

1. Casing Program:

Hole Size	Hole Interval	Casing OD	Casing Interval	Weight	Collar	Grade
17-1/2"	0 – 2,000'	13-3/8"	0 – 2,000'	54.5#	BTC	J-55
12-1/4"	2,000' – 3,225'	9-5/8"	0 – 3,225'	36#	BTC	J-55
8-3/4"	3,225' – 13,752'	5-1/2"	0-13,752'	17#	BTC	P-110

Maximum TVD in lateral: 9,191 ft

2. Design Factors:

Casing Size	Collapse Design Factor	Burst Design Factor	Tension Design Factor
13-3/8"	1.21	2.92	8.34
9-5/8"	1.20	2.10	3.90
5-1/2"	1.74	2.47	3.49

3. Cement Program:

Cementing Program (cement volumes based on at least 25% excess)

String	Number of sx	Weight lbs/gal	Water Volume g/sx	Yield cf/sx	Stage; Lead/Tail	Slurry Description
13-3/8" Surface	1220	13.5	9.08	1.72	Lead	Class C Cement + 0.125 lbs/sack Poly-E-Flake + 4% bwoc Bentonite + 70.1% Fresh Water
	560	14.8	6.32	1.33	Tail	Class C Cement + 63.5% Fresh Water
9-5/8" Intermediate	480	12.9	9.81	1.85	Lead	(65:35) Class C Cement: Poz (Fly Ash): 6% BWOC Bentonite + 5% BWOW Sodium Chloride + 0.125 lbs/sack Poly-E-Flake + 70.9 % Fresh Water
	430	14.8	6.32	1.33	Tail	Class C Cement + 63.5% Fresh Water
Pilot Hole Plug Back	560	15.6	5.39	1.19	Plug Cement	Class H Cement + 0.2% Halad-9 + 0.2% HR-601 + 60.5 % Fresh Water
5-1/2" Production Casing Single Stage	670	11.0	15.23	2.71	Lead	Tuned Light Blend + 0.125 lb/sk Pol-E-Flake + 76.3% Fresh Water
	1380	14.5	5.32	1.21	Tail	(50:50) Class H Cement: Poz (Fly Ash) + 0.5% bwoc HALAD-344 + 0.25% bwoc CFR-3 + 0.1% bwoc HR-601 + 2% bwoc Bentonite + 58.8% Fresh Water

5-1/2" Production Casing  2-Stage Option	530	12.5	10.86	1.96	Lead	(65:35) Class H Cement: Poz (Fly Ash) + 6% BWOC Bentonite + 0.25% BWOC HR-601 + 0.125 lbs/sack Poly-E-Flake + 74.1 % Fresh Water
	1380	14.5	5.38	1.22	Tail	(50:50) Class H Cement: Poz (Fly Ash) + 0.5% bwoc HALAD-344 + 0.25% bwoc CFR-3 + 0.1% bwoc HR-601 + 2% bwoc Bentonite + 58.8% Fresh Water
	DV Tool @ 5300ft					
	270	11.9	12.89	2.26	Lead	(50:50) Class H Cement: Poz (Fly Ash) + 10% BWOC Bentonite + 1 lb/sk of Kol-Seal + 0.3% BWOC HR-601 + 0.5lb/sk D-Air 5000 + 76.4% Fresh Water
	120	14.8	6.32	1.33	Tail	Class C Cement + 0.125 lbs/sack Poly-E-Flake + 63.5% Fresh Water

**TOC for all Strings:**

13-3/8" Surface	0ft
9-5/8" Intermediate	0ft
Pilot Hole Plug Back	8354ft
5-1/2" Production Single Stage	2725ft
5-1/2" Production 2-Stage	Stage #1 = 5300ft Stage #2 = 2725ft

**Notes:**

- Cement volumes Surface 100%, Intermediate 75%, Pilot 10% and Production based on at least 25% excess
- Actual cement volumes will be adjusted based on fluid caliper and caliper log data
- If lost circulation is encountered while drilling the production and/or the intermediate wellbores, a DV tool will be installed a minimum of 50' below the previous casing shoe and a minimum of 200' above the current shoe. If the DV tool has to be moved, the cement volumes will be adjusted proportionately. Both single and double stage proposals are listed in the cement table.

**4. Pressure Control Equipment**

A 3M 13-5/8" BOP system (Double Ram and Annular preventer) will be installed and tested prior to drilling out the surface casing shoe. The BOP system used to drill the intermediate hole will be tested per BLM Onshore Oil and Gas Order 2.

A 3M 13-5/8" BOP system (Double Ram and Annular preventer) will be installed and tested prior to drilling out the intermediate casing shoe. The BOP system used to drill the production hole will be tested per BLM Onshore Oil and Gas Order 2.

2050

The pipe rams will be operated and checked each 24 hour period and each time the drill pipe is out of the hole. These tests will be logged in the daily driller's log. A 2" kill line and 3" choke line will be incorporated into the drilling spool below the ram BOP. In addition to the rams and annular preventer, additional BOP accessories include a kelly cock, floor safety valve, choke lines, and choke manifold rated at 3,000 psi WP.

