E.3. INJECTION AND MONITORING WELL PLUGGING PLAN
40 CFR 146.92(b)

Vernon One CCS Site

Facility Information

Facility name: Vernon One CCS Site

[redacted]

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Well location: Vernon Parish, Louisiana

[redacted]

The proposed plugging plan details for [redacted] injection wells ([redacted]) plus one in-zone monitoring well ([redacted]) is described in this section. The [redacted] proposed injection wells will consist of [redacted] injection wells, [redacted] injection wells and [redacted] injection wells. The in-zone monitoring well will be fully cased and designed to measure the external pressure and temperature in the [redacted] injection zones through an array of tools installed and cemented in the production casing and open hole wellbore annulus. The wells will be plugged in accordance with 40 CFR 146.92(b). The planned procedures and four wellbore diagrams one for each injection zone in the [redacted] plus the in-zone monitoring well are provided to illustrate what the proposed wellbore conditions will look like after the plugging and abandonment of the wells. The plugging schedule of the wells will occur at different times during the project life cycle. The last well to be plugged will be the in-zone monitoring well and this will occur after verification that the CO_2 plume and pressure front have stabilized. CapturePoint Solutions, LLC will conduct injection well plugging and abandonment according to the procedures below.

1 Planned Tests or Measures to Determine Bottom-Hole Reservoir Pressure

A bottomhole reservoir pressure will be determined prior to commencing injection well plugging operations [40 CFR 146.92(b)(1)]. Prior to running bottomhole pressure tests (BHP), the well will be flushed with a buffer fluid first [40 CFR 146.92(a)].

BHP measurements will be taken by running wireline pressure gauges prior to starting any P&A procedure on the wells. The bottomhole pressure measurement will be used to calculate the density of the workover fluid required to safely complete the plug and abandonment procedure. Determination of BHP is described in Section 4 for each well to be plugged.

2 Planned External Mechanical Integrity Test(s)

CapturePoint Solutions, LLC will conduct at least one of the tests listed in **Table 1** to verify external mechanical integrity prior to plugging the injection well as required by 40 CFR 146.92(b)(2).

An active pulsed-neutron log will be run and then the well will be pressure-tested to ensure integrity both inside and outside of the casing prior to plugging. Production logging tools (PLTs), tracers, noise or temperature logs could be run as substitutions.

Pulsed-neutron logs are used to evaluate the CO_2 or water saturations over time and the temperature surveys could detect the movement of fluid behind cement and casing. If such a condition is detected the location of fluid movement in the well can be evaluated and corrected. Pressure tests are used to ensure the casing is sufficiently sealed to prevent the loss or addition of formation fluids into the well. If a pressure decrease is observed, it may indicate that the well does not have sufficient mechanical integrity and that the well needs repaired.

If a loss of mechanical integrity is discovered, the well will be further evaluated and repaired prior to proceeding further with the plugging operations. Testing criteria to determine whether mechanical integrity test results are successful or not is described in Module E.1. Testing and Monitoring Plan, Details for MITs are also described below in Section 4.

All casing strings in each well will have been cemented to the surface at the time of construction and will not be retrievable at abandonment.

Details regarding equipment, precision and MITs are described in section 6.6 of the Testing and Monitoring Plan.

Table 1. Planned MITs.

Test Description	Location
Pulsed-Neutron Log	Monitoring and injection well locations
Noise or Temperature Log	
Oxygen-Activation Log	

3 Information on Plugs

40 CFR 146.92(b) reads as follows

CapturePoint Solutions, LLC will use the materials and methods noted in Tables 2, 3, 4 and 5 to plug the [redacted] injection wells and the in-zone monitoring well, respectively. The volume and depth of the plug or plugs will depend on the final geology and downhole conditions of the well as assessed during construction. The proposed plugging plans are illustrated in Figures 1 – [redacted] injection well, Figure 2- [redacted] injection well, Figure 3 – [redacted] injection well and Figure 4 -In-zone monitor well. The cement(s) formulated for plugging will be designed to prevent any unwanted fluid movement, resist the corrosive aspects of CO_2 with water mixtures and protect all USDWs. The cement formulation and required certification documents will be submitted to the agency with the well plugging plan. The owner or operator will report the wet density and will retain duplicate samples of the cement used for each plug. Volume calculations will be based upon the final dimensions of the long string casing. The balance method will be used to spot the Plugs. Plugs will be tagged at the cement plug top to verify location and integrity.

Volume calculations for determining the quantity of cement and slurry volume are as follows:

> Cement plug volume calculation (sacks) = Casing capacity (cu ft/ft) * plug height/cement yield (cu ft/sk)

Example for plug 9 5/8" casing with 8.681" using 15.8 ppg cement with 1.179 yield (cu ft/sk)

> Plug volume in sacks = (0.41102 cu ft/ft)*(600 ft) / (1.179cu ft/sack) 209.17 round up to 210 sacks

Details regarding materials used to prevent detrimental interactions because of contact with formation fluids and injectate are described in the following procedures and detailed in tables 2 through 5 in Section 4.

