5.4 Completeness

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected under normal conditions. It is expected that the designated analytical laboratory will provide data meeting the quality control (QC) acceptance criteria for 90 percent or more for the samples tested. In addition to the laboratory internal quality assurance (QA)/QC processes, the sampling contractor will evaluate the data validation and whether samples meet the QC acceptance criteria. For direct pressure and temperature measurements, it is expected that data will be recorded no less than 90% of the time.

E.5.5 Comparability

Data comparability is defined as the degree of confidence with which one data set may be compared to another. The groundwater samples will be comparable if collection, compositing, splitting, and testing methods are the same and the measurement units are the same. Comparability for field measurements will be achieved if the test procedures and measurement units within each group of tests are the same (e.g., pH, conductivity, temperature). Operating procedures will be followed to ensure comparability, including those specified in published EPA guidance documents.

E.6 Standards for Calibration of Instrument and Equipment

The following standards for operation and care of field instruments and equipment are planned in support of quality assurance. Both field equipment and laboratory instruments will be calibrated in accordance with the manufacturer guidelines. Permanent data instruments will be calibrated prior to or during the installation process and then checked for precision and accuracy in accordance with the manufacturer's guidelines. Calibration of field instruments will consist of the measurement of instrument response to standards of known composition and concentration and may include the preparation of a standard response curve for the compound or parameter at different concentrations.

Portable field instruments will be maintained in accordance with the procedures and schedule prescribed by the manufacturer to enable the collection of precise and accurate data. Field instruments and equipment will be acquired, inspected, and accepted for the field activity. Inspections will be conducted prior to use in accordance with the operational manuals.

E.7 Data Management System and Acquisition

Data, in the form of measurements and information about the performance of the injection system, will be collected electronically or manually and stored in an electronic data management system. This system will be aligned with the compliance requirements of the Class VI UIC permit. The electronic data collection systems are envisioned to be a part of the operational management program for the Sunflower Project. Manual data collection activities, such as groundwater monitoring, will be documented in either written or electronic data entry forms. The types of information collected include time and date of activity, person(s) performing the activity, location(s), equipment, calibration data, and field parameter values.

Overall project data quality will be managed through a system of reviews extending from field and laboratory through the data reduction and reporting process. ExxonMobil will perform a quality assurance review of the data entered into the data management system. Data acquired from the injection system may be uploaded directly into the data management system. Analytical results for CO_2 gas composition and groundwater will be obtained from the laboratory using electronic data deliverables. ExxonMobil will utilize its internal data management system for archiving project documentation, data security, and backup.

The following discussion presents the data acquisition plans for each major recording.

Acquisition of Well Completion Data

ExxonMobil employs a third-party contractor to conduct a series of tests on completed wells using downhole tools. The data obtained from these tools is used to assess the alignment of the actual well completion with the well design. Table E-3 provides a summary of representative logging tools and the anticipated data to be obtained from these tools. The quality assurance process is provided as part of the services of the third-party contractor. ExxonMobil reviews the provided test results and associated data quality reports to identify whether the data are fit for purpose.

Table E-2 – Representative Logging Tool Specifications

Parameter	Logging Speed	Vertical Resolution	Acquired Data	Temp. Rating	Pressure Rating
Ultrasonic casing/ cement inspection	400 to 4,500 ft/hr	0.3 to 6.0 in	Image of casing and cement throughout well completion	350°F	20,000 psi
Electromagnetic	600 to 900 ft/hr	Tubular defect location and resolution: • First tubular: 1 ft • Second tubular: 2 ft • Third tubular: 3 ft • Fourth tubular: 4 ft • Fifth tubular: 4 ft	Electromagnetic log of casing thickness	350°F	15,000 psi
Cement bond log	Up to 3,600 ft/hr	3 ft	Image of cement between casing and formation	350°F	20,000 psi
Caliper	1,800 to 3,600 ft/hr	0.12 in.	Log of inside diameter of casing	350°F	20,000 psi
Temperature log	NA	1.2 in. to 6 in. depending on sampling rate	Vertical temperature profile of well	350°F	20,000 psi

*psi – pounds per square inch

E.7.1 Acquisition of CO_2 Stream Monitoring Data

Table E-4 provides the pressure gauge data-quality specifications for gauges to be located at the central injection pad. Samples of the CO_2 will be collected to monitor the chemical composition in addition to monitoring the mass flow, temperature, and pressure of the CO_2.

Table E-3 – Pressure Field Gauge – Central Injection Pad

Parameter	Value
Calibrated working pressure range	0 to 4,000 psig
Initial pressure accuracy	+/-0.04% of span (1.6 psig)
Pressure resolution	+/- 0.000061% of span (0.244 psig)
Pressure drift stability	0.2% of upper range limit (8 psig) for 10 years

*psig – pounds per square inch gauge

Samples of CO_2 will be collected at the central pad using the sampling container types, preservation, and holding times provided in Table E-5. If multiple samples are collected, values will be averaged.

Table E-4 – Typical Summary of Sample Containers, Preservation Treatments, and Holding Times for CO_2 Gas Stream Analysis

Sample	Volume/Container Material	Preservation Technique	Sample Holding time (max)
CO_2 stream	(2) 2 L MLB polybags (1) 75 cc mini-cylinder	Sample cooler/cabinet	5 days

*L – liter; cc – cubic centimeter

The samples will be obtained at a sample port on the project's central pad and analyzed for the list of constituents and parameters in Table E-6. The central pad is the connection point between the CO_2 pipeline and the storage field's distribution system. The sampling station will be equipped with the ability to purge and collect a gas sample into a sealed container.

Table E-5 – Summary of Analytical Parameters for CO_2 Stream

Parameters	Analytical Methods[(1)]	Typical Detection Limit/Range	Typical Precisions
CO_2 Purity	GC/DID or Method 3A (Subtraction)	5%–10%	±5%
Water	GC/FTIR, Method 320, or EPA Method 4	1.0 ppm v/v / 100 ppm	±5%
Oxygen	GC/DID or Method 3A	1.0 ppm v/v / 5,000 ppm	±5%
Nitrogen	GC/DID or by difference	1.0 ppm v/v / 5,000 ppm	±5%
Sulfur Dioxide	GC	0.05 ppm v/v / 300 ppm	±5–10%
Oxides of Nitrogen	GC/DT	0.5 ppm v/v / 200 ppm	±5–10%
Hydrogen Sulfide	GC	1.0 ppm v/v /300 ppm	±5–10%
Total Hydrocarbons	GC/FID	0.1 ppm v/v / 10,000 ppm	±5–10%
Carbon Monoxide	GC	1.0 ppm v/v / 1,000 ppm	±5%
Methane	GC/DID	0.1 ppm v/v / 10,000 ppm	±5–10%

DID = discharge ionization detector; DT = drager tube; FID = flame ionization detector; FTIR = Fourier transform infrared spectroscopy; GC = gas chromatography; ppm = parts per million; v/v = volume/volume
[1] A suitable alternative analytical method may be used/identified by an accredited third-party laboratory.

The analytical methods, detection limit and range, and typical limits of precision are provided. The quality control requirements of the laboratory will be aligned for this project with the laboratory's certification process and may include routine calibrations.

E.7.2 Acquisition of Corrosion Monitoring Data

Monitoring of well tubing and casing material corrosion will be conducted on a routine basis to evaluate the corrosion coupon monitoring system. Table E-7 provides an analytical testing plan for the corrosion coupons. As shown, ExxonMobil plans to follow ASTM Standard G1-03 (2017) [e1] and recommendations of AMPP NACE SP0775-2023 (2023). Coupons will be sent to a qualified contractor for analysis that will use AMPP NACE SP0775-2023 for assessing coupons. The typical data reported includes length, width, thickness, weight (±0.5 milligrams [mg]), coupon identification number, exposed dimensions, and calculated surface area including the edges. The contractor will provide quality control documentation with the analytical report. Holding times and preservation techniques are not applicable to corrosion coupon samples, which are maintained as physically separated to prevent abrasion.

Table E-6 – Summary of Analytical Parameters for Corrosion Coupons

Parameters	Analytical Methods	Detection Limit/Range	Typical Precisions	QC Requirements
Mass and thickness	Baseline: ASTM G1-03 (2017) [e1] After Baseline: AMPP NACE SP0775-2023	±0.2 mg	±1%	Laboratory equipment calibration to manufacturer's specification
ASTM = American Society for Testing and Materials; AMPP = Association for Materials Protection and Performance; NACE = National Association of Corrosion Engineers				

E.7.3 Acquisition of Injection Well Performance Data

ExxonMobil will install and use continuous measurement devices to monitor injection pressure, rate, and mass injected; the pressure on the annulus between the tubing and the long string casing; and the temperature of the CO_2 stream, as required under 16 TAC **§5.206(d)(2)(F)(i)**, **§5.203(h)(1)(C)**, and **§5.203(j)(2)(B)**. Table E-8 provides a summary of the data acquisition and measurements limits. Data will also be collected to document the addition or removal of any fluid from the annulus system. ExxonMobil will utilize the following continuous monitoring devices:

- A Coriolis flow meter will be used to measure the flow rate at the central pad and compute flow rates for each injection well. The meter directly measures the mass flow rate of the injected fluid.
- The injected CO_2 stream pressure will be continuously monitored in the CO_2 flowline near the wellhead interface. The annulus pressure will also be continuously recorded. The combined wellhead and downhole monitoring data will be used to continuously characterize the injection stream in detail.
- Reservoir temperatures and pressures will be measured using a fiber optic cable, embedded in the cemented annulus of the long string casing, and a tubing encapsulated conductor pressure-and-temperature gauge on the injector well tubing.
- The annular pressure between the tubing and the injection casing string will be monitored on a continuous basis. The pressure gauge on the annulus will be tied into the data management system or a suitable equivalent system and set to alarm if pressure or

volumes move outside set tolerances. The annulus tanks are to be equipped with a level transducer and sight glass. If any annulus fluid is added or removed, it will be recorded. An annulus tank level is to be recorded on any day when injection occurs.

The calibration and operating methods will be based on the manufacturer's specifications. For the Coriolis flow meter, the calibration and operating methods will also include quarterly zero-flow verification and online diagnostics as well as an 8-year cycle of off-site laboratory calibration. The Coriolis flow meter will be out of service for short periods once per quarter for the zero-flow checks.

Table E-7 – Summary of Measurement Parameters for Field Gauges

Equipment/Location	Parameter	Value
Pressure Field Gauge – Pressure Gauge (Upstream of Choke)	Calibrated working pressure range	0 to 3,000 psig
	Initial pressure accuracy	+/-0.04% of span (1.2 psig)
	Pressure resolution	+/- 0.000061% of span (0.183 psig)
	Pressure drift stability	0.2% of upper range limit (8 psig) for 10 years
Pressure Field Gauge – Wellhead Pressure Gauge (Downstream of Choke)	Calibrated working pressure range	0 to 3,000 psig
	Initial pressure accuracy	+/-0.04% of span (1.2 psig)
	Pressure resolution	+/- 0.000061% of span (0.183 psig)
	Pressure drift stability	0.2% of upper range limit (8 psig) for 10 years
Pressure Field Gauge – Downhole Pressure Gauge	Calibrated working pressure range	200 to 10,000 psi
	Initial pressure accuracy	0.015 psi
	Pressure resolution	0.006 psi/sec
	Pressure drift stability	0.02 psi/year at max pressure and temperature
Temperature Field Gauge – Downhole Temperature Gauge	Calibrated working temperature range	25–150°C
	Initial temperature accuracy	0.5°C
	Temperature resolution	0.005°C/sec
	Temperature drift stability	0.1°C/year at max temperature
Mass Flow Rate Field Gauge – Coriolis Flow Meter at Central Injection Pad and Well Pad	Calibrated working flow rate range	0 to 200,000 kg/hr
	Initial mass flow rate accuracy	+/-0.1% of rate
	Mass flow rate resolution	Pulses +/-50 ppm
	Mass flow rate drift stability	At central injection pad: zero point stability – 32 kg/hr At well pad: zero point stability – 14 kg/hr
Temperature Transmitter – Downstream of Choke	Calibrated working temperature range	0–300°F
	Initial temperature accuracy	0.06°F
	Temperature resolution	0.000183°F

Equipment/Location	Parameter	Value
	Temperature drift stability	+/-0.1% of reading or 0.18°F, whichever is greater for 2 years

*kg/hr – kilograms per hour

E.7.4 Acquisition of Groundwater Monitoring Data

Samples of groundwater will be collected from Sunflower USDW No. 01, No. 02, and No. 03, - and from the first permeable water-bearing zone above the UCZ, in Sunflower AZM No. 01 and No. 02.

E.7.4.1 USDW Monitoring

For USDW sample collection, a decontaminated submersible pump equipped with new dedicated and disposable sampling tubing will be used. The tubing intake will be set in the middle of the screen interval. An in-line flow-through cell (AquaTROLL 6000 or similar) will be used to continuously monitor water-quality indicator parameters during well purging. A set of field measurements (Table E-9) will be collected to evaluate the trend in stability of certain parameters. The measured parameter values will be recorded in field sampling records and compared with the stabilization criteria listed in Table E-9.

Table E-8 – Field Stabilization Criteria for USDW Well Sampling

Field Parameter	Stabilization Criteria
pH	+/- 0.2 units
Temperature	+/- 3%
Specific conductance	+/- 3%
Dissolved oxygen	+/- 10%
Turbidity	Stabilized or <10 NTUs

*NTU – nephelometric turbidity unit

Once water quality parameters in the purged well have stabilized, groundwater samples will be collected using laboratory-provided sample containers. Each sample will be containerized and labeled at the time of collection. The label will contain a unique sample number identifying the sampling location and sample date. The individual sample containers will be placed in a cooler with packing material. Ice or chemical ice packs will be placed on top of the packing materials to maintain the applicable preservation temperature (typically less than 6°C and without allowing the sample to become frozen) while in transport to the laboratory. Sample containers and/or bags will be new and used as received from the selected laboratory. Table E-10 details specifications for sample containers, preservation techniques and holding times for groundwater samples. Table E-11 provides the analysis plan for groundwater samples.

Data precision for groundwater samples will be assessed by the collection and analysis of field duplicate samples. Field duplicates will be collected by taking a second sample using the same

collection method in the field at a given location immediately following the original sample. Differences between the original and duplicate samples are indicative of variability and/or error in the sampling technique. The frequency of field duplicates is at least one sample per sample group or 10% for sample sizes above 20 samples.

Decontamination procedures will be followed between sampling at each monitoring well to reduce the potential for cross-contamination of groundwater samples. Field equipment will be cleaned and rinsed per standard field decontamination procedures between sampling locations. Nitrile gloves will be worn during groundwater sampling activities and while handling sample containers. The sampler will remove waste associated with sampling activities (tubing, personal protective equipment, consumables) from the Sunflower Project area.

For each sampling event, the field sampling activities will be recorded at each sampling location, with calibration of field instruments, details of well purging process, field parameter measurements, sample collection date and time, QA/QC sampling, and details of sample handling, storage, and shipping. The samples will be shipped under a chain of custody process, signed by the sampler, and upon transfer of custody to a commercial delivery service or the laboratory, tracking information will be retained. The samples will be shipped to one or more accredited laboratories for analysis.

First Water-Bearing Zone Above UCZ

Sunflower AZM Nos. 01 and 02 will be equipped with the capability to sample fluids. The above-zone reservoir will be accessed through perforations. The sampling depth will correspond to the first laterally continuous permeable and porous formation above the UCZ. Actual sampling depth will be determined based on the as-drilled depths. Monitoring will be quarterly for the first 2 years and then annually for the remainder of the operational phase.

Table E-9 – Summary of Sample Containers, Preservation Treatments, and Holding Times for Groundwater Samples

Target Parameters	Volume/Container Material	Preservation Technique	Sample Holding Time
EPA Method 6020A Dissolved cations (As, Ba, Ca, Fe, Mg, Mn, Pb, K, Na, Zn)	1 liter, plastic	0–6°C	60 days
EPA Method 300.0 Dissolved anions (HCO_3, Br, Cl, NO_3, SO_4)	1 liter, plastic	0–6°C	28 days
Method SM 2540C Total dissolved solids	1 liter, plastic	0–6°C	7 days
Method SM 2320B Alkalinity Bicarbonate (HCO_3)	500 mL, plastic	0–6°C	7 days
RSK-175 Gas composition (CO_2)	Three 40 mL VOA vials	0–6°C	14 days
RSK-175 Gas composition (CH_4)	Two 40 mL VOA vials	0–6°C, hydrochloric acid	14 days
Calculated from TKN Method 351.2 Nitrite/Nitrate 353.2	Three 250 mL, plastic	0–6°C, sulfuric acid	48 hours
Field Methods: Electrical conductivity, temperature, pH, DO, ORP, turbidity	Field measurement	Not Applicable	Not Applicable
Note: The listed sample container sizes and preservation techniques may be revised based on input from the accredited laboratory selected to do the work. DO = dissolved oxygen; ORP = oxidation-reduction potential; VOA = volatile organic analysis			

Table E-10 – Summary of Analytical and Field Parameters for Fluid Samples in USDW and Above the UCZ

Parameters	Analytical Methods [1,2]	Typical Detection Limit or Range [3]	Typical Precisions [3]	QC Requirements [2]
Dissolved cations: As, Ba, Ca, Fe, Mg, Mn, Pb, K, Na, Zn	EPA Method 6020A	0.001 to 2 mg/L [4]	±20%	Daily calibration; blanks, duplicates, and matrix spikes at 10% or greater frequency
Dissolved anions: HCO_3, Br, Cl, NO_3, SO_4	EPA Method 300.0	0.001 to 2 mg/L [4]	±20%	
Total dissolved solids	Method SM 2540C	10 mg/L	±20%	
Alkalinity Bicarbonate (HCO_3)	Method SM 2320B	2 mg/L	±200%	
pH (field)	Field measurement	2–12 s.u. [5]	±0.2	Factory calibration and user calibration per manufacturer's instructions, duplicates
Electrical conductivity (field)	Field measurement	0–100 mS/cm [5]	±1%	
Temperature (field)	Field measurement	-10 to -55 °C [5]	±0.10	
Dissolved oxygen (field)	Field measurement	0-50 mg/L	±0.10 mg/L	
Gas composition (CO_2)	RSK-175 or ASTM D513-16 [6] depending on laboratory availability	0.1 µg/L	±25%	Daily calibration; blanks, duplicates, and matrix spikes at 10% or greater frequency
Gas composition (CH_4)	RSK-175	0.1 µg/L	±20%	
Gas composition (N_2)	TKN Method 351.2; Nitrite/Nitrate 353.2; or RSK-175 depending on laboratory availability	0.1 mg N	±20%	

[1] An equivalent method may be employed with the prior approval of the UIC Director.
[2] The listed analytical methods and QC requirements may be revised based on input from the accredited laboratories or field instrumentation selected to do the work.
[3] The exact detection limit, range, and precision can vary depending on the sample matrix and the conditions under which the analysis is performed. Precision may also be affected by equipment utilized in analytical procedures by the laboratory.
[4] These are analyte, dilution, and matrix dependent.
[5] These are dependent on manufacturer specification and calibrated range.
[6] ASTM 2017b
µg/L = micrograms per liter; mg N = milligrams nitrogen; mS/cm = milliSiemens per centimeter

E.7.5 Sample Custody for CO_2 and Groundwater Samples

Possession of samples collected in the field will be traceable from the time of collection until analysis in the laboratory. The chain of custody (COC) form will be completed daily for samples collected during the sampling event and will include project name and number, sample identification number and location, name(s) of individual(s) who collected the sample(s), type of sample, number and type of containers, date and time of collection, required analyses, preservatives, shipping or courier data, and signatures documenting transfer of sample custody. From sample collection through laboratory analysis to the final evidence files, the procedures for sample handling and custody are described below. The method for demonstrating custody is that a sample or evidence file is in one's custody if it is:

1. In one's physical possession.
2. In one's view during their possession.
3. In one's physical possession and placed in a secured location.
4. In a secured area restricted to authorized personnel only.

The COC form is typically provided by the laboratory with the sample kit. Once the sample containers are filled, the COC form will always accompany the sample. Individuals receiving and relinquishing the samples will sign, date, and note the time of transfer on the record. A commercial delivery service will be identified by company name. Samples will remain in the physical possession of the person to whom they are assigned until the samples are shipped to the laboratory or are stored prior to shipping. The COC form will accompany the samples to the laboratory.

E.7.6 Acquisition of CO_2 Plume and Brine Pressure Front Tracking Data

Sunflower AZM/IZM Well No. 01 will be equipped with a tubing encapsulated conductor cable with in-line pressure/temperature gauges to collect continuous pressure and temperature measurements for evaluating the rate of CO_2 plume and pressure front movement. This system will also provide data for assessing internal mechanical integrity. Sunflower INJ No. 01, No. 02 and No. 03 will contain a downhole pressure/temperature gauge for monitoring. Table E-12 provides a list of pressure and temperature gauge specifications for Sunflower Project Injection Wells No. 01, No. 02, and No. 03, and Sunflower AZM/IZM Well No. 01.

Table E-11 – Downhole Pressure and Temperature Gauge Specifications

Parameter	Value
Calibrated working pressure range	200 to 10,000 psi
Initial pressure accuracy	0.015 psi
Pressure resolution	0.006 psi/sec
Pressure drift stability	0.02 psi/year at max pressure and temperature
Calibrated working temperature range	25–150°C

Parameter	Value
Initial temperature accuracy	0.5°C
Temperature resolution	0.005°C/sec
Temperature drift stability	0.1°C/year at 177°C
Max temperature	177°C
Instrument calibration frequency	Per manufacturer's specifications

This well and each CO_2 injection well will also be equipped with a DTS cable to assess external mechanical integrity. Table E-13 provides the specifications for the cable.

Table E-12 – DTS Cable Specifications

Parameter	Logging Speed	Vertical Resolution	Temperature Rating	Pressure Rating
Distributed Temperature Sensing	12 seconds	0.5-meter	-82–177°C	Not Applicable

E.8 Data Validation and Usability

Data validation procedures will be performed for both field and laboratory data to assess whether the requirements of the specified QC acceptance criteria were met. Checklists, forms, and calculations may be developed to meet the Class VI UIC permit requirements for the Sunflower Project. ExxonMobil and/or its designated contractor(s) will provide verification and validation of data generated with the project. This process may include the following elements:

1. Review the cover letter signed by the Laboratory Project Manager (or designee) to assess the laboratory narrative report regarding the overall performance of the laboratory and potential deviations or uncertainties in the data.
2. Review the case narrative discussing any technical problems or deviations from the analytical methods (e.g., did the laboratory receive the samples in good condition). Samples are considered in good condition if they meet temperature and preservative requirements, and the sample receipt condition is acceptable (i.e., the bottles are not broken and the cooler custody seals are intact).
3. Review date and time of receipt relative to holding time requirements.
4. Review COC forms to verify that samples were maintained under COC protocol with signatures from the field personnel and the lab personnel.
5. Compare sampling dates to sample extraction and analysis dates to check that these procedures were completed within proper holding times.
6. Review target constituent list, analytical methods, and result units for alignment with permit requirements.
7. Review lab summary/chronicle describing client ID/analysis, laboratory identification number, prep number, collection date, extraction/prep date, analysis date, and laboratory management sign-off.

8. Review sample data report including the results listed by analytical method with sample preparation, extraction, cleanup, digestion, and analytical methods; analysis and extraction dates; analyst initials; qualifiers; and qualifier definitions.
9. Review QC summary report including date of analyses, parameters assessed, system monitoring compound summary, method blank data, sample duplicates and control samples, surrogate spike recoveries, and matrix spike/matrix spike duplicate (MS/MSD) results.
10. Review the laboratory case narrative and any corrective actions necessary and data quality assessment items.

The data quality indicators of precision, accuracy, representativeness, completeness, comparability, and sensitivity associated with newly collected data will be reviewed and an assessment made regarding the usability of the data. Data validation may include the review and evaluation of multiple data characteristics including the unit(s) of measurement, sample holding times, and QA/QC results (such as field duplicates, trip blanks, matrix spike samples). After sufficient data have been collected, additional methods, such as those described in the EPA Unified Guidance (EPA 2009), may be used to examine variations and trends in the data.