Devon requests a variance to use a flexible line with flanged ends between the BOP and the choke manifold (choke line). The line will be kept as straight as possible with minimal turns.

**5. Proposed Mud Circulation System:**

Depth Range	Mud Weight	Viscosity	Fluid Loss	Type System
0 - 2000'	8.4-9.0	30-34	N/C	FW
2000' - 3,225'	9.8-10.0	28-32	N/C	Brine
3,225' - 13,752'	8.6-9.0	28-32	N/C	FW

The necessary mud products for weight addition and fluid loss control will be on location at all times.

**6. Auxiliary Well Control and Monitoring Equipment:**

- a. A Kelly cock will be in the drill string at all times.
- b. A full opening drill pipe stabbing valve having the appropriate connections will be on the rig floor at all times.
- c. Hydrogen Sulfide detection equipment will be in operation after drilling out the 13-3/8" casing shoe until the 5-1/2" casing is cemented. Breathing equipment will be on location upon drilling the 13-3/8" shoe until total depth is reached.



LEGEND

- Flint Unit Well #2, Original Hole, Original Hole V0
- Design 3



Azimuths to Grid North  
 True North: -0.50°  
 Magnetic North: 6.82°

Magnetic Field  
 Strength: 48635.9snT  
 Dip Angle: 60.60°  
 Date: 2/24/2014  
 Model: BGGM2012

Project: Lea County (NAD83)  
 Site: Dunkel 7 State 1H  
 Well: Dunkel 7 State 1H  
 Original Hole  
 Design 3



A Schlumberger Company

US State Plane 1983  
 New Mexico Eastern Zone

WELL DETAILS: Dunkel 7 State 1H

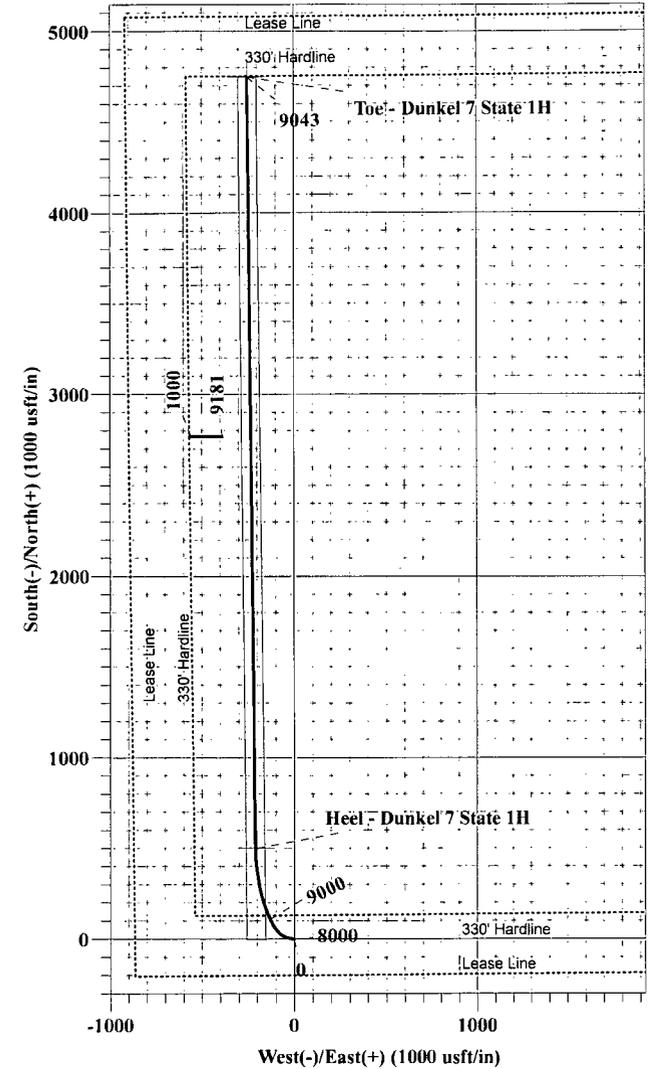
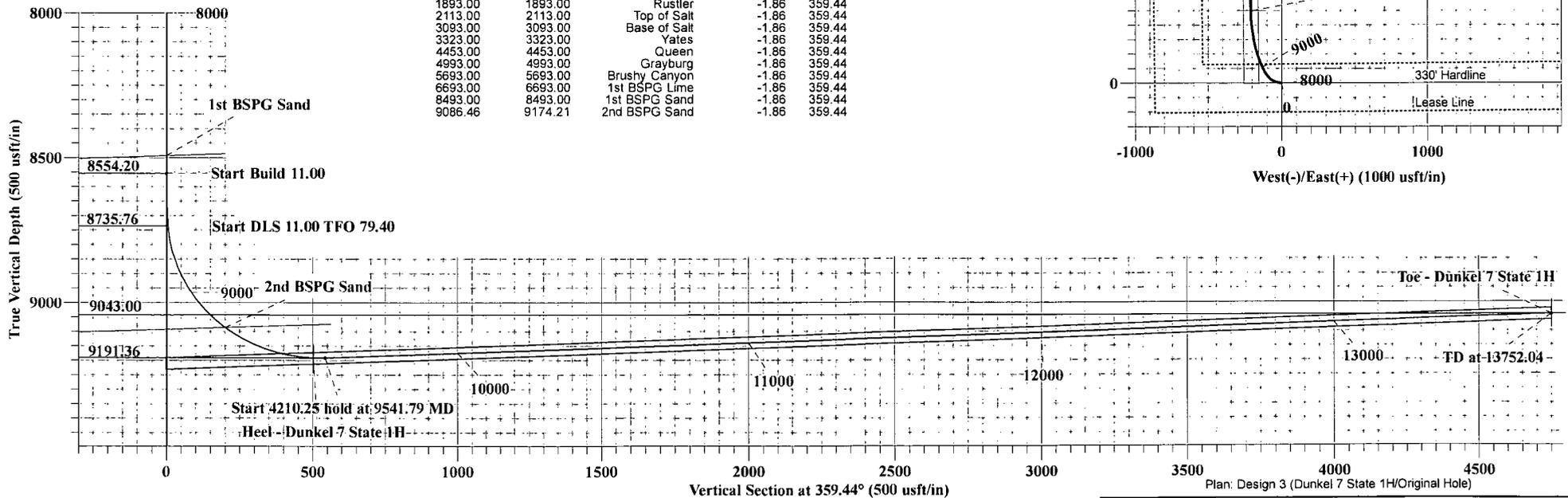
		WELL @ 3893.40usft (Original Well Elev)		3866.40	
+N-S	+E-W	Northing	Easting	Latitude	Longitude
0.00	0.00	639796.41	828438.27	32° 45' 19.282 N	103° 23' 58.006 W