4 Narrative Description of Plugging Procedures

Notifications, Permits, and Inspections

In compliance with 40 CFR 146.92(c), CapturePoint Solutions, LLC will notify the regulatory agency at least 60 days before plugging the well and provide updated Injection Well Plugging Plan, if applicable. Additionally, CapturePoint Solutions, LLC will submit a request for Plugging and Abandonment through the Louisiana Department of Natural Resources pursuant to LAC §137(A)(4) and §137(F)(1).

Inspections will be made available to the regulatory authority at their request. A closure report certifying that the well or wells were closed in accordance with applicable requirements will be submitted to the proper agencies within 60 days of plugging each well. The report will include records for any newly constructed or discovered wells within the Area of Review.

When plugging and abandonment is complete, CapturePoint, LLC will submit certification to the authorized regulatory body (by the facility and by a licensed, professional engineer with current registration, who is knowledgeable and experienced in practical drilling engineering and who is familiar with the special conditions and requirements of injection well construction) that the injection well has been closed in accordance with the regulations. Plugging reports will be submitted within 60 days of well plugging and CapturePoint, LLC will retain a copy of the plugging report for a minimum of 10 years following site closure [40 CFR 146.92(d)].

5. Preparation and Plugging Procedures

Preparation Procedures for a [redacted] *Injection Well to be plugged:*

1. After ceasing injection, bottomhole pressure measurements will be taken by running wireline pressure gauges prior to starting the P&A process on the well. Use the recorded bottomhole pressure to calculate the density of workover fluid required to safely complete the proposed plug and abandon procedure.
2. Run active pulsed-neutron log. Production logging tools (PLTs) such as tracers, noise or temperature logs could be run in substitution.
3. Move rig in. Pump into well with the calculated density of the workover fluid based on BHP survey in Step 1. A minimum of three tubing volumes will be injected into the formation without exceeding the fracture pressure.
4. The injection wells all have a well head and tubing installed. A permanent packer is set in the casing within 75' of the top injection perforations. Test casing/ tubing annulus to 1,000 psi or pressure required. Bleed casing pressure to 0 psi.
    a. If a loss of mechanical integrity is discovered, the well will be repaired prior to proceeding further with the plugging operations.
    b. All casing in the well has been cemented to surface at the time of construction and will not be retrievable at abandonment.
    c. If the tubing and casing pressure measures 0 psi, continue with well plugging procedures for the [redacted] CO2 injection zone.

Table 2 and **Figure 1** contain the individual cement plug details and a proposed wellbore diagram for a [redacted] Injection well, respectively.

