

DIRECTIONAL SURVEY CALCULATION

MINIMUM CURVATURE METHOD

Well Name		Target Direction	Slot Coordinate	N / S	E / W	Hole Size	Calculation by	Date			
James 2922 1-13F		359.93						1/22/13			
Job Number		Type of Survey	Tie-in Point				Directional Co.				
0											
Measured Depth	Hole Angle	Hole Direction	Course Length	True Vertical Depth	Vertical Section	Total Coordinate		Dogleg Severity	Build Up °/100 ft	Walk/ °/100 ft	
						N + / S -	E + / W -				
0	0	0	0	0.00	0.00					<< TIE-IN POINT >>	
0	0	0		0.00	0.00	0.00	0.00				
295	1	0	295	294.99	1.80	1.80	0.00	0.24	0.24	0.00	
615	1	0	320	614.97	5.99	5.99	0.00	0.03	0.03	0.00	
900	0	0	285	899.95	8.98	8.98	0.00	0.14	-0.14	0.00	
1163	1	89	263	1,162.94	9.91	9.92	1.61	0.30	0.11	33.92	
1620	1	106	457	1,619.88	8.62	8.64	9.00	0.12	0.11	3.68	
2076	1	132	456	2,075.81	5.19	5.21	15.97	0.13	-0.09	5.59	
2532	1	140	456	2,531.73	-0.88	-0.86	21.69	0.11	0.11	1.84	
2988	1	136	456	2,987.67	-6.27	-6.23	26.41	0.18	-0.18	-0.96	
3445	0	36	457	3,444.66	-7.04	-7.01	28.28	0.12	-0.07	-21.84	
3902	1	152	457	3,901.65	-9.57	-9.53	30.42	0.22	0.15	25.47	
4267	1	184	365	4,266.59	-15.92	-15.88	31.53	0.17	0.08	8.60	
4326	1	190	59	4,325.58	-16.99	-16.95	31.41	0.55	-0.51	11.53	
4356	1	226	30	4,355.57	-17.37	-17.33	31.22	1.78	-0.33	120.33	
4387	1	301	31	4,386.57	-17.35	-17.31	30.78	4.02	1.29	239.03	
4417	3	335	30	4,416.56	-16.60	-16.56	30.23	5.52	4.33	115.00	
4448	4	345	31	4,447.50	-14.86	-14.83	29.64	6.08	5.81	31.61	
4478	6	350	30	4,477.38	-12.28	-12.25	29.09	5.23	5.00	17.67	
4509	8	355	31	4,508.16	-8.65	-8.61	28.62	6.66	6.45	14.19	
4539	10	355	30	4,537.81	-4.10	-4.07	28.18	6.33	6.33	0.33	
4570	12	352	31	4,568.25	1.74	1.78	27.49	8.20	8.06	-7.74	
4600	14	352	30	4,597.45	8.53	8.57	26.56	6.67	6.67	0.00	
4631	16	349	31	4,627.36	16.57	16.60	25.20	7.36	6.77	-10.97	
4661	18	346	30	4,656.06	25.11	25.14	23.29	5.06	4.33	-9.00	
4692	19	344	31	4,685.52	34.42	34.45	20.84	3.65	3.23	-5.48	
4722	20	344	30	4,713.82	44.00	44.02	18.08	5.43	5.33	-3.00	
4753	23	344	31	4,742.67	54.88	54.90	14.88	8.07	8.06	0.65	
4783	25	343	30	4,770.12	66.49	66.51	11.45	7.34	7.33	-1.00	
4814	28	345	31	4,797.92	79.70	79.71	7.76	9.12	8.71	6.13	
4844	31	348	30	4,824.10	93.95	93.95	4.43	11.66	10.67	9.67	
4875	31	351	31	4,850.72	109.58	109.58	1.53	4.31	0.32	8.39	
4905	32	351	30	4,876.32	125.02	125.01	-0.94	3.35	3.33	0.67	
4936	33	352	31	4,902.51	141.42	141.41	-3.42	3.21	2.90	2.58	
4966	36	353	30	4,927.22	158.28	158.27	-5.71	11.79	11.67	3.00	
4997	41	354	31	4,951.51	177.41	177.40	-7.89	13.88	13.55	4.84	
5027	45	356	30	4,973.60	197.61	197.60	-9.68	14.03	13.67	4.67	
5058	48	357	31	4,995.02	219.98	219.96	-11.08	11.58	10.97	5.16	
5088	51	360	30	5,014.50	242.78	242.76	-11.69	11.84	10.00	8.33	
5118	51	0	30	5,033.30	266.16	266.14	-11.73	1.69	1.33	#####	
5149	51	0	31	5,052.72	290.31	290.30	-11.66	1.31	-1.29	0.32	
5179	50	360	30	5,071.73	313.53	313.52	-11.68	2.38	-2.00	1,198.33	
5210	50	360	31	5,091.63	337.29	337.28	-11.83	2.27	-2.26	-0.32	
5240	49	0	30	5,111.15	360.07	360.06	-11.83	2.85	-2.00	#####	
5271	49	360	31	5,131.55	383.41	383.40	-11.77	2.02	-1.61	1,159.68	
5301	50	360	30	5,151.16	406.12	406.11	-11.79	4.01	4.00	0.33	
5332	53	0	31	5,170.60	430.26	430.25	-11.70	8.77	8.71	#####	
5362	56	1	30	5,188.21	454.54	454.53	-11.38	10.50	10.33	2.33	
5392	59	2	30	5,204.35	479.82	479.80	-10.72	12.54	12.33	2.67	
5423	63	3	31	5,219.23	506.98	506.97	-9.57	13.21	12.90	3.23	
5454	67	4	31	5,232.21	535.07	535.06	-7.90	12.92	12.58	3.23	
5484	71	3	30	5,243.03	562.99	562.98	-6.17	11.21	11.00	-2.33	
5514	74	3	30	5,252.30	591.48	591.48	-4.75	10.24	10.00	-2.33	
5545	76	3	31	5,260.35	621.38	621.38	-3.37	9.40	9.35	0.97	
5575	79	3	30	5,266.79	650.64	650.64	-1.96	8.01	8.00	-0.33	
5606	81	2	31	5,272.33	681.12	681.12	-0.82	6.78	5.81	-3.55	
5648	84	2	42	5,277.92	722.72	722.72	0.34	8.33	8.33	0.00	
5710	87	2	62	5,282.84	784.49	784.50	2.07	4.35	4.35	0.00	

