

# Shell Exploration & Production Co. Inc.

Sumner Co. KS (NAD 27)

Sec 25-T31S-R4W

Heimerman Farms 3104 #25-1H / Job #9777742 / Nabors 102

Wellbore #1

Survey: MWD Surveys

## Sperry Drilling Services Combo Report

24 September, 2012

Well Coordinates: 237,212.36 N, 2,232,538.99 E (37° 18' 55.45" N, 097° 42' 01.48" W)

Ground Level: 1,310.00 ft

Local Coordinate Origin:

Centered on Well Heimerman Farms 3104 #25-1H / Job #9777742 / Nabors 102

Viewing Datum:

WELL @ 1341.70ft (Original Well Elev)

TVDs to System:

N

North Reference:

True

Unit System:

API US Survey Feet

Version: 2003.21 Build: 43

**HALLIBURTON**

## Survey Report for Heimerman Farms 3104 #25-1H / Job #9777742 / Nabors 102 - MWD Surveys

Measured Depth (ft)	Inclination (°)	Azimuth (°)	TVD below System (ft)	Vertical Depth (ft)	Local Coordinates		Map Coordinates		Dogleg Rate (°/100ft)	Vertical Section (ft)	Comments
					Northing (ft)	Easting (ft)	Northing (ft)	Easting (ft)			
0.00	0.00	0.00	-1,341.70	0.00	0.00 N	0.00 E	237,212.36	2,232,538.99	0.00	0.00	
178.00	1.10	151.80	-1,163.71	177.99	1.51 S	0.81 E	237,210.86	2,232,539.81	0.62	1.52	First Sperry MWD Survey
332.00	0.85	167.02	-1,009.73	331.97	3.92 S	1.76 E	237,208.45	2,232,540.79	0.23	3.95	
506.00	4.60	222.12	-835.95	505.75	10.36 S	2.63 W	237,201.98	2,232,536.45	2.40	10.31	
597.00	5.63	224.80	-745.31	596.39	16.23 S	8.22 W	237,196.06	2,232,530.91	1.16	16.10	
688.00	6.12	214.17	-654.79	686.91	23.41 S	14.09 W	237,188.83	2,232,525.10	1.31	23.18	
778.00	4.85	191.10	-565.19	776.51	31.12 S	17.52 W	237,181.09	2,232,521.74	2.80	30.83	
877.00	3.77	154.14	-466.45	875.25	38.15 S	16.91 W	237,174.06	2,232,522.41	2.95	37.88	
968.00	3.43	143.12	-375.63	966.07	43.02 S	13.97 W	237,169.22	2,232,525.39	0.85	42.79	
1,062.00	3.50	150.31	-281.80	1,059.90	47.77 S	10.86 W	237,164.50	2,232,528.54	0.47	47.58	
1,156.00	1.12	168.66	-187.88	1,153.82	51.16 S	9.26 W	237,161.12	2,232,530.17	2.62	51.00	
1,251.00	0.18	155.10	-92.89	1,248.81	52.20 S	9.01 W	237,160.08	2,232,530.43	1.00	52.05	
1,345.00	0.53	180.38	1.11	1,342.81	52.77 S	8.95 W	237,159.51	2,232,530.49	0.40	52.62	
1,439.00	0.44	185.37	95.10	1,436.80	53.57 S	8.99 W	237,158.72	2,232,530.46	0.11	53.42	
