



Company:	Tug Hill Operating, LLC	Local Co-ordinate Reference:	Well 1-25H
Project:	Comanche County, Kansas (NAD83)	TVD Reference:	WELL @ 2143.00usft (Patterson 421)
Site:	Proctor	MD Reference:	WELL @ 2143.00usft (Patterson 421)
Well:	1-25H	North Reference:	Grid
Wellbore:	Wellbore #1	Survey Calculation Method:	Minimum Curvature
Design:	Surveys	Database:	Southern Region

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)	
1,948.00	0.20	128.40	1,945.46	44.99	41.34	45.62	0.17	0.11	55.58	
2,043.00	0.30	164.60	2,040.46	44.65	41.54	45.28	0.19	0.11	38.11	
2,138.00	0.20	217.40	2,135.46	44.27	41.50	44.91	0.25	-0.11	55.58	
2,233.00	0.20	194.40	2,230.46	43.98	41.36	44.61	0.08	0.00	-24.21	
2,328.00	0.40	226.00	2,325.46	43.59	41.08	44.22	0.27	0.21	33.26	
2,424.00	0.20	221.50	2,421.45	43.23	40.73	43.85	0.21	-0.21	-4.69	
2,520.00	0.40	244.40	2,517.45	42.96	40.32	43.58	0.24	0.21	23.85	
2,614.00	0.40	190.00	2,611.45	42.50	39.96	43.11	0.39	0.00	-57.87	
2,709.00	0.20	198.00	2,706.45	42.01	39.86	42.62	0.21	-0.21	8.42	
2,803.00	0.40	200.70	2,800.45	41.55	39.69	42.15	0.21	0.21	2.87	
2,899.00	0.40	166.70	2,896.45	40.91	39.65	41.51	0.24	0.00	-35.42	
2,994.00	0.40	173.40	2,991.44	40.26	39.76	40.86	0.05	0.00	7.05	
3,089.00	0.40	180.40	3,086.44	39.60	39.80	40.20	0.05	0.00	7.37	
3,183.00	0.40	194.00	3,180.44	38.95	39.72	39.56	0.10	0.00	14.47	
3,278.00	0.30	162.20	3,275.44	38.39	39.71	39.00	0.23	-0.11	-33.47	
3,374.00	0.30	204.00	3,371.44	37.92	39.69	38.53	0.22	0.00	43.54	
3,469.00	0.40	146.10	3,466.43	37.42	39.77	38.03	0.37	0.11	-60.95	
3,563.00	0.40	185.10	3,560.43	36.82	39.92	37.43	0.28	0.00	41.49	
3,658.00	0.20	167.20	3,655.43	36.33	39.93	36.94	0.23	-0.21	-18.84	
3,753.00	0.20	138.50	3,750.43	36.04	40.08	36.66	0.10	0.00	-30.21	
3,848.00	0.30	214.20	3,845.43	35.71	40.05	36.32	0.33	0.11	79.68	
3,943.00	0.40	223.40	3,940.43	35.27	39.68	35.87	0.12	0.11	9.68	
4,039.00	0.30	164.10	4,036.43	34.78	39.52	35.39	0.37	-0.10	-61.77	
4,133.00	0.60	168.40	4,130.42	34.06	39.69	34.67	0.32	0.32	4.57	
4,228.00	0.60	163.10	4,225.42	33.10	39.93	33.71	0.06	0.00	-5.58	
4,323.00	0.70	138.70	4,320.41	32.19	40.46	32.81	0.31	0.11	-25.68	
4,419.00	0.70	130.80	4,416.41	31.36	41.29	31.99	0.10	0.00	-8.23	
4,515.00	0.60	133.40	4,512.40	30.64	42.10	31.28	0.11	-0.10	2.71	
4,588.00	0.50	141.00	4,585.40	30.13	42.58	30.78	0.17	-0.14	10.41	
4,620.00	2.40	356.60	4,617.39	30.69	42.62	31.34	8.82	5.94	-451.25	
4,651.00	6.40	357.80	4,648.29	33.06	42.52	33.71	12.91	12.90	3.87	
4,683.00	10.50	1.10	4,679.94	37.76	42.51	38.41	12.90	12.81	10.31	
4,715.00	14.00	2.30	4,711.20	44.55	42.72	45.20	10.97	10.94	3.75	
4,746.00	16.00	3.10	4,741.14	52.56	43.10	53.22	6.49	6.45	2.58	
4,777.00	18.60	1.30	4,770.74	61.77	43.44	62.43	8.56	8.39	-5.81	
4,809.00	21.40	357.60	4,800.81	72.71	43.31	73.36	9.60	8.75	-11.56	
4,840.00	24.10	356.40	4,829.39	84.68	42.68	85.32	8.84	8.71	-3.87	
4,872.00	26.90	355.50	4,858.27	98.42	41.70	99.05	8.83	8.75	-2.81	
4,904.00	31.40	356.80	4,886.21	113.97	40.67	114.58	14.20	14.06	4.06	
4,936.00	36.60	359.20	4,912.74	131.84	40.07	132.44	16.78	16.25	7.50	
4,967.00	40.70	1.30	4,936.94	151.19	40.17	151.79	13.88	13.23	6.77	
5,000.00	44.20	2.60	4,961.29	173.45	40.94	174.06	10.93	10.61	3.94	
5,031.00	47.60	2.60	4,982.86	195.69	41.94	196.31	10.97	10.97	0.00	