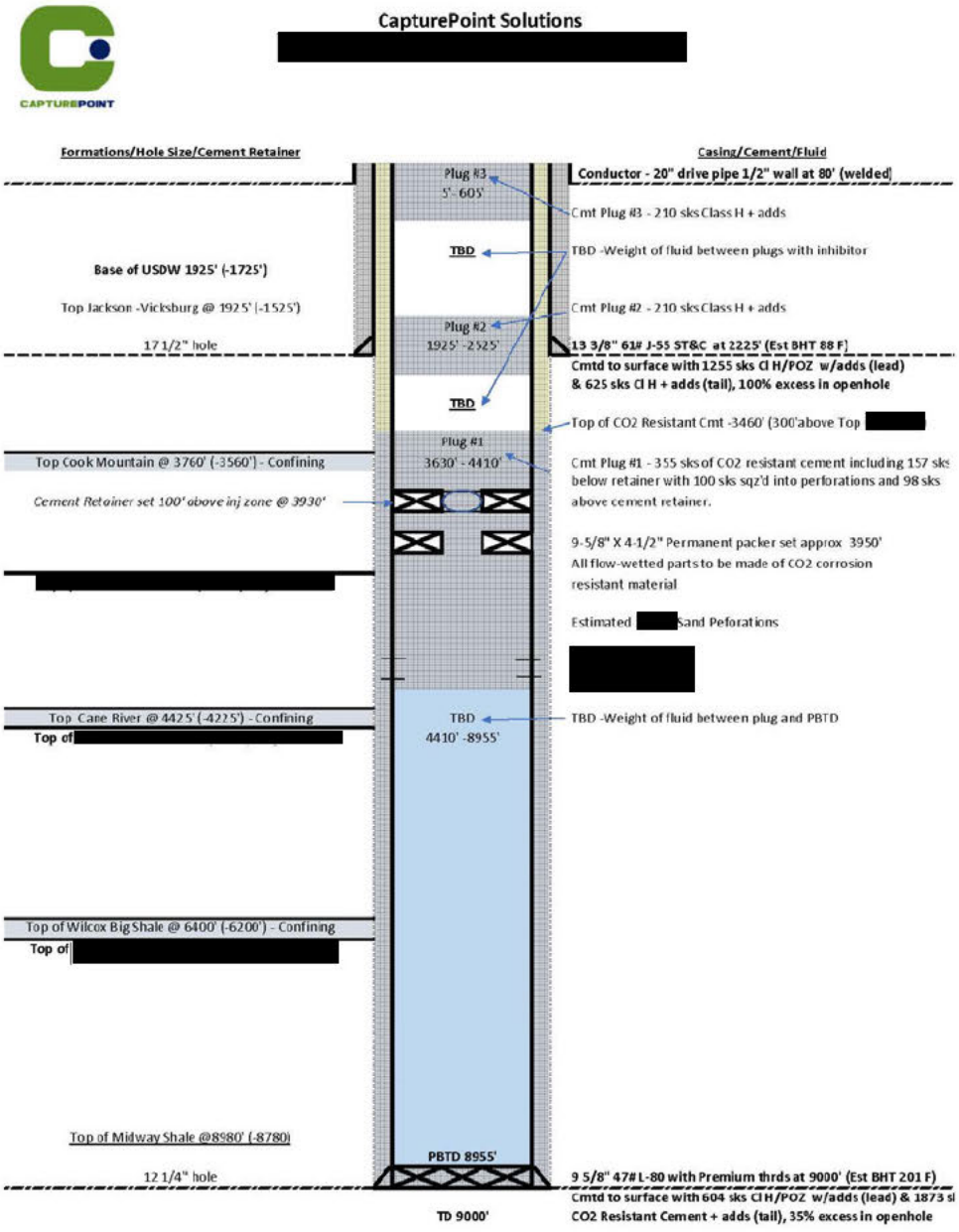
1. ND tree and NU BOP's. Test BOPs per regulations. Pull injection tubing. Permanent packer will remain in casing.
2. Set cement retainer above permanent packer and within 100 feet of [redacted] zone perforations at [redacted]'. RIH with work string and sting into cement retainer.
3. Squeeze perforations with 355 sacks of CO_2 resistant cement allowing for 100 sacks of cement to be squeezed into perforations and leave 300 feet of cement on top of retainer (approximately 130' above the [redacted] confining zone). Displace cement with calculated workover fluid (TBD). Allow cement to set.
4. Tag top of cement (TOC) and pressure test to 1,000 psi.

5. Set balance plug using 210 sacks of CL H cement plus additives from [redacted] to [redacted] to isolate the surface casing and into the J[redacted] confining zone. Displace with calculated workover fluid (TBD). Allow cement to set. Tag top of plug.
6. Set balance plug using 210 sacks of CL H cement plus additives from 605'- 5' to isolate the top of the surface casing. Allow cement to set.
7. Cut casing off 5 feet below ground level. Clean cellar and weld on plate with well information

Table 2. Plugging details [redacted] Injection Well

Plug Information	Plug #1	Plug #2	Plug #3
Diameter of casing in which plug will be placed (Inches)	8.681"	8.681"	8.681"
Depth to bottom of tubing or drill pipe (Feet)	Sting into Cement Retainer at [redacted]'	[redacted]'	605'
Sacks of cement to be used	355	210	210
Slurry volume to be pumped (bbls)	447	247	247
Slurry weight (lb/gal)	14.5	15.6	15.6
Calculated top of plug (Feet)	[redacted]'	[redacted]'	5'
Bottom of plug (Feet)	[redacted]'	[redacted]'	605'
Type of cement or other material	CO_2 resistant cement	CL H plus additives	CL H plus additives
Method of emplacement (e.g., balance method, retainer method, or two-plug method)	Set Cement Retainer at [redacted]', squeeze 100 sacks into perfs and Balance Plug	Balance Plug	Balance Plug

Figure 1. Proposed Well Plugging Diagram [redacted] Injection Well



5.1 Preparation Procedures for an [redacted] Injection Well to be plugged

1. After ceasing injection, bottomhole pressure measurements will be taken by running wireline pressure gauges prior to starting the P&A process on the wells. Use the recorded bottomhole pressure to calculate the density of workover fluid required to safely complete each plug and abandon procedure.
2. Run active pulsed-neutron log. Production logging tools (PLTs) such as tracers, noise or temperature logs could be run in substitution.
3. Move rig in. Pump into well with the calculated density of the workover fluid based on BHP survey in step 1. A minimum of three tubing volumes will be injected into the formation without exceeding fracture pressure.
4. The injection wells all have a well head and tubing installed. A permanent packer is set in the casing within 75' of the top injection perforations. Test casing/tubing annulus to 1,000 psi or pressure required. Bleed casing pressure to 0 psi.
    a. If a loss of mechanical integrity is discovered, the well will be repaired prior to proceeding further with the plugging operations.
    b. All casing in the well has been cemented to surface at the time of construction and will not be retrievable at abandonment.
    c. If the tubing and casing pressures measure 0 psi, continue with well plugging procedures for the [redacted] injection well.