1,628.00	0.43	124.87	284.10	1,625.80	54.70 S	8.47 W	237,157.59	2,232,530.99	0.23	54.55	
1,817.00	0.29	108.86	473.10	1,814.80	55.26 S	7.44 W	237,157.04	2,232,532.02	0.09	55.13	
2,006.00	0.89	78.51	662.09	2,003.79	55.12 S	5.55 W	237,157.20	2,232,533.91	0.35	55.02	
2,195.00	0.66	59.48	851.07	2,192.77	54.27 S	3.17 W	237,158.06	2,232,536.28	0.18	54.21	
2,384.00	0.62	48.02	1,040.06	2,381.76	53.04 S	1.47 W	237,159.31	2,232,537.97	0.07	53.01	
2,573.00	0.64	97.23	1,229.05	2,570.75	52.48 S	0.33 E	237,159.88	2,232,539.77	0.28	52.48	
2,761.00	0.52	92.58	1,417.04	2,758.74	52.66 S	2.23 E	237,159.73	2,232,541.67	0.07	52.68	
2,950.00	0.14	315.94	1,606.03	2,947.73	52.53 S	2.92 E	237,159.86	2,232,542.36	0.33	52.57	
3,139.00	0.26	337.51	1,795.03	3,136.73	51.97 S	2.60 E	237,160.42	2,232,542.03	0.07	52.00	
3,328.00	0.43	234.37	1,984.03	3,325.73	51.98 S	1.86 E	237,160.40	2,232,541.29	0.29	52.01	
3,422.00	0.13	293.30	2,078.03	3,419.73	52.15 S	1.47 E	237,160.23	2,232,540.91	0.40	52.16	
3,454.00	0.90	180.64	2,110.03	3,451.73	52.38 S	1.44 E	237,159.99	2,232,540.88	2.99	52.40	
3,485.00	4.10	175.74	2,141.00	3,482.70	53.73 S	1.52 E	237,158.64	2,232,540.97	10.34	53.75	
3,517.00	7.77	177.35	2,172.82	3,514.52	57.03 S	1.70 E	237,155.34	2,232,541.18	11.48	57.05	
3,548.00	11.34	179.28	2,203.38	3,545.08	62.18 S	1.84 E	237,150.20	2,232,541.36	11.56	62.20	
3,580.00	15.27	179.61	2,234.52	3,576.22	69.54 S	1.91 E	237,142.84	2,232,541.49	12.28	69.56	
3,611.00	18.88	180.81	2,264.15	3,605.85	78.64 S	1.86 E	237,133.74	2,232,541.53	11.70	78.66	
3,643.00	22.29	180.22	2,294.10	3,635.80	89.89 S	1.77 E	237,122.49	2,232,541.53	10.68	89.91	
3,674.00	25.11	180.56	2,322.48	3,664.18	102.35 S	1.68 E	237,110.03	2,232,541.55	9.11	102.36	
3,705.00	27.50	179.92	2,350.27	3,691.97	116.08 S	1.62 E	237,096.29	2,232,541.61	7.76	116.10	
3,737.00	30.00	179.82	2,378.32	3,720.02	131.47 S	1.66 E	237,080.90	2,232,541.78	7.81	131.48	
3,769.00	33.29	178.15	2,405.56	3,747.26	148.26 S	1.97 E	237,064.13	2,232,542.23	10.64	148.27	
3,800.00	37.11	177.78	2,430.89	3,772.59	166.11 S	2.61 E	237,046.28	2,232,543.02	12.34	166.13	
3,832.00	40.21	178.09	2,455.87	3,797.57	186.09 S	3.32 E	237,026.31	2,232,543.91	9.71	186.12	
3,863.00	42.53	178.07	2,479.14	3,820.84	206.56 S	4.01 E	237,005.84	2,232,544.77	7.48	206.60	