MS Energy Services
Survey Report



Company:	Tug Hill Operating, LLC	Local Co-ordinate Reference:	Well 1-25H
Project:	Comanche County, Kansas (NAD83)	TVD Reference:	WELL @ 2143.00usft (Patterson 421)
Site:	Proctor	MD Reference:	WELL @ 2143.00usft (Patterson 421)
Well:	1-25H	North Reference:	Grid
Wellbore:	Wellbore #1	Survey Calculation Method:	Minimum Curvature
Design:	Surveys	Database:	Southern Region

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)	
5,063.00	51.50	2.30	5,003.62	220.01	42.98	220.64	12.21	12.19	-0.94	
5,094.00	54.30	2.60	5,022.31	244.71	44.04	245.36	9.07	9.03	0.97	
5,126.00	57.80	1.00	5,040.18	271.24	44.87	271.89	11.70	10.94	-5.00	
5,158.00	59.70	359.40	5,056.78	298.59	44.96	299.25	7.32	5.94	-5.00	
5,188.00	60.00	359.20	5,071.85	324.53	44.64	325.18	1.15	1.00	-0.67	
5,220.00	60.10	359.00	5,087.83	352.25	44.21	352.89	0.63	0.31	-0.63	
5,252.00	60.00	358.50	5,103.80	379.97	43.60	380.60	1.39	-0.31	-1.56	
5,284.00	62.90	358.90	5,119.09	408.07	42.97	408.68	9.13	9.06	1.25	
5,315.00	67.30	359.10	5,132.14	436.18	42.48	436.78	14.21	14.19	0.65	
5,347.00	72.00	359.30	5,143.27	466.17	42.06	466.76	14.70	14.69	0.63	
5,379.00	74.50	359.30	5,152.49	496.81	41.68	497.39	7.81	7.81	0.00	
5,410.00	75.30	359.30	5,160.57	526.74	41.32	527.31	2.58	2.58	0.00	
5,441.00	77.30	359.10	5,167.91	556.85	40.90	557.41	6.48	6.45	-0.65	
5,473.00	80.40	359.00	5,174.09	588.24	40.38	588.79	9.69	9.69	-0.31	
5,505.00	84.20	359.10	5,178.38	619.94	39.85	620.48	11.88	11.88	0.31	
5,537.00	87.50	358.90	5,180.70	651.84	39.29	652.37	10.33	10.31	-0.63	
5,568.00	88.50	359.10	5,181.78	682.82	38.75	683.34	3.29	3.23	0.65	
5,600.00	88.70	358.60	5,182.56	714.80	38.11	715.31	1.68	0.63	-1.56	
5,653.00	89.60	358.40	5,183.35	767.78	36.72	768.25	1.74	1.70	-0.38	
5,745.00	90.90	0.50	5,182.95	859.77	35.84	860.22	2.68	1.41	2.28	
5,838.00	91.50	0.80	5,181.00	952.74	36.90	953.20	0.72	0.65	0.32	
5,930.00	90.70	2.10	5,179.23	1,044.69	39.22	1,045.17	1.66	-0.87	1.41	
6,022.00	90.90	1.90	5,177.95	1,136.63	42.43	1,137.14	0.31	0.22	-0.22	
6,114.00	92.00	2.70	5,175.62	1,228.52	46.12	1,229.08	1.48	1.20	0.87	
6,206.00	89.90	1.50	5,174.09	1,320.44	49.50	1,321.04	2.63	-2.28	-1.30	
6,297.00	88.60	359.20	5,175.28	1,411.42	50.05	1,412.02	2.90	-1.43	-2.53	
6,360.00	89.00	358.90	5,176.60	1,474.40	49.01	1,474.98	0.79	0.63	-0.48	
6,454.00	89.90	358.90	5,177.51	1,568.38	47.20	1,568.92	0.96	0.96	0.00	
6,549.00	90.80	358.70	5,176.93	1,663.35	45.21	1,663.85	0.97	0.95	-0.21	
6,644.00	91.10	0.40	5,175.35	1,758.33	44.47	1,758.81	1.82	0.32	1.79	
6,738.00	90.10	1.30	5,174.37	1,852.32	45.86	1,852.80	1.43	-1.06	0.96	
6,833.00	90.30	0.80	5,174.03	1,947.30	47.60	1,947.80	0.57	0.21	-0.53	
6,929.00	91.20	0.50	5,172.78	2,043.28	48.69	2,043.79	0.99	0.94	-0.31	
7,023.00	89.70	0.70	5,172.04	2,137.27	49.68	2,137.78	1.61	-1.60	0.21	
7,118.00	90.30	0.40	5,172.04	2,232.27	50.59	2,232.78	0.71	0.63	-0.32	
7,213.00	89.00	1.60	5,172.62	2,327.25	52.25	2,327.78	1.86	-1.37	1.26	
7,309.00	89.80	1.30	5,173.63	2,423.21	54.67	2,423.77	0.89	0.83	-0.31	
7,404.00	88.20	1.10	5,175.28	2,518.17	56.66	2,518.75	1.70	-1.68	-0.21	
7,499.00	89.30	1.30	5,177.36	2,613.13	58.65	2,613.72	1.18	1.16	0.21	
7,593.00	89.90	1.60	5,178.01	2,707.09	61.03	2,707.71	0.71	0.64	0.32	
7,689.00	87.90	0.50	5,179.86	2,803.05	62.79	2,803.69	2.38	-2.08	-1.15	
7,784.00	88.10	0.40	5,183.17	2,897.99	63.54	2,898.63	0.24	0.21	-0.11	
7,879.00	89.00	359.70	5,185.57	2,992.96	63.62	2,993.59	1.20	0.95	-0.74	