SECTION DETAILS

Sec	MD	Inc	Azi	TVD	+N-S	+E-W	Dleg	TFace	Vsect	Target
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
2	8554.20	0.00	0.00	8554.20	0.00	0.00	0.00	0.00	0.00	
3	8739.65	20.40	280.00	8735.76	5.67	-32.17	11.00	280.00	5.99	
4	9541.79	92.02	359.44	9191.36	540.98	-210.45	11.00	79.40	543.01	
5	13752.04	92.02	359.44	9043.00	4748.41	-251.33	0.00	0.00	4750.64	Toe - Dunkel 7 State 1H

FORMATION TOP DETAILS

TVDPath	MDPath	Formation	DipAngle	DipDir
1893.00	1893.00	Rustler	-1.86	359.44
2113.00	2113.00	Top of Salt	-1.86	359.44
3093.00	3093.00	Base of Salt	-1.86	359.44
3323.00	3323.00	Yates	-1.86	359.44
4453.00	4453.00	Queen	-1.86	359.44
4993.00	4993.00	Grayburg	-1.86	359.44
5693.00	5693.00	Brushy Canyon	-1.86	359.44
6693.00	6693.00	1st BSPG Sand	-1.86	359.44
8493.00	8493.00	1st BSPG Sand	-1.86	359.44
9086.46	9174.21	2nd BSPG Sand	-1.86	359.44



# **Devon Energy, Inc.**

Lea County (NAD83)

Dunkel 7 State 1H

Dunkel 7 State 1H

Original Hole

Plan: Design 3

## **Standard Planning Report**

24 February, 2014

# Pathfinder - A Schlumberger Company

## Planning Report

<b>Database:</b>	EDM 5000.1 Single User Db	<b>Local Co-ordinate Reference:</b>	Well Dunkel 7 State 1H
<b>Company:</b>	Devon Energy, Inc.	<b>TVD Reference:</b>	WELL @ 3893.40usft (Original Well Elev)
<b>Project:</b>	Lea County (NAD83)	<b>MD Reference:</b>	WELL @ 3893.40usft (Original Well Elev)
<b>Site:</b>	Dunkel 7 State 1H	<b>North Reference:</b>	Grid
<b>Well:</b>	Dunkel 7 State 1H	<b>Survey Calculation Method:</b>	Minimum Curvature
<b>Wellbore:</b>	Original Hole		
<b>Design:</b>	Design 3		

<b>Project</b> Lea County (NAD83)			
<b>Map System:</b>	US State Plane 1983	<b>System Datum:</b>	Mean Sea Level
<b>Geo Datum:</b>	North American Datum 1983		
<b>Map Zone:</b>	New Mexico Eastern Zone		

<b>Site</b> Dunkel 7 State 1H			
<b>Site Position:</b>		<b>Northing:</b>	639,796.41 usft
<b>From:</b>	Map	<b>Easting:</b>	828,438.27 usft
<b>Position Uncertainty:</b>	0.00 usft	<b>Slot Radius:</b>	13-3/16 "
		<b>Latitude:</b>	32° 45' 19.282 N
		<b>Longitude:</b>	103° 23' 58.006 W
		<b>Grid Convergence:</b>	0.51 °