## Survey Report for Heimerman Farms 3104 #25-1H / Job #9777742 / Nabors 102 - MWD Surveys

Measured Depth (ft)	Inclination (°)	Azimuth (°)	TVD below System (ft)	Vertical Depth (ft)	Local Coordinates		Map Coordinates		Dogleg Rate (°/100ft)	Vertical Section (ft)	Comments
					Northing (ft)	Easting (ft)	Northing (ft)	Easting (ft)			
3,895.00	43.86	179.10	2,502.46	3,844.16	228.46 S	4.55 E	236,983.95	2,232,545.50	4.70	228.50	
3,926.00	46.24	179.83	2,524.36	3,866.06	250.39 S	4.75 E	236,962.02	2,232,545.89	7.86	250.44	
3,958.00	48.35	180.50	2,546.07	3,887.77	273.91 S	4.68 E	236,938.50	2,232,546.02	6.77	273.95	
3,989.00	50.26	180.90	2,566.28	3,907.98	297.41 S	4.39 E	236,915.00	2,232,545.93	6.24	297.44	
4,020.00	52.42	181.74	2,585.64	3,927.34	321.61 S	3.83 E	236,890.80	2,232,545.58	7.28	321.63	
4,052.00	55.69	181.27	2,604.43	3,946.13	347.50 S	3.15 E	236,864.90	2,232,545.12	10.29	347.51	
4,083.00	59.59	180.80	2,621.01	3,962.71	373.68 S	2.68 E	236,838.72	2,232,544.88	12.65	373.67	
4,115.00	61.83	179.80	2,636.67	3,978.37	401.58 S	2.54 E	236,810.81	2,232,544.97	7.51	401.57	
4,146.00	64.24	179.13	2,650.73	3,992.43	429.21 S	2.80 E	236,783.19	2,232,545.47	8.01	429.20	
4,178.00	66.96	179.26	2,663.94	4,005.64	458.35 S	3.21 E	236,754.06	2,232,546.13	8.51	458.34	
4,209.00	69.32	178.18	2,675.49	4,017.19	487.11 S	3.85 E	236,725.30	2,232,547.02	8.27	487.11	
4,241.00	72.78	178.44	2,685.88	4,027.58	517.36 S	4.75 E	236,695.06	2,232,548.17	10.84	517.37	
4,272.00	75.94	178.08	2,694.23	4,035.93	547.19 S	5.65 E	236,665.24	2,232,549.34	10.25	547.21	
4,304.00	79.31	177.82	2,701.09	4,042.79	578.42 S	6.77 E	236,634.02	2,232,550.72	10.56	578.46	
4,355.00	85.54	178.25	2,707.81	4,049.51	628.92 S	8.50 E	236,583.53	2,232,552.89	12.24	628.98	
4,457.00	89.51	178.78	2,712.21	4,053.91	730.77 S	11.14 E	236,481.71	2,232,556.40	3.93	730.86	
4,489.00	89.63	178.87	2,712.45	4,054.15	762.77 S	11.80 E	236,449.73	2,232,557.33	0.47	762.86	
4,583.00	89.97	178.41	2,712.78	4,054.48	856.74 S	14.03 E	236,355.78	2,232,560.37	0.61	856.85	
4,677.00	89.42	178.48	2,713.28	4,054.98	950.70 S	16.58 E	236,261.84	2,232,563.72	0.59	950.84	
4,772.00	89.57	178.82	2,714.12	4,055.82	1,045.67 S	18.82 E	236,166.89	2,232,566.77	0.39	1,045.84	
4,866.00	89.97	178.35	2,714.50	4,056.20	1,139.64 S	21.14 E	236,072.94	2,232,569.90	0.66	1,139.83	
4,961.00	89.54	178.64	2,714.90	4,056.60	1,234.61 S	23.63 E	235,978.00	2,232,573.21	0.55	1,234.83	
5,055.00	89.94	178.83	2,715.33	4,057.03	1,328.58 S	25.71 E	235,884.05	2,232,576.09	0.47	1,328.82	
5,149.00	89.94	179.06	2,715.43	4,057.13	1,422.57 S	27.44 E	235,790.08	2,232,578.63	0.24	1,422.82	
5,244.00	88.43	177.69	2,716.78	4,058.48	1,517.51 S	30.13 E	235,695.16	2,232,582.14	2.15	1,517.80	
5,338.00	89.20	180.04	2,718.72	4,060.42	1,611.47 S	31.99 E	235,601.23	2,232,584.80	2.63	1,611.77	
5,433.00	91.33	180.99	2,718.28	4,059.98	1,706.46 S	31.14 E	235,506.24	2,232,584.76	2.45	1,706.74	
5,527.00	89.23	180.94	2,717.82	4,059.52	1,800.44 S	29.56 E	235,412.25	2,232,583.99	2.23	1,800.68	
5,621.00	88.64	180.16	2,719.57	4,061.27	1,894.42 S	28.66 E	235,318.26	2,232,583.89	1.04	1,894.63	
5,712.00	88.77	179.87	2,721.63	4,063.33	1,985.39 S	28.63 E	235,227.29	2,232,584.65	0.35	1,985.60	
5,803.00	90.37	181.03	2,722.31	4,064.01	2,076.38 S	27.92 E	235,136.30	2,232,584.71	2.17	2,076.56	
5,893.00	88.95	180.78	2,722.84	4,064.54	2,166.37 S	26.50 E	235,046.30	2,232,584.06	1.60	2,166.51	
5,985.00	90.46	182.15	2,723.32	4,065.02	2,258.33 S	24.14 E	234,954.32	2,232,582.50	2.22	2,258.43	
6,076.00	89.10	182.95	2,723.67	4,065.37	2,349.24 S	20.10 E	234,863.39	2,232,579.23	1.73	2,349.26	
6,167.00	87.81	183.05	2,726.12	4,067.82	2,440.08 S	15.33 E	234,772.51	2,232,575.25	1.42	2,440.01	
6,258.00	86.91	183.15	2,730.31	4,072.01	2,530.85 S	10.42 E	234,681.70	2,232,571.11	1.00	2,530.69	
6,348.00	86.60	180.96	2,735.41	4,077.11	2,620.64 S	7.20 E	234,591.88	2,232,568.66	2.45	2,620.42	
6,439.00	87.75	179.80	2,739.89	4,081.59	2,711.52 S	6.59 E	234,501.00	2,232,568.84	1.79	2,711.28	
6,530.00	87.57	179.18	2,743.61	4,085.31	2,802.44 S	7.40 E	234,410.09	2,232,570.43	0.71	2,802.20	