If at any point the occurrence of erroneous data becomes apparent, corrective actions will be taken to identify the cause of the error, recommend a feasible corrective action, seek approval if needed to implement corrective action, and implement the corrective action. Field team members may identify problems during sampling, and laboratory analysts may identify problems during chemical analyses. Field staff will be responsible for testing equipment and performing corrective actions on broken or malfunctioning field equipment. If corrective action cannot be taken in the field, then equipment will be repaired or replaced. Significant corrective actions affecting analytical results will be documented in field activity reports and re-measurement/re-sampling may occur as appropriate.

E.9 Self-Assessment of QASP

The quality system described in the QASP will be assessed to reduce the potential for questionable data to be used in the demonstration of regulatory compliance. The scope of internal assessments may include the following:

- Surveillance of scheduled field activities including sample collection, sample handling, logging, and indirect data collection (e.g., seismic data)
- Review of laboratory data management activities
- Examination of data reporting systems
- Verification of instrument and equipment acceptability including maintenance and calibration frequency
- Reevaluation of analytical method implementation, including CO_2 stream and corrosion evaluation methods

- Evaluation of external organization/contractor adherence to application elements of this QASP

ExxonMobil may contract the collection of samples, conduct well logging, and perform other activities as outlined in the Testing and Monitoring Plan. Each organization gathering data will be responsible for conducting their internal assessments so that data acquisition is aligned with the Testing and Monitoring Plan. In the event that issues requiring corrective action are identified, those issues will be addressed, and corrective actions will be designed and implemented. Documentation of such corrective actions will be maintained in the archives of the data management system.

E.10 References

AMPP. 2023. Preparation, Installation, Analysis, and Interpretation of Corrosion Coupons in Hydrocarbon Operations. Standard NACE SP0775-2023.

ASTM (ASTM International). 2017a. "Standard G1-03(2017)[e1]: Standard Practice for Preparing, Cleaning, and Evaluating Corrosion Test Specimens."
[e1] – NOTE – Editorially updated references in Section 2 in December 2017

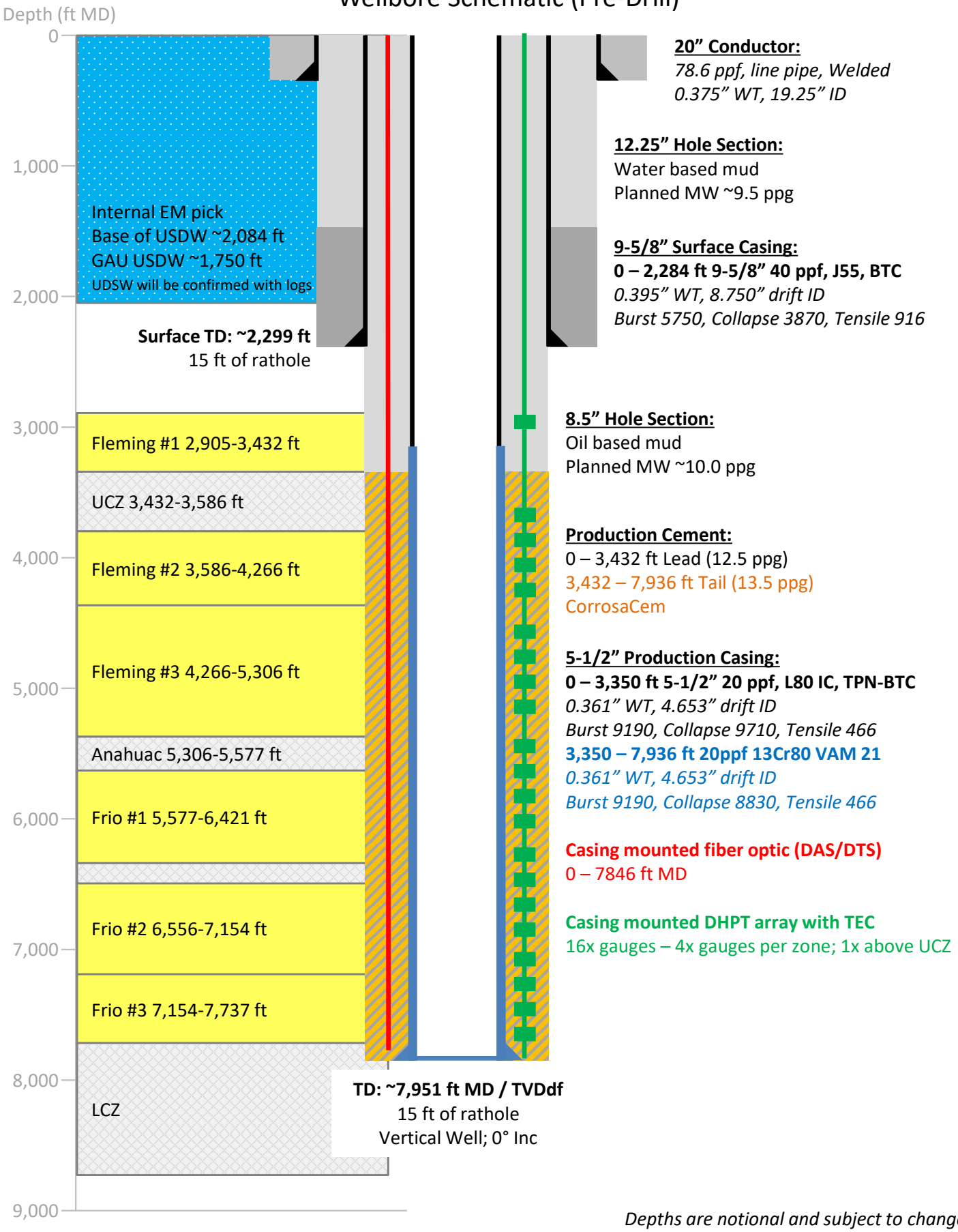
ASTM (ASTM International). 2017b. "Standard D513-16: Standard Test Methods for Total and Dissolved Carbon Dioxide in Water."

EPA. 2009. Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities Unified Guidance. EPA 530/R-09-007.

Appendix E2 – Sunflower A□M□I□M □ o□□□ and Sunflower A□M □ os□□□ and □□ Schematics

Sunflower AZM/IZM Well No. 01

Wellbore Schematic (Pre-Drill)



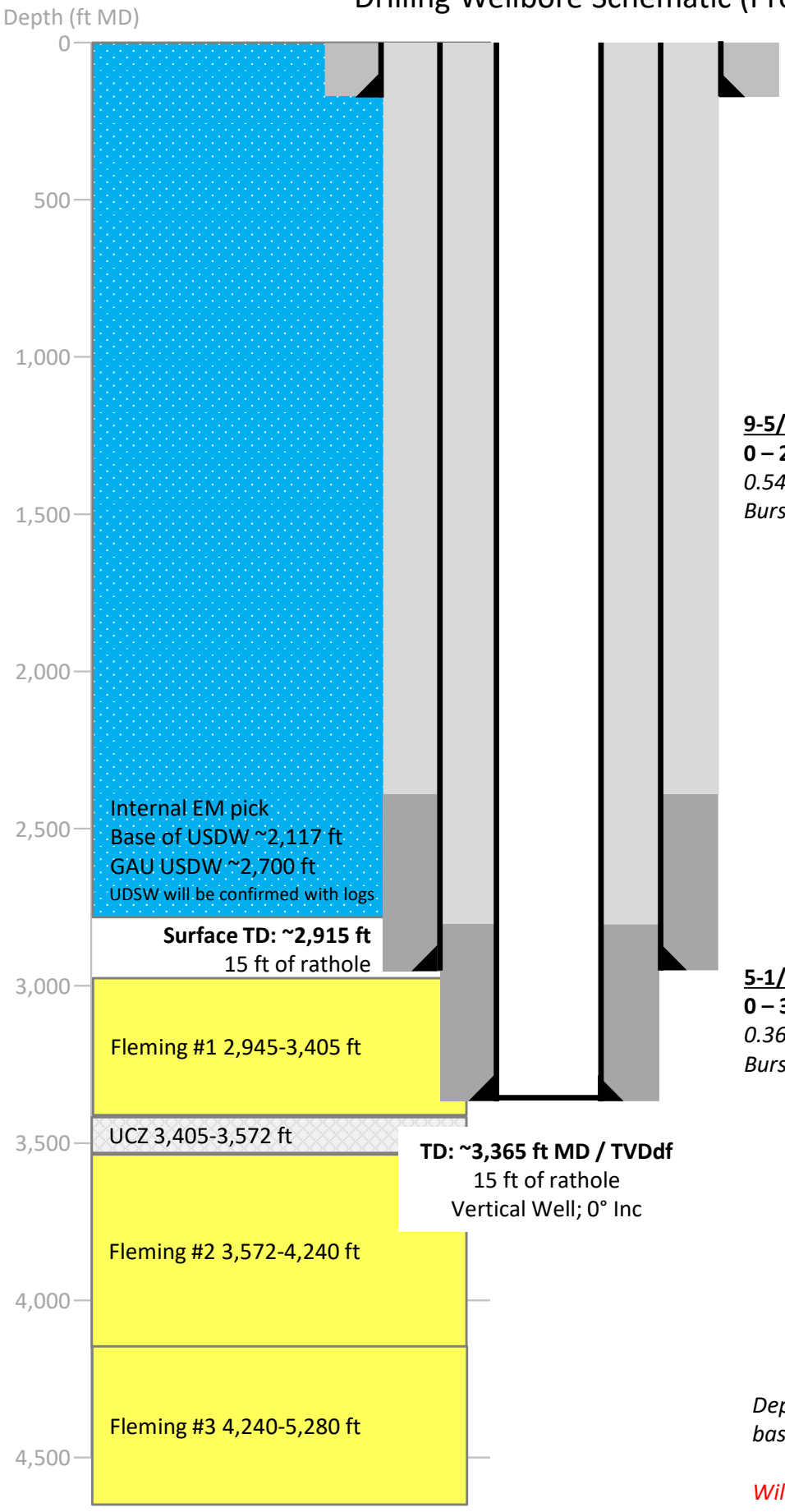
Depths are notional and subject to change based on as-drilled conditions

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Sunflower AZM Well No. 01 – Injector 1 Pad

Drilling Wellbore Schematic (Pre-Drill)



20" Conductor:
78.6 ppf, line pipe, Welded
0.375" WT, 19.25" ID

9-5/8" Surface Casing:
0 – 2,900 ft 9-5/8" 53.5 ppf, T95, VAM21
0.545" WT, 8.500" drift ID
Burst 9,410psi, Collapse 7,340psi, Tensile 1,477klb

5-1/2" Production Casing:
0 – 3,350 ft 5-1/2" 20 ppf, L80 IC, BTC-TPN
0.361" WT, 4.653" drift ID
Burst 9,190psi, Collapse 9,710psi, Tensile 466klb

Depths are notional and subject to change based on as-drilled conditions

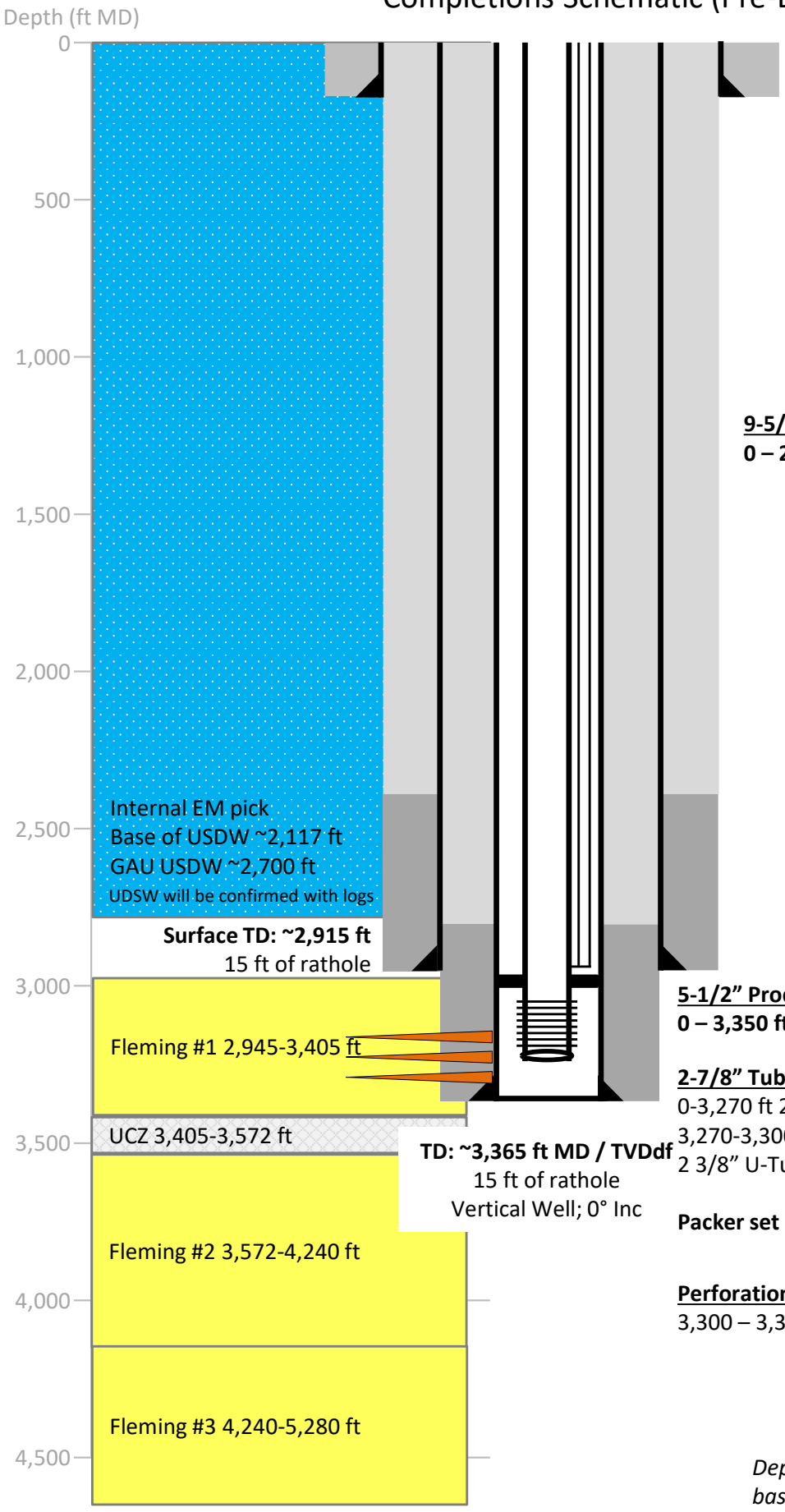
Will not plan to penetrate the UCZ

ExxonMobil

6/2/2026 3:18 PM

Sunflower AZM Well No. 01 – Injector 1 Pad

Completions Schematic (Pre-Drill)



20" Conductor

9-5/8" Surface Casing:
0 – 2,900 ft 9-5/8" 53.5 ppf, T95, VAM21

5-1/2" Production Casing:
0 – 3,350 ft 5-1/2" 20 ppf, L80 IC, BTC-TPN

2-7/8" Tubing
0-3,270 ft 2-7/8" 6.5 ppf L80 EUE 8RD
3,270-3,300 ft 2-7/8" 6.5 ppf L80 EUE 8RD Screen
2 3/8" U-Tube lines mounted to tubing from 0-3,250 ft

Packer set at 3,260 ft

Perforations:
3,300 – 3,320 ft (1st permeable sand above UCZ)

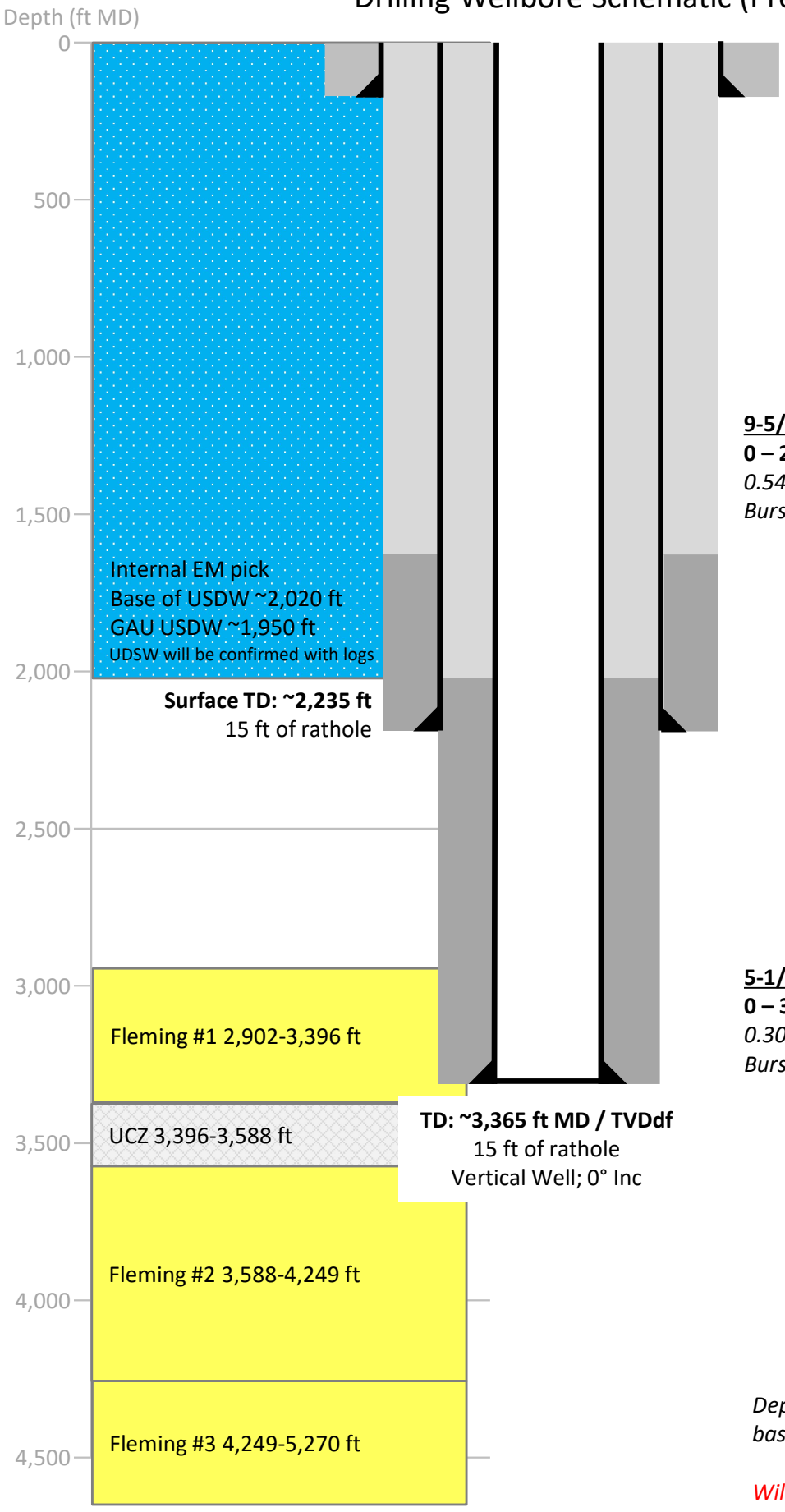
Depths are notional and subject to change based on as-drilled conditions

ExxonMobil

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Sunflower AZM Well No. 02 – Injector 2 Pad

Drilling Wellbore Schematic (Pre-Drill)



20" Conductor:
78.6 ppf, line pipe, Welded
0.375" WT, 19.25" ID

9-5/8" Surface Casing:
0 – 2,220 ft 9-5/8" 53.5 ppf, T95, VAM21
0.545" WT, 8.500" drift ID
Burst 9,410psi, Collapse 7,340psi, Tensile 1,477klb

5-1/2" Production Casing:
0 – 3,350 ft 5-1/2" 17 ppf, L80, VAM TOP HC
0.304" WT, 4.767" drift ID
Burst 7,740psi, Collapse 6,290psi, Tensile 397klb

Depths are notional and subject to change based on as-drilled conditions

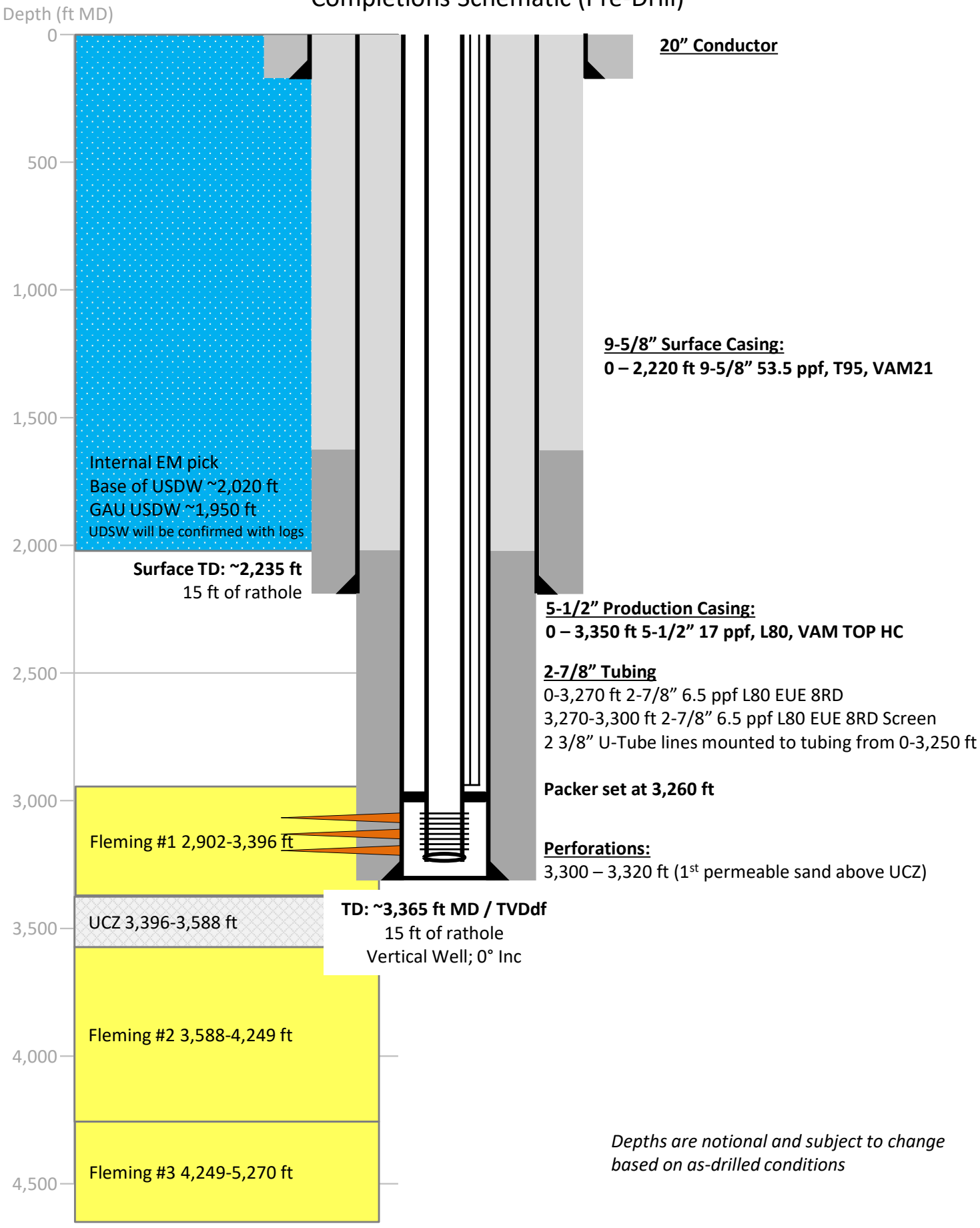
Will not plan to penetrate the UCZ

ExxonMobil

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Sunflower AZM Well No. 02 – Injector 2 Pad

Completions Schematic (Pre-Drill)



Depths are notional and subject to change based on as-drilled conditions

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Underground Injection Control – Class VI Permit Application for Sunflower Carbon Capture and Storage Project Injection Wells No. 01, No. 02, and No. 03

SECTION 6 – INJECTION WELL PLUGGING PLAN

Sunflower Carbon Capture and Storage Project
Jefferson and Liberty Counties, Texas
ExxonMobil Low Carbon Solutions Onshore Storage, LLC
Amendment 3: August 2026

SECTION 6 – INJECTION WELL PLUGGING PLAN

TABLE OF CONTENTS

6.1 Injection Well Plugging Plan 3
6.2 Objectives 3
6.3 Preparation of Wells Prior to Plugging 3
6.3.1 Flushing the Well with Kill Weight Fluid 4
6.3.2 Removal of Well Components and Obstructions 4
6.3.3 Planned Tests or Measures to Determine Bottomhole Pressure 4
6.3.4 Planned External MITs 4
6.3.5 CO_2-Compatible Materials 4
6.3.6 Planned Site Restoration Activities 7
6.4 Injection Well Zonal Isolation and Final P&A 8
6.4.1 Zonal Isolation and Intermediate Plug-Back Plan 8
6.4.2 Final P&A 8
6.5 Notifications and Record Keeping 12
6.6 Monitoring Well P&A 13
6.6.1 Plugging Details, Deep Monitoring Wells 13
6.6.2 Plugging Procedure for the Sunflower AZM/IZM No. 01 15
6.6.3 Plugging Procedure for the Sunflower AZM Nos. 01 and 02 15
6.6.4 Plugging Procedure for the Sunflower USDW Nos. 01, 02, and 03 16
6.7 Amendments to the P&A Plan 16

Figures

None

Tables

Table 6- 1 – External MIT Methods 4
Table 6- 2 – Common Cement Additives 7
Table 6- 3– Plugging Details for Injection Well No. 01 10
Table 6- 4– Plugging Details for Injection Well No. 02 11
Table 6- 5– Plugging Details for Injection Well No. 03 11
Table 6- 6– Plugging Details for Sunflower AZM/IZM No. 01 13
Table 6- 7– Plugging Details for Sunflower AZM No. 01 14
Table 6- 8– Plugging Details for Sunflower AZM No. 02 14

6.1 Injection Well Plugging Plan

ExxonMobil Low Carbon Solutions Onshore Storage, LLC (ExxonMobil) is undertaking the Sunflower Carbon Capture and Storage (CCS) Project (Sunflower Project) in Jefferson and Liberty Counties, Texas, to sequester CO_2 using three injection wells. This section for the Class VI Underground Injection Control (UIC) permit application for the proposed project was prepared to meet the requirements of Title 16, Texas Administrative Code (16 TAC), Part 1, Chapter 5, for plugging and abandonment (P&A) of the Sunflower CCS Project Injection Wells No. 01, No. 02, and No. 03. The purpose of the Injection Well Plugging Plan is to demonstrate the actions that ExxonMobil will take to mitigate potential impacts to underground sources of drinking water (USDWs) during the post-injection period.