Company:	Tug Hill Operating, LLC	Local Co-ordinate Reference:	Well 1-25H
Project:	Comanche County, Kansas (NAD83)	TVD Reference:	WELL @ 2143.00usft (Patterson 421)
Site:	Proctor	MD Reference:	WELL @ 2143.00usft (Patterson 421)
Well:	1-25H	North Reference:	Grid
Wellbore:	Wellbore #1	Survey Calculation Method:	Minimum Curvature
Design:	Surveys	Database:	Southern Region

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)	
7,975.00	90.00	359.70	5,186.41	3,088.96	63.12	3,089.56	1.04	1.04	0.00	
8,069.00	90.50	0.10	5,186.00	3,182.95	62.95	3,183.55	0.68	0.53	0.43	
8,164.00	91.10	359.80	5,184.68	3,277.94	62.87	3,278.52	0.71	0.63	-0.32	
8,259.00	89.10	1.40	5,184.51	3,372.93	63.86	3,373.51	2.70	-2.11	1.68	
8,353.00	90.20	359.80	5,185.08	3,466.92	64.85	3,467.51	2.07	1.17	-1.70	
8,448.00	91.30	359.80	5,183.84	3,561.91	64.52	3,562.48	1.16	1.16	0.00	
8,543.00	89.30	0.50	5,183.34	3,656.90	64.77	3,657.47	2.23	-2.11	0.74	
8,638.00	89.10	0.50	5,184.67	3,751.89	65.59	3,752.45	0.21	-0.21	0.00	
8,732.00	89.40	359.90	5,185.90	3,845.88	65.92	3,846.44	0.71	0.32	-0.64	
8,827.00	89.50	0.90	5,186.81	3,940.87	66.59	3,941.43	1.06	0.11	1.05	
8,922.00	89.80	0.50	5,187.39	4,035.86	67.75	4,036.43	0.53	0.32	-0.42	
9,017.00	89.50	0.20	5,187.97	4,130.86	68.33	4,131.42	0.45	-0.32	-0.32	
9,112.00	90.70	359.30	5,187.81	4,225.86	67.91	4,226.40	1.58	1.26	-0.95	
9,206.00	91.30	359.10	5,186.17	4,319.83	66.60	4,320.35	0.67	0.64	-0.21	
9,300.00	90.60	1.00	5,184.61	4,413.81	66.68	4,414.32	2.15	-0.74	2.02	
9,395.00	91.50	0.80	5,182.87	4,508.79	68.17	4,509.30	0.97	0.95	-0.21	
9,488.00	90.40	0.90	5,181.32	4,601.76	69.55	4,602.29	1.19	-1.18	0.11	
9,561.00	90.00	0.80	5,181.07	4,674.75	70.64	4,675.29	0.56	-0.55	-0.14	
9,622.00	90.00	0.80	5,181.07	4,735.75	71.49	4,736.29	0.00	0.00	0.00	
Projection to TD-9622.00' MD										