**Survey Report for Heimerman Farms 3104 #25-1H / Job #9777742 / Nabors 102 - MWD Surveys**

Measured Depth (ft)	Inclination (°)	Azimuth (°)	TVD below System (ft)	Vertical Depth (ft)	Local Coordinates		Map Coordinates		Dogleg Rate (°/100ft)	Vertical Section (ft)	Comments
					Northing (ft)	Easting (ft)	Northing (ft)	Easting (ft)			
6,624.00	88.46	178.40	2,746.86	4,088.56	2,896.36 S	9.39 E	234,316.19	2,232,573.22	1.26	2,896.14	
6,719.00	89.72	177.70	2,748.37	4,090.07	2,991.30 S	12.62 E	234,221.29	2,232,577.26	1.52	2,991.11	
6,813.00	89.41	178.50	2,749.09	4,090.79	3,085.24 S	15.74 E	234,127.37	2,232,581.18	0.91	3,085.09	
6,908.00	89.54	178.85	2,749.96	4,091.66	3,180.21 S	17.93 E	234,032.43	2,232,584.20	0.39	3,180.09	
7,002.00	90.28	177.95	2,750.10	4,091.80	3,274.17 S	20.56 E	233,938.49	2,232,587.63	1.24	3,274.08	
7,096.00	90.28	179.27	2,749.65	4,091.35	3,368.14 S	22.84 E	233,844.55	2,232,590.71	1.40	3,368.07	
7,191.00	90.92	180.14	2,748.65	4,090.35	3,463.13 S	23.33 E	233,749.56	2,232,592.02	1.14	3,463.06	
7,285.00	90.56	179.20	2,747.44	4,089.14	3,557.12 S	23.87 E	233,655.58	2,232,593.36	1.07	3,557.05	
7,380.00	89.14	178.76	2,747.69	4,089.39	3,652.10 S	25.56 E	233,560.62	2,232,595.87	1.56	3,652.04	
7,474.00	87.74	179.85	2,750.24	4,091.94	3,746.06 S	26.70 E	233,466.68	2,232,597.81	1.89	3,746.00	
7,569.00	89.69	180.64	2,752.37	4,094.07	3,841.03 S	26.29 E	233,371.71	2,232,598.22	2.21	3,840.96	
7,663.00	87.90	179.33	2,754.35	4,096.05	3,935.00 S	26.32 E	233,277.74	2,232,599.05	2.36	3,934.92	
7,758.00	89.45	176.52	2,756.55	4,098.25	4,029.90 S	29.76 E	233,182.87	2,232,603.30	3.38	4,029.86	
7,852.00	91.32	175.37	2,755.92	4,097.62	4,123.66 S	36.40 E	233,089.17	2,232,610.76	2.34	4,123.71	
7,947.00	90.00	176.20	2,754.82	4,096.52	4,218.39 S	43.38 E	232,994.50	2,232,618.55	1.64	4,218.55	
8,041.00	90.22	177.12	2,754.64	4,096.34	4,312.23 S	48.86 E	232,900.71	2,232,624.83	1.01	4,312.46	
8,135.00	90.25	177.19	2,754.26	4,095.96	4,406.12 S	53.53 E	232,806.87	2,232,630.30	0.08	4,406.41	
8,230.00	90.06	177.54	2,754.00	4,095.70	4,501.01 S	57.89 E	232,712.02	2,232,635.48	0.42	4,501.36	
8,324.00	89.29	176.24	2,754.53	4,096.23	4,594.87 S	62.99 E	232,618.21	2,232,641.39	1.61	4,595.29	
8,419.00	90.09	177.27	2,755.05	4,096.75	4,689.72 S	68.37 E	232,523.41	2,232,647.58	1.37	4,690.21	
8,513.00	90.00	176.73	2,754.97	4,096.67	4,783.59 S	73.29 E	232,429.59	2,232,653.30	0.58	4,784.15	
8,608.00	90.15	178.97	2,754.85	4,096.55	4,878.51 S	76.85 E	232,334.69	2,232,657.68	2.36	4,879.12	
8,702.00	90.40	179.49	2,754.40	4,096.10	4,972.50 S	78.12 E	232,240.72	2,232,659.75	0.61	4,973.12	
8,797.00	90.52	180.71	2,753.63	4,095.33	5,067.50 S	77.95 E	232,145.73	2,232,660.40	1.29	5,068.10	
8,891.00	90.49	180.22	2,752.81	4,094.51	5,161.49 S	77.19 E	232,051.73	2,232,660.44	0.52	5,162.07	
8,993.00	90.46	180.65	2,751.96	4,093.66	5,263.49 S	76.41 E	231,949.73	2,232,660.54	0.42	5,264.03	Final Sperry MWD Survey
9,047.00	90.46	180.65	2,751.53	4,093.23	5,317.48 S	75.80 E	231,895.74	2,232,660.39	0.00	5,318.01	Projection to TD