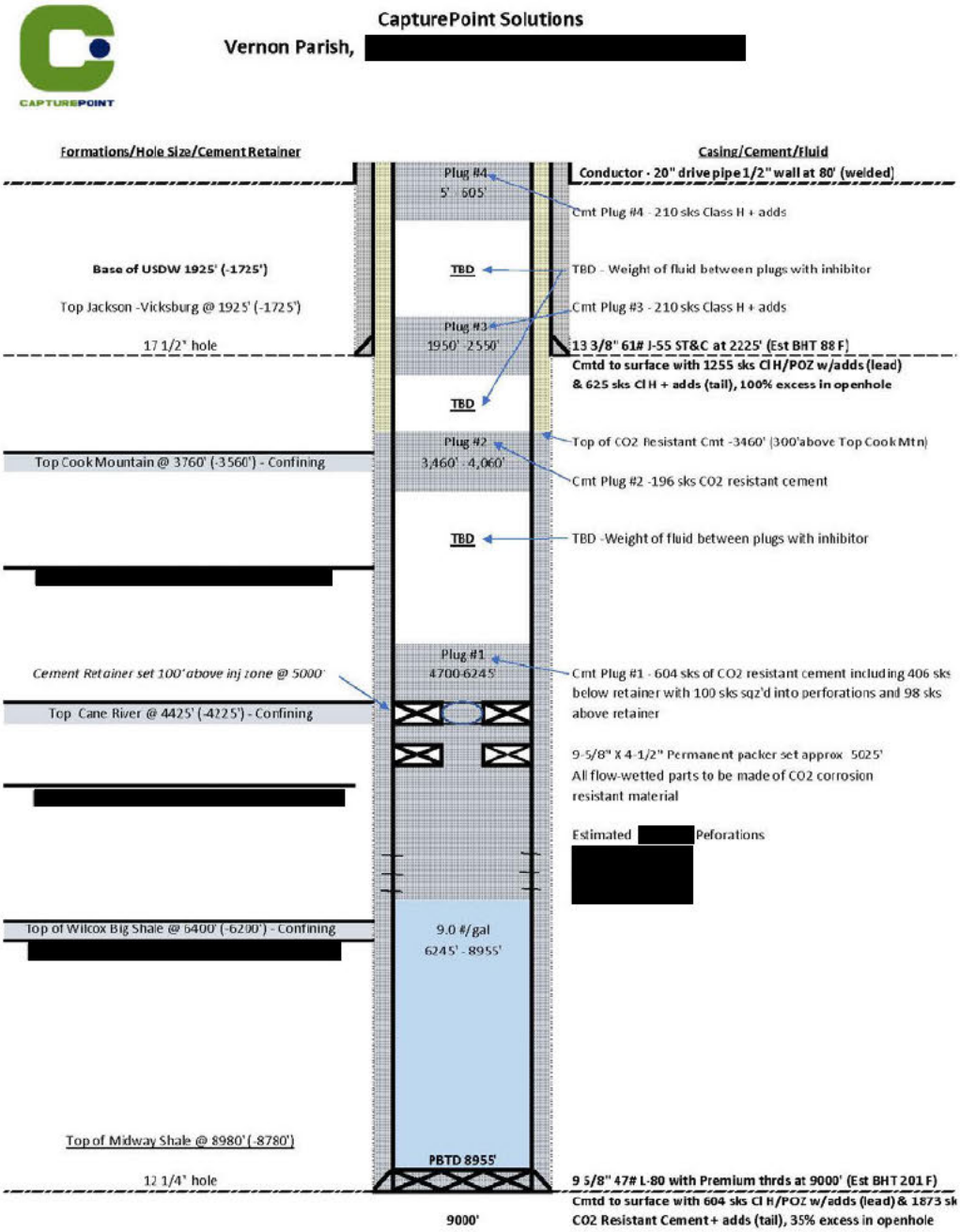
Table 3 and Figure 2 contain the individual cement plug details and a proposed wellbore diagram for an [redacted] Injection well, respectively.

1. ND tree and NU BOP's. Test BOPs per regulations. Pull injection tubing. Permanent packer will remain in casing.
2. Set cement retainer above permanent packer and within 100 feet of [redacted] zone perforations at [redacted]'. RIH with work string and sting into cement retainer.
3. Squeeze perforations with 604 sacks of CO_2 resistant cement allowing for 100 sacks of cement to be squeezed into perforations and leave 100 feet of cement on top of retainer. Displace cement with calculated workover fluid (TBD).
4. Allow cement to set. Tag top of cement (TOC) and pressure test to 1,000 psi.
5. Set balance plug using 196 sacks of CO_2 resistant cement plus additives from [redacted]' – [redacted]' (approximately 300' above the [redacted] confining zone). A Displace cement with calculated workover fluid (TBD).
6. Allow cement to set. Tag top of plug.
7. Set balance plug using 210 sacks of CL H cement plus additives from [redacted]' to [redacted]' to isolate the surface casing and into the [redacted] confining zone. Displace cement with calculated workover fluid (TBD). Allow cement to set and then tag top of plug.
8. Set balance plug using 210 sacks of CL H cement plus additives from 605'- 5' to isolate the top of the surface casing. Allow cement to set.
9. Cut casing off 5 feet below ground level. Clean cellar and weld on plate with well information

