



Directional Survey

Well Name: THISTLE UNIT 23H

Sub-Division DELAWARE BASIN		Region DELAWARE BASIN EAST		Field Name JOHNSON RANCH		County LEA		State/Province NM					
Surface Legal Location SEC 34 23S 33E		API/UWI 3002542420		Latitude (°) 32° 15' 15.339" N		Longitude (°) 103° 33' 55.229" W		Orig KB Elevation (ft) 3,655.00		Ground Elev MSL (ft) 3,632.00		KB - GL (ft) 23.00	
Wellbores													
Wellbore Name OH				Parent Wellbore OH				SAP Well ID 38364				Vertical Section Direction (°) HOBBS OGD	
Kick Offs & Key Depths													
Date 5/13/2015				Type Kick Off				Top Depth (ftKB) 8,407.0					
Actual Deviation Survey				Definitive?		Proposed?		Proposed Deviation Survey					
Deviation Survey													
Date				Description									
MD Tie In (ftKB)		TVD Tie In (ftKB)		Inclination Tie In (°)		Azimuth Tie In (°)		NSTie In (ft)		EWTie In (ft)			
Survey Data													
Date	MD (ftKB)	Incl (°)	Azm (°)	TVD (ftKB)	VS (ft)	N/S (ft)	E/W (ft)	DLS (°/100ft)	Survey Tool	Survey Company			
Wellbore Name ST01				Parent Wellbore OH				SAP Well ID				Vertical Section Direction (°)	
Kick Offs & Key Depths													
Date 5/20/2015				Type Kick Off				Top Depth (ftKB) 12,663.0					
Actual Deviation Survey EXTREME TOOL, Proposed? No				Definitive? Yes		Proposed? No		Proposed Deviation Survey					
Deviation Survey													
Date 5/20/2015				Description EXTREME TOOL									
MD Tie In (ftKB) 0.00		TVD Tie In (ftKB) 0.00		Inclination Tie In (°) 0.00		Azimuth Tie In (°) 0.00		NSTie In (ft) 0.00		EWTie In (ft) 0.00			
Survey Data													
Date	MD (ftKB)	Incl (°)	Azm (°)	TVD (ftKB)	VS (ft)	N/S (ft)	E/W (ft)	DLS (°/100ft)	Survey Tool	Survey Company			
5/3/2015	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	MS	EXTREME			
5/3/2015	154.00	0.31	41.91	154.00	0.31	0.31	0.28	0.20	MS	EXTREME			
5/3/2015	241.00	0.31	63.21	241.00	0.59	0.59	0.65	0.13	MS	EXTREME			
5/3/2015	345.00	0.40	45.63	345.00	0.97	0.97	1.16	0.13	MS	EXTREME			
5/3/2015	521.00	0.62	70.81	520.99	1.70	1.71	2.49	0.18	MS	EXTREME			
5/3/2015	642.00	0.70	70.81	641.98	2.15	2.17	3.81	0.07	MS	EXTREME			
5/3/2015	705.00	0.88	59.43	704.98	2.52	2.55	4.59	0.38	MS	EXTREME			
5/3/2015	798.00	0.88	47.21	797.96	3.36	3.39	5.73	0.20	MS	EXTREME			
5/3/2015	873.00	0.70	61.23	872.96	3.97	4.01	6.55	0.35	MS	EXTREME			
5/3/2015	985.00	0.70	63.91	984.95	4.59	4.64	7.77	0.03	MS	EXTREME			
5/3/2015	1,079.00	1.01	71.60	1,078.94	5.10	5.15	9.07	0.35	MS	EXTREME			
5/3/2015	1,177.00	0.88	68.39	1,176.92	5.64	5.70	10.59	0.14	MS	EXTREME			
5/3/2015	1,254.00	0.70	78.58	1,253.92	5.94	6.01	11.60	0.30	MS	EXTREME			
5/3/2015	1,389.00	0.70	78.58	1,388.91	6.26	6.34	13.22	0.00	MS	EXTREME			
5/3/2015	1,459.00	0.44	68.25	1,458.90	6.44	6.52	13.89	0.40	MS	EXTREME			
5/3/2015	1,551.00	0.53	54.01	1,550.90	6.82	6.90	14.56	0.16	MS	EXTREME			
5/3/2015	1,641.00	0.70	324.36	1,640.90	7.51	7.59	14.57	0.97	MS	EXTREME			