For plugging the injection wells, ExxonMobil has selected materials that are compatible with the corrosive properties of the injection fluid to maintain the mechanical integrity of the plugs and well casing. The planned plugging procedures are aligned with best practices for restoring the upper confining zone (UCZ) integrity at each injection well location. As outlined in *Section 4 – Well Construction Plan and Operating Conditions*, ExxonMobil has a staged perforation schedule for the proposed injection wells to optimize the storage of CO_2. As a result, multiple injection-well workover events will be undertaken to isolate one injection stage to the next, prior to permanent abandonment operations. Once the storage capacity has been reached, the last injection stage and the remainder of the injection wells will be plugged for final abandonment.

6.2 Objectives

ExxonMobil will plug and abandon the proposed injection wells to restore the UCZ and provide a barrier sufficient to contain CO_2 and brine in the permitted injection zone—and to isolate the USDW.

The Injection Well Plugging Plan and procedures were designed to meet the following objectives:

- Measure the bottomhole reservoir pressure prior to conducting plugging activities (16 TAC **§5.203(k)(2)(B)**).
- Assess the mechanical integrity of the long string casing by using appropriate testing methods to demonstrate isolation consistent with 16 TAC **§5.203(k)(2)(C)**.
- Select the type, grade, and quantity of material to be used in plugging, to withstand contact with CO_2 and acidified liquids in the injection stages (16 TAC **§5.203(k)(1)(C)**).
- Detail the methods, locations, and types of plugs used within the wells (16 TAC **§5.203(k)(1)(B)** and **§5.203(k)(1)(D)**).

6.3 Preparation of Wells Prior to Plugging

ExxonMobil will repair deficiencies identified during the life of the proposed injection wells, to mitigate potential leaks to USDWs (16 TAC **§5.206(d)(2)(F)(ii)**). Historical mechanical integrity

test (MIT) data and prior remedial measures will be considered prior to plugging operations. If required, those remedial activities will be included in an amendment to this plan.

6.3.1 Flushing the Well with Kill Weight Fluid

Pressure control will be accomplished using kill weight brine that is weighted and compatible with the injectate and formation fluids. The kill weight brine fluids will be circulated through the injection wells to remove fluids or fine debris that could have a significant impact on the integrity of cementing operations (16 TAC **§5.203(k)(2)(C)**).

6.3.2 Removal of Well Components and Obstructions

Prior to plugging, uncemented and non-permanent components of the wells will be removed. The surface and long string casings will be cemented to the surface during well construction per *Section 4 – Well Construction Plan and Operating Conditions* and will remain in place.

6.3.3 Planned Tests or Measures to Determine Bottomhole Pressure

Prior to each interim plug-back from total depth and prior to permanent abandonment, ExxonMobil will measure the bottomhole reservoir pressure using either the downhole pressure temperature (DHPT) gauge installed above the packer or other suitable means of pressure measurements. The bottomhole reservoir pressure will be used to estimate the density of kill weight brine needed to establish static equilibrium prior to plug placement.

6.3.4 Planned External MITs

The MIT will be used to identify the potential for significant fluid movement in the casing, tubing, or packer toward the USDW (16 TAC **§5.203(h)**). ExxonMobil will conduct at least one of the tests listed in Table 6-1 as part of the monitoring program, to verify external mechanical integrity as required in 16 TAC **§5.203(k)(2)(C)**. [illegible]

Table 6- 1 – External MIT Methods

Test Description	Method of Testing
Temperature Log	Wireline Log
Distributed Temperature Sensing	Fiber Optic Reading
Casing Inspection Log	Wireline Log
Oxygen Activation Log	Wireline Log

The MIT results will be documented and provided to the UIC Program director.

6.3.5 CO_2-Compatible Materials

In accordance with 16 TAC **§5.203(k)(1)(A)** and **§5.203(k)(1)(C)**, a cement that is compatible with CO_2 will be used in all cement plugs. ExxonMobil will evaluate potential cement options prior to implementing the cementing operations, with the intent to provide a barrier that can withstand the temperature, pressure, and chemical interactions.

The compilation of published research, experimental data, and industry experience highlighted in American Petroleum Institute (API) Bulletin 5100 provides technical clarity on the suitability of ordinary Portland cement (OPC) as a well construction material for CCS applications and other environments where it may be exposed to CO_2. While chemical and physical alterations do occur in the presence of carbonic acid—a product of the reaction between CO_2 and water—the rate and depth of alteration are negligible for long-term storage objectives. The preponderance of literature referenced in the bulletin concludes that, when sound well construction and cement placement techniques are followed and operationally induced wellbore stresses are considered, the alteration of OPC by CO_2 does not compromise well integrity— making OPC a barrier material that is sound in environments with highly saturated CO_2. Additionally, the literature referenced in the bulletin states that where minor defects of mechanical damage are present, the reaction products of CO_2 and OPC can exhibit self-healing properties.

Beyond this overall conclusion, API Bulletin 5100 (2025) also states that, "*While current literature and experimental data support the use of OPC in CO_2-exposed applications, this conclusion does not eliminate the need to account for site-specific well conditions when designing and optimizing OPC barrier systems. Factors that can affect performance include temperature exposure; post-set well stresses; formation lithologies; formation fluid compositions; and CO_2 stream composition*" (Wu, Stiles and Gupta 2025). These factors are addressed below.

Regarding temperature exposure, the maximum anticipated bottom hole temperature expected for the Sunflower wells is ~170˚ F API Bulletin 5100 Table 1 – Summary of Experimental Results of Alteration Rates of OPC Under Influence of CO2, shows a test case at ~170˚ F run on Class H cement. Based on the experiment, a penetration depth of 0.79m after 10,000 years (0.079 mm/yr.) was predicted.

Furthermore, ExxonMobil conducted internal testing of the impact of CO_2 on cement at 30- and 90- day durations and presented results supporting the conclusions of API Bulletin 5100 (2025) at a March 2025 CCUS SPE conference. ExxonMobil's experiment-based prediction of the carbonation rate results in less penetration than the noted API 5100 example.

To further evaluate long term effects, ExxonMobil repeated internal testing on cement samples at 180 days. The 180-day testing reaffirmed the findings of the 30- and 90-day tests and further supported the conclustions presented in API Bulletin 5100. In fact, the longer term 180-day testing indicates that carbonization occurs more slowly than predicted by extrapolation of short term data, as there was no significant increase in carbonization depth between test intervals. Additionally, all tested speciemens maintained sufficient compressive strength to qualify as a barrier under API cement barrier requirements.

Importantly, alteration (penetration) should not be interpreted as degradation. Rather, it indicates the depth to which the cement and carbonic acid have reacted, or the depth to which carbonation of the cement has occurred. The reaction forms $CaCO_3$ (limestone) which is harder and less permeable than the original cement. Internal cement testing performed at 200^0F showed that the gas permeability of a Class H cement dropped from 0.016mD to 0.0015mD after 30 days of brine and CO_2 exposure. As per API Bulletin 5100 (2025), "*In practical terms, when OPC is used for zonal isolation in the annulus, the cement column is long enough that the extrapolated time required for CO_2 to migrate through the entire length of the cement sheath exceeds long-term storage objectives*."

Regarding stress, the primary stress will be from the original pressure test of the casing up to a maximum of 5000psi. Subsequent tests will be done to 200psi above injection pressure. The cement will be fully set at the time of pressure test with a minimum of eight hours waiting time. Note that while damage to the cement is not expected, cement bond logs will be run to verify cement quality and yearly mechanical integrity tests will be run to identify any potential behind pipe fluid migration.

Formation lithology across the injection interval consists of sand and shale intervals that will not impact the cement. Formation fluid is high salinity brine (100mg/L chlorides). The cement will not be exposed to the formation fluid during setting due to overbalance, mud filter cake, and cement fluid loss additive which aids in development of a filter cake for the cement. Once the well is perforated and cement is exposed to the brine, the chlorides in the brine will not react with the cement after it has been set.

Finally, the worst-case injection gas composition is CO_2: >97.0%, O_2: <50ppm, H_2S: <50ppm, SO_x: <15ppm | NO_x: <15ppm. API Bulletin 5100 (2025) addresses the interaction between the CO_2 and cement where a protective carbonated layer will develop which has lower permeability than the original cement. Cement is fully oxidized and O_2 will not react with it. To address H_2S and SO_x content in the injection gas, a high sulfate resistant Class H cement will be used to prevent post-set degradation due to sulfate alteration. Both H_2S and SO_x can react with the cement to form calcium sulfate (gypsum). Calcium sulfate then reacts with tricalcium aluminate in the cement to form a crystal that has potential to expand and impact cement quality. High sulfate resistant Class H cement limits the amount of allowable tricalcium aluminate in the cement to prevent significant sulfate damage. SO_x and NO_x mixed with water can lower the pH; however, the small amount available (<15ppm each) does not have a meaningful effect on the pH already altered by the CO_2.

Overall, both API Bulletin 5100 (2025) and ExxonMobil's internal testing support the conclusion that OPC-based cement systems remain suitable barrier materials for CO_2 service. The anticipated temperature, stress conditions, formation lithology, formation fluid composition, and injection gas composition for the Sunflower Facility fall within conditions for which OPC performance has been demonstrated to maintain long-term well integrity.

While ExxonMobil deems OPC as the fit for purpose technical solution for the Sunflower CCS Project justified and supported by API 5100 and ExxonMobil's own 30-, 60-, and 180-day testing which has been provided to the Texas Railroad Commission, presented and published at industry conference, and both having been summarized in this permit, CorrosaCem – or suitable equivalent - is being proposed for the plug across the UCZ to address regulator feedback on any uncertainty of approval through the permitting process with OPC at the confining zone. *Section 4.4.3* in *Section 4 – Well Construction and Operating Conditions* presents additional discussion on OPC.

A list of common cement additives is provided in Table 6-2 for the blended Portland cement, to improve setting time, reduce porosity, and improve overall strength if needed. Not all additives listed will be utilized. ExxonMobil will provide specifics at the time of plugging, including additives utilized and cement density, and will retain in the plugging reports duplicate samples of the cement used for each plug.

Table 6- 2 – Common Cement Additives

Additive Type/Category	Common Additives
Fluid-loss additive	• Cellulosic polymers • Polyamines • Sulfonated aromatic polymers • Polyvinyl pyrrolidone • Polyvinyl alcohol • Acrylamide methyl propane sulfonate copolymers and terpolymers • Bentonite • Latexes • Crosslinked polyvinyl pyrrolidone
Dispersant	• Polynapthalene sulfonate • Polymelamine sulfonate
Retarder	• Lignosulfonates • Hydroxycarboxylic acids • Cellulose derivatives • Organophosphonates • Certain inorganic compounds
Accelerator	• Calcium chloride • Sodium chloride • Sodium silicates
Antifoam agent	• Polyglycol ethers • Silicones

6.3.6 Planned Site Restoration Activities

After the injection wells have been plugged and abandoned, the wellhead equipment and surface facilities will be removed from the Sunflower Project site. The surface will be restored to a condition agreed upon by the landowner and by the UIC Director, as appropriate.

6.4 Injection Well Zonal Isolation and Final P&A

As discussed above, a plug will be set for injection zone isolation and the final P&A will occur at the end of the Sunflower Project. The following details outline the procedures for plugs to be installed. The volume and depth of the plugs will depend on the final geology and downhole conditions of the proposed injection wells as assessed during construction, as required by 16 TAC **§5.203(k)(1)(A)** and **§5.203(k)(1)(B)**.

6.4.1 Zonal Isolation and Intermediate Plug-Back Plan

The proposed injection wells will be completed in multiple intervals within the gross injection zone. Each injection interval will be used for a discrete period (or stage) as described in *Section 4 – Well Construction Plan and Operating Conditions*.

When a current completion interval has reached the end of its injection period for each well, that set of perforations will be isolated and abandoned. The general procedure for zonal isolation of completion stages within each injection well is defined below.

6.4.1.1 Pre-Zonal Isolation Activities

ExxonMobil will comply with reporting and notification provisions for the UIC Director, which require a 60-day advanced written notice before planned recompletion efforts are undertaken (16 TAC **§5.203(k)(3)(A)**). A similar notice of recompletion will be communicated to the Railroad Commission of Texas (TRRC).

Prior to initiating zonal isolation activities, the bottomhole reservoir pressure will be measured using the DHPT gauge installed above the packer (16 TAC **§5.203(k)(2)(A)**) or other appropriate methods. Schematics of the initial completion plans for the three proposed injection wells are presented in *Appendix D*.

6.4.1.2 Zonal Isolation Activities

A barrier will be set above the injection zone to be isolated. This is generally completed via a bridge plug or a permanent packer with plug-in nipple profile completed with approximately 20 feet of cement. The plug integrity will be assessed by conducting a pressure test or tagging. The perforations will not be squeezed.

6.4.2 Final P&A

After injection operations cease and post-operational monitoring in the injection wells is completed, the wells will be prepared for final P&A—the general procedures for which are described below.

6.4.2.1 Pre-Plugging Activities (Notifications, Permits, and Inspections)

ExxonMobil will comply with reporting and notification provisions and provide written notification to the UIC Director 60 days before planned plugging efforts. If changes have been made to the original approved Injection Well Plugging Plan, ExxonMobil will provide the amended plan (16 TAC **§5.203(k)(3)(A)**). A Notice of Intention to Plug and Abandon Form W-3A will be submitted to the TRRC District Office 3 and the Austin Office at least 5 days before plugging operations are planned to commence. In accordance with 16 TAC **§5.203(k)(4)**, a plugging report will be submitted to the UIC Director and TRRC within 60 days after plugging. Plugging Record Form W-3 will be filed, in duplicate, with TRRC District Office 3 within 30 days after plugging.

6.4.2.2 Plugging Procedure, Injection Wells

The following sequence of plugging procedures is planned:

Please note, these plug depths referenced in Tables 6-3 through 6-6 are based off of water depths listed in the Groundwater Advisory Unit (GAU) letters for each injection well and will likely be amended once the wells are drilled. As such, plug depths may be revised to ensure proper isolation of each protected water strata as required under 16 TAC **§5.203(k) and §3.14**.

1. Check tubing and casing pressures. Determine the bottomhole pressure (BHP) and record measurable annulus pressures (16 TAC **§5.203(k)(2)(A)**).
2. Pump kill weight brine while not exceeding the maximum allowed surface injection pressure.
3. Rig up the slickline unit, run in hole with appropriate blanking plug into lower-profile nipple beneath the packer.
4. Move in and rig up the workover unit.
5. Release tubing from the packer.
6. Rig up slick line, dump 20 feet of cement on top of the packer.
7. Pull out and lay down 7-inch tubing and cables to the next cement plug depth.
8. Pump a minimum of 130 feet of blended CorrosaCem – or suitable equivalent - plug across the UCZ (16 TAC **§5.203(k)(1)**).
9. Pull out and lay down 7-inch tubing and cables to the next cement plug depth.
10. Pump a blended OPC balanced cement plug at the base of the surface casing with a 130-foot cement plug (16 TAC **§5.203(k)(1)**).
11. Pull out and lay down 7-inch tubing and cables to the next cement plug depth.
12. Pump a blended OPC balanced cement plug across the base of the USDW with a 130-foot cement plug (16 TAC **§5.203(k)(1)**).
13. Pull out and lay down 7-inch tubing and cables to the next cement plug depth.
14. Pump a blended OPC balanced cement plug across the base of usable quality water (BUQW) with a 130-foot cement plug (16 TAC **§5.203(k)(1)**).
15. Pull out and lay down 7-inch tubing and cables to the next cement plug depth.
16. Pump a blended OPC balanced cement plug at the base of the superior quality water (SQW) with a 130-foot cement plug (16 TAC **§5.203(k)(1)**).
17. Pull out and lay down 7-inch tubing and cables to the next cement plug depth.
18. Pump the surface cement plug with at least 30 feet of cement (16 TAC **§5.203(k)(1)**).
19. Cut and cap the casing to a minimum of 5 feet below ground level (16 TAC **§5.203(k)(1)**).

20. Rig down and move off the location.
21. Perform site closure requirements (16 TAC **§5.203(m)**).

Note: All plug verification(s) (pressure test/tag) will be conducted as per regulatory requirements

6.4.2.3 Plugging Details, Injection Well No. 01

Table 6-3 provides the plugging details for Injection Well No. 01 (16 TAC **§5.203(k)(1)(A)**, **§5.203(k)(1)(B)**, **§5.203(k)(1)(C)**, and **§5.203(k)(1)(D)**); *Appendix F* shows the final plugged schematic.

Table 6- 3– Plugging Details for Injection Well No. 01

Plugging Description	UCZ Plug	Surface Casing Shoe Plug	USDW Plug*	BUQW Plug*	SQW Plug*	Surface Plug
Plug Number	1	2	3	4	5	6
Diameter of Boring in Which Plug Will Be Placed	8.681 in.	8.681 in.	8.681 in.	8.681	8.681 in.	8.681 in.
Depth to Bottom of Tubing or Drill Pipe or Mechanical Base (MD)	3,455 ft KB	2,950 ft KB	2,750 ft KB	2,500 ft KB	900 ft KB	30 ft KB
Sacks of Cement to Be Used (each plug)	48	52	52	52	52	11
Slurry Volume to Be Pumped (bbl)	9.5	9.5	9.5	9.5	9.5	2
Slurry Weight (lb/gal)[1]	15.0-16.5	15.0-16.5	15.0-16.5	15.0-16.5	15.0-16.5	15.0-16.5
Top of Plug (MD)	3,325 ft KB	2,820 ft KB	2,620 ft KB	2,370 ft KB	770 ft KB	0 ft KB
Bottom of Plug (MD)	3,455 ft KB	2,950 ft KB	2,750 ft KB	2,500 ft KB	900 ft KB	30 ft KB
Type of Cement or Other Material	CorrosaCem	Portland	Portland	Portland	Portland	Portland
Method of Emplacement	Circulation	Circulation	Circulation	Circulation	Circulation	Circulation
New Plug?	Yes	Yes	Yes	Yes	Yes	Yes

bbl = barrels; lb/gal = pounds per gallon; MD = measured depth from kelly bushing (KB)
[1] Proposed slurry density may be modified as needed due to field conditions and vendor availability.
Depth of plugs to be determined at time of operations.
*To be determined by the GAU upon drilling of well

6.4.2.4 Plugging Details, Injection Well No. 02

Table 6-4 provides the plugging details for Injection Well No. 02 (16 TAC **§5.203(k)(1)(A)**, **§5.203(k)(1)(B)**, **§5.203(k)(1)(C)**, and **§5.203(k)(1)(D)**); *Appendix F* shows the final plugged schematic.

Table 6- 4– Plugging Details for Injection Well No. 02

Plugging Description	UCZ Plug	Surface Casing Shoe Plug	USDW Plug*	BUQW Plug*	SQW Plug*	Surface Plug
Plug Number	1	2	3	4	5	6
Diameter of Boring in Which Plug Will Be Placed	8.681 in.	8.681 in.	8.681 in.	8.681 in.	8.681 in.	8.681 in.
Depth to Bottom of Tubing or Drill Pipe or Mechanical Base (MD)	3,446 ft KB	2,270 ft KB	2,000 ft KB	1,750 ft KB	900 ft KB	30 ft KB
Sacks of Cement to Be Used (each plug)	48	52	52	52	52	11
Slurry Volume to Be Pumped (bbl)	9.5	9.5	9.5	9.5	9.5	2
Slurry Weight (lb/gal)[1]	15.0-16.5	15.0-16.5	15.0-16.5	15.0-16.5	15.0-16.5	15.0-16.5
Top of Plug (MD)	3,316 ft KB	2,140 ft KB	1,870 ft KB	1,620 ft KB	770 ft KB	0 ft KB
Bottom of Plug (MD)	3,446 ft KB	2,270 ft KB	2,000 ft KB	1,750 ft KB	900 ft KB	30 ft KB
Type of Cement or Other Material	CorrosaCem	Portland	Portland	Portland	Portland	Portland
Method of Emplacement	Circulation	Circulation	Circulation	Circulation	Circulation	Circulation
New Plug?	Yes	Yes	Yes	Yes	Yes	Yes

[1] Proposed slurry density may be modified as needed due to field conditions and vendor availability.
Depth of plugs to be determined at time of operations.
*To be determined by the GAU upon drilling of well

6.4.2.5 Plugging Details, Injection Well No. 03

Table 6-5 provides the plugging details for Injection Well No. 03 (16 TAC **§5.203(k)(1)(A)**, **§5.203(k)(1)(B)**, **§5.203(k)(1)(C)**, and **§5.203(k)(1)(D)**); *Appendix F* shows the final plugged schematic.

Table 6- 5– Plugging Details for Injection Well No. 03

Plugging Description	UCZ Plug	Surface Casing Shoe Plug	USDW Plug*	BUQW Plug*	SQW Plug*	Surface Plug
Plug Number	1	2	3	4	5	6
Diameter of Boring in which Plug Will Be Placed	8.681 in.	8.681 in.	8.681 in.	8.681 in.	8.681 in.	8.681 in.
Depth to Bottom of Tubing or Drill Pipe	3,475 ft KB	2,200 ft KB	2,000 ft KB	1,750 ft KB	900 ft KB	30 ft KB

Plugging Description	UCZ Plug	Surface Casing Shoe Plug	USDW Plug*	BUQW Plug*	SQW Plug*	Surface Plug
or Mechanical Base (MD)						
Sacks of Cement to Be Used (each plug)	48	52	52	52	52	11
Slurry Volume to Be Pumped (bbl)	9.5	9.5	9.5	9.5	9.5	2
Slurry Weight (lb/gal)[1]	15.0-16.5	15.0-16.5	15.0-16.5	15.0-16.5	15.0-16.5	15.0-16.5
Top of Plug (MD)	3,345 ft KB	2,070 ft KB	1,870 ft KB	1,620 ft KB	770 ft KB	0 ft KB
Bottom of Plug (MD)	3,475 ft KB	2,200 ft KB	2,000 ft KB	1,750 ft KB	900 ft KB	30 ft KB
Type of Cement or Other Material	CorrosaCem	Portland	Portland	Portland	Portland	Portland
Method of Emplacement	Circulation	Circulation	Circulation	Circulation	Circulation	Circulation
New Plug?	Yes	Yes	Yes	Yes	Yes	Yes

[1] Proposed slurry density may be modified as needed due to field conditions and vendor availability.
Depth of plugs to be determined at time of operations.
*To be determined by the GAU upon drilling of well

6.5 Notifications and Record Keeping

The procedures described above are subject to modification during execution, as necessary, for implementation of plugging operations that protect worker safety and the USDW. ExxonMobil will submit a revised plan to the UIC director in the event it finds it necessary to change the approved plugging plan. Completed plugging forms, records, and lab information will be supplied to the regulatory agencies as required by the permit. The plugging report will be certified as accurate by ExxonMobil and the plugging contractor and will be submitted to the UIC Director and EPA Region 6 (16 TAC**§5.207(b)(2)**) within 60 days after plugging is completed (16 TAC **§5.203(k)(4)**).