Table 3. Plugging details [redacted] Injection Well

Plug Information	Plug #1	Plug #2	Plug #3	Plug #4
Diameter of casing in which plug will be placed (Inches)	8.681”	8.681”	8.681”	8.681”
Depth to bottom of tubing or drill pipe (Feet)	Sting into Cement Retainer at [redacted]'	[redacted]’	[redacted]’	605’
Sacks of cement to be used	604	196	210	210
Slurry volume to be pumped (bbls)	762	247	247	247
Slurry weight (lb/gal)	14.5	14.5	15.6	15.6
Calculated top of plug (Feet)	[redacted]’	[redacted]’	1,950’	5
Bottom of plug (Feet)	[redacted]’	[redacted]’	2,550’	605
Type of cement or other material	CO_2 resistant cement	CL H plus additives	CL H plus additives	CL H plus additives
Method of emplacement (e.g., balance method, retainer method, or two-plug method)	Set Cement Retainer at [redacted]’, squeeze 100 sacks into perfs and Balance Plug	Balance Plug	Balance Plug	Balance Plug

Figure 2. Proposed Well Plugging Diagram [redacted] Injection Well



5.2 Preparation Procedures for a [redacted] Injection Well to be plugged

1. After ceasing injection, bottomhole pressure measurements will be taken by running wireline pressure gauges prior to starting the P&A process on the wells. Use the recorded bottomhole pressure to calculate the density of workover fluid required to safely complete each plug and abandon procedure.
2. Run active pulsed-neutron log. Production logging tools (PLTs) such as tracers, noise or temperature logs could be run in substitution.
3. Move rig in. Pump into well with the calculated density of the workover fluid based on BHP survey in step 1. A minimum of three tubing volumes will be injected into the formation without exceeding fracture pressure.
4. The injection wells all have a well head and tubing installed. A permanent packer is set in the casing within 75' of the top injection perforations. Test casing/tubing annulus to 1,000 psi or pressure required. Bleed casing pressure to 0 psi.
    a. If a loss of mechanical integrity is discovered, the well will be repaired prior to proceeding further with the plugging operations.
    b. All casing in the well has been cemented to surface at the time of construction and will not be retrievable at abandonment.
    c. If the tubing and casing pressures measure 0 psi, continue with well plugging procedures for the [redacted] injection well.

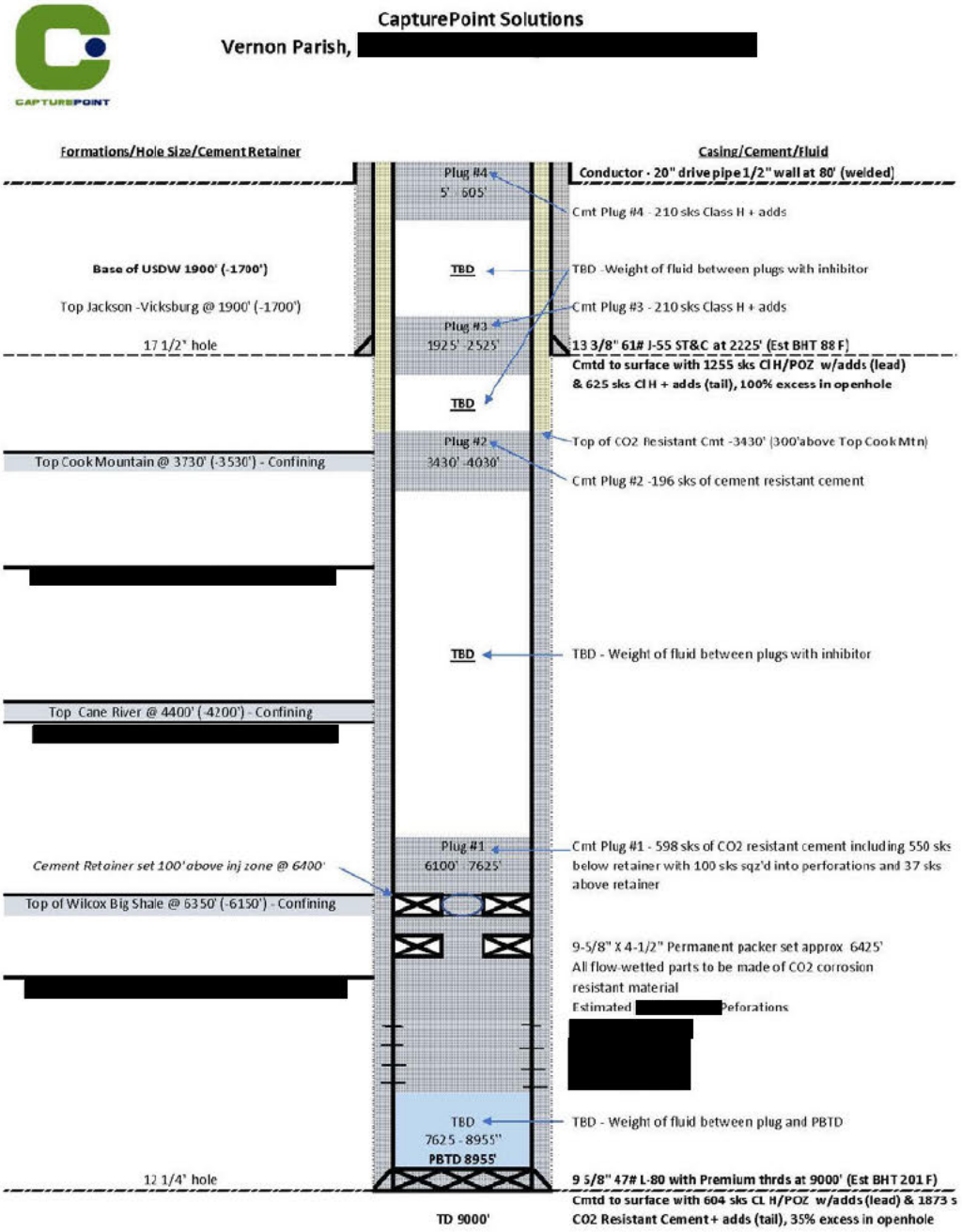
Table 3 and Figure 2 contain the individual cement plug details and a proposed wellbore diagram for a [redacted] Injection well, respectively.