**Survey Annotations**

Measured Depth (ft)	Vertical Depth (ft)	Local Coordinates		Comment
		+N/-S (ft)	+E/-W (ft)	
178.00	177.99	-1.51	0.81	First Sperry MWD Survey
8,993.00	4,093.66	-5,263.49	76.41	Final Sperry MWD Survey
9,047.00	4,093.23	-5,317.48	75.80	Projection to TD

**Survey Report for Heimerman Farms 3104 #25-1H / Job #9777742 / Nabors 102 - MWD Surveys**

**Vertical Section Information**

Angle Type	Target	Azimuth (°)	Origin Type	Origin +N/_S (ft)	Origin +E/-W (ft)	Start TVD (ft)
User	No Target (Freehand)	179.08	Slot	0.00	0.00	0.00

**Survey tool program**

From (ft)	To (ft)	Survey/Plan	Survey Tool
178.00	9,047.00	MWD Surveys	MWD+SC

**Design Targets**

Target Name	Dip Angle (°)	Dip Dir. (°)	TVD (°)	+N/-S (°)	+E/-W (°)	Northing (°)	Easting (°)	Latitude	Longitude
- hit/miss target									
- Shape									

**Directional Difficulty Index**

Average Dogleg over Survey:	1.92 °/100ft	Maximum Dogleg over Survey:	12.65 °/100ft at 4,083.00 ft
Net Tortousity applicable to Plans:	0.78 °/100ft	Directional Difficulty Index:	6.311

**Audit Info**

**North Reference Sheet for Sec 25-T31S-R4W - Heimerman Farms 3104 #25-1H / Job #9777742 / Nabors 102 - Wellbore #1**

All data is in Feet unless otherwise stated. Directions and Coordinates are relative to True North Reference.  
Vertical Depths are relative to WELL @ 1341.70ft (Original Well Elev). Northing and Easting are relative to Heimerman Farms 3104 #25-1H / Job #9777742 / Nabors 102  
Coordinate System is US State Plane 1927 (Exact solution), Kansas South 1502 using datum NAD 1927 (NADCON CONUS), ellipsoid Clarke 1866  
Projection method is Lambert Conformal Conic (2 parallel)  
Central Meridian is 98° 30' 0.000 W°, Longitude Origin:0° 0' 0.000 E°, Latitude Origin:37° 16' 0.000 N°  
False Easting: 2,000,000.00ft, False Northing: 0.00ft, Scale Reduction: 0.99999078

Grid Coordinates of Well: 237,212.36 ft N, 2,232,538.99 ft E  
Geographical Coordinates of Well: 37° 18' 55.45" N, 097° 42' 01.48" W  
Grid Convergence at Surface is: 0.49°

Based upon Minimum Curvature type calculations, at a Measured Depth of 9,047.00ft the Bottom Hole Displacement is 5,318.02ft in the Direction of 179.18° (True).

Magnetic Convergence at surface is: -3.92° (27 August 2012, , BGGM2012)

Magnetic Model: BGGM2012  
Date: 27-Aug-12  
Declination: 4.41°  
Inclination/Dip: 65.47°  
Field Strength: 51957

Grid North is 0.49° East of True North (Grid Convergence)  
Magnetic North is 4.41° East of True North (Magnetic Declination)  
Magnetic North is 3.92° East of Grid North (Magnetic Convergence)

To convert a True Direction to a Grid Direction, Subtract 0.49°  
To convert a Magnetic Direction to a True Direction, Add 4.41° East  
To convert a Magnetic Direction to a Grid Direction, Add 3.92°