Well plugging reports, post-injection site care data (including data and information used to develop the demonstration of the alternative post-injection site care time frame), and the site closure report collected pursuant to the requirements in 16 TAC **§5.203(k)(6)**) and **§5.203(m)**, will be retained by ExxonMobil. Site closure and reporting are discussed in *Section 7 – Post-Injection Site Care and Site Closure Plan*.

The plugging report will provide the following information:

- Results of tests to determine BHP and mechanical integrity
- Type and number of plugs used
- Cement type, grade, weight, and quantity of material for plugs

- Method of cement plug emplacement
- Top and bottom of each cement plug

6.6 Monitoring Well P&A

The Sunflower IZM/AZM No. 01 monitoring well and Sunflower AZM Nos. 01 and 02 will be plugged in accordance with 16 TAC **§5.203(k)** to not allow movement of injection or formation fluids that could endanger USDWs. Specific monitoring wells will remain in place after the proposed injection wells have been plugged and abandoned for use in monitoring activities associated with the Post-Injection Site Care and Site Closure Plan. ExxonMobil will assess the monitoring well plugging procedures prior to P&A in relation to this plan. Documentation of appropriate P&A of the monitoring wells will be submitted to the UIC Director in accordance with 16 TAC **§5.203(k)(4)**. The USDW monitoring wells do not penetrate the BUQW and will be plugged in accordance with 16 TAC Chapter 76 and certified at the time of plugging (16 TAC **§5.203(k)(5) and** 16 TAC **§5.203(k)(6)**) unless the landowner's preference is to take ownership.

6.6.1 Plugging Details, Deep Monitoring Wells

Tables 6-6 and 6-7 provide the plugging details for Sunflower AZM/IZM No. 01 and Sunflower AZM Nos. 01 and 02 (16 TAC **§5.203(k)(1)(A)**, **§5.203(k)(1)(B)**, **§5.203(k)(1)(C)**, and **§5.203(k)(1)(D)**); *Appendix F* shows the final plugged schematics.

Table 6- 6– Plugging Details for Sunflower AZM/IZM No. 01

Plugging Description	UCZ Plug	Surface Casing Shoe Plug	USDW Plug*	BUQW Plug*	SQW Plug*	Surface Plug
Plug Number	1	2	3	4	5	6
Diameter of Boring in which Plug Will Be Placed	4.778 in.	4.778 in.	4.778 in.	4.778 in.	4.778 in.	4.778 in.
Depth to Bottom of Tubing or Drill Pipe or Mechanical Base (MD)	3,482 ft KB	2,334 ft KB	1,800 ft KB	1,500 ft KB	850 ft KB	30 ft KB
Sacks of Cement to Be Used (each plug)	15	16	16	16	16	6
Slurry Volume to Be Pumped (bbl)	2.9	2.9	2.9	2.9	2.9	1
Slurry Weight (lb/gal)[1]	15.0-16.5	15.0-16.5	15.0-16.5	15.0-16.5	15.0-16.5	15.0-16.5
Top of Plug (MD)	3,352 ft KB	2,204 ft KB	1,670 ft KB	1,370 ft KB	720 ft KB	0 ft KB
Bottom of Plug (MD)	3,482 ft KB	2,334 ft KB	1,800 ft KB	1,500 ft KB	850 ft KB	30 ft KB

Plugging Description	UCZ Plug	Surface Casing Shoe Plug	USDW Plug*	BUQW Plug*	SQW Plug*	Surface Plug
Type of Cement or Other Material	CorrosaCem	Portland	Portland	Portland	Portland	Portland
Method of Emplacement	Circulation	Circulation	Circulation	Circulation	Circulation	Circulation
New Plug?	Yes	Yes	Yes	Yes	Yes	Yes
[1] Proposed slurry density may be modified as needed due to field conditions and vendor availability. Depth of plugs to be determined at time of operations. *To be determined by the GAU upon drilling of well						

Table 6- 7– Plugging Details for Sunflower AZM No. 01

Plugging Description	Surface Casing Shoe Plug	USDW Plug*	BUQW Plug*	SQW Plug*	Surface Plug
Plug Number	1	2	3	4	5
Diameter of Boring in which Plug Will Be Placed	4.778 in.	4.778 in.	4.778 in.	4.778 in.	4.778 in.
Depth to Bottom of Tubing or Drill Pipe or Mechanical Base (MD)	2,950 ft KB	2,750 ft KB	2,500 ft KB	900 ft KB	30 ft KB
Sacks of Cement to Be Used (each plug)	16	16	16	16	6
Slurry Volume to Be Pumped (bbl)	2.9	2.9	2.9	2.9	1
Slurry Weight (lb/gal)[1]	15.0-16.5	15.0-16.5	15.0-16.5	15.0-16.5	15.0-16.5
Top of Plug (MD)	2,820 ft KB	2,620 ft KB	2,370 ft KB	770 ft KB	0 ft KB
Bottom of Plug (MD)	2,950 ft KB	2,750 ft KB	2,500 ft KB	900 ft KB	30 ft KB
Type of Cement or Other Material	Portland	Portland	Portland	Portland	Portland
Method of Emplacement	Circulation	Circulation	Circulation	Circulation	Circulation
New Plug?	Yes	Yes	Yes	Yes	Yes

Table 6- 8– Plugging Details for Sunflower AZM No. 02

Plugging Description	Surface Casing Shoe Plug	USDW Plug*	BUQW Plug*	SQW Plug*	Surface Plug
Plug Number	1	2	3	4	5
Diameter of Boring in which Plug Will Be Placed	4.778 in.	4.778 in.	4.778 in.	4.778 in.	4.778 in.
Depth to Bottom of Tubing or Drill Pipe or Mechanical Base (MD)	2,270 ft KB	2,000 ft KB	1,750 ft KB	900 ft KB	30 ft KB

Plugging Description	Surface Casing Shoe Plug	USDW Plug*	BUQW Plug*	SQW Plug*	Surface Plug
Sacks of Cement to Be Used (each plug)	16	16	16	16	6
Slurry Volume to Be Pumped (bbl)	2.9	2.9	2.9	2.9	1
Slurry Weight (lb/gal)[1]	15.0-16.5	15.0-16.5	15.0-16.5	15.0-16.5	15.0-16.5
Top of Plug (MD)	2,140 ft KB	1,870 ft KB	1,620 ft KB	770 ft KB	0 ft KB
Bottom of Plug (MD)	2,270 ft KB	2,000 ft KB	1,750 ft KB	900 ft KB	30 ft KB
Type of Cement or Other Material	Portland	Portland	Portland	Portland	Portland
Method of Emplacement	Circulation	Circulation	Circulation	Circulation	Circulation
New Plug?	Yes	Yes	Yes	Yes	Yes

6.6.2 Plugging Procedure for the Sunflower AZM/IZM No. 01

1. Check casing pressures. Determine BHP via appropriate methods and record measurable annulus pressures. Move in and rig up the workover unit.
2. Run in hole with cement stinger to UCZ plug depth. Pump 130 feet of blended CorrosaCem – or suitable equivalent - balanced cement plug.
3. Pull out of hole to next cement plug depth. Pump 130 feet of blended OPC balanced cement plug across the shoe of the 9 5/8-inch casing.
4. Pull out of hole to next cement plug depth. Pump 130 feet of blended OPC balanced cement plug across the across the base of the USDW.
5. Pull out of hole to next cement plug depth. Pump 130 feet of blended OPC balanced cement plug across the across the base of the BUQW.
6. Pull out of hole to next cement plug depth. Pump 130 feet of blended OPC balanced cement plug across the across the base of the SQW.
7. Pull out of hole to next plug. Pump surface cement plug with at least 30 feet of OPC.
8. Cut and cap casing to a minimum of 5 feet below the ground level.
9. Rig down and move off of the location.
10. Perform site closure requirements (16 TAC §5.203(m)).

Note: All plug verification(s) (pressure test/tag) will be conducted as per regulatory requirements

6.6.3 Plugging Procedure for the Sunflower AZM Nos. 01 and 02

1. Check casing pressures. Determine BHP via appropriate methods and record measurable annulus pressures. Move in and rig up the workover unit.
2. Unsting the packer and pull out with the tubing.
3. Run in hole with cement stinger to surface shoe. Pump 130 feet of blended OPC balanced cement plug across the shoe of the 9 5/8-inch casing.
4. Pull out of hole to next cement plug depth. Pump 130 feet of blended OPC balanced cement plug across the across the base of the USDW.
5. Pull out of hole to next cement plug depth. Pump 130 feet of blended OPC balanced cement plug across the across the base of the BUQW.

6. Pull out of hole to next cement plug depth. Pump 130 feet of blended OPC balanced cement plug across the across the base of the SQW.
7. Pull out of hole to next plug. Pump surface cement plug with at least 30 feet of OPC.
8. Cut and cap casing to a minimum of 5 feet below the ground level.
9. Rig down and move off of the location.
10. Perform site closure requirements (16 TAC §5.203(m)).

Note: All plug verification(s) (pressure test/tag) will be conducted as per regulatory requirements

6.6.4 Plugging Procedure for the Sunflower USDW Nos. 01, 02, and 03

The Sunflower USDW No. 01 through 03 will be plugged and certified in accordance with the requirements of 16 TAC Chapter 76 unless the landowner wishes to take ownership.

6.7 Amendments to the P&A Plan

The Injection Well Plugging Plan will be amended to account for changes in conditions that trigger modification to the area of review. ExxonMobil will inquire with the UIC Director to confirm whether such changes in condition warrant amendments to this plan. If changes have been made to the plan, the revised plan will be submitted when notifying the UIC Director of the intent to plug the well at least 60 days prior to conducting the plugging activity per 16 TAC **§5.203(k)(3)(A)**.

Appendix F – Injection Well Plugging Plan

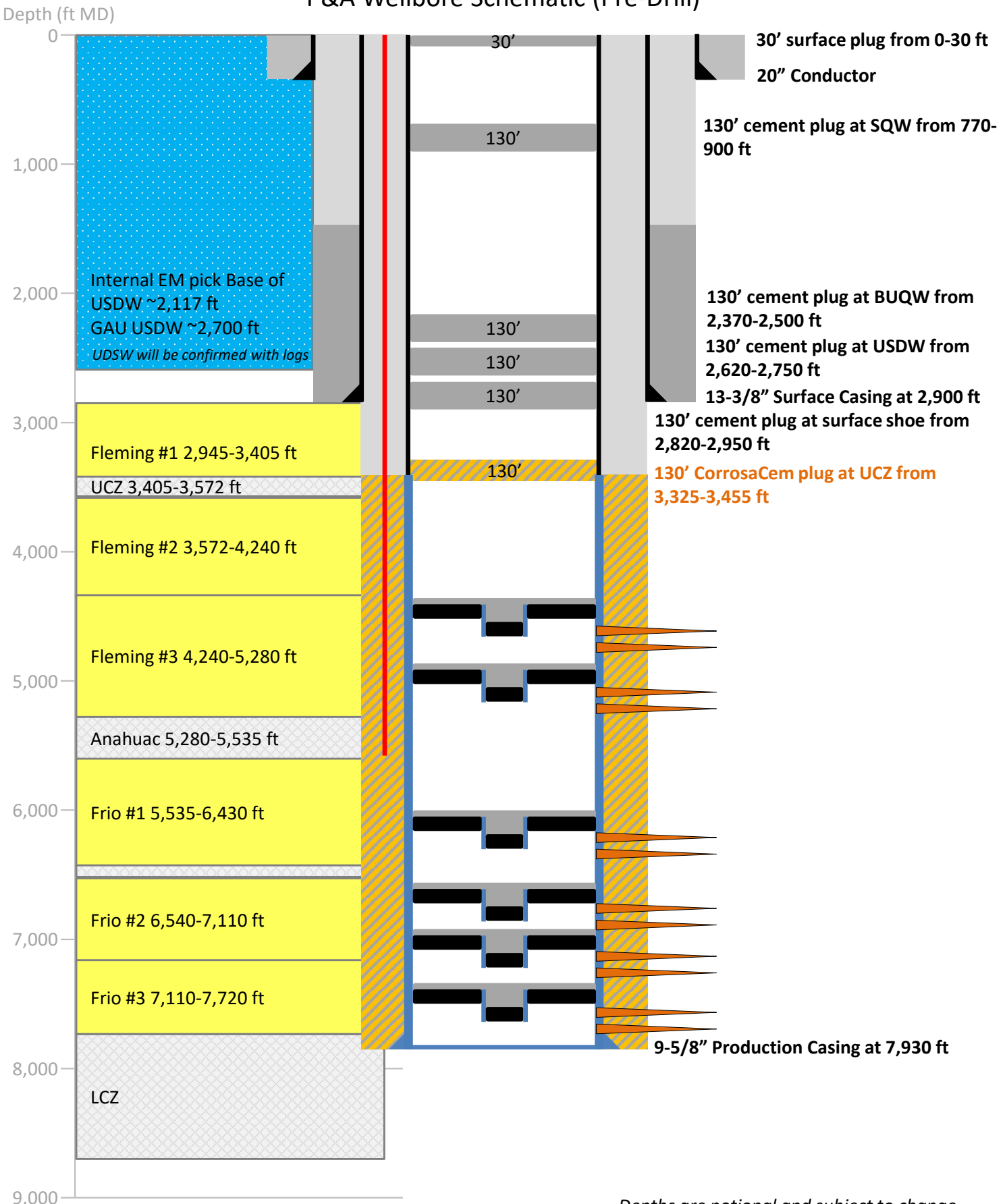
Appendix F-1: Plugging Wellbore Schematics

Appendix F – In□ection □ ell Plugging Plan

Appendix F1 – Plugging Wellbore Schematics

Sunflower CCS Project Injection Well No. 01

P&A Wellbore Schematic (Pre-Drill)



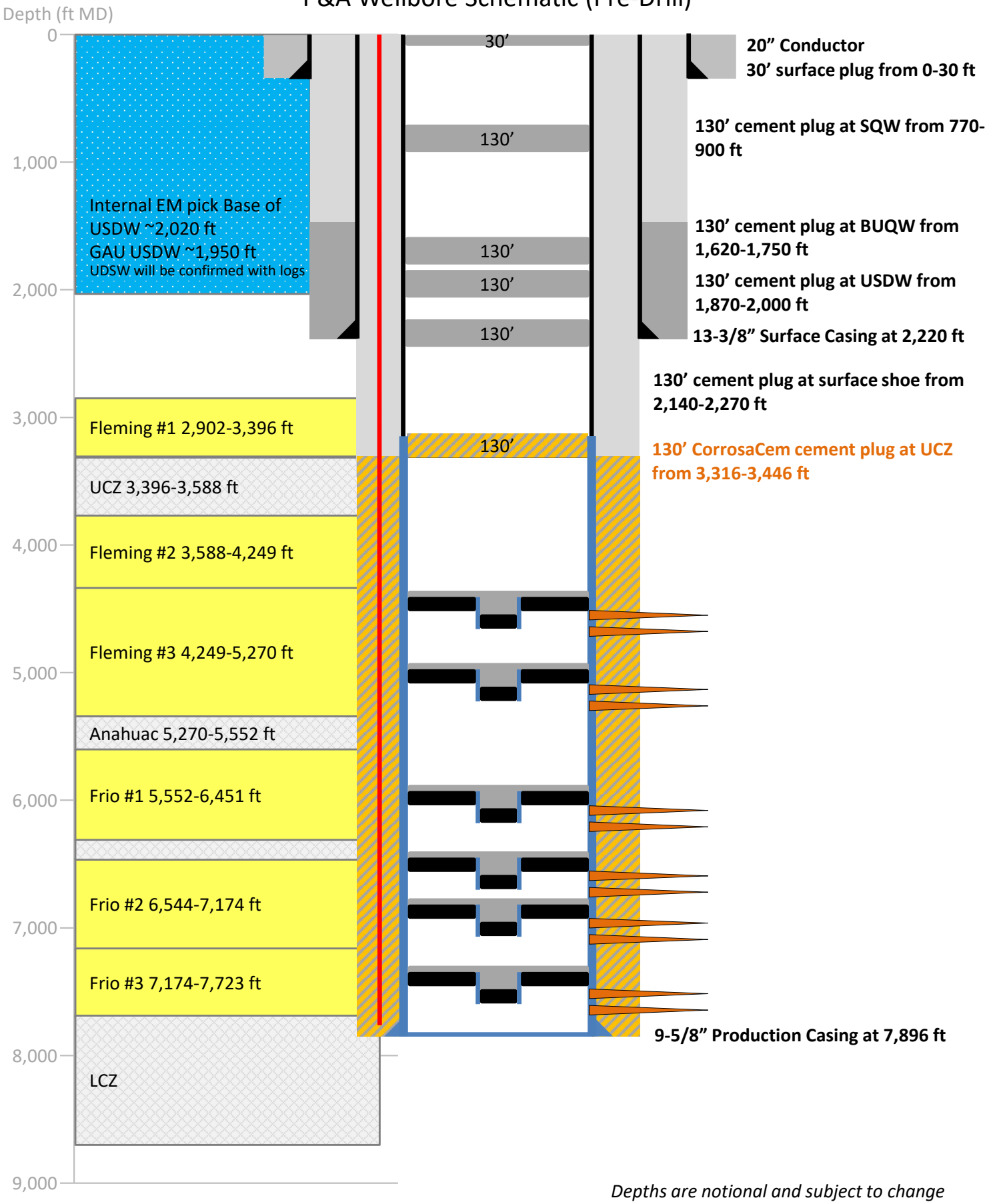
Depths are notional and subject to change based on as-drilled conditions

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Sunflower CCS Project Injection Well No. 02

P&A Wellbore Schematic (Pre-Drill)



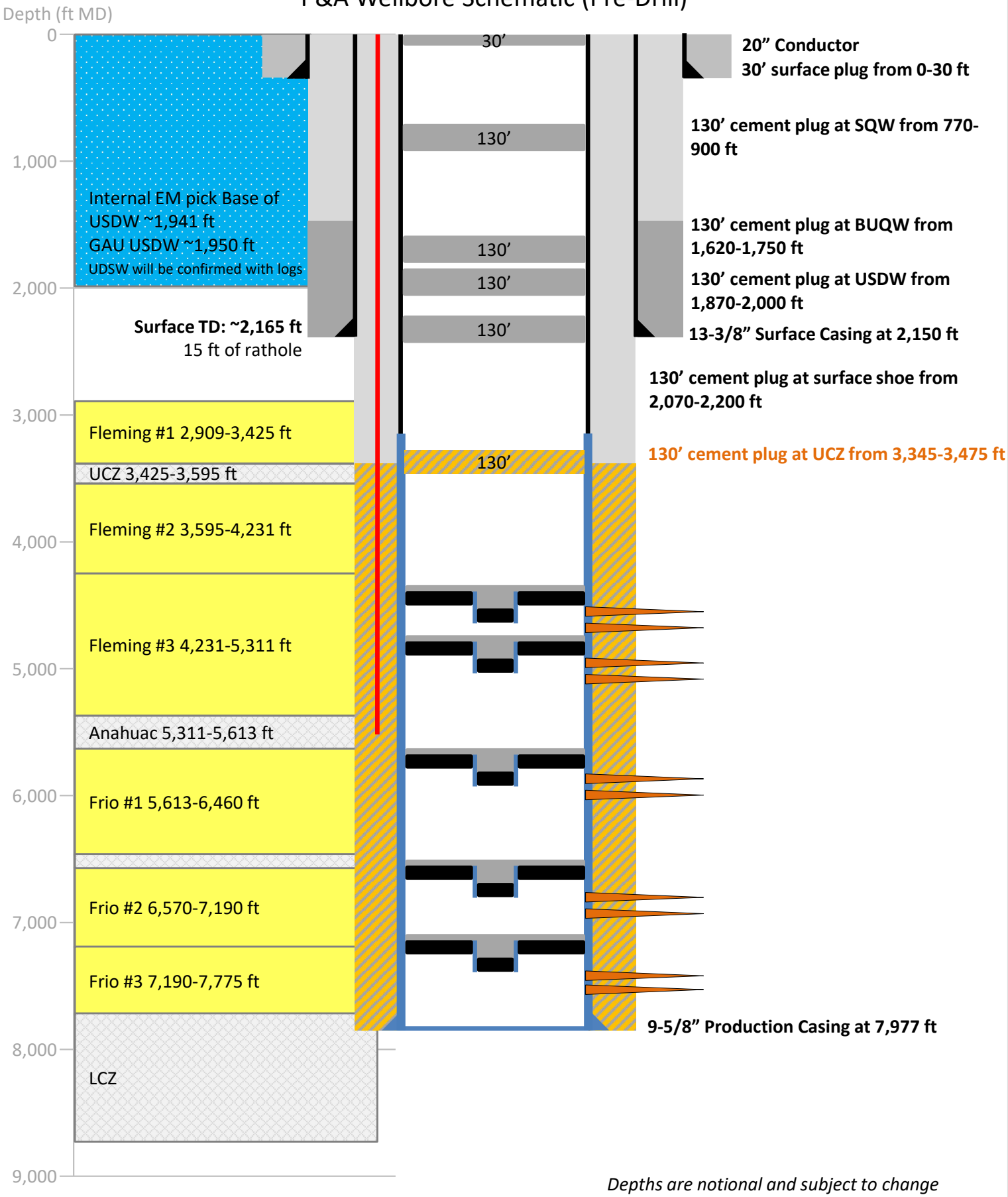
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Sunflower CCS Project Injection Well No. 03

P&A Wellbore Schematic (Pre-Drill)



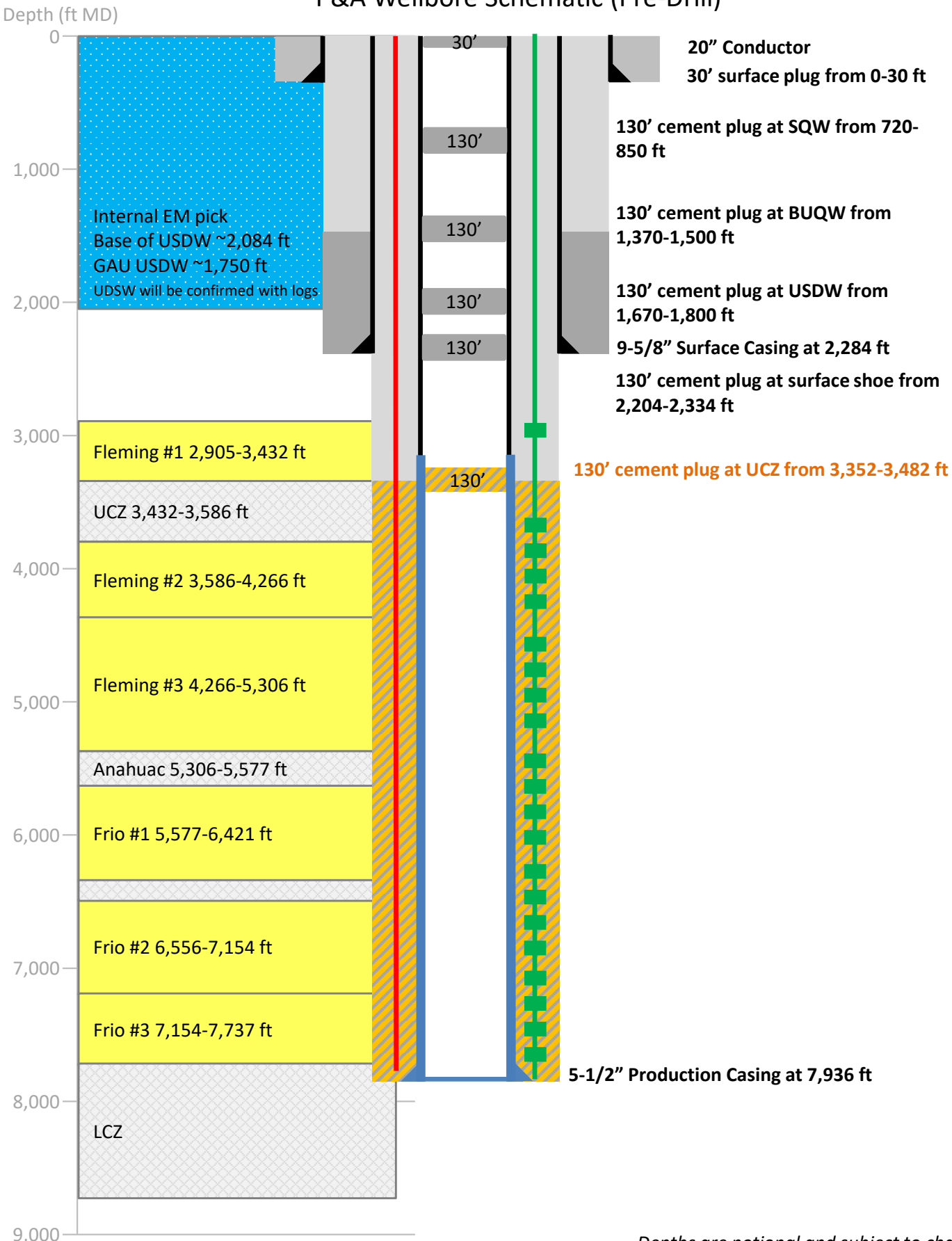
Depths are notional and subject to change based on as-drilled conditions