DIRECTIONAL SURVEY CALCULATION

MINIMUM CURVATURE METHOD

Well Name		Target Direction		Slot	N / S	E / W	Hole Size	Calculation by		Date
James 2922 1-13H		359.93		Coordinate						1/22/13
Job Number		Type of Survey		Tie-in Point				Directional Co.		
0										
Measured Depth	Hole Angle	Hole Direction	Course Length	True Vertical Depth	Vertical Section	Total Coordinate		Dogleg Severity	Build Up %/100 ft	Walk/ %/100 ft
						N + / S -	E + / W -			
0	0	0	0	0.00	0.00			<< TIE-IN POINT >>		
5741	87	1	31	5,284.46	815.44	815.45	2.82	1.82	1.29	-1.29
5773	87	1	32	5,286.14	847.39	847.40	3.30	2.52	-1.25	-2.19
5804	87	1	31	5,287.84	878.34	878.35	3.57	0.32	0.32	0.00
5835	87	1	31	5,289.38	909.30	909.31	3.92	1.88	1.61	0.97
5867	87	0	32	5,290.86	941.27	941.27	4.26	1.29	-0.31	-1.25
5898	88	360	31	5,292.22	972.24	972.24	4.28	2.60	1.29	1,159.03
5930	90	360	32	5,292.97	1,004.23	1,004.23	4.17	5.97	5.94	0.62
5961	90	360	31	5,292.97	1,035.23	1,035.23	4.12	2.58	2.58	0.00
5993	90	360	32	5,292.77	1,067.23	1,067.23	3.95	1.29	-0.31	-1.25
6024	91	360	31	5,292.56	1,098.22	1,098.23	3.68	0.65	0.65	0.00
6056	91	359	32	5,292.22	1,130.22	1,130.23	3.37	0.70	0.63	-0.31
6087	90	360	31	5,291.98	1,161.22	1,161.22	3.21	2.52	-1.61	1.94
6115	90	360	28	5,291.88	1,189.22	1,189.22	3.16	0.71	0.00	-0.71
6146	90	359	31	5,291.77	1,220.22	1,220.22	2.94	1.29	0.00	-1.29
6178	91	359	32	5,291.49	1,252.21	1,252.22	2.44	2.65	1.87	-1.87
6209	92	359	31	5,290.79	1,283.20	1,283.20	1.76	3.24	3.23	-0.32
6241	92	358	32	5,289.84	1,315.17	1,315.17	0.84	2.27	-0.63	-2.19
6272	92	358	31	5,288.87	1,346.14	1,346.14	-0.24	1.29	1.29	0.00
6304	92	357	32	5,287.81	1,378.10	1,378.09	-1.58	2.58	-0.63	-2.50
6335	92	357	31	5,286.73	1,409.03	1,409.03	-3.25	2.33	1.29	-1.94
6367	92	357	32	5,285.44	1,440.95	1,440.95	-5.15	0.62	0.63	0.00
6398	93	356	31	5,284.09	1,471.87	1,471.86	-7.04	0.91	0.65	-0.65
6430	92	356	32	5,282.78	1,503.77	1,503.76	-9.21	2.44	-1.56	-1.87
6474	87	354	44	5,283.31	1,547.59	1,547.57	-13.01	13.18	-12.73	-3.41
6524	87	355	50	5,286.15	1,597.28	1,597.26	-17.79	1.28	1.00	0.80