Survey Annotations					
Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment	
		+N/-S (usft)	+E/-W (usft)		
668.00	667.99	-3.07	0.84	Tie-In to VES Gyro-668.00' MD	
9,622.00	5,181.07	4,735.75	71.49	Projection to TD-9622.00' MD	



Company:	Tug Hill Operating, LLC	Local Co-ordinate Reference:	Well 1-25H
Project:	Comanche County, Kansas (NAD83)	TVD Reference:	WELL @ 2143.00usft (Patterson 421)
Site:	Proctor	MD Reference:	WELL @ 2143.00usft (Patterson 421)
Well:	1-25H	North Reference:	Grid
Wellbore:	Wellbore #1	Survey Calculation Method:	Minimum Curvature
Design:	Surveys	Database:	Southern Region

Project	Comanche County, Kansas (NAD83)		
Map System:	US State Plane 1983	System Datum:	Mean Sea Level
Geo Datum:	North American Datum 1983		
Map Zone:	Kansas Southern Zone		

Well	1-25H				
Well Position	+N/-S	0.00 usft	Northing:	1,547,771.84 usft	Latitude: 37° 18' 36.7363 N
	+E/-W	0.00 usft	Easting:	1,066,914.81 usft	Longitude: 99° 20' 37.823 W
Position Uncertainty		0.00 usft	Wellhead Elevation:	usft	Ground Level: 2,120.00 usft

Wellbore	Wellbore #1				
Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	WMM_2010	09/28/2012	5.39	65.26	51,844

Design	Surveys				
Audit Notes:					
Version:	1.0	Phase:	ACTUAL	Tie On Depth:	0.00
Vertical Section:	Depth From (TVD) (usft)	+N/-S (usft)	+E/-W (usft)	Direction (°)	
	0.00	0.00	0.00	0.88	

Survey Program	Date	10/15/2012			
From (usft)	To (usft)	Survey (Wellbore)	Tool Name	Description	
100.00	668.00	VES Gyro (Wellbore #1)	NS-GYRO-MS	North sensing gyrocompassing m/s	
808.00	9,622.00	MS MWD (Wellbore #1)	MWD	MWD - Standard	

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)	
668.00	0.25	191.89	667.99	-3.07	0.84	-3.05	0.00	0.00	0.00	
Tie-In to VES Gyro-668.00' MD										
745.00	0.70	220.30	744.99	-3.59	0.50	-3.58	0.64	0.58	36.90	
808.00	0.40	222.60	807.98	-4.04	0.10	-4.04	0.48	-0.48	3.65	
903.00	0.80	21.70	902.98	-3.67	0.12	-3.67	1.24	0.42	167.47	
998.00	2.70	31.30	997.93	-1.14	1.53	-1.12	2.02	2.00	10.11	
1,093.00	4.70	38.60	1,092.73	3.81	5.12	3.89	2.16	2.11	7.68	
1,188.00	5.20	40.80	1,187.38	10.11	10.36	10.27	0.56	0.53	2.32	
1,283.00	5.20	43.10	1,281.99	16.51	16.12	16.76	0.22	0.00	2.42	
1,378.00	5.50	40.30	1,376.57	23.13	22.00	23.46	0.42	0.32	-2.95	
1,472.00	5.40	44.80	1,470.15	29.70	28.04	30.13	0.47	-0.11	4.79	
1,567.00	4.60	43.10	1,564.78	35.66	33.79	36.17	0.86	-0.84	-1.79	
1,662.00	3.20	39.70	1,659.56	40.48	38.08	41.06	1.49	-1.47	-3.58	
1,757.00	1.70	26.70	1,754.47	43.78	40.41	44.39	1.67	-1.58	-13.68	
1,853.00	0.10	75.60	1,850.46	45.07	41.13	45.70	1.70	-1.67	50.94	