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Sunflower AZM/IZM Well No. 01

P&A Wellbore Schematic (Pre-Drill)



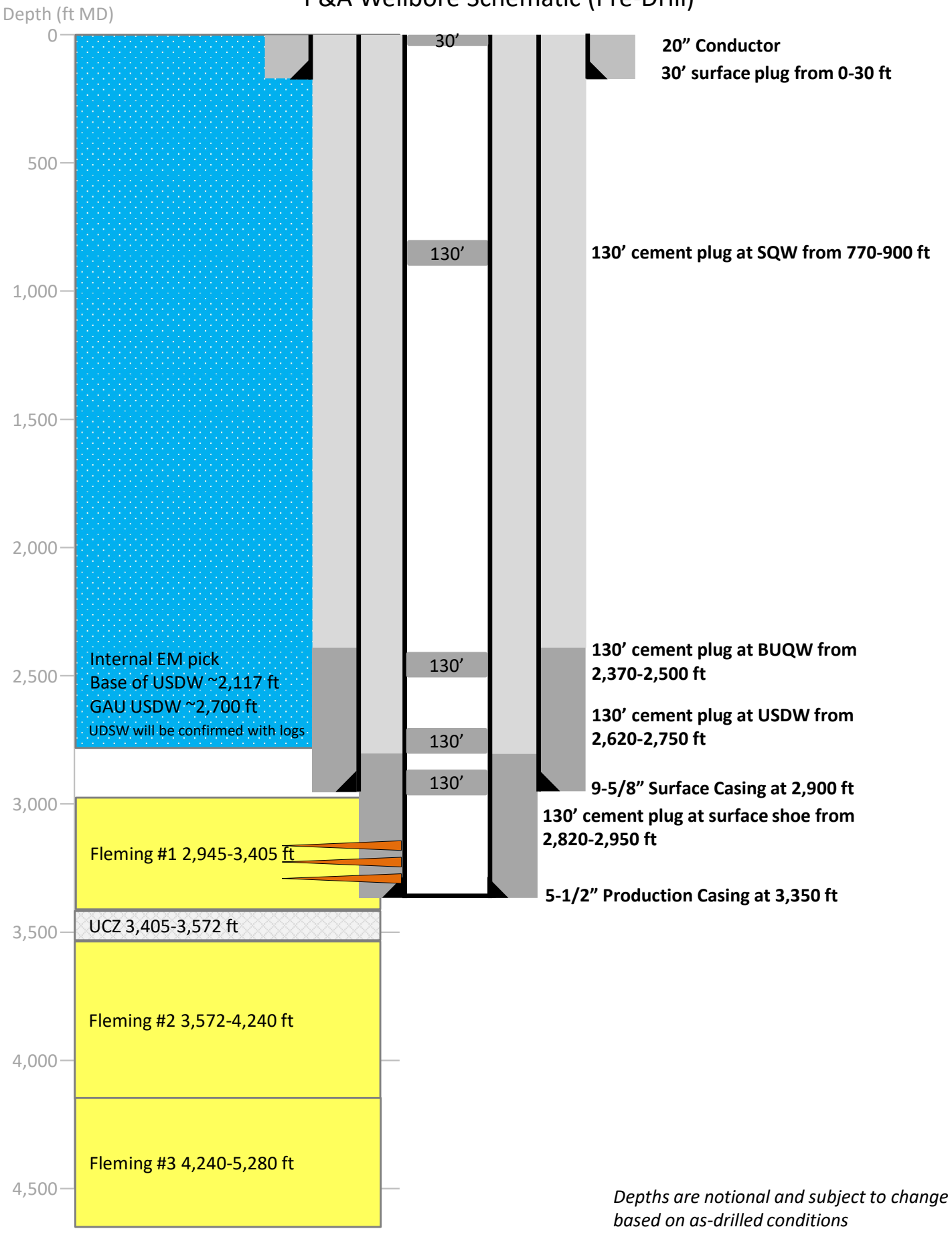
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Sunflower AZM Well No. 01 – Injector 1 Pad

P&A Wellbore Schematic (Pre-Drill)



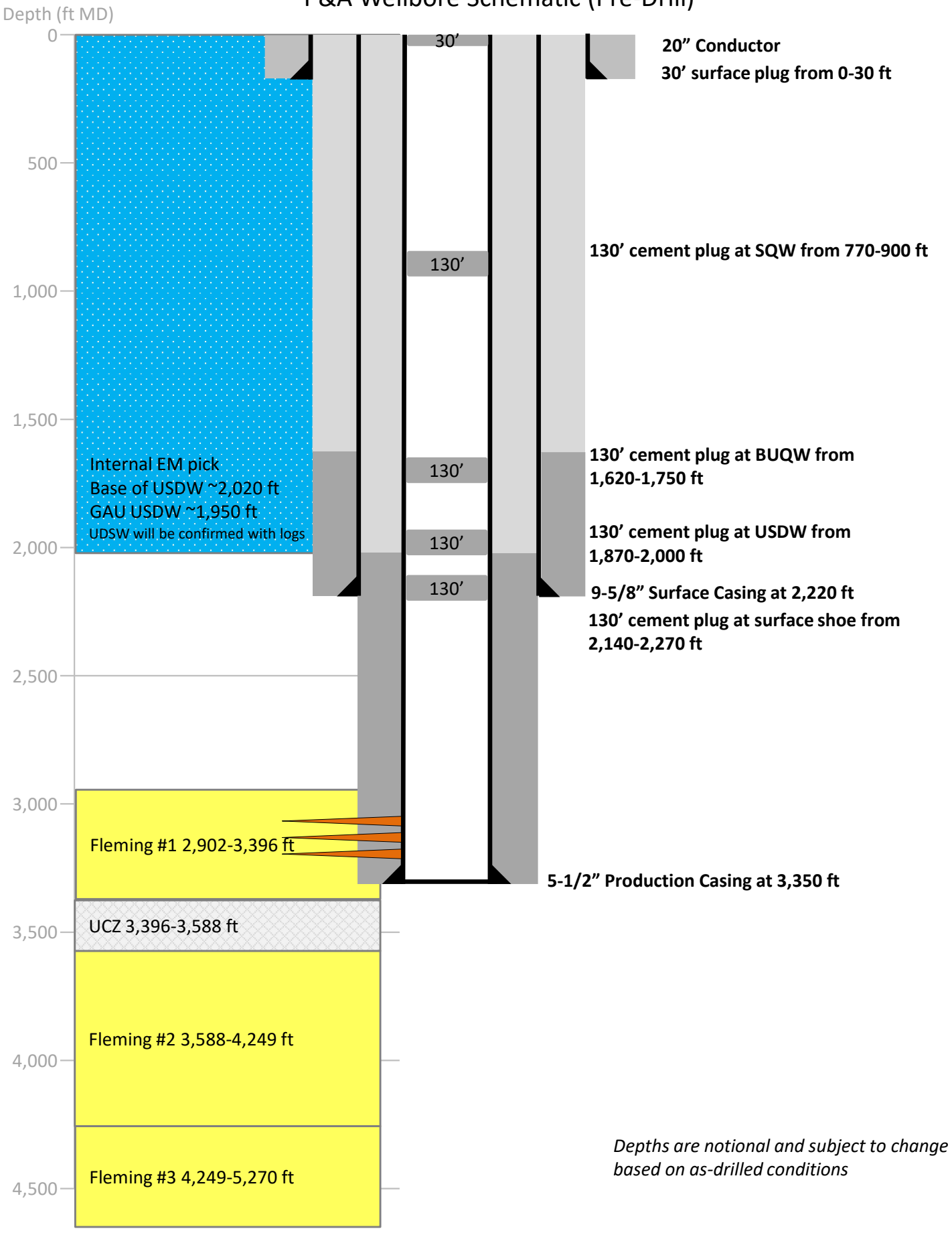
Depths are notional and subject to change based on as-drilled conditions

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Sunflower 2 AZM No. 02

P&A Wellbore Schematic (Pre-Drill)



Depths are notional and subject to change based on as-drilled conditions

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Underground Injection Control – Class VI Permit Application for Sunflower Carbon Capture and Storage Project Injection Wells No. 01, No. 02, and No. 03

SECTION 7 – POST-INJECTION SITE CARE AND SITE CLOSURE PLAN

Sunflower Carbon Capture and Storage Project
Jefferson and Liberty Counties, Texas
ExxonMobil Low Carbon Solutions Onshore Storage, LLC
Amendment 2: May 2026

SECTION 7 – POST-INJECTION SITE CARE AND SITE CLOSURE PLAN

TABLE OF CONTENTS

7.1 Introduction 3
7.2 Objectives 3
7.3 Calculation of Pre- and Post-Injection Pressure Differentials 4
7.4 Predicted Position of the CO_2 Plume and Pressure Front at Site Closure 7
7.5 Post-Injection Site Care Monitoring Plan 9
7.5.1 PISC and Site Closure Plan Reviews and Amendments 9
7.5.2 Monitoring Above the UCZ and USDW 10
7.5.3 In-Zone CO_2 Plume and Pressure Front Tracking 12
7.5.4 Submitting PISC Monitoring Results 13
7.6 Demonstration of Non-Endangerment of USDW 13
7.6.1 Introduction and Overview for Non-Endangerment Demonstration 14
7.6.2 Summary of Existing Monitoring Data 14
7.6.3 Summary of Computational Modeling History 15
7.6.4 Evaluation of Reservoir Pressure 15
7.6.5 Evaluation of the CO_2 Plume 16
7.6.6 Evaluation of Emergencies or Other Events 16
7.7 Site Closure Plan 16
7.7.1 Pre-Closure 16
7.7.2 Plugging Activities 17
7.7.3 Site Restoration 17
7.7.4 Documentation of Site Closure 18

Figures

Figure 7-1 – Proposed Injection Interval Schedule 5
Figure 7-2 – Extent of Maximum CO_2 Plume and Pressure Front Stabilized in Year 50 from End of Injection 8

Tables

Table 7-1 – Average Pressure Differential by Year for the Proposed Injection Wells 6
Table 7-2 – Direct Above-Zone Monitoring and USDW Sampling and Analysis Program 11
Table 7-3 – Indirect Above-Zone Monitoring Program 11
Table 7-4 – Direct and Indirect In-Zone Monitoring Program for PISC 12
Table 7-5 – USDW and Above-zone Monitoring and Sampling Program During the PISC Phase 13

7.1 Introduction

The Post-Injection Site Care (PISC) and Site Closure Plan for the Sunflower Carbon Capture and Storage (CCS) Project (Sunflower Project) Injection Wells No. 01, No. 02, and No. 03 was prepared to meet the requirements of Title 16, Texas Administrative Code (16 TAC), Part 1, Chapter 5. ExxonMobil Low Carbon Solutions Onshore Storage, LLC (ExxonMobil) is undertaking the project in Jefferson and Liberty Counties, Texas, to sequester approximately 25.3 million metric tons per annum (MMT) of CO_2 over 11 years.

The PISC Plan describes the activities that will occur once injection operations have ceased, and the project moves into maintaining a non-endangerment condition for underground sources of drinking water (USDWs). The Site Closure Plan will be implemented once ExxonMobil demonstrates to the Underground Injection Control (UIC) Program director (UIC Director) that no additional monitoring is required to demonstrate protection of USDWs, and that the testing and monitoring system can be dismantled. ExxonMobil's strategy for PISC monitoring is based on the same systems and processes described in *Section 5 – Testing and Monitoring Plan*. The major monitoring elements include continued measurements of the CO_2 plume and pressure front location and monitoring the USDW and groundwater above the upper confining zone (UCZ). The data collected from this activity will be used to confirm compliance with the water-quality objectives for the project, and generate information needed to support the final non-endangerment demonstration and subsequent site closure. Pursuant to1 6 TAC **§5.203(m)(8)(A)**, the analyses and tests performed to support the demonstration will be accurate, reproducible, and performed in accordance with *Appendix E.1 – Quality Assurance and Surveillance Plan.* The end of the project will occur once the closure activities have been documented and approved by the UIC Director.

Upon cessation of injection, ExxonMobil will either submit an amended plan or demonstrate to the UIC Director through monitoring data and modeling results that no amendment to the plan is needed (16 TAC **§5.206 (k)(1)(C)**).

7.2 Objectives

The PISC and Site Closure Plan has been developed to meet the following objectives as outlined in 16 TAC **§5.203** and **§5.206**:

- Describe the pressure differential between pre-injection and predicted post-injection pressures in the injection zones, as well as the predicted positions of the CO_2 plume and associated pressure front at site closure.
- Describe the post-injection monitoring locations, methods, and proposed frequencies to demonstrate non-endangerment to the USDW over the time frame of the PISC.
- Identify the pre-closure, plugging, and site-restoration steps to achieve approval for site closure.

- Outline the documentation and recordkeeping practices that will provide the information for decision-making purposes.

ExxonMobil will not cease post-injection monitoring until the non-endangerment demonstration pursuant to 16 TAC **§5.206(k)(2)** has been approved by the UIC Director. ExxonMobil will monitor groundwater quality and track the position of the CO_2 plume and pressure front for 50 years after cessation of injection, unless a lesser period is approved by the UIC Director. Once the non-endangerment demonstration has been approved, ExxonMobil will plug the monitoring wells, restore each well pad to the surface owner's agreed-upon condition, and submit a Site Closure Report to the UIC Director.

7.3 Calculation of Pre- and Post-Injection Pressure Differentials

As described in 16 TAC **§5.203(m)(7)(B)**, the Class VI non-endangerment demonstration will establish that pressure has declined to a level that no longer poses potential endangerment of USDWs. For the purposes of this section, ExxonMobil evaluated the pressure differentials by comparing the pre-operating pressure with the post-injection pressure differentials predicted by the plume model. The predicted pressure differential between pre-injection and the modeled post-injection pressures are favorable, showing a steep and continuous decline in pressure toward pre-operational baseline conditions. The primary mechanisms responsible for the anticipated pressure decay rates are the injection sequencing plan, the geological conditions of the injection zones (e.g., net sand thickness, permeability, porosity) and confining zones, and the projected CO_2 storage volume for the Sunflower Project site.

A staged injection sequence is planned for the proposed injection wells to optimize the storage of CO_2 in the injection intervals. *Section 3 – Area of Review and Corrective Action Plan* and *Section 4 – Well Construction Plan and Operating Conditions* provide detailed discussions of the injection sequencing strategy. Figure 7-1 summarizes the injection sequence schedule for the proposed injection period. The actual injection period will depend on the issuance of the permits for each injection well.

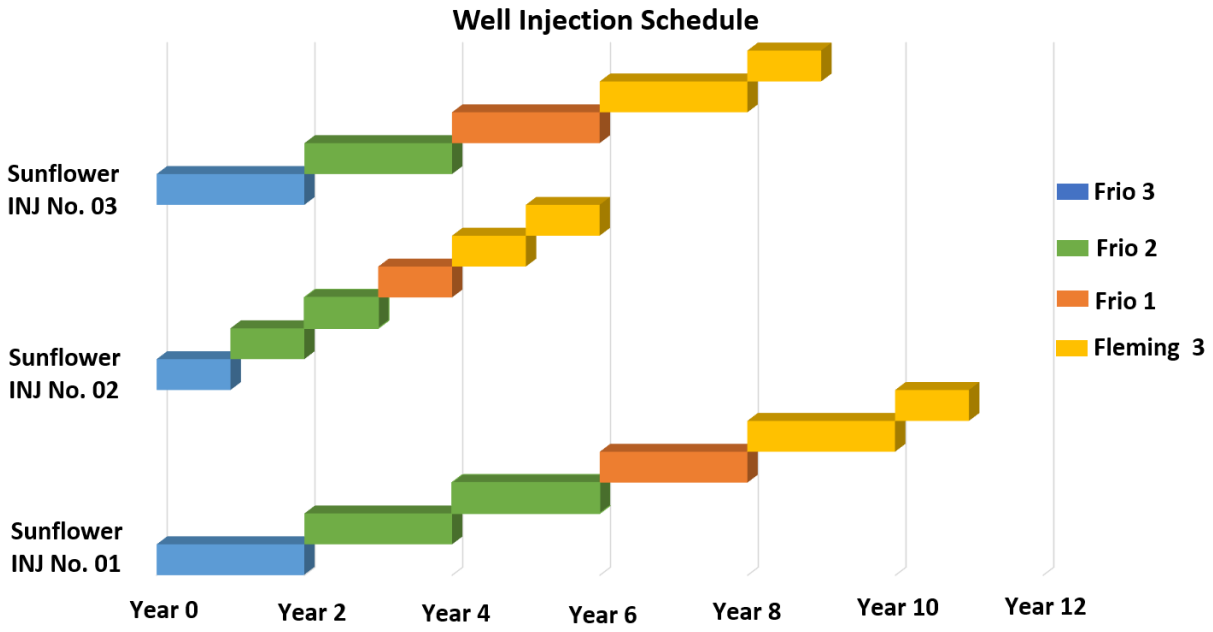
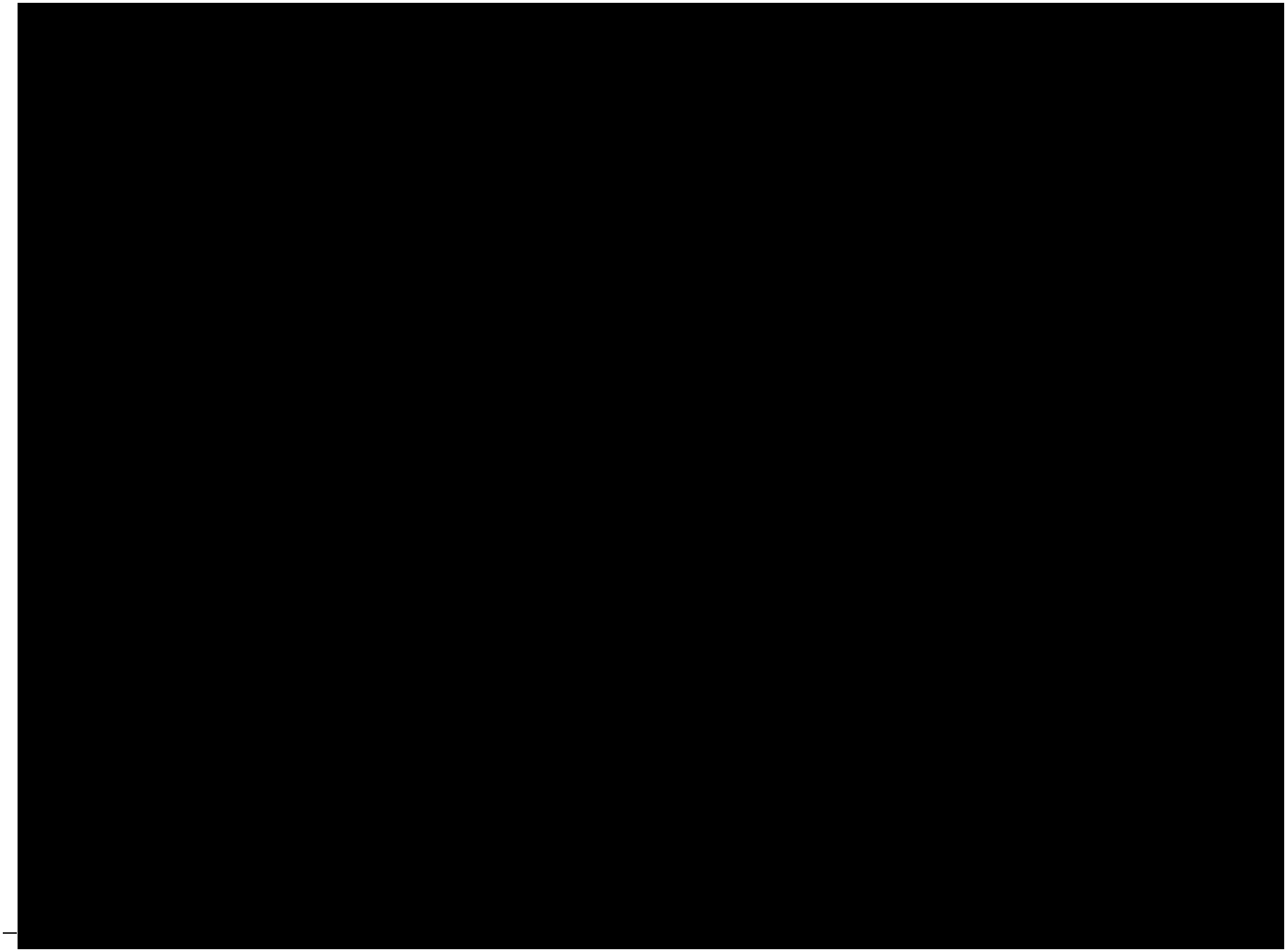


Figure 7-1 – Proposed Injection Interval Schedule

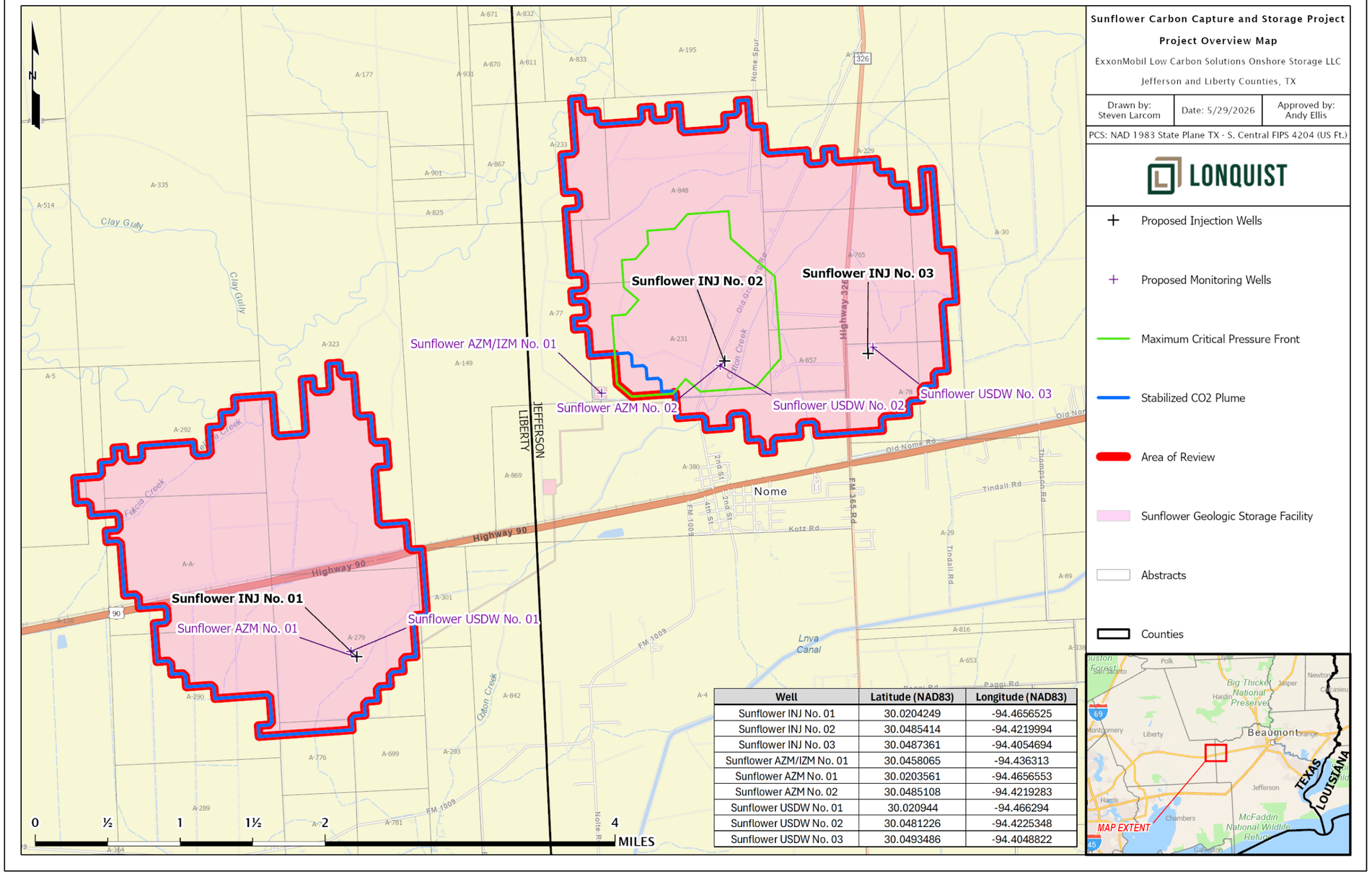
Table 7-1 provides the model-predicted average pressure differential (16 TAC **§5.203(m)(2)**) and the change in injection pressures in each injection interval over time pursuant to 16 TAC **§5.203(m)(7)(B)**. The pressure stabilization occurs almost immediately after injection cease.