<b>Well</b> Dunkel 7 State 1H			
<b>Well Position</b>	<b>+N-S</b>	0.00 usft	<b>Northing:</b> 639,796.41 usft
	<b>+E-W</b>	0.00 usft	<b>Easting:</b> 828,438.27 usft
<b>Position Uncertainty</b>		0.00 usft	<b>Wellhead Elevation:</b> 3,893.40 usft
			<b>Latitude:</b> 32° 45' 19.282 N
			<b>Longitude:</b> 103° 23' 58.006 W
			<b>Ground Level:</b> 3,866.40 usft

<b>Wellbore</b> Original Hole					
<b>Magnetics</b>	<b>Model Name</b>	<b>Sample Date</b>	<b>Declination (°)</b>	<b>Dip Angle (°)</b>	<b>Field Strength (nT)</b>
	BGGM2012	2/24/2014	7.32	60.60	48,636

<b>Design</b> Design 3				
<b>Audit Notes:</b>				
<b>Version:</b>	<b>Phase:</b>	PLAN	<b>Tie On Depth:</b>	0.00
<b>Vertical Section:</b>	<b>Depth From (TVD) (usft)</b>	<b>+N-S (usft)</b>	<b>+E-W (usft)</b>	<b>Direction (°)</b>
	0.00	0.00	0.00	359.44

<b>Plan Sections</b>										
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N-S (usft)	+E-W (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)	TFO (°)	Target
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
8,554.20	0.00	0.00	8,554.20	0.00	0.00	0.00	0.00	0.00	0.00	
8,739.65	20.40	280.00	8,735.76	5.67	-32.17	11.00	11.00	0.00	280.00	
9,541.79	92.02	359.44	9,191.36	540.98	-210.45	11.00	8.93	9.90	79.40	
13,752.04	92.02	359.44	9,043.00	4,748.41	-251.33	0.00	0.00	0.00	0.00	Toe - Dunkel 7 State

## Pathfinder - A Schlumberger Company

### Planning Report

<b>Database:</b>	EDM 5000.1 Single User Db	<b>Local Co-ordinate Reference:</b>	Well Dunkel 7 State 1H
<b>Company:</b>	Devon Energy, Inc.	<b>TVD Reference:</b>	WELL @ 3893.40usft (Original Well Elev)
<b>Project:</b>	Lea County (NAD83)	<b>MD Reference:</b>	WELL @ 3893.40usft (Original Well Elev)
<b>Site:</b>	Dunkel 7 State 1H	<b>North Reference:</b>	Grid
<b>Well:</b>	Dunkel 7 State 1H	<b>Survey Calculation Method:</b>	Minimum Curvature
<b>Wellbore:</b>	Original Hole		
<b>Design:</b>	Design 3		