1. ND tree and NU BOP's. Test BOPs per regulations. Pull injection tubing. Permanent packer will remain in casing.
2. Set cement retainer above permanent packer and within 100 feet of [redacted] zone perforations at [redacted]'. RIH with work string and sting into cement retainer.
3. Squeeze perforations with 598 sacks of CO_2 resistant cement allowing for 100 sacks of cement to be squeezed into perforations and leave 100 feet of cement on top of retainer. Displace cement with calculated workover fluid (TBD).
4. Allow cement to set. Tag top of cement (TOC) and pressure test to 1,000 psi.
5. Set balance plug using 196 sacks of CO_2 resistant cement plus additives from [redacted]' – [redacted]' (approximately 300' above the [redacted] confining zone). Displace cement with calculated workover fluid (TBD).
6. Allow cement to set. Tag top of plug.
7. Set balance plug using 210 sacks of CL H cement plus additives from [redacted]' to [redacted]' to isolate the surface casing and into the [redacted] confining zone. Displace cement with calculated workover fluid (TBD). Allow cement to set and then tag top of plug.
8. Set balance plug using 210 sacks of CL H cement plus additives from 605'- 5' to isolate the top of the surface casing. Allow cement to set.
9. Cut casing off 5 feet below ground level. Clean cellar and weld on plate with well information

Table 4. Plugging details [redacted] Injection Well

Plug Information	Plug #1	Plug #2	Plug #3	Plug #4
Diameter of casing in which plug will be placed (Inches)	8.681"	8.681"	8.681"	8.681"
Depth to bottom of tubing or drill pipe (Feet)	Sting into Cement Retainer at [redacted]'	[redacted]'	[redacted]'	605'
Sacks of cement to be used	598	196	210	210
Slurry volume to be pumped (bbls)	753	247	247	247
Slurry weight (lb/gal)	14.5	14.5	15.6	15.6
Calculated top of plug (Feet)	[redacted]'	[redacted]'	1,925'	5
Bottom of plug (Feet)	[redacted]'	[redacted]'	2,525'	605
Type of cement or other material	CO_2 resistant cement	CL H plus additives	CL H plus additives	CL H plus additives
Method of emplacement (e.g., balance method, retainer method, or two-plug method)	Set CIBP at [redacted]', squeeze 100 sacks cement into perfs and Balance Plug	Balance Plug	Balance Plug	Balance Plug

Figure 3. Proposed Well Plugging Diagram [redacted] Injection Well



5.3 Well Plugging Procedures In-Zone Monitoring and Observation Wells

5.3.1 In-Zone Monitoring Well Plugging Procedures

Please refer to Table 5 and Figure 4.