5/3/2015	1,732.00	1.06	315.75	1,731.89	8.57	8.65	13.66	0.42	MS	EXTREME			
5/3/2015	1,827.00	1.06	301.51	1,826.87	9.66	9.74	12.30	0.28	MS	EXTREME			
5/3/2015	1,921.00	1.06	307.49	1,920.85	10.66	10.72	10.87	0.12	MS	EXTREME			
5/3/2015	2,016.00	0.97	308.89	2,015.84	11.70	11.76	9.55	0.10	MS	EXTREME			
5/3/2015	2,110.00	1.06	309.77	2,109.82	12.77	12.82	8.26	0.10	MS	EXTREME			
5/3/2015	2,206.00	1.23	309.60	2,205.81	14.00	14.04	6.78	0.18	MS	EXTREME			
5/3/2015	2,300.00	1.23	308.19	2,299.78	15.28	15.31	5.21	0.03	MS	EXTREME			
5/3/2015	2,395.00	1.14	308.36	2,394.76	16.50	16.52	3.67	0.09	MS	EXTREME			
5/3/2015	2,490.00	1.14	305.55	2,489.74	17.65	17.66	2.16	0.06	MS	EXTREME			
5/3/2015	2,585.00	1.06	313.81	2,584.73	18.81	18.82	0.76	0.19	MS	EXTREME			
5/3/2015	2,680.00	0.97	322.43	2,679.71	20.07	20.06	-0.37	0.19	MS	EXTREME			
5/3/2015	2,774.00	0.97	303.44	2,773.70	21.14	21.13	-1.52	0.34	MS	EXTREME			
5/3/2015	2,869.00	0.70	295.36	2,868.69	21.84	21.82	-2.71	0.31	MS	EXTREME			
5/3/2015	2,964.00	0.53	276.55	2,963.68	22.14	22.12	-3.67	0.28	MS	EXTREME			
5/3/2015	3,058.00	0.53	276.02	3,057.68	22.25	22.22	-4.54	0.01	MS	EXTREME			
5/3/2015	3,153.00	0.18	263.36	3,152.68	22.28	22.25	-5.12	0.38	MS	EXTREME			
5/3/2015	3,248.00	0.35	301.69	3,247.68	22.41	22.38	-5.52	0.25	MS	EXTREME			
5/3/2015	3,341.00	0.53	347.92	3,340.67	22.99	22.95	-5.85	0.41	MS	EXTREME			
5/3/2015	3,435.00	0.62	17.62	3,434.67	23.90	23.86	-5.79	0.33	MS	EXTREME			
5/3/2015	3,530.00	0.62	25.71	3,529.66	24.85	24.82	-5.41	0.09	MS	EXTREME			
5/3/2015	3,625.00	0.62	37.13	3,624.66	25.72	25.69	-4.87	0.13	MS	EXTREME			
5/3/2015	3,719.00	0.62	9.19	3,718.65	26.62	26.60	-4.49	0.32	MS	EXTREME			
5/3/2015	3,813.00	0.70	26.59	3,812.65	27.64	27.61	-4.15	0.23	MS	EXTREME			
5/3/2015	3,907.00	0.44	44.53	3,906.64	28.40	28.38	-3.64	0.33	MS	EXTREME			
5/3/2015	4,001.00	0.35	43.46	4,000.64	28.87	28.85	-3.19	0.10	MS	EXTREME			
5/3/2015	4,096.00	0.26	82.31	4,095.64	29.10	29.09	-2.77	0.23	MS	EXTREME			
5/3/2015	4,190.00	0.35	40.65	4,189.64	29.35	29.33	-2.38	0.25	MS	EXTREME			
5/3/2015	4,285.00	0.26	33.27	4,284.64	29.75	29.73	-2.07	0.10	MS	EXTREME			
5/3/2015	4,379.00	0.53	82.49	4,378.63	29.98	29.97	-1.52	0.44	MS	EXTREME			
5/3/2015	4,474.00	1.32	118.17	4,473.62	29.51	29.51	-0.12	0.99	MS	EXTREME			
5/3/2015	4,567.00	1.58	113.07	4,566.59	28.49	28.50	2.00	0.31	MS	EXTREME			
5/3/2015	4,662.00	1.32	138.91	4,661.56	27.14	27.16	3.93	0.73	MS	EXTREME			
5/3/2015	4,757.00	1.58	153.50	4,756.53	25.14	25.17	5.23	0.47	MS	EXTREME			
5/3/2015	4,851.00	1.49	169.15	4,850.50	22.77	22.81	6.04	0.45	MS	EXTREME			
5/3/2015	4,945.00	1.49	162.99	4,944.47	20.40	20.44	6.63	0.17	MS	EXTREME			
5/3/2015	5,038.00	1.76	159.83	5,037.43	17.90	17.94	7.47	0.31	MS	EXTREME			

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Survey Data													
Date	MD (ftKB)	Incl (°)	Azm (°)	TVD (ftKB)	VS (ft)	N/S (ft)	E/W (ft)	DLS (°/100ft)	Survey Tool	Survey Company			