Planned Survey									
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
8,500.00	0.00	0.00	8,500.00	0.00	0.00	0.00	0.00	0.00	0.00
8,554.20	0.00	0.00	8,554.20	0.00	0.00	0.00	0.00	0.00	0.00
8,600.00	5.04	280.00	8,599.94	0.35	-1.98	0.37	11.00	11.00	0.00
8,700.00	16.04	280.00	8,698.10	3.52	-19.96	3.72	11.00	11.00	0.00
8,739.65	20.40	280.00	8,735.76	5.67	-32.17	5.99	11.00	11.00	0.00
8,800.00	22.54	297.24	8,791.97	12.80	-52.84	13.32	11.00	3.55	28.57
8,900.00	29.10	317.77	8,882.12	39.66	-86.33	40.50	11.00	6.55	20.53
9,000.00	37.64	330.48	8,965.66	84.37	-117.81	85.52	11.00	8.54	12.72
9,100.00	47.09	338.89	9,039.52	145.29	-146.13	146.71	11.00	9.45	8.41
9,174.21	54.40	343.57	9,086.46	199.68	-164.48	201.27	11.00	9.86	6.31
<b>2nd BSPG Sand</b>									
9,200.00	56.99	345.00	9,101.00	220.18	-170.25	221.83	11.00	10.01	5.53
9,300.00	67.12	349.85	9,147.83	306.29	-189.28	308.12	11.00	10.13	4.85
9,400.00	77.38	354.02	9,178.28	400.45	-202.51	402.41	11.00	10.26	4.17
9,500.00	87.70	357.87	9,191.26	499.21	-209.47	501.23	11.00	10.32	3.84
9,541.79	92.02	359.44	9,191.36	540.98	-210.45	543.01	11.00	10.33	3.77
9,600.00	92.02	359.44	9,189.31	599.14	-211.02	601.18	0.00	0.00	0.00
9,700.00	92.02	359.44	9,185.78	699.08	-211.99	701.12	0.00	0.00	0.00
9,800.00	92.02	359.44	9,182.26	799.01	-212.96	801.05	0.00	0.00	0.00
9,900.00	92.02	359.44	9,178.74	898.94	-213.93	900.99	0.00	0.00	0.00
10,000.00	92.02	359.44	9,175.21	998.88	-214.90	1,000.93	0.00	0.00	0.00
10,100.00	92.02	359.44	9,171.69	1,098.81	-215.87	1,100.87	0.00	0.00	0.00
10,200.00	92.02	359.44	9,168.16	1,198.74	-216.84	1,200.81	0.00	0.00	0.00
10,300.00	92.02	359.44	9,164.64	1,298.68	-217.82	1,300.74	0.00	0.00	0.00
10,400.00	92.02	359.44	9,161.12	1,398.61	-218.79	1,400.68	0.00	0.00	0.00
10,500.00	92.02	359.44	9,157.59	1,498.54	-219.76	1,500.62	0.00	0.00	0.00
10,600.00	92.02	359.44	9,154.07	1,598.48	-220.73	1,600.56	0.00	0.00	0.00
10,700.00	92.02	359.44	9,150.55	1,698.41	-221.70	1,700.49	0.00	0.00	0.00
10,800.00	92.02	359.44	9,147.02	1,798.34	-222.67	1,800.43	0.00	0.00	0.00
10,900.00	92.02	359.44	9,143.50	1,898.28	-223.64	1,900.37	0.00	0.00	0.00
11,000.00	92.02	359.44	9,139.97	1,998.21	-224.61	2,000.31	0.00	0.00	0.00
11,100.00	92.02	359.44	9,136.45	2,098.14	-225.58	2,100.25	0.00	0.00	0.00
11,200.00	92.02	359.44	9,132.93	2,198.08	-226.55	2,200.18	0.00	0.00	0.00
11,300.00	92.02	359.44	9,129.40	2,298.01	-227.52	2,300.12	0.00	0.00	0.00
11,400.00	92.02	359.44	9,125.88	2,397.94	-228.49	2,400.06	0.00	0.00	0.00
11,500.00	92.02	359.44	9,122.36	2,497.87	-229.47	2,500.00	0.00	0.00	0.00
11,600.00	92.02	359.44	9,118.83	2,597.81	-230.44	2,599.94	0.00	0.00	0.00
11,700.00	92.02	359.44	9,115.31	2,697.74	-231.41	2,699.87	0.00	0.00	0.00
11,800.00	92.02	359.44	9,111.78	2,797.67	-232.38	2,799.81	0.00	0.00	0.00
11,900.00	92.02	359.44	9,108.26	2,897.61	-233.35	2,899.75	0.00	0.00	0.00
12,000.00	92.02	359.44	9,104.74	2,997.54	-234.32	2,999.69	0.00	0.00	0.00
12,100.00	92.02	359.44	9,101.21	3,097.47	-235.29	3,099.63	0.00	0.00	0.00
12,200.00	92.02	359.44	9,097.69	3,197.41	-236.26	3,199.56	0.00	0.00	0.00
12,300.00	92.02	359.44	9,094.17	3,297.34	-237.23	3,299.50	0.00	0.00	0.00
12,400.00	92.02	359.44	9,090.64	3,397.27	-238.20	3,399.44	0.00	0.00	0.00
12,500.00	92.02	359.44	9,087.12	3,497.21	-239.17	3,499.38	0.00	0.00	0.00
12,600.00	92.02	359.44	9,083.59	3,597.14	-240.15	3,599.31	0.00	0.00	0.00
12,700.00	92.02	359.44	9,080.07	3,697.07	-241.12	3,699.25	0.00	0.00	0.00
12,800.00	92.02	359.44	9,076.55	3,797.01	-242.09	3,799.19	0.00	0.00	0.00
12,900.00	92.02	359.44	9,073.02	3,896.94	-243.06	3,899.13	0.00	0.00	0.00
13,000.00	92.02	359.44	9,069.50	3,996.87	-244.03	3,999.07	0.00	0.00	0.00
13,100.00	92.02	359.44	9,065.98	4,096.81	-245.00	4,099.00	0.00	0.00	0.00
13,200.00	92.02	359.44	9,062.45	4,196.74	-245.97	4,198.94	0.00	0.00	0.00

**Pathfinder - A Schlumberger Company**  
Planning Report

<b>Database:</b>	EDM 5000.1 Single User Db	<b>Local Co-ordinate Reference:</b>	Well Dunkel 7 State 1H
<b>Company:</b>	Devon Energy, Inc.	<b>TVD Reference:</b>	WELL @ 3893.40usft (Original Well Elev)
<b>Project:</b>	Lea County (NAD83)	<b>MD Reference:</b>	WELL @ 3893.40usft (Original Well Elev)
<b>Site:</b>	Dunkel 7 State 1H	<b>North Reference:</b>	Grid
<b>Well:</b>	Dunkel 7 State 1H	<b>Survey Calculation Method:</b>	Minimum Curvature
<b>Wellbore:</b>	Original Hole		
<b>Design:</b>	Design 3		