6556	90	356	32	5,286.96	1,629.17	1,629.15	-20.30	10.90	9.69	5.00
6587	91	357	31	5,286.63	1,660.12	1,660.09	-22.14	3.76	3.23	1.94
6619	92	358	32	5,285.82	1,692.08	1,692.05	-23.56	4.07	2.19	3.44
6650	93	359	31	5,284.61	1,723.05	1,723.02	-24.27	5.37	2.90	4.52
6682	94	359	32	5,282.88	1,755.00	1,754.97	-24.63	2.52	2.50	-0.31
6713	96	360	31	5,280.26	1,785.88	1,785.85	-24.90	8.80	8.71	1.29
6745	93	359	32	5,277.66	1,817.77	1,817.74	-25.34	10.18	-9.69	-3.13
6776	89	357	31	5,277.23	1,848.73	1,848.70	-26.62	16.31	-14.84	-6.77
6808	88	357	32	5,278.29	1,880.66	1,880.63	-28.54	2.52	-2.50	-0.31
6839	87	357	31	5,279.67	1,911.59	1,911.55	-30.21	3.04	-1.61	2.58
6870	88	359	31	5,280.91	1,942.55	1,942.51	-31.11	7.50	3.23	6.77
6902	90	1	32	5,281.30	1,974.54	1,974.50	-31.11	7.83	6.88	#####
6933	91	1	31	5,281.03	2,005.54	2,005.50	-30.70	1.16	0.65	0.97
6965	91	1	32	5,280.61	2,037.53	2,037.49	-30.20	0.94	0.94	0.00
6996	91	1	31	5,280.07	2,068.52	2,068.49	-29.77	0.91	0.65	-0.65
7028	92	360	32	5,279.32	2,100.51	2,100.48	-29.57	2.69	1.56	1,122.81
7059	92	0	31	5,278.37	2,131.50	2,131.46	-29.52	1.16	0.97	#####
7091	91	0	32	5,277.48	2,163.48	2,163.45	-29.38	1.90	-1.88	0.31
7122	92	360	31	5,276.72	2,194.47	2,194.44	-29.29	1.16	0.65	1,160.32
7154	92	360	32	5,275.86	2,226.46	2,226.43	-29.29	0.31	0.31	0.00
7185	92	0	31	5,274.99	2,257.45	2,257.41	-29.21	0.97	0.00	#####
7217	90	1	32	5,274.46	2,289.44	2,289.41	-28.77	5.13	-4.06	3.13
7248	89	2	31	5,274.65	2,320.43	2,320.40	-27.98	4.30	-4.19	0.97
7280	89	2	32	5,275.15	2,352.41	2,352.38	-27.06	0.70	0.63	0.31
7311	90	2	31	5,275.42	2,383.39	2,383.36	-26.09	2.04	1.94	0.65
7343	90	2	32	5,275.42	2,415.38	2,415.35	-25.08	1.40	1.25	-0.63
7374	90	2	31	5,275.42	2,446.36	2,446.33	-24.08	1.61	-1.29	0.97
7405	90	2	31	5,275.50	2,477.34	2,477.31	-23.14	1.64	0.32	-1.61
7437	90	1	32	5,275.48	2,509.33	2,509.31	-22.41	1.56	0.94	-1.25
7468	90	0	31	5,275.37	2,540.33	2,540.30	-22.03	2.58	0.00	-2.58
7500	90	360	32	5,275.23	2,572.33	2,572.30	-22.06	2.21	0.31	1,122.81
7531	90	359	31	5,275.04	2,603.33	2,603.30	-22.38	1.33	0.32	-1.29