5/3/2015	10,511.00	89.96	0.75	9,019.19	1,752.91	1,752.58	-60.84	1.88	MS	EXTREME			
5/3/2015	10,606.00	89.69	0.75	9,019.48	1,847.89	1,847.57	-59.59	0.28	MS	EXTREME			
5/3/2015	10,700.00	90.75	1.10	9,019.12	1,941.87	1,941.55	-58.07	1.19	MS	EXTREME			
5/3/2015	10,795.00	91.28	1.45	9,017.43	2,036.81	2,036.52	-55.96	0.67	MS	EXTREME			
5/3/2015	10,890.00	91.71	1.80	9,014.96	2,131.72	2,131.44	-53.27	0.58	MS	EXTREME			
5/3/2015	10,984.00	89.96	0.92	9,013.59	2,225.67	2,225.40	-51.04	2.08	MS	EXTREME			
5/3/2015	11,079.00	89.16	0.92	9,014.32	2,320.64	2,320.39	-49.51	0.84	MS	EXTREME			
5/3/2015	11,173.00	88.64	0.40	9,016.12	2,414.61	2,414.36	-48.43	0.78	MS	EXTREME			
5/3/2015	11,268.00	88.64	0.75	9,018.37	2,509.57	2,509.33	-47.48	0.37	MS	EXTREME			
5/3/2015	11,362.00	89.87	0.75	9,019.60	2,603.54	2,603.31	-46.25	1.31	MS	EXTREME			
5/3/2015	11,457.00	90.75	1.27	9,019.08	2,698.51	2,698.30	-44.57	1.08	MS	EXTREME			
5/3/2015	11,553.00	89.78	1.45	9,018.64	2,794.47	2,794.27	-42.29	1.03	MS	EXTREME			
5/3/2015	11,648.00	90.57	1.80	9,018.35	2,889.41	2,889.23	-39.60	0.91	MS	EXTREME			
5/3/2015	11,743.00	91.28	1.10	9,016.81	2,984.35	2,984.18	-37.20	1.05	MS	EXTREME			
5/3/2015	11,838.00	91.28	1.27	9,014.69	3,079.29	3,079.14	-35.23	0.18	MS	EXTREME			
5/3/2015	11,933.00	91.36	1.63	9,012.50	3,174.22	3,174.08	-32.83	0.39	MS	EXTREME			
5/3/2015	12,027.00	90.40	0.57	9,011.06	3,268.18	3,268.05	-31.02	1.52	MS	EXTREME			
5/3/2015	12,122.00	91.19	0.57	9,009.74	3,363.16	3,363.04	-30.08	0.83	MS	EXTREME			
5/3/2015	12,217.00	89.78	0.75	9,008.94	3,458.14	3,458.03	-28.98	1.50	MS	EXTREME			
5/3/2015	12,312.00	87.76	0.92	9,010.98	3,553.09	3,552.99	-27.60	2.13	MS	EXTREME			
5/3/2015	12,414.00	88.20	0.92	9,014.57	3,655.00	3,654.91	-25.96	0.43	MS	EXTREME			
5/3/2015	12,507.00	88.99	0.04	9,016.85	3,747.96	3,747.88	-25.19	1.27	MS	EXTREME			
5/3/2015	12,602.00	89.87	359.69	9,017.80	3,842.96	3,842.87	-25.41	1.00	MS	EXTREME			
5/3/2015	12,690.00	89.25	1.63	9,018.47	3,930.94	3,930.86	-24.40	2.31	MS	EXTREME			
5/3/2015	12,785.00	91.89	2.86	9,017.53	4,025.82	4,025.77	-20.68	3.07	MS	EXTREME			
5/3/2015	12,880.00	92.86	2.86	9,013.59	4,120.59	4,120.57	-15.94	1.02	MS	EXTREME			
5/3/2015	12,975.00	93.65	0.92	9,008.20	4,215.36	4,215.36	-12.81	2.20	MS	EXTREME			
5/3/2015	13,069.00	93.03	0.04	9,002.72	4,309.19	4,309.20	-12.02	1.14	MS	EXTREME			
5/3/2015	13,163.00	91.80	358.81	8,998.76	4,403.10	4,403.11	-12.97	1.85	MS	EXTREME			
5/3/2015	13,258.00	91.10	358.64	8,996.36	4,498.06	4,498.05	-15.08	0.76	MS	EXTREME			
5/3/2015	13,353.00	91.63	357.76	8,994.09	4,593.00	4,592.98	-18.06	1.08	MS	EXTREME			
5/3/2015	13,448.00	90.75	357.94	8,992.12	4,687.93	4,687.89	-21.63	0.95	MS	EXTREME			
5/3/2015	13,543.00	90.75	357.76	8,990.88	4,782.88	4,782.81	-25.19	0.19	MS	EXTREME			
5/3/2015	13,582.00	91.54	357.41	8,990.10	4,821.84	4,821.77	-26.83	2.22	MS	EXTREME			
5/3/2015	13,630.00	91.54	357.41	8,988.81	4,869.79	4,869.70	-29.00	0.00	BIT	EXTREME			