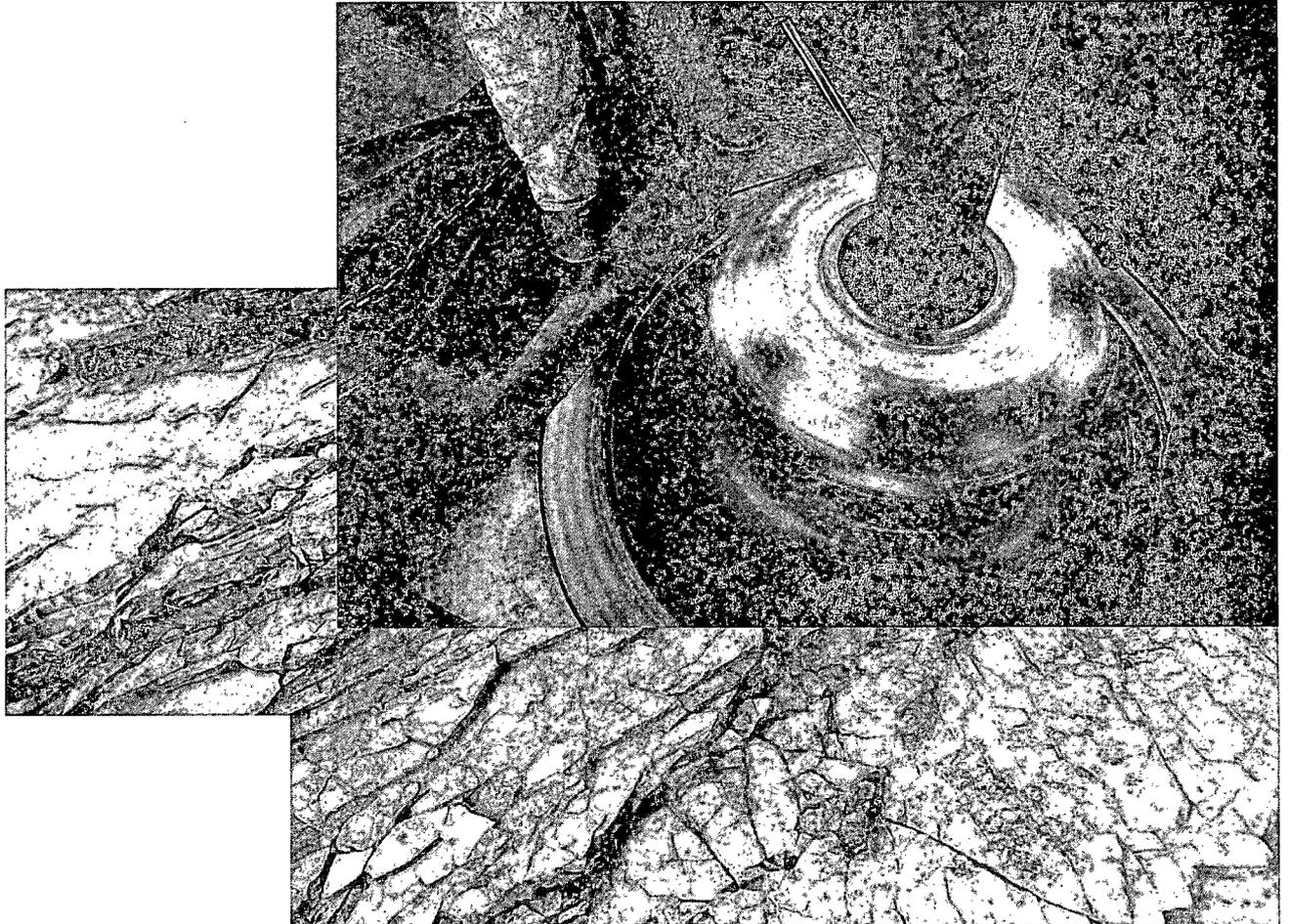
Planned Survey										
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)	
13,300.00	92.02	359.44	9,058.93	4,296.67	-246.94	4,298.88	0.00	0.00	0.00	
13,400.00	92.02	359.44	9,055.41	4,396.61	-247.91	4,398.82	0.00	0.00	0.00	
13,500.00	92.02	359.44	9,051.88	4,496.54	-248.88	4,498.76	0.00	0.00	0.00	
13,600.00	92.02	359.44	9,048.36	4,596.47	-249.85	4,598.69	0.00	0.00	0.00	
13,700.00	92.02	359.44	9,044.83	4,696.40	-250.82	4,698.63	0.00	0.00	0.00	
13,752.04	92.02	359.44	9,043.00	4,748.41	-251.33	4,750.64	0.00	0.00	0.00	