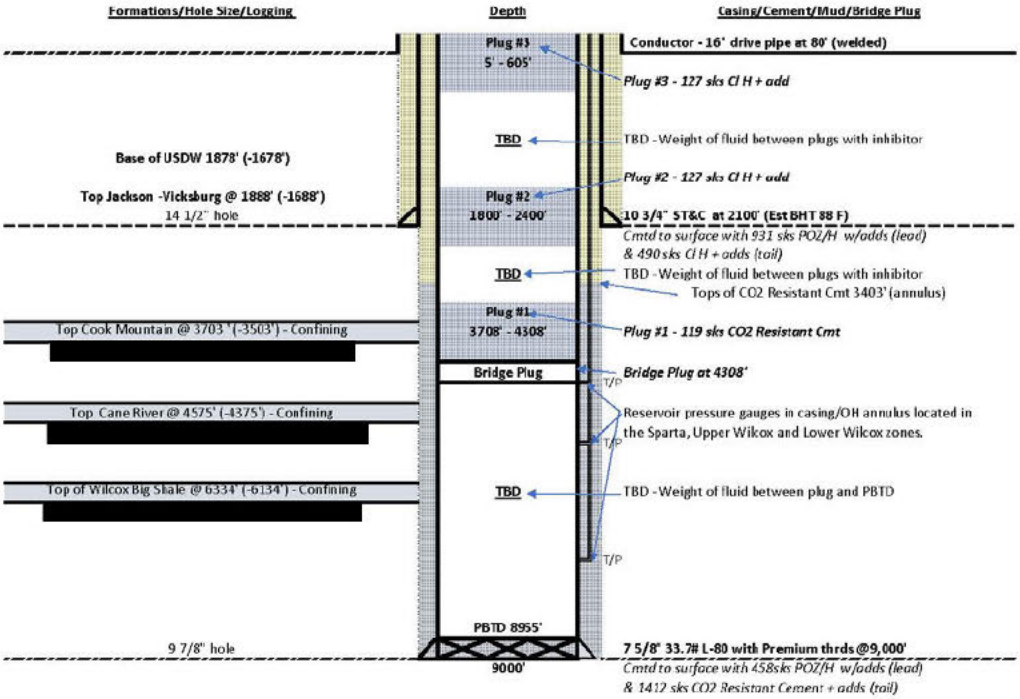
1. The well has a wellhead, no tubing and does not have any perforations. Test casing to 1,000 psi or required pressure.
    a. If a loss of mechanical integrity is discovered, the well will be repaired prior to proceeding further with plugging operations.
    b. All casing in the well is cemented to surface at the time of construction and will not be retrievable at abandonment.
    c. If casing has measured 0 psi, continue with well plugging procedures.
2. ND tree and NU BOP's. Test BOPs per regulations.
3. Set CIBP at 4,308'. Set balance plug on top of CIBP using 119 sacks of CO_2 resistant cement plus additives from [redacted]' – [redacted]' (approximately 300' above the [redacted] zone). Displace cement with calculated workover fluid (TBD). Allow cement to set. Tag top of plug.
4. Set balance plug using 127 sacks of CL H cement plus additives from 2,400' to 1,800' to isolate the surface casing and into the [redacted] confining zone. Displace cement with calculated workover fluid (TBD). Allow cement to set and then tag top of plug.
5. Set balance plug using 127 sacks of CL H cement plus additives from 605'- 5' to isolate the top of the surface casing. Allow cement to set.
6. Cut casing off 5 feet below ground level. Clean cellar and weld on plate with well information

Table 5. Plugging details In-Zone Monitoring Well

Plug Information	Plug #1	Plug #2	Plug #3
Diameter of casing in which plug will be placed (Inches)	6.765'	6.765'	6.765'
Depth to bottom of tubing or drill pipe (Feet)	[redacted]'	[redacted]'	603'
Sacks of cement to be used	119	127	127
Slurry volume to be pumped (bbls)	150	150	150
Slurry weight (lb/gal)	14.5	15.6	15.6
Calculated top of plug (Feet)	[redacted]'	[redacted]'	5'
Bottom of plug (Feet)	[redacted]'	[redacted]'	605'

Plug Information	Plug #1	Plug #2	Plug #3
Type of cement or other material	CO_2 resistant cement	CO_2 resistant cement	CL H plus additives
Method of emplacement (e.g., balance method, retainer method, or two-plug method)	Set CIBP at [redacted]' and Balance Plug	Balance Plug	Balance Plug

Figure 4. Proposed Wellbore Diagram In-Zone Monitoring Well



5.3.2 In-Zone Observation Well Plugging Procedures

Please refer to Table 6 and Figure 5.

