

## **APPENDIX P-4 – SAMPLING WELL NO. 1 DRILLING AND COMPLETION PROCEDURES**

The following procedure is the original approved drilling and completion procedure submitted to ODEQ for Sampling Well No. 1.

### **Drilling and Completion Procedures**

The following procedures are for the drilling and testing the proposed USDW test well and the drilling and completion of the proposed monitor well for the McClain Energy Facility in Newcastle, Oklahoma. These procedures include the testing of the Garber-Wellington formation fluid as requested by the Oklahoma Department of Environmental Quality.

1. Mobilize drilling rig and associated equipment.
2. Drill 12.25-inch conductor pipe hole to 30 feet below ground surface (bgs).
3. Set 10.75-inch steel casing to 30-feet bgs and cement back to surface.
4. Rig up top of casing to allow circulation of drilling fluids.
5. Run in hole with 9.5-inch drilling bit and drill from 30-feet to 1,000-feet bgs. Maintain freshwater mud system with minimal fluid loss characteristics.
6. Once at total depth, pump a slug of high viscosity gel to fill hole prior to pulling the drill pipe.
7. Pull drill pipe from hole.
8. Rig up logging truck and run open hole logging tool (dual induction/SP, gamma ray, open hole caliper) from total depth (TD) to base of surface casing.
9. Rig down logging equipment and run in hole with 960-feet of new/used 5.5-inch casing. Install casing centralizers every 40-feet
10. Rig up cementing equipment and cement the casing back to surface.
11. After the cement has been allowed to harden for 24 hours, rig up and run a cement bond log to verify the quality of the annular seal.
12. If the annular seal is acceptable rig up the perforating equipment and perforate the 5.5-inch casing from approximately 910-feet to 960-feet (final interval to be picked by contract geologist and engineer).
13. Rig up sampling pump and run in hole to 950-feet. Pump will be configured to allow variable rate pumping. Due to potential sand pumping problems, a pre-packed screen assembly may be attached to the pump inlet to minimize sand intake at the pump.
14. Pump well using variable rates to develop well. Pump a minimum of three well volumes from the well prior to sampling (approximately 700 barrels).
15. After 75 barrels have been pumped from well, monitor the conductivity of the pumped fluid to monitor for stabilization of the pH, temperature and conductivity. Once these parameters have stabilized, prepare to grab a sample of the fluid for submittal to the lab for analysis.

16. Grab a sample of the fluid from the well and properly label the containers for submittal to the lab for TDS analysis.
17. Pull pump from well.
18. After receiving the lab analysis, rig up and cement the inside of the 5.5 inch casing from TD to 820 feet. Allow cement to harden at least 8 hours.
19. After 8 hours, run in hole and perforate the well from 760 to 800 and sample as shown in steps 14 through 17.
20. After receiving the lab analysis and comparing the lab derived TDS values to the log values, cement the inside of the 5.5 inch casing from 820 to 450 feet.
21. After 8 hours, run in hole and perforate the well from 390 to 430 feet and sample as shown in steps 14 through 17.
22. After receiving the lab analysis and verifying that this zone is under 10,000 TDS, cement the inside of the 5.5 inch casing from 450 feet to surface.
23. Cut off the casing four feet below ground surface and weld a steel plate over the casing.
24. Backfill the hole above the well and restore to original condition.
25. Move the drilling rig to the proposed location for the monitoring well and rig up the equipment.
26. Drill 12.25-inch conductor pipe hole to 30 feet below ground surface (bgs).
27. Set 10.75-inch steel casing to 30-feet bgs and cement to surface.
28. Based on the results of the USDW test well, drill a 9.5 inch hole to 445 feet bgs.
29. Run in hole with approximately 390-feet of 4-inch casing with 40-feet of 4-inch well screen on bottom. Casing specifications are given below.

Hole (inches)	Size	Depth (feet)	Interval (feet)	Casing type	Casing size (inches)
9 ½		0 - 390	390	10.1 #/ft , Steel Pipe SCH-40	4
9 ½		390 - 430	40	Well Screen	4
9 ½		430 - 440	10	10.1 #/ft, Steel Pipe SCH-40	4

30. Attach centering guides spaced at 120-degree intervals around the casing 5 feet from the bottom end and every 40 feet thereafter. Casing and screens will be run as one string. Run a tremie pipe in conjunction with casing to allow placement of sand pack and cement grout. Potable drinking water will be used to assist placing the sand pack.
31. Pump sand through the tremie pipe in a manner that will allow even placement of the sand across the well screen. Every precaution shall be taken to ensure placement of the sand pack continuously from the bottom of the well to a point approximately 10 feet above the top well screen without separation or bridging of the materials as they are introduced into the

well. During placement, the sand top shall be continuously sounded to measure its rate of rise and to determine if bridging is occurring.

32. Once the sand is placed, pump two barrels of Bentonite slurry through the tremie pipe on top of sand pack, and then pump cement grout through the tremie pipe in a manner that will allow even placement of the cement from top of sand pack to surface.
33. After the cement has cured (12+ hours), run in hole with development pump.
34. Develop monitor well sand pack by surging well with pump. Pump a minimum of three wellbore volumes from well after development.
35. Conduct a drawdown and yield test on well to determine well capacity.
36. Collect a sample of formation fluid and submit to lab for analysis.
37. Rig up casing head equipment necessary to install sampling pump.
38. Run in hole with sampling pump and tubing. Sampling pump and tubing will be sized based on results of drawdown testing. Tubing specifications are given below.

OD (inches)	Size	Depth (feet)	Interval (feet)	Tubing Type
2.375		0 - 10	10	3.65 #/ft , Steel Pipe SCH-40
2.375		10 - 10.5	0.5	Stainless Steel Pipe Adapter
2.375		10.5 - 430.5	420	PVC SCH-40
2.375		430.5 – 431	0.5	Stainless Steel Pipe Adapter
2		431+		Submersible Pump

39. After pump is installed in well, hook up temporary power and test pump assembly. If test successful, start rigging down drill rig and associated equipment.
40. Complete construction of surface well box and cement pad around well head. Hook up electrical power and control box.
41. Clean up location and demob from site.