Design Targets									
Target Name	Dip Angle (°)	Dip Dir. (°)	TVD (usft)	+N/-S (usft)	+E/-W (usft)	Northing (usft)	Easting (usft)	Latitude	Longitude
- hit/miss target									
- Shape									
Target Line (Dunkel 7 St - plan hits target center - Rectangle (sides W100.00 H4,755.00 D20.00)	-2.02	359.44	9,043.00	4,748.41	-251.33	644,544.82	828,186.94	32° 46' 6.284 N	103° 24' 0.459 W
Toe - Dunkel 7 State 1H - plan hits target center - Point	0.00	0.00	9,043.00	4,748.41	-251.33	644,544.82	828,186.94	32° 46' 6.284 N	103° 24' 0.459 W
Heel - Dunkel 7 State 1H - plan misses target center by 5.38usft at 9500.68usft MD (9191.28 TVD, 499.88 N, -209.50 E) - Point	0.00	0.00	9,193.00	500.00	-204.40	640,296.41	828,233.87	32° 45' 24.247 N	103° 24' 0.348 W

Formations						
Measured Depth (usft)	Vertical Depth (usft)	Name	Lithology	Dip (°)	Dip Direction (°)	
1,893.00	1,893.00	Rustler		-1.86	359.44	
2,113.00	2,113.00	Top of Salt		-1.86	359.44	
3,093.00	3,093.00	Base of Salt		-1.86	359.44	
3,323.00	3,323.00	Yates		-1.86	359.44	
4,453.00	4,453.00	Queen		-1.86	359.44	
4,993.00	4,993.00	Grayburg		-1.86	359.44	
5,693.00	5,693.00	Brushy Canyon		-1.86	359.44	
6,693.00	6,693.00	1st BSPG Lime		-1.86	359.44	
8,493.00	8,493.00	1st BSPG Sand		-1.86	359.44	
9,174.21	9,086.46	2nd BSPG Sand		-1.86	359.44	



Commitment Runs Deep



Design Plan  
Operation and Maintenance Plan  
Closure Plan

SENM - Closed Loop Systems  
February 2014

## I. Design Plan

Devon uses MI SWACO closed loop system (CLS). The MI SWACO CLS is designed to maintain drill solids at or below 5%. The equipment is arranged to progressively remove solids from the largest to the smallest size. Drilling fluids can thus be reused and savings is realized on mud and disposal costs. Dewatering may be required with the centrifuges to insure removal of ultra fine solids.

The drilling location is constructed to allow storm water to flow to a central sump normally the cellar. This insures no contamination leaves the drilling pad in the event of a spill. Storm water is reused in the mud system or stored in a reserve fluid tank farm until it can be reused. All lubricants, oils, or chemicals are removed immediately from the ground to prevent the contamination of storm water. An oil trap is normally installed on the sump if an oil spill occurs during a storm.

A tank farm is utilized to store drilling fluids including fresh water and brine fluids. The tank farm is constructed on a 20 ml plastic lined, bermed pad to prevent the contamination of the drilling site during a spill. Fluids from other sites may be stored in these tanks for processing by the solids control equipment and reused in the mud system. At the end of the well the fluids are transported from the tank farm to an adjoining well or to the next well for the rig.

Prior to installing a closed-loop system on site, the topsoil, if present, will be stripped and stockpiled for use as the final cover or fill at the time of closure.

Signs will be posted on the fence surrounding the closed-loop system unless the closed-loop system is located on a site where there is an existing well, that is operated by Devon.