1. The well has a wellhead, no tubing and does not have any perforations. Test casing to 1,000 psi or required pressure.
    a. If a loss of mechanical integrity is discovered, the well will be repaired prior to proceeding further with plugging operations.
    b. All casing in the well is cemented to surface at the time of construction and will not be retrievable at abandonment.
    c. If casing has measured 0 psi, continue with well plugging procedures.
2. ND tree and NU BOP's. Test BOPs per regulations.
3. Set CIBP at 4,300'. Set balance plug on top of CIBP using 134 sacks of CO_2 resistant cement plus additives from [redacted]' – [redacted]' (approximately 300' above the [redacted] confining zone). Displace cement with calculated workover fluid (TBD). Allow cement to set. Tag top of plug.
4. Set balance plug using 127 sacks of CL H cement plus additives from [redacted]' to [redacted]'' to isolate the surface casing and into the [redacted] confining zone. Displace cement with calculated workover fluid (TBD). Allow cement to set and then tag top of plug.
5. Set balance plug using 127 sacks of CL H cement plus additives from 605'- 5' to isolate the top of the surface casing. Allow cement to set.
6. Cut casing off 5 feet below ground level. Clean cellar and weld on plate with well information

Table 6. Plugging details In-Zone Observation Well

Plug Information	Plug #1	Plug #2	Plug #3
Diameter of casing in which plug will be placed (Inches)	4"	4"	4"
Depth to bottom of tubing or drill pipe (Feet)	[redacted]'	[redacted]'	605'
Sacks of cement to be used	42	45	45
Slurry volume to be pumped (bbls)	53	53	53
Slurry weight (lb/gal)	14.5	15.6	15.6
Calculated top of plug (Feet)	[redacted]'	[redacted]'	5'
Bottom of plug (Feet)	[redacted]'	[redacted]'	605'
Type of cement or other material	CO_2 resistant cement	CL H plus additives	CL H plus additives

Plug Information	Plug #1	Plug #2	Plug #3
Method of emplacement (e.g., balance method, retainer method, or two-plug method)	Set CIBP at [redacted]' and Balance Plug	Balance Plug	Balance Plug

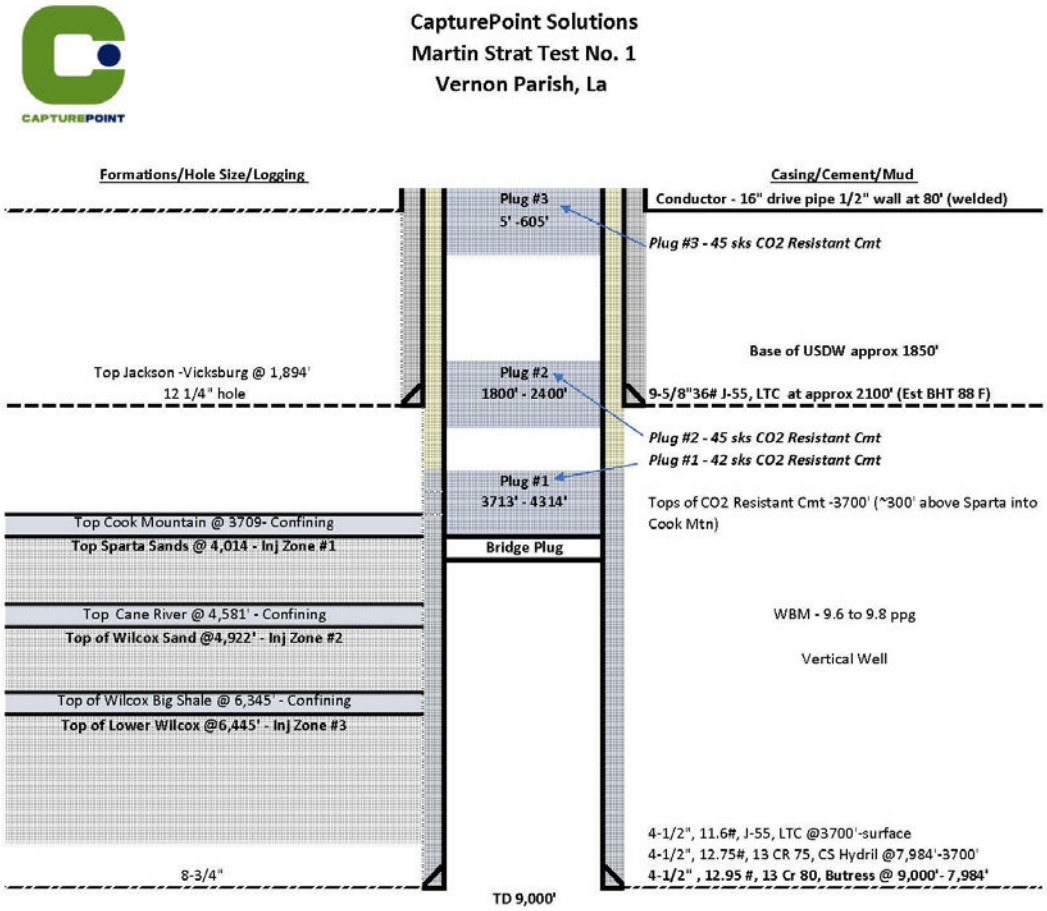



Figure 5. Proposed Wellbore Diagram In-Zone Observation Well