7.4 Predicted Position of the CO_2 Plume and Pressure Front at Site Closure

Pursuant to 16 TAC **§5.203(d)(1)(A)(i)**, the area of review (AOR) was delineated using computational modeling that accounts for all phases of CO_2 (e.g., supercritical, dissolved, etc.) under proposed operational conditions. The predictive model was appropriate, tailored to site conditions (including CO2 stream composition), calibrated with existing information, and used reasonably conservative values and modeling assumptions as further outlined in *Section 1 – Site Characterization* and *Section 2 – Plume Model* (16 TAC **§5.203(m)(8)(C) through (E)**). The AOR consists of both the CO_2 plume and the extent of the pressure front. The following discussion provides the predicted evolution of both the CO_2 plume and pressure front throughout the course of the 50-year PISC time frame.

Figure 7-2 shows the extent of the AOR and its subcomponents 11 years from the start of injection and 50 years from the cessation of injection. Based on the model, the CO_2 plume stabilization is predicted to occur approximately 50 years after injection ceases, with pressure differentials below the critical pressure threshold, thereby reducing the potential for USDW endangerment. The CO_2 plume from the proposed injection wells is based on the maximum extent of any injection interval. The maximum extent of the pressure front represents a composite of the maximum extent of the pressure front at any point in time for the injection intervals during all stages of injection operation.



Well	Latitude (NAD83)	Longitude (NAD83)
Sunflower INJ No. 01	30.0204249	-94.4656525
Sunflower INJ No. 02	30.0485414	-94.4219994
Sunflower INJ No. 03	30.0487361	-94.4054694
Sunflower AZM/IZM No. 01	30.0458065	-94.436313
Sunflower AZM No. 01	30.0203561	-94.4656553
Sunflower AZM No. 02	30.0485108	-94.4219283
Sunflower USDW No. 01	30.020944	-94.466294
Sunflower USDW No. 02	30.0481226	-94.4225348
Sunflower USDW No. 03	30.0493486	-94.4048822

Figure 7-2 – Extent of Maximum CO_2 Plume and Pressure Front Stabilized in Year 50 from End of Injection

7.5 Post-Injection Site Care Monitoring Plan

Post-injection site care monitoring is required by 16 TAC **§5.206(k)(2)** to demonstrate that the geologic storage facility will not endanger the USDW. Much like the operational phase, direct and indirect forms of monitoring will be used to track the evolution of the CO_2 plume and pressure front after cessation of CO_2 injection. The strategy for the PISC monitoring is to rely on a core set of monitoring locations established during the operational phase of the project.

The following set of core monitoring locations was assumed to be installed and monitored pursuant to the Testing and Monitoring Plan (*Section 5*) and found sufficient pursuant to the AOR reevaluation process:

- In-zone monitoring at Sunflower INJ No. 01 through No. 03 for direct monitoring
- Sunflower AZM/IZM No. 01 for direct in-zone monitoring and above-zone monitoring of temperature and pressure
- Sunflower AZM No. 01 and No. 02 for above-zone pressure monitoring and fluid sampling
- Sunflower USDW Wells No. 01, No. 02, and No. 03 for direct monitoring of the USDW

Figure 7-2 illustrated the locations of these monitoring wells. If additional monitoring locations are added during the course of the injection operations under the direction of the UIC Director, this core set of monitoring wells will be updated to reflect the monitoring system in place at the close of the injection phase of the project.

Monitoring of the pressure front and CO_2 plume will occur for at least 50 years from the cessation of injection unless an alternate duration is approved by the UIC Director. ExxonMobil is proposing a schedule to submit PISC monitoring results annually and within 30 days of the anniversary date of injection cessation. **16 TAC §5.203(m)(5)**.

The following discussion provides details on the elements of the PISC monitoring strategy outlined above.

7.5.1 PISC and Site Closure Plan Reviews and Amendments

As required by 16 TAC **§5.206(k)(1)(B)** and **(C)**, ExxonMobil will submit an amended PISC and Site Closure Plan or demonstrate that no amendment is needed upon cessation of injection. Amendments to the plan, or the demonstration that no revisions are necessary, will be based on monitoring data collected during injection and the most-recent AOR delineation.

During PISC monitoring, ExxonMobil will conduct periodic reviews to incorporate new monitoring data, changes to the site computational model that may warrant changes in PISC monitoring, and/or changes in the methodology proposed to demonstrate non-endangerment of the USDW. This approach will also support the use of new technologies that may be available in the future that would facilitate a higher level of performance than the existing system. Pursuant to 16 TAC

§5.206(g) and as described in *Section 3 – Area of Review and Corrective Action Plan*, ExxonMobil will reevaluate the AOR periodically by comparing model predictions with monitoring results.

Following an AOR reevaluation process, if the AOR and Corrective Action Plan are amended, ExxonMobil will review the PISC and Site Closure Plan to determine whether any updates are needed to ensure consistency across all plans. ExxonMobil may submit an amended PISC that describes how changes to the model affect predictions of pressure dissipation, plume migration rates, CO_2 trapping, and additional processes that need to be accounted for in the non-endangerment demonstration.

In accordance with 16 TAC **§5.206(k)(1)(B)**, at any time during the life of the project, ExxonMobil may modify and resubmit the PISC and Site Closure Plan for the UIC Director's approval within 30 days of such change.

7.5.2 Monitoring Above the UCZ and USDW

During the injection phase, periodic monitoring of groundwater quality for significant geochemical changes above the UCZ is required by 16 TAC **§5.203(j)(2)(D)(i)** for the purpose of detecting potential leakage through the UCZ. In accordance with 16 TAC **§5.206(k)(3)(B)** and **(C)**, groundwater quality and geochemical characteristics will be monitored in the first laterally continuous permeable and porous formation above the UCZ at Sunflower AZM No. 1 and No. 02 and in the USDW at Sunflower USDW No. 01, No. 02, and No. 03 during the post-injection period.

ExxonMobil's strategy for monitoring groundwater above the UCZ is a risk-based approach correlated to modeled CO_2 plume and injection-zone characteristics. By the time the PISC monitoring program is initiated, the risk-mitigating effects of the injection sequence plan, the operating strategy, and the corrective actions taken on artificial penetrations will likely have demonstrated protection of the USDW throughout the operational phase of the project. The list of analyses to be performed at these monitoring wells is summarized in Table 7-2 based on the same approach used for the operational phase of the project.

Table 7-3 provides a summary of indirect monitoring technologies to be used for above-zone CO_2 plume and pressure front monitoring during the PISC phase of the project. This monitoring strategy is consistent with the details and rationale provided in *Section 5 – Testing and Monitoring Plan*. The results of the monitoring activities will be submitted in the annual report for the year in which they occur—and within 30 days of the anniversary date of injection cessation or through an alternate schedule agreed upon with the UIC Director.

Table 7-2 – Direct Above-Zone Monitoring and USDW Sampling and Analysis Program

Target Formation	Monitoring Activity	Monitoring Location(s)	Frequency[1]	Geochemical Analyses
USDW (Chicot Aquifer)	Water Level Gauging and Collection of Fluid Samples	Sunflower USDW No. 01, No. 02, and No. 03	Annual	Total dissolved solids, alkalinity, electrical conductivity, temperature, pH, gas composition (CO_2, CH_4, O_2, N_2), dissolved cations (i.e., As, Ba, Ca, Fe, Mg, Mn, Na, other relevant metals), and dissolved anions (i.e., HCO_3, Br, Cl, F, SO_4)
First Laterally Continuous Permeable Formation Above the UCZ	Collection of Fluid Samples and Pressure	Sunflower AZM No. 01 and No. 02	Annual	
	Pressure, Temperature	Sunflower AZM/IZM No. 01	Continuous	

As = arsenic; Ba = barium; Br = bromine; Ca = calcium; CH_4 = methane; Cl = chlorine; CO_2 = carbon dioxide; F = fluorine; Fe = iron; HCO_3 = bicarbonate; Mg = magnesium; Mn = manganese; N_2 = Nitrogen; Na = sodium; O_2 = oxygen; SO_4 = sulfate

[1] The word "continuous" as used to express the frequency of measures collected during monitoring equipment operation is defined as the instrument's normal data collection frequency as defined by the manufacturer. The frequency will vary by instrument and application. Measurements that are collected "continuously" will be averaged across a reasonable and appropriate time interval for reporting the detection monitoring results during the operational phase of the Sunflower Project.

Table 7-3 – Indirect Above-Zone Monitoring Program

Testing/Monitoring Activity	Frequency	Reporting Schedule	Comment
Indirect plume monitoring by time-lapse seismic surveys or equivalent technologies	Monitor Survey No. 03 will occur at the end of the operational period, 11 years after the start of operation. Contingent additional monitor surveys during the PISC phase are to be determined based on the results from the direct and indirect monitoring and model prediction.	After the collected time-lapse data has been integrated into the geologic and plume models	The frequency and method of indirect plume monitoring will be determined in conjunction with the UIC Director.

The analytical methods and quality assurance/quality control measures discussed in *Section 5 – Testing and Monitoring Plan* for collecting and analyzing fluid samples will apply to the data collection program of the PISC, as appropriate.

7.5.3 In-Zone CO_2 Plume and Pressure Front Tracking

ExxonMobil proposes to use direct and indirect methods to track the extent of the CO_2 plume and pressure front in the injection zone during the PISC period. Direct monitoring in the injection zone includes continuous pressure and temperature measurements for Sunflower AZM/IZM No. 01. Indirect monitoring technologies include a geophysical survey to indirectly monitor subsurface conditions. By the start of the PISC phase of the Sunflower Project, the direct and indirect monitoring activities will have been used for approximately 11 years—making them a proven set of monitoring technologies for detection monitoring of CO_2 plume and brine crossflow potential.

Table 7-4 describes the proposed CO_2 and pressure plume tracking methods for the PISC Plan. The water quality and geochemical parameters to be analyzed are presented in Table 7-5, consistent with *Section 5 – Testing and Monitoring Plan*, which includes additional information on the monitoring methods described and how deviations would be identified.

Table 7-4 – Direct and Indirect In-Zone Monitoring Program for PISC

Monitoring Element	Strategy
Time Period	Immediately following and for up to 50 years from cessation of injection operations
Monitored Locations, Conditions, and Frequency	• Sunflower AZM/IZM No. 01: continuous pressure and temperature throughout the injection zone • Sunflower AZM No. 01 and No. 02: annual fluid samples for water quality and geochemical parameters • Sunflower USDW No. 01, No. 02, and No. 03: annual fluid samples for water quality and geochemical parameters • Time-lapse seismic surveys or equivalent technologies for the AOR from the surface to the base of the Upper Frio sand. Monitor Survey No. 03 will occur at the end of the operational period, a total of 11 years after the start of operation. The need for additional surface seismic surveys during the PISC phase of the project will be determined based on the results from direct and indirect monitoring and model prediction.
Planned Changes in Monitoring Techniques	None. The model-predicted rapid decrease in CO_2 plume movement and pressure significantly reduces the potential for USDW endangerment following injection and eliminates the need for additional monitoring.
Triggers	*Section 3 – AOR and Corrective Action Plan* provides a list of triggers for the AOR reevaluation process. Those triggers are applicable to the monitoring program.

Table 7-5 – USDW and Above-zone Monitoring and Sampling Program During the PISC Phase

Monitoring Well	Frequency	Parameter/Analyte
Sunflower AZM No. 01 and No. 02	Annually	• Total dissolved solids • Alkalinity • Electrical conductivity • Temperature • pH • Gas composition (CO_2, CH_4, O_2, N_2) • Dissolved cations (As, Ba, Ca, Fe, Mg, Mn, Na, and other relevant metals) • Dissolved anions (i.e. HCO_3, Br, Cl, NO_3, SO_4)
Sunflower USDW No. 01, No. 02, and No. 03		

7.5.4 Submitting PISC Monitoring Results

In accordance with 16 TAC **§5.203(m)(5)**, ExxonMobil will submit PISC monitoring data to the UIC Director in annual reports within 30 days following the anniversary of the date that injection ceases. The annual reports will contain information and data generated during the reporting period, such as the following:

- A list of monitoring events performed during the reporting period and the associated dates
- A brief description of sampling/testing/analytical locations, elevations/depths, equipment, and procedures, indicating whether (and why) departures from the procedures specified in the PISC and Site Closure Plan occurred
- Changes to the monitoring program that took place during the reporting period (e.g., repair to monitoring wells, implementation of approved changes in the frequency of monitoring activities based on criteria established in the PISC and Site Closure Plan and on approval of the UIC Director)
- Synthesis and interpretation of the results that describe trends in parameter values or the lack of trends, alignment between actual and plume model predictions, the appearance of anomalous or unexpected results, and progress toward attaining the EPA and Railroad Commission of Texas (TRRC) criteria for non-endangerment
- Map(s) and cross section(s) showing the AOR, monitoring locations, and interpreted extent of the separate-phase CO_2 plume and the pressure front
- Any recommended changes to the PISC and Site Closure Plan to continue protection of the USDWs

7.6 Demonstration of Non-Endangerment of USDW

Prior to the approval of the site closure authorization and in accordance with 16 TAC **§5.206(k)(3)**, ExxonMobil will provide documentation demonstrate that no additional monitoring is needed to

assure that the geologic storage facility will not endanger the USDW. The non-endangerment demonstration will be based on monitoring data and a demonstration that the structure of the confining zones, combined with the geochemical conditions of the subsurface, have effectively permanently sequestered the stored CO_2. This information will be used to demonstrate that additional monitoring is not needed to ensure non-endangerment of the USDW and that the project has met the compliance obligations to receive authorization for site closure.

This demonstration will be in the form of a detailed report submitted to the UIC Director that synthesizes site- and project-specific information and demonstrates a current understanding of system behavior at the time of the non-endangerment demonstration. The following subsections outline the type of information to be presented in the non-endangerment demonstration report.

ExxonMobil will engage the UIC Director as soon as the available data are aligned with the criteria for site closure, which may ultimately be less than the default PISC duration of 50 years pursuant to 16 TAC **§5.206(k)(3)**.

7.6.1 Introduction and Overview for Non-Endangerment Demonstration

A summary of relevant background information will be provided in the introduction section of the report, 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.

7.6.2 Summary of Existing Monitoring Data

The monitoring data collected throughout the project's life cycle will be summarized and used to describe how the UCZ functioned as a barrier to mitigate endangerment of the USDW, and how the CO_2 is effectively trapped in the injection zones. The non-endangerment demonstration will include a summary of previous monitoring data collected at the site, pursuant to the details in *Section 4 – Well Construction Plan and Operating Conditions* and *Section 5 – Testing and Monitoring Plan*, as well as the PISC and Site Closure Plan.

Data submittals will be in a format acceptable to the UIC Director 16 TAC **§5.207(b)(2)** and will include the following:

- An explanation of monitoring activities, including the dates of all monitoring events and changes to the monitoring program over time
- An explanation of the monitoring infrastructure that has existed at the site
- A comparison with baseline data collected during the site characterization to assess trends in key parameters that support the proposal for site closure

7.6.3 Summary of Computational Modeling History

A series of data sources detailed in *Section 5 – Testing and Monitoring Plan* will be used to update the computational model at least once every 5 years—more frequently if warranted. The following measured data will be utilized to update the computational model to demonstrate non-endangerment:

- In-zone temperature and pressure data
- Injection rate and volume data
- CO_2 plume location based on indirect geophysical monitoring
- Above-zone monitoring data regarding the performance of the UCZ

The procedure used to reevaluate the AOR will be based on the data collected between reevaluations and the well conditions at the time of reevaluation. The post-injection data will include historical injection rates, pressures, pressure falloff, and historical operational parameters of the three proposed injection wells. ExxonMobil will rely on a process of history matching the plume model results with the actual monitoring data. The measured data will be used as a calibration point for the plume model, and the input parameters adjusted to provide a reasonable match between the two data sets. Through this or a similar process, ExxonMobil will provide a validation of the model performance for the CO_2 plume and pressure front.

Items satisfying **§5.203(m)(7)(C) through §5.203(m)(7)(G)** can be found in other sections of this permit application.

- **§5.203(m)(7)(C)** The predicted CO2 injection rate and duration within each injection zone per well is shown in Figure 2-46 through 2-48. In addition, Figure 2-45 includes total million metric tons (MMT) stored per well and per zone.
- **§5.203(m)(7)(D)** Site specific processes of CO2 trapping mechanisms can be found in section 2.4
- **§5.203(m)(7)(E)** At stable plume (50 years post cessation of injection) Figure 2-2 shows the breakdown of the percentage of injected CO2 stored per trapping mechanism
- **§5.203(m)(7)(F)** Research studies used to verify information can be found in section 2.4
- **§5.203(m)(7)(G)** Please refer to section 1.3.2 and Appendix B3 for details on the UCZ.

7.6.4 Evaluation of Reservoir Pressure

The non-endangerment demonstration will include an evaluation of the residual pressure and the potential for continued trends in pressure dissipation that might endanger USDWs in the future. Information will be provided to describe how the pressure and buoyancy effects on plume and pressure migration decayed over time, and how the residual levels comply with the requirements for non-endangerment. This evaluation will consider the most-recent AOR delineation/modeling results and pressure monitoring data. The same model that supported the delineation of the AOR or a similar model approved by the UIC Director will be used for this

modeling, as it will be verified (or calibrated) by actual monitoring and operational data via AOR reevaluations.

7.6.5 Evaluation of the CO_2 Plume

The non-endangerment demonstration will include an evaluation of the gas-phase CO_2 plume and the dissolved-phase CO_2 plume, as appropriate. The evaluation of the potential CO_2 plumes will rely on monitoring data, including geochemical and geophysical analyses and the most recent AOR modeling results. Direct measurements of the temperature and pressure of CO_2 in the injection zone, as well as the results of geophysical measurements, will be used to confirm plume location and demonstrate plume migration rates.

7.6.6 Evaluation of Emergencies or Other Events

Eleven artificial penetrations of the UCZ were noted in *Section 3 – Area of Review and Corrective Action Plan*—each of which will be remediated as also described in *Section 3*. If any subsequent artificial penetrations are discovered to have potential to threaten USDW, they will be remediated using the same procedures so that no artificial penetrations of concern remain at the time of site closure.

The data and evaluation methods specified pursuant to the requirements of *Section 5 – Testing and Monitoring Plan* as well as the PISC Plan provide the basis for demonstrating that no future endangerment of the USDW is likely to occur.

7.7 Site Closure Plan

ExxonMobil will conduct site closure activities to meet the requirements of 16 TAC **§5.206(k)(4)** through **(l)(5)** as described below. ExxonMobil will submit a final Site Closure Plan and notify the UIC Director at least 120 days prior to its intent to close the site. Once the UIC Director has approved closure of the site, ExxonMobil will plug all injection and monitoring wells and submit a site closure report to the TRRC. The activities, as described below, represent the planned activities based on information provided to TRRC. The actual Site Closure Plan may employ different methods and procedures.

Additionally, ExxonMobil will record a notation on the deed to the site that the land has been used to sequester CO_2. Site closure activities will also include removing all surface equipment and restoring the site to its prior land surface condition.

7.7.1 Pre-Closure

In accordance with 16 TAC **§5.206(k)(4)**, a notice of intent to close the site will be submitted to the UIC Director at least 120 days prior to the commencement of closure operations. If any changes are made to the original PISC and Site Closure Plan, a revised plan will also be submitted.

Relevant notifications and applications, such as plugging requests, will be submitted and approved by the appropriate agency prior to commencing such activities.

The site closure notice submitted to the UIC Director will include the following:

- Facility information, name, and location
- A list of contact personnel for allowing timely direct communication to resolve any pressing issues
- A projected closure date, no less than 120 days following the site closure notification submission, unless the UIC Director has approved a different period prior to notice submission

7.7.2 Plugging Activities

Sunflower INJ No. 01 through No. 03, Sunflower AZM/IZM No. 01, Sunflower USDW No. 01 through No. 03, and Sunflower AZM No. 01 and No. 02 (including additional wells that may be installed during the operation or post-operation phase of the Sunflower Project) will be plugged in accordance with applicable Texas requirements. The plugging plan for the injection and monitoring wells which penetrate the base of the usable quality of water is further discussed in *Section 6 – Injection Well Plugging Plan*. After injection ceases and after the appropriate post-injection monitoring period is complete, the monitoring wells will be plugged and abandoned to meet the requirements of 16 TAC **§5.203(k)** and in compliance with applicable state requirements. Additionally, per 16 TAC **§5.203(k)(5) and (6)**, ExxonMobil will certify and plug the Sunflower USDW No. 01, No. 02, and No. 03 in accordance with 16 TAC Chapter 76. In certain instances, the landowner may ask for the wells to remain active and assume ownership at the time of site closure. Should such an agreement exist between the landowner and ExxonMobil at the time of site closure, ExxonMobil will transfer ownership of the wells to the landowner.

The plugging procedure and materials will be designed to mitigate fluid movement and protect the USDW. Prior to plugging the wells, the necessary procedural revisions to address new information will be submitted to the UIC Director for review and approval. The final plugging plans will be submitted to the UIC Director no later than 60 days prior to the plugging of the wells. Following receipt of the approved plugging plans, the wells which penetrate the base of usable quality of water will be logged and pressure-tested to ensure mechanical integrity. If a loss of mechanical integrity is discovered, the mechanical integrity will be restored prior to proceeding with plugging operations. The casing in these wells will be left in place and will not be retrieved at abandonment. A combination of bridge plugs and cement plugs will be set to plug the wells. All casing strings will be cut at least 3 feet below ground level. A steel plate with the required permit information will be welded to the top of the casing to meet the requirements of the TRRC.

7.7.3 Site Restoration

Once the injection and monitoring wells are plugged and abandoned, the surface equipment will be decommissioned and removed from the well site, which will then be restored to a condition agreed upon with the surface owner.