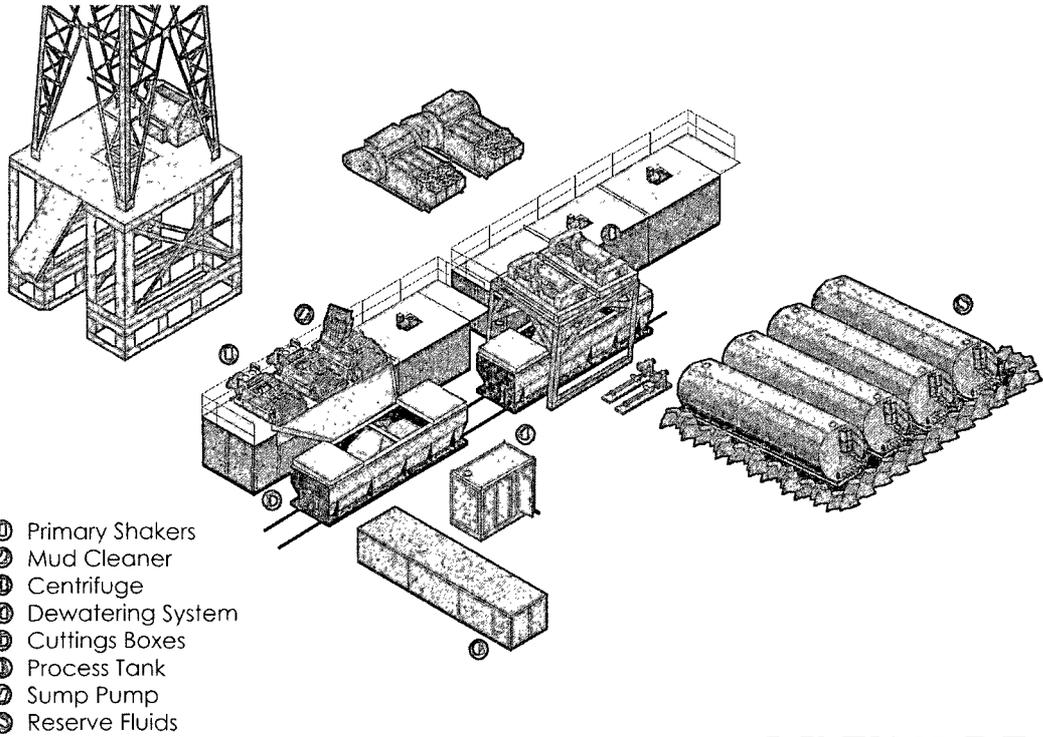
## II. Operations and Maintenance Plan

*Primary Shakers:* The primary shakers make the first removal of drill solids from the drilling mud as it leaves the well bore. The shakers are sized to handle maximum drilling rate at optimal screen size. The shakers normally remove solids down to 74 microns.

**Mud Cleaner:** The Mud Cleaner cleans the fluid after it leaves the shakers. A set of hydrocyclones are sized to handle 1.25 to 1.5 times the maximum circulating rate. This ensures all the fluid is being processed to an average cut point of 25 microns. The wet discharged is dewatered on a shaker equipped with ultra fine mesh screens and generally cut at 40 microns.



Closed Loop Schematic



**Centrifuges:** The centrifuges can be one or two in number depending on the well geometry or depth of well. The centrifuges are sized to maintain low gravity solids at 5% or below. They may or may not need a dewatering system to enhance the removal rates. The centrifuges can make a cut point of 8-10 microns depending on bowl speed, feed rate, solids loading and other factors.

The centrifuge system is designed to work on the active system and be flexible to process incoming fluids from other locations. This set-up is also dependant on well factors.

**Dewatering System:** The dewatering system is a chemical mixing and dosing system designed to enhance the solids removal of the centrifuge. Not commonly used in shallow wells. It may contain pH adjustment, coagulant mixing and dosing, and polymer mixing and dosing. Chemical flocculation binds ultra fine solids into a mass that is within the centrifuge operating design. The

dewatering system improves the centrifuge cut point to infinity or allows for the return of clear water or brine fluid. This ability allows for the ultimate control of low gravity solids.

*Cuttings Boxes:* Cuttings boxes are utilized to capture drill solids that are discarded from the solids control equipment. These boxes are set upon a rail system that allows for the removal and replacement of a full box of cuttings with an empty one. They are equipped with a cover that insures no product is spilled into the environment during the transportation phase.

*Process Tank:* (Optional) The process tank allows for the holding and process of fluids that are being transferred into the mud system. Additionally, during times of lost circulation the process tank may hold active fluids that are removed for additional treatment. It can further be used as a mixing tank during well control conditions.

*Sump and Sump Pump:* The sump is used to collect storm water and the pump is used to transfer this fluid to the active system or to the tank for to hold in reserve. It can also be used to collect fluids that may escape during spills. The location contains drainage ditches that allow the location fluids to drain to the sump.

*Reserve Fluids (Tank Farm):* A series of frac tanks are used to replace the reserve pit. These are steel tanks that are equipped with a manifold system and a transfer pump. These tanks can contain any number of fluids used during the drilling process. These can include fresh water, cut brine, and saturated salt fluid. The fluid can be from the active well or reclaimed fluid from other locations. A 20 ml liner and berm system is employed to ensure the fluids do not migrate to the environment during a spill.

If a leak develops, the appropriate division district office will be notified within 48 hours of the discovery and the leak will be addressed. Spill prevention is accomplished by maintaining pump packing, hoses, and pipe fittings to insure no leaks are occurring. During an upset condition the source of the spill is isolated and repaired as soon as it is discovered. Free liquid is removed by a diaphragm pump and returned to the mud system. Loose topsoil may be used to stabilize the spill and the contaminated soil is excavated and placed in the cuttings boxes. After the well is finished and the rig has moved, the entire location is scrapped and testing will be performed to determine if a release has occurred.

All trash is kept in a wire mesh enclosure and removed to an approved landfill when full. All spent motor oils are kept in separate containers and they are removed and sent to an approved recycling center. Any spilled lubricants, pipe

dope, or regulated chemicals are removed from soil and sent to landfills approved for these products.

These operations are monitored by Mi Swaco service technicians. Daily logs are maintained to ensure optimal equipment operation and maintenance. Screen and chemical use is logged to maintain inventory control. Fluid properties are monitored and recorded and drilling mud volumes are accounted for in the mud storage farm. This data is kept for end of well review to insure performance goals are met. Lessons learned are logged and used to help with continuous improvement.

A MI SWACO field supervisor manages from 3-5 wells. They are responsible for training personnel, supervising installations, and inspecting sites for compliance of MI SWACO safety and operational policy.

### **III. Closure Plan**

A maximum 340' X 340' caliche pad is built per well. All of the trucks and steel tanks fit on this pad. All fluid cuttings go to the steel tanks to be hauled by various trucking companies to an agency approved disposal.