7.7.4 Documentation of Site Closure

Within 90 days of site closure, a final report will be submitted to the UIC Director per the requirements of 16 TAC **§5.206(k)(6)** and include the following:

- Documentation of appropriate injection and monitoring well plugging, including a copy of the survey plats. (16 TAC **§5.206(k)(6)(A)**]). A copy of the plat will be filed with both the TRRC and the EPA Regional Office.
- The survey plat, indicating the locations of the injection wells relative to permanently surveyed benchmarks and including the location of the monitoring wells
- Documentation of the well-plugging report, to be filed with the TRRC 16 TAC **§5.206(k)(6)(B)**
- Post-injection monitoring records, summarized
- Records of the nature, composition, and volume of the CO_2 stream for the injection period, summarized 16 TAC **§5.206(k)(6)(C)**

Pursuant to 16 TAC **§5.206(l)**, a record of notation in the Sunflower Project facilities and infrastructure will be filed on the property deed to provide notice to landowners of the following:

- The land having been used to sequester CO_2
- The name of the state agency with which the survey plat was filed (TRRC) and the EPA Regional Office (Region VI) at which it was submitted
- The total volume of CO_2 injected, the injection zones into which it was injected, and the period over which injection occurred

As required by 16 TAC **§5.206(m)**, ExxonMobil will retain all records collected during the PISC period for 10 years following site closure. At the end of the retention period, ExxonMobil will deliver all records to the UIC Director for retention at a location designated by the director for that purpose.

Underground Injection Control – Class VI Permit Application for Sunflower Carbon Capture and Storage Project Injection Wells No. 01, No. 02, and No. 03

SECTION 8 – EMERGENCY AND REMEDIAL RESPONSE PLAN

Sunflower Carbon Capture and Storage Project
Jefferson and Liberty Counties, Texas
ExxonMobil Low Carbon Solutions Onshore Storage, LLC
Amendment □: □□□□□□2026

SECTION 8 – EMERGENCY AND REMEDIAL RESPONSE PLAN

TABLE OF CONTENTS

8.1 Emergency and Remedial Response Plan 3
8.2 Overview 5
8.3 Identification of Resources and Infrastructure in AOR and Flood Hazard Risk 5
8.4 Emergency Identification and Response Actions 9
8.4.1 Well Integrity Failure 9
8.4.2 Injection Well Monitoring Equipment Failure 11
8.4.3 Fluid (CO_2, Brine, Formation Fluid) Leakage to USDW 12
8.4.4 Fluid (CO_2, Brine, Formation Fluid) Leakage to Surface 13
8.4.5 Induced or Natural Seismicity Event 14
8.4.6 Natural Disaster and Other Unplanned Events 15
8.5 Response Personnel and Equipment 17
8.6 Communications Plan and Emergency Notification Procedures 18
8.7 Plan Review 20
8.8 Staff Training and Exercise Procedures 20

Figures

Figure 8-1 – Testing and Monitoring Safeguards 4
Figure 8-2 – Map of Resources and Infrastructure Within the AOR 7
Figure 8-3 – FEMA Flood Zone Hazard Map Within the AOR 8

Tables

Table 8-1 – Degrees of Risk for Emergency Events 9
Table 8-2 – Response Actions for Seismicity Events 15
Table 8-3 – Contact Information of ExxonMobil Emergency Authorities 17
Table 8-4 – Emergency Services 17

8.1 Emergency and Remedial Response Plan

This Emergency and Remedial Response Plan (ERRP) accounts for the entire AOR and was developed in compliance with the requirements of Title 16, Texas Administrative Code (16 TAC), Part 1, Chapter 5, to develop and maintain an ERRP that describes actions to be taken to address movement of the injection or formation fluids that may cause endangerment to an underground source of drinking water (USDW) during the construction, operation, and post-injection site care periods of the Sunflower Carbon Capture and Storage (CCS) Project (Sunflower Project). Under 16 TAC **§5.203(j)(2)(E)**), the actions described in the ERRP are to be implemented immediately to address a rare event where the movement of the injection fluid or formation fluid endangers a USDW. ExxonMobil Low Carbon Solutions Onshore Storage, LLC (ExxonMobil) prepared this ERRP to provide both the scope of actions to be taken and the schedule under which the actions would be expected to be implemented.

ExxonMobil is undertaking the project in Jefferson and Liberty Counties, Texas, to sequester approximately 25.3 million metric tons (MMT) of CO_2 over 11 years. The ERRP was developed for injection of CO_2 into the proposed Sunflower Project Injection Wells No. 01, No. 02, and No. 03.

ExxonMobil will use engineering design and planning safeguards (Figure 8-1) to reduce the potential for the occurrence of a rare emergency and remedial response event. These steps are based on ExxonMobil's global experience and expertise with risk management for rare events in site selection, well drilling and completion, and reservoir operations. Additionally, the site will employ the use of gates and locks to provide security measures against unauthorized activity pursuant to 16 TAC **§5.203(l)(3)(B)**.

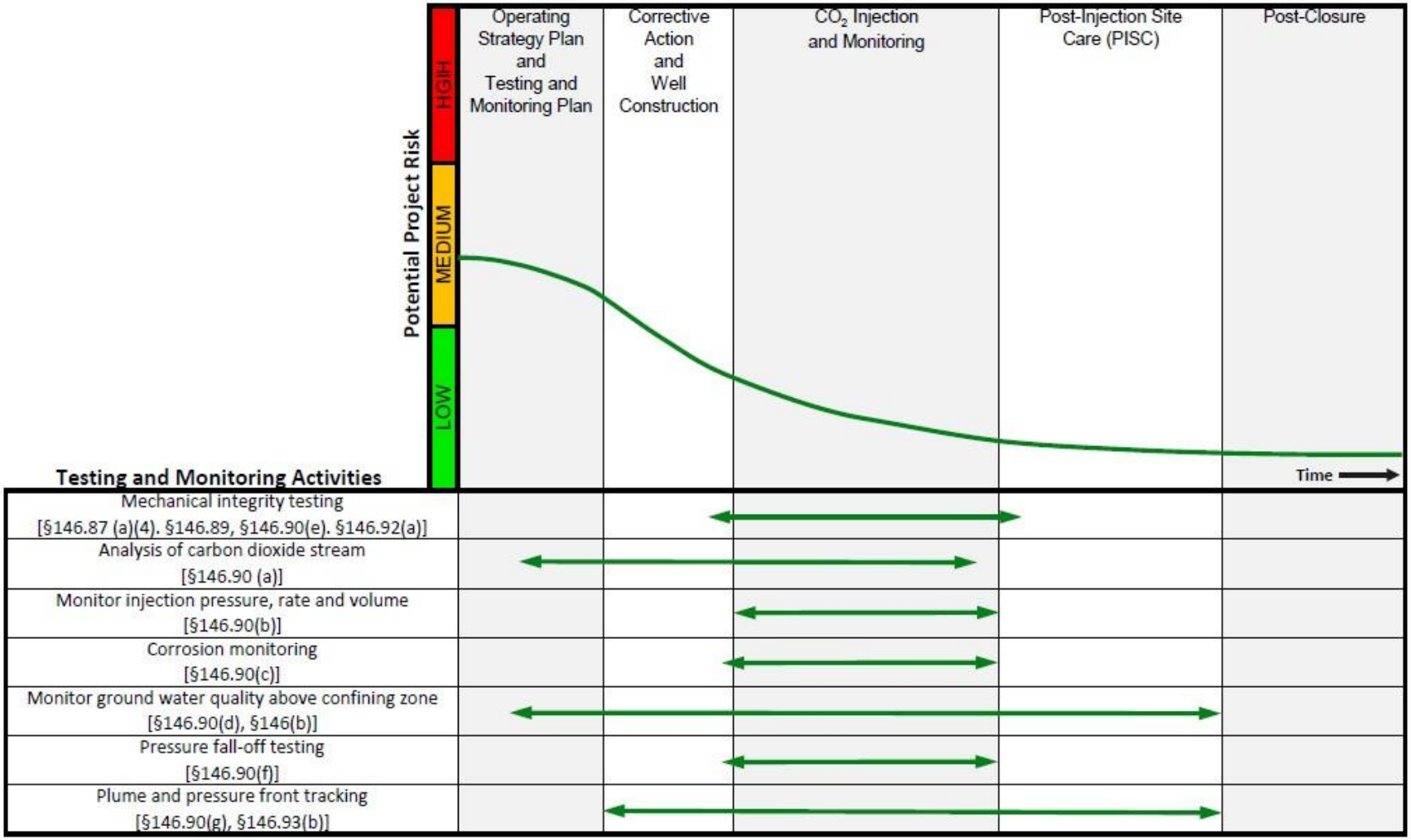


Figure 8-1 – Testing and Monitoring Safeguards

8.2 Overview

ExxonMobil took the findings from *Section 1 – Site Characterization* and *Section 3 – Area of Review and Corrective Action Plan* and identified hypothetical risk scenarios that could—in the rare event of occurrence—pose a threat to USDWs. ExxonMobil's risk assessment process was used to estimate the probability and consequence of each risk scenario based on the experience and judgment of the risk subject matter experts for the project. The ERRP will apply over the life of the project, including throughout the post-injection site care period per 16 TAC **§5.203(l)**.

This ERRP describes the actions that ExxonMobil plans to perform in the event of an emergency that could endanger public health and safety or any USDW during the construction, operation, or post-injection site care periods.

If ExxonMobil obtains verified evidence that the injected CO_2 stream and associated pressure front may cause an endangerment to a USDW, ExxonMobil will perform the following actions:

1. Initiate the shutdown plan for the injection well(s).
2. Take all steps reasonably necessary to identify and characterize the release.
3. Notify the permitting agency's Underground Injection Control (UIC) Program director (UIC Director) of the emergency event within 24 hours.
4. Implement the approved ERRP.
5. Prepare and submit an incident report to the UIC Director

Where the phrase "initiate the shutdown plan" is used, the following protocol will be employed. First, ExxonMobil will implement the steps needed to immediately cease injection. In some circumstances (e.g., for safety reasons), ExxonMobil will, in consultation with the UIC Director, gradually ramp down injection as appropriate as part of the process of immediately ceasing injection. Additionally, ExxonMobil will coordinate with the UIC Director to determine if an emergency scenario does not warrant shutdown for the wells (e.g., because there is not an endangerment to a USDW).

8.3 Identification of Resources and Infrastructure in AOR and Flood Hazard Risk

Figure 8-2 illustrates resources and infrastructure near the area of review (AOR). As shown, the resources and infrastructure are primarily related to agricultural crop production and undeveloped rural acreage with some residential development. The infrastructure development is primarily in the form of county roads, pipelines, and power transmission lines to service the developed areas.

Figure 8-3 displays the proposed injection wells and the AOR with respect to flood hazard areas. There is digital coverage of the FEMA flood hazard layer for Liberty County, but not Jefferson County. Jefferson County flood zones are shown using georeferenced FIRM panels. Sunflower INJ No. 01 is Zone X (unshaded), which corresponds to areas determined to be outside of the 500-year floodplain (0.2% annual chance of a flood). Sunflower INJ No. 02 is in

Zone A2, which is an area of 100-year flood. Sunflower INJ No. 03 is in Zone C, which is defined as an area of minimal flooding. The three injection wells are, therefore, located in areas of minimal flood hazard.

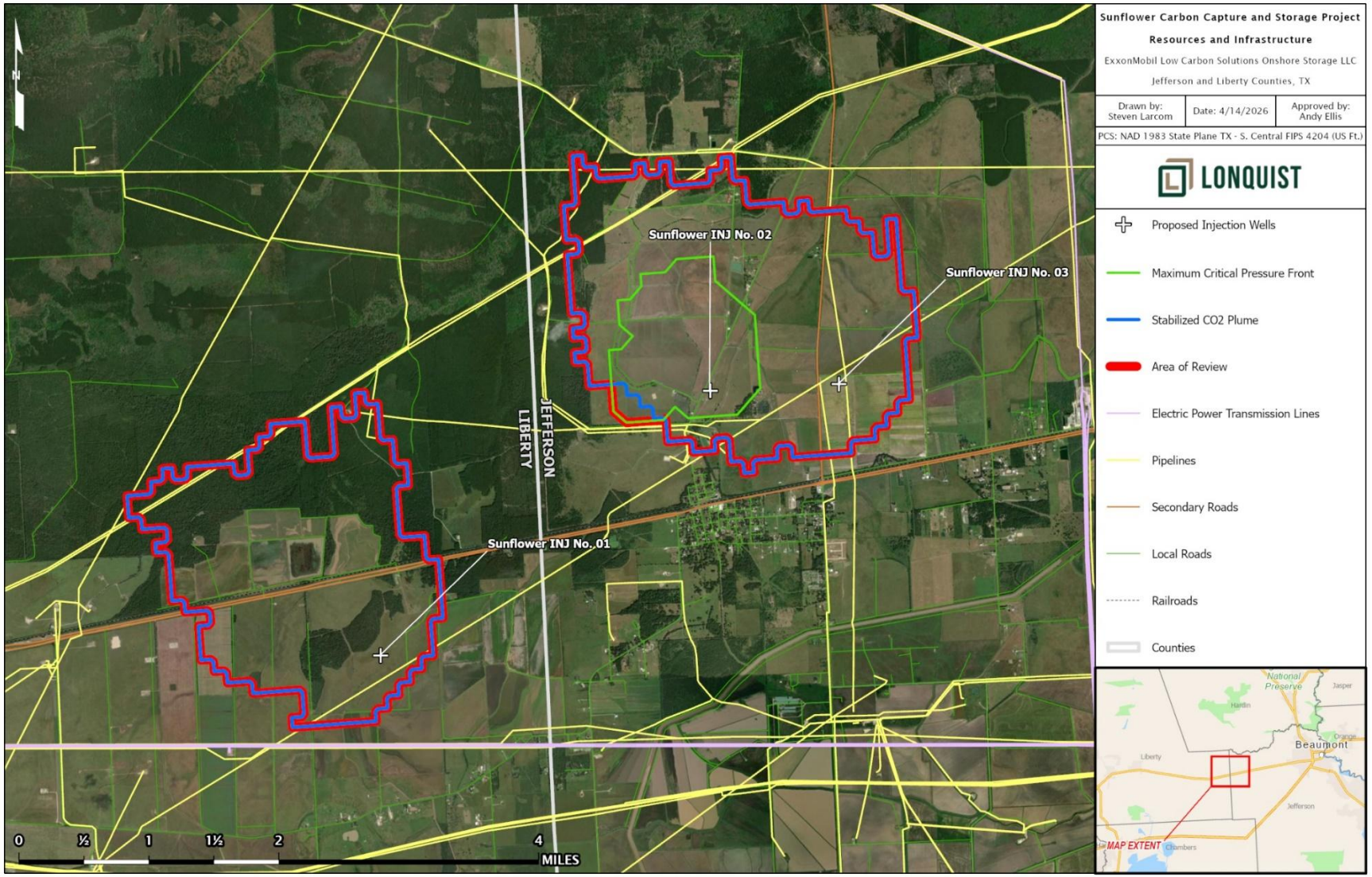


Figure 8-2 – Map of Resources and Infrastructure Within the AOR

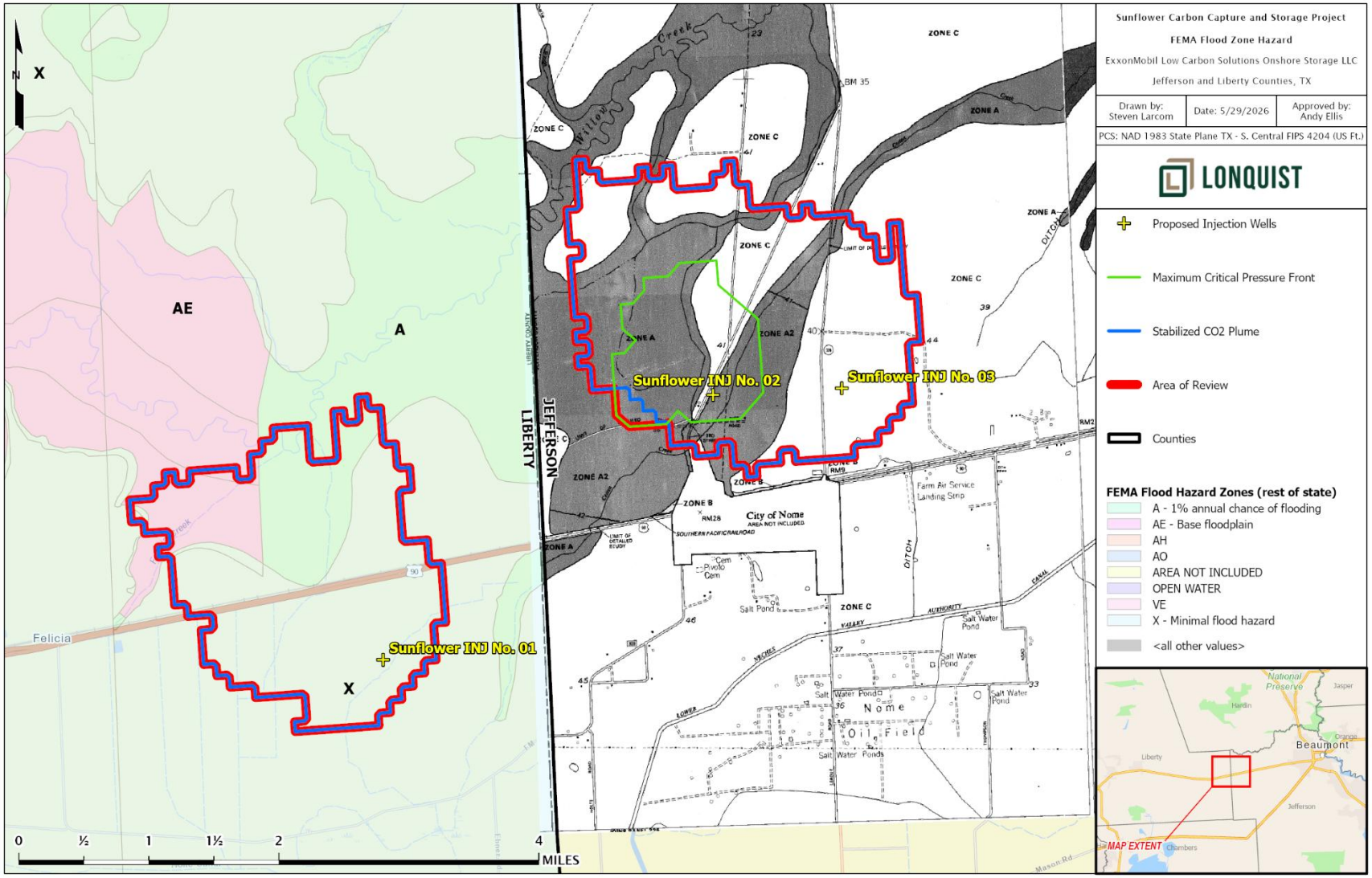


Figure 8-3 – FEMA Flood Zone Hazard Map Within the AOR

Potential Risk Scenarios

The following are events that could potentially result in an emergency response:

- Fluid leakage into USDW
- An equipment integrity, control system, or monitoring system failure, such as damage to a wellhead, valve, pipe, or flange connection that may cause a CO_2 release to the atmosphere
- A natural disaster or other unplanned event (e.g., hurricane, tornado, lightning strike, earthquake)

Response actions will depend on the severity of the event(s) triggering an emergency response. "Emergency events" are categorized as shown in Table 8-1.

Table 8-1 – Degrees of Risk for Emergency Events

Emergency Condition	Definition
Major	Event poses immediate substantial risk to human health, resources, or infrastructure. Emergency actions involving local authorities (evacuation or isolation of areas) should be initiated.
Serious	Event poses a potential, significant near-term risk to human health, resources, or infrastructure if conditions worsen, or no response actions are taken.
Minor	Event poses no immediate risk to human health, resources, or infrastructure—but could escalate if not addressed.

8.4 Emergency Identification and Response Actions

Steps to identify and characterize an emergency event will depend on specific issues identified and the severity of the event. The potential risk scenarios are detailed below.

8.4.1 Well Integrity Failure

Integrity failure of an injection or monitoring well may have occurred with the potential to endanger USDWs if monitoring results identify a loss of mechanical integrity, or automatic shutdown devices are activated as follows:

- Wellhead pressure exceeds the maximum injection pressure specified in the permit.
- Annulus pressure indicates a loss of external or internal well containment.

Emergency Condition: Minor to major, depending on the results of the investigation into the incident and identified remedial activities

Timing of Event: Construction, pre-injection, injection, and post-injection phases

Avoidance Measures:

- Proper well design, construction, inspection, and maintenance
- Routine mechanical integrity testing
- Routine inspection of monitoring equipment

Detection Methods:

- Well pressure monitoring
- Annulus pressure and fluid-level monitoring
- Monitoring drilling-fluid returns and parameters during well construction and workovers

Potential Response Actions:

- Notify the UIC Director within 24 hours of the emergency event.
- Determine the severity of the event based on the information available within 24 hours of notification.
- Investigate the source and extent of the problem and determine an appropriate course of action to repair and/or remediate the issue.
- Prepare and submit an incident report to the UIC Director in an acceptable format.
- For a major or serious emergency:
  - Initiate the shutdown plan.
  - If contamination is detected, identify and implement appropriate remedial actions (in consultation with the UIC Director).
  - Implement the start-up plan once necessary remedial actions are completed and as agreed to by the UIC Director.
- For a minor emergency:
  - Conduct an assessment to determine whether there has been a loss of mechanical integrity.
  - If there has been a loss of mechanical integrity, initiate the shutdown plan.
- ExxonMobil may enact the following remedial actions to control the flow of injected CO_2 and/or associated reservoir fluids outside the permitted injection zone or USDW:
  - Cease injection of CO_2.
  - Pump heavy fluid into the injection well(s).
  - Perform workover operations on the well(s).
  - Develop and perform relief well-flowback operations.

Response Personnel: Drilling, workover, or injection crew; supervisory personnel

Equipment: Depending on the severity of the event, the equipment required may include a workover rig, drilling rig, casing and cementing equipment, drilling fluids/muds/kill fluids, logging equipment, and surface monitoring equipment.

8.4.2 Injection Well Monitoring Equipment Failure

The failure of monitoring equipment for wellhead pressure, temperature, and/or annulus pressure may indicate a problem that could endanger USDWs.

Emergency Condition: Minor to major, depending on the results of the investigation into the incident and identified remedial activities

Timing of Event: Injection, post-injection phases

Avoidance Measures:

- Preventative and routine maintenance of monitoring equipment
- Backup monitoring equipment

Detection Methods:

- Continuous monitoring and recording of well parameters (*Section 5 – Testing and Monitoring Plan*)

Potential Response Actions:

- Notify the UIC Director within 24 hours of the emergency event.
- Determine the severity of the event based on the information available within 24 hours of notification.
- Investigate the source and extent of the problem and determine an appropriate course of action to repair and/or remediate the issue.
- Prepare and submit an incident report to the UIC Director in an acceptable format.
- For a major or serious emergency:
  - Initiate the shutdown plan.
  - If contamination is detected, identify and implement appropriate remedial actions (in consultation with the UIC Director).
  - Implement the start-up plan once necessary remedial actions are completed and as agreed to by UIC Director.
- For a minor emergency:
  - Conduct an assessment to determine whether there has been a loss of mechanical integrity.
  - If there has been a loss of mechanical integrity, initiate the shutdown plan.
  - Implement the start-up plan once necessary remedial actions are completed and as agreed to by the UIC Director.

Response Personnel: Supervisory personnel, maintenance technicians, contract personnel

Equipment: Applicable equipment for repair and/or replacement of monitoring systems

8.4.3 Fluid (CO_2, Brine, Formation Fluid) Leakage to USDW

Elevated concentrations of indicator parameter(s) in groundwater sample(s) as identified in the Testing and Monitoring Plan—or other verified evidence—indicate a fluid (CO_2 or brine) leakage into a USDW.

Emergency Condition: Major, due to potential endangerment of USDWs

Timing of Event: Injection, post-injection phases

Avoidance Measures:

- Following the methods and sampling schedules as specified in the Testing and Monitoring Plan (*Section 5*).

Detection Methods:

- Elevated concentrations of indicator parameters in USDW samples
- Anomalies in the results of any monitoring outlined in the Testing and Monitoring Plan or during the post-injection site care period may be cause for additional samples to be taken in the USDW to investigate a potential leakage.

Potential Response Actions:

- Notify the UIC Director within 24 hours of the emergency event.
- Determine the severity of the event based on the information available within 24 hours of notification.
- Investigate the source and extent of the problem and determine an appropriate course of action to repair and/or remediate the issue.
- Prepare and submit an incident report to the UIC Director in an acceptable format.
- For all emergencies (major):
  - Initiate the shutdown plan.
  - Collect confirmation samples from the USDW(s).
  - If the presence of indicator parameters is confirmed, develop (in consultation with the UIC Director) a case-specific work plan to:
    - Install additional groundwater monitoring points near the affected groundwater well(s) to delineate the extent of impact.
    - Remediate unacceptable impacts to the affected USDW.
  - Arrange for an alternate potable water supply if the USDW was being utilized and drinking water standards for contaminants have been exceeded.
  - ExxonMobil will immediately enact the notification process.

- Proceed with efforts to remediate the USDW to mitigate any unsafe conditions (e.g., install system to intercept, extract, and dispose of brine or brine-contaminated water, and "pump and treat" to aerate CO_2-laden water).
- Continue groundwater remediation and monitoring on a frequent basis (frequency to be determined by ExxonMobil and the UIC Director) until the unacceptable adverse USDW impact has been fully addressed.
- Implement the start-up plan once necessary remedial actions are completed and as agreed to by the UIC Director.

Response Personnel: Supervisory personnel, environmental professionals/subcontractors

Equipment: Depending on the severity of the event, response equipment may include water testing and treatment/sampling equipment, and water supply equipment

8.4.4 Fluid (CO_2, Brine, Formation Fluid) Leakage to Surface

Elevated concentrations of indicator parameter(s) in surface water, soil gas, ambient air sample(s), if triggered, as specified in the Testing and Monitoring Plan—or other verified evidence—indicate a CO_2 or brine leakage to the surface.

Emergency Condition: Major, due to potential contamination of surface water, soil, and ambient air

Timing of Event: Injection, post-injection phases

Avoidance Measures:

- Following the methods and sampling schedules as specified in the Testing and Monitoring Plan (*Section 5*)

Detection Methods:

- Elevated concentrations of indicator parameters in surface water, soil gas, and ambient air samples which may be implemented as a triggered response to confirmed USDW contamination.
- Anomalies in the results of any monitoring outlined in the Testing and Monitoring Plan or during the post-injection site care period may be cause for additional samples to be taken to investigate a potential leakage.

Potential Response Actions:

- Notify the UIC Director within 24 hours of the emergency event.
- Determine the severity of the event based on the information available within 24 hours of notification.
- Investigate the source and extent of the problem and determine an appropriate course of action to repair and/or remediate the issue.

- Prepare and submit an incident report to the UIC Director in an acceptable format.
- For all emergencies (major):
  - Initiate the shutdown plan.
  - If the presence of indicator parameters is confirmed, develop (in consultation with the UIC Director) a case-specific work plan to:
    - Install additional groundwater monitoring points near the affected groundwater well(s) to delineate the extent of impact.
    - Remediate unacceptable impacts to the affected ground surface(s).
  - ExxonMobil will communicate to the relevant public authorities about an event that may require emergency response—so that the public understands the emergency event—and if there are any environmental, health, or safety concerns.
  - Proceed with efforts to remediate or mitigate any unsafe conditions (e.g., surface cleanup methods such as removal of brine via vacuum truck, soil excavation, or soil treatment).
  - Continue groundwater remediation and monitoring on a frequent basis (the frequency to be determined by ExxonMobil and the UIC Director) until the unacceptable adverse surface impact has been fully addressed.
  - Implement the start-up plan once necessary remedial actions are completed and as agreed to by the UIC Director.

Response Personnel: Supervisory personnel, environmental professionals/subcontractors

Equipment: Depending on the severity of the event, response equipment may include sampling equipment for surface water, soil gas, ambient air, and surface water remediation equipment.

8.4.5 Induced or Natural Seismicity Event

Natural or induced seismicity events of sufficient magnitude to create damage were found to be highly improbable for the site location for this project which will be operating under conditions that are below the fracture pressure. In the very rare chance that such seismicity conditions occurred, the consequences could be of significance regarding the integrity of the artificial penetrations of the upper confining zone (UCZ) and the natural faults and fractures. Therefore, the following response actions were developed to gather information regarding the potential for CO_2 and brine confinement issues to arise under such events.

ExxonMobil has installed a permanent seismicity monitoring system onsite, which is being monitored by a third party to detect seismic activity prior to and during injection operations. ExxonMobil will additionally receive notifications from USGS of recorded seismicity events for the site and surrounding area, should an event occur. If a review of the data indicates that the event was within a 5.6 mi radius of an injector ExxonMobil will notify the UIC Director to jointly determine if the events are likely to be associated with the operations, and if so, implement response actions for seismicity events as contained in Table 8-2.

Table 8-2 – Response Actions for Seismicity Events

Threshold Condition[1]	Response Action for Epicenter Within a 100 Square Mile Area (5.6-Mile Radius) of an Injection Well[2]
Seismic event above magnitude 2.0 and below magnitude 3.0	• Monitor well pressure, temperature, and annulus pressure to assess if well operation within permitted status and assess the potential for mechanical integrity issues to have occurred from the seismic event. • Otherwise, continue normal operation within permitted levels and review seismicity data. • Report findings to the UIC Director as appropriate.
Seismic event greater than or equal to magnitude 3.0	• Communicate with facility personnel and local authorities about the operating condition of the injection wells and initiate correspondence with other nearby operators. • Monitor well pressure, temperature, and annulus pressure to verify well operation within permitted status and assess the potential for mechanical integrity issues to have occurred from the seismic event. • If evidence of mechanical integrity issues, cease injection, notify the UIC Program Director within 24 hours, and, if the loss of mechanical integrity may endanger the USDW, implement the emergency and remedial response plan approved by the UIC Program Director. • Collect fluid samples from the above-zone monitoring wells and USDW monitoring wells. • Review seismicity and operational data to identify potential source areas for a release above the UCZ. • Within 30 days of the triggering seismic event, determine causality and, if deemed causally related, propose appropriate corrective measures to project operations. • Report findings to the UIC Director and implement corrective measures if warranted. • Operations will resume upon UIC Director concurrence that necessary remedial or corrective measures have been taken so that the risk to the USDW is in compliance with EPA standards for protection of human health and the environment.

[1] Specified magnitudes determined by local or U.S. Geological Survey (USGS) seismic monitoring stations or reported by the U.S. Geological Survey National Earthquake Information Center using the national seismic network.
[2] Based on Railroad Commission of Texas Seismicity Review (RRC, 2024): https://www.rrc.texas.gov/oil-and-gas/applications-and-permits/injection-storage-permits/oil-and-gas-waste-disposal/injection-disposal-permit-procedures/seismicity-review

8.4.6 Natural Disaster and Other Unplanned Events

A natural disaster (e.g., hurricane, tornado, lightning strike) affecting the normal operation of the injection well(s) could impact site operations by loss of well integrity, fluid leakage, and/or equipment malfunction. Weather-related events may affect surface facilities.

Due to the proximity of the location to the Gulf of Mexico, hurricanes and severe storms involving tornadoes are the most likely natural disasters/severe weather events to occur at the facility.

Emergency Condition: Minor to major, depending on the type and severity of the natural disaster. Any immediate, near-term, or prolonged risk to human health, resources, or infrastructure will be assessed immediately to determine emergency actions that will be taken.

Timing of Event: Construction, pre-injection, injection, and post-injection phases

Avoidance Measures:

- Preparation measures may be taken by monitoring current and predicted conditions.

Detection Methods:

- Weather forecast monitoring

Potential Response Actions: If a natural disaster occurs that affects the normal operation of the injection well, ExxonMobil will perform the following:

- Notify the UIC Director within 24 hours of the emergency event.
- Determine the severity of the event based on the information available within 24 hours of notification.
- Investigate the extent of the problem and determine an appropriate course of action to repair and/or remediate any issues caused by or resulting from the disaster.
- Prepare and submit an incident report to the UIC Director in an acceptable format.
- For a major or serious emergency:
  - Initiate the shutdown plan.
  - Notify the UIC Director within 24 hours of an emergency event.
  - Limit facility access to authorized personnel only.
  - Monitor well pressure, temperature, and annulus pressure to verify well integrity and determine the cause and extent of any failure.
  - If contamination or endangerment of the USDW is detected, ExxonMobil will identify and implement appropriate remedial actions (in consultation with the UIC Director).
  - Implement the start-up plan once necessary remedial actions are completed and as agreed to by UIC Director.
- For a minor emergency:
  - Conduct an assessment to determine whether there has been a loss of mechanical integrity.
  - If there has been a loss of mechanical integrity, initiate the shutdown plan.
  - Limit access to authorized personnel only.
  - Monitor well pressure, temperature, and annulus pressure to verify well integrity and determine the cause and extent of any failure.
  - Implement the start-up plan once necessary remedial actions are completed and as agreed to by UIC Director.

Response Personnel: Supervisory personnel, and applicable personnel to diagnose, repair, and remediate as needed

Equipment: Applicable equipment to diagnose, repair, and remediate as needed

8.5 Response Personnel and Equipment

Site personnel, project personnel, and local authorities will be relied upon to implement this ERRP and will be dispatched in the case of an emergency. In the event of an emergency, appropriate city, county, and state emergency responders and agencies may be notified based on the severity of the risk. Contact information for ExxonMobil Emergency Authorities and state and local emergency services are outlined in Tables 8-3 and 8-4, respectively.

A site-specific emergency notification chart will be developed and maintained during the life of the project. ExxonMobil will provide the current site-specific emergency contact list to the UIC Director.

Table 8-3 – Contact Information of ExxonMobil Emergency Authorities

Name	Title	Telephone Number
Propietary Business Information	Low Carbon Solutions (LCS) U.S. Gulf Coast Venture Executive	Propietary Business Information
	Emergency Response & Preparedness Manager	
	Advisor, Public & Government Affairs – Low Carbon Solutions	

Table 8-4 – Emergency Services

Agency	Telephone Number
Liberty County Emergency Services District (ESD) 2	936-536-1334
Liberty County ESD 7	936-298-2828
Liberty County Sheriff	911 or 936-336-4500
Liberty County Public Health Unit	936-336-3859
Liberty County Office of Emergency Management and Homeland Security	936-334-3219
Liberty County Local Emergency Planning Committee	409-277-8720 or 936-334-3219
Liberty County EMS	911
Liberty County EMS	911
Jefferson County ESD 3	911 or 409-752-5100
Jefferson County ESD 4	911 or 409-796-3036
Jefferson County Sheriff	911 or 409-835-8411
Jefferson County Public Health Unit #1	409-835-8530

Agency	Telephone Number
Jefferson County Office of Emergency Management	409-835-8757
Jefferson County Local Emergency Planning Committee	409-835-8757
Texas Division of Emergency Management	512-424-2208
Texas Department of Public Safety	512-424-2000
State of Texas Spill-Reporting Hotline	800-832-8224
Texas Parks and Wildlife Department	512-389-4800
EPA Region 6	800-887-6063 or 214-665-2760
Texas Commission on Environmental Quality (TCEQ)	512-239-1000
TCEQ Office of Water	512-239-6696
National Response Center	800-424-8802
State of Texas Spill-Reporting Hotline	800-832-8224
EPA National Response Center (24 hours)	800-424-8802

Necessary equipment for emergency and remedial response may vary depending on the event. Generally, no specialized equipment will be required for response actions (such as cessation of injection, well shut-in, and evacuation). If specialized equipment (such as a drilling rig or logging equipment) is required, ExxonMobil will be responsible for its procurement.

8.6 Communications Plan and Emergency Notification Procedures

As appropriate, ExxonMobil will communicate to the relevant public authorities about an event that may require emergency responseso that the public understands the emergency event and if there are any environmental, health, or safety concerns. Based on the emergency event, ExxonMobil will determine the appropriate information, timing, and communication method for the event. This information may include the following:

- Description of the event
- Severity
- Potential impact to the environment
- Investigation steps
- Mitigation actions taken or planned
- Current status

ExxonMobil will notify the UIC Director and relevant state/local emergency management agencies of any event that requires an emergency response and that has the potential to impact the public immediately, within 24 hours. Agencies which may be contacted are listed in Table 8-4. ExxonMobil will coordinate with the appropriate agencies to inform the public on steps to be taken in the event of an emergency and, if deemed necessary, request assistance from said agencies or coordinate removal of the public from an area of exposure.

If required, ExxonMobil will also communicate with other entities who may need to be informed about or act in response to the event. These may include local water purveyors or operators, CO_2 suppliers, pipeline operators, oil and gas operators, landowners, regional response teams, and other departments or authorities as guided by the UIC Director.

Pursuant to **TAC §5.203(l)(3)(F)**, ExxonMobil has performed substantial community outreach and sponsored, hosted, or materially participated in multiple events which discussed Emergency Response and provided advanced briefing to members of the public, both inside and outside the AOR, on the the proposed Sunflower CCS project including discussions on the hazards and characteristics of CO_2. Since October 2025, ExxonMobil has participated in eight events reaching over 240 residents within the AOR. Additionally, ExxonMobil has delivered CCS presentations and educational activities at five events in Jefferon County reaching over 4,100 attendees. ExxonMobil will continue to conduct community outreach events to inform the public about the planned Sunflower CCS project. These events focus on the public within the AOR but extend beyond the AOR as part of ExxonMobil's broader community education and benefits plan.

Our efforts focus on providing clear, accurate information about CCS, its environmental benefits, and the safety measures in place to protect the community. Key aspects of our education involve briefing the public within the AOR and beyond the AOR on subjects such as:

- What is Carbon Capture and Storage (CCS)?
- What is CO_2?
- What is the scope of ExxonMobil's Sunflower CCS project?
- How does ExxonMobil ensure drinking water is protected and unaffected by CCS?
- How is CO_2 permanently stored?
- What does ExxonMobil do to monitor, verify, and report on the status of the CO_2 stored?

In April 2026, we launched the Sunflower CCS project website (https://texas.exxonmobilpipeline.com/our-work/sunflower-project), which offers a project overview, map, FAQs about CCS and community safety, information on first responder training for CO_2-specific hazards, and updates on our community engagement and investments.

To further inform the community, we have placed an information sign at the project site on Old Grayburg Road in Nome, informational postcards at Nome City Hall, and contact cards at the U.S. Post Office in Nome. These materials encourage residents to contact us via email, phone, or by scanning a QR code for more information.

Starting in June 2026, a Community Liaison will host office hours twice a week at Nome City Hall to answer questions and provide CCS educational materials.

ExxonMobil is committed to supporting the communities within the AOR. We have contributed over $800,000 to emergency response and preparedness efforts at the local emergency service

districts, and an additional $102,000 to support education and STEM resources for students in Hardin-Jefferson ISD and community safety initiatives.

8.7 Plan Review

The UIC Director will evaluate this proposed ERRP to verify that it meets the requirements of 16 TAC **§5.203(l)** and that the plan accounts for all site-specific conditions.
This ERRP will be reviewed as follows:

- At least once every 5 years following its approval by the permitting agency
- Within 1 year of any AOR reevaluation (16 TAC **§5.207(a)(2)(E)**)
- Following any significant changes to the facility, such as addition of injection or monitoring wells, on a schedule determined by the UIC Director (16 TAC **§5,207(a)(2)(E)**)
- When required by the UIC Director (16 TAC **§5.207(a)(3)**)

If the review indicates that no amendments to the ERRP are necessary, ExxonMobil will provide the permitting agency with the documentation supporting the "no amendment necessary" determination. If the review indicates that amendments to the ERRP are necessary, amendments will be made and submitted to the permitting agency within 30 days following an event that initiates the ERRP review procedure.

The amended plan must be approved by the UIC Director and would then be incorporated into the Class VI permit. If significant changes to the plan are needed, the UIC Director may need to modify the permit. A permit modification under 16 TAC **§5.202** would require notification of the public and an opportunity for comment. Minor changes to the plan, as defined under 16 TAC **§5.202**, do not require a permit modification or a public process.

8.8 Staff Training and Exercise Procedures

ExxonMobil will train all personnel on the knowledge they need to conduct their job safely. Incident Command System (ICS) training is required for personnel who are named in either the Spill Management Team in a Facility Plan or the Emergency and Remedial Response Plan—or who are reasonably expected to fulfill a supervisory role in the management of an incident/emergency. All personnel expected to participate in an emergency response will be trained annually on the hazardous substances that they may encounter during an emergency response, and will be provided training on mitigating those hazards.

Hazardous Waste Operations (HAZWOPER) and Emergency Response Operations level training is required for personnel who are required to participate in the active response to an incident/emergency. The training program administrator will certify personnel as HAZWOPER trained through the completion of comprehensive quarterly training, hands-on training, response drill participation, and applicable on-the-job experiences.

Training and Personnel Competency is one of the 11 elements of ExxonMobil's Operations Integrity Management System (OIMS). Storage site operations are conducted in accordance with this corporate framework, specifically OIMS 5.4 – Training, which establishes requirements for managing personnel competency and training. The objective of OIMS 5.4 is to ensure that personnel are competent to perform their assigned responsibilities in a manner that supports safe, secure, and environmentally sound operations, and that complies with all applicable legal and regulatory requirements. This element requires that personnel receive appropriate training and demonstrate competency prior to performing safety-critical tasks. The intended outcome is to reduce the likelihood and severity of Safety, Security, Health, and Environmental (SSHE) incidents attributable to inadequate training or competency.

Operations personnel attend and have attended multiple trainings per year related to both ExxonMobil procedures and site-specific procedures. Training is delivered through a combination of instructor-led, computer-based, and on-the-job methods. All training completion and competency records are documented and maintained to ensure traceability, auditability, and compliance verification.

All personnel working at storage sites are required to complete training on the site-specific Emergency and Remedial Response (ERR) Plan. ERR training includes a tabletop exercise conducted in coordination with local emergency response agencies. This exercise is designed to validate communication protocols, confirm roles and responsibilities under the Incident Command System (ICS), and ensure an effective and coordinated response capability. Operations personnel are required to participate in ERR training annually. For CO_2 storage sites, the next scheduled ERR exercise is October 1, 2026. In accordance with OIMS 5.4 requirements, ERR plans are reviewed annually and formally updated at a minimum of every five years.

Operating Instructions (OI) are governed under Element 6 – Operating and Maintaining Assets within OIMS. Control Room Operators (CROs) and Field Operators are required to complete training and demonstrate competency in both standard Operating Instructions and Local Operating Instructions (LOI) prior to startup and prior to performing applicable tasks. Refresher training is conducted as needed to maintain competency.

Site activities are further supported by a structured Work Management System that includes daily safety meetings, pre-job briefings and safety meetings, Job Safety Analyses (JSAs), simultaneous operations (SIMOPS) reviews, and muster procedures. These processes ensure that hazards are systematically identified, communicated, and mitigated prior to and during work execution. Contractor and third-party personnel are required to adhere to site safety requirements and are provided with appropriate orientation and training prior to commencing work.

Training schedules, dates, and course outlines for CO2 storage sites are available upon request.

Additionally, ExxonMobil will offer appropriate training and provide response plans to emergency first responders as required by organizations with geographic and logistical jurisdiction at the facility including steps to be taken in case of an emergency. Safety is ExxonMobil's number one priority. The Sunflower CCS Project has been designed to mitigate any potential risks and while an emergency event is highly unlikely, ExxonMobil understands the critical importance of preparedness. To date, ExxonMobil has provided world-class emergency response training to over 100 first responders in Liberty and Jefferson Counties. This training includes Texas A&M Engineering Extension Services (TEEX) training, National Association of State Fire Marshals (NASFM) training, and Mobile CO_2 Trailer training, among others.

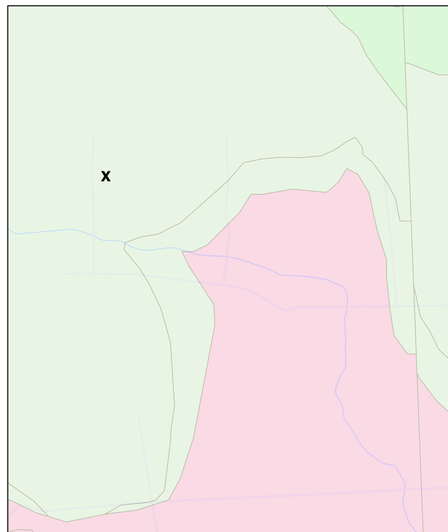
Appendix G-3 is included as a supplement to this Section 8 - Emergency and Remedial Response Plan and as supporting evidence to show the level of work and planning ExxonMobil performs for Emergency Response planning. A similar plan will be developed for the Sunflower project.

Appendix G – Emergency And Remedial Response Plan

Appendix G-1: FEMA Flood Zone Hazard Map
Appendix G-2: Infrastructure and Resources Map
Appendix G-3: Integrated Contingency Plan

Appendix G: Emergency And Remedial Response Plan

Appendix G1: FEMA Flood Hazard Zone Map



Sunflower Carbon Capture and Storage Project

FEMA Flood Zone Hazard

ExxonMobil Low Carbon Solutions Onshore Storage LLC

Jefferson and Liberty Counties, Texas

Appendix G-1

Drawn by:	Date:	Approved by:
Steven Larcom	5/29/2026	Andy Ellis

PCS: NAD 1983 State Plane TX - S. Central FIPS 4204 (US Ft.)

LONQUIST

Texas Registration No. F-8952

- Proposed Injection Wells
- Maximum Critical Pressure Front
- Stabilized CO2 Plume
- Area of Review
- Counties

FEMA Flood Hazard Zones (rest of state)

- A - 1% annual chance of flooding
- AE - Base floodplain
- X - Minimal flood hazard

Sunflower INJ No. 01

Sunflower INJ No. 02

Sunflower INJ No. 03

1:15,000

0 ½ 1 1½ 2 4 Miles

0 1,000 2,000 3,000 4,000 5,000 10,000 Feet

FIRM Panel 100 Legend

KEY TO MAP

- 500-Year Flood Boundary
- 100-Year Flood Boundary
- Zone Designations*
- 100-Year Flood Boundary
- 500-Year Flood Boundary
- Base Flood Elevation Line With Elevation In Feet** — 513
- Base Flood Elevation in Feet Where Uniform Within Zone** — (EL 987)
- Elevation Reference Mark — RM7×
- Zone D Boundary
- River Mile — •M1.5

ZONE B / ZONE A1 / ZONE A5 / ZONE B

**Referenced to the National Geodetic Vertical Datum of 1929

*EXPLANATION OF ZONE DESIGNATIONS

ZONE	EXPLANATION
A	Areas of 100-year flood; base flood elevations and flood hazard factors not determined.
A0	Areas of 100-year shallow flooding where depths are between one (1) and three (3) feet; average depths of inundation are shown, but no flood hazard factors are determined.
AH	Areas of 100-year shallow flooding where depths are between one (1) and three (3) feet; base flood elevations are shown, but no flood hazard factors are determined.
A1-A30	Areas of 100-year flood; base flood elevations and flood hazard factors determined.
A99	Areas of 100-year flood to be protected by flood protection system under construction; base flood elevations and flood hazard factors not determined.
B	Areas between limits of the 100-year flood and 500-year flood; or certain areas subject to 100-year flooding with average depths less than one (1) foot or where the contributing drainage area is less than one square mile; or areas protected by levees from the base flood. (Medium shading)
C	Areas of minimal flooding. (No shading)
D	Areas of undetermined, but possible, flood hazards.
V	Areas of 100-year coastal flood with velocity (wave action); base flood elevations and flood hazard factors not determined.
V1-V30	Areas of 100-year coastal flood with velocity (wave action); base flood elevations and flood hazard factors determined.

Appendix G2: Infrastructure and Resources Map



Sunflower Carbon Capture and Storage Project

Resources and Infrastructure

ExxonMobil Low Carbon Solutions Onshore Storage LLC

Jefferson and Liberty Counties, Texas

Appendix G-2

Drawn by: Steven Larcom	Date: 5/29/2026	Approved by: Andy Ellis

PCS: NAD 1983 State Plane TX - S. Central FIPS 4204 (US Ft.)

LONQUIST

Texas Registration No. F-8952

- Proposed Injection Wells
- Pipelines
- Electric Power Transmission Lines
- Primary Roads
- Secondary Roads
- Local Roads
- Railroads
- Maximum Critical Pressure Front
- Stabilized CO2 Plume
- Area of Review
- Counties

Sunflower INJ No. 01

Sunflower INJ No. 02

Sunflower INJ No. 03

JEFFERSON

LIBERTY

N

1:15,000

0 ½ 1 1½ 2 4 Miles

0 1,000 2,000 3,000 4,000 5,000 10,000 Feet

Appendix G: Integrated Contingency Plan



Claimed as PBI

Claimed as PBI

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