DIRECTIONAL SURVEY CALCULATION

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James 2922 1-13H		359.93	Coordinate					1/22/13			
Job Number		Type of Survey	Tie-in Point				Directional Co.				
0											
Measured Depth	Hole Angle	Hole Direction	Course Length	True Vertical Depth	Vertical Section	Total Coordinate		Dogleg Severity	Build Up %/100 ft	Walk/ %/100 ft	
						N + / S -	E + / W -				
0	0	0	0	0.00	0.00			<< TIE-IN POINT >>			
7573	90	360	42	5,274.82	2,645.33	2,645.30	-22.68	1.96	-0.48	1.90	
7605	90	2	32	5,274.79	2,677.32	2,677.29	-22.20	5.39	-0.94	#####	
7636	90	3	31	5,274.71	2,708.29	2,708.27	-21.01	3.61	1.61	3.23	
7668	91	3	32	5,274.43	2,740.26	2,740.23	-19.50	0.62	0.62	0.00	
7699	91	2	31	5,274.05	2,771.22	2,771.20	-18.15	1.44	0.65	-1.29	
7731	91	3	32	5,273.55	2,803.19	2,803.17	-16.78	1.13	0.63	0.94	
7762	91	4	31	5,272.95	2,834.13	2,834.12	-15.08	3.61	0.65	3.55	
7794	90	4	32	5,272.65	2,866.06	2,866.05	-13.02	4.06	-4.06	0.00	
7825	90	4	31	5,272.70	2,897.00	2,896.98	-11.04	0.32	0.00	-0.32	
7857	90	4	32	5,272.70	2,928.93	2,928.92	-9.01	0.70	0.62	0.31	
7888	90	3	31	5,272.81	2,959.88	2,959.87	-7.33	4.33	-1.94	-3.87	
7920	91	3	32	5,272.81	2,991.84	2,991.83	-5.71	4.00	3.13	2.50	
7951	91	3	31	5,272.54	3,022.79	3,022.78	-4.03	1.29	0.00	-1.29	
7982	91	4	31	5,272.19	3,053.73	3,053.73	-2.28	2.46	0.97	2.26	
8014	91	3	32	5,271.71	3,085.67	3,085.67	-0.41	1.59	0.31	-1.56	
8045	90	2	31	5,271.44	3,116.63	3,116.64	1.03	3.88	-2.58	-2.90	
8077	90	2	32	5,271.36	3,148.61	3,148.62	2.23	0.44	0.31	-0.31	
8108	90	2	31	5,271.25	3,179.59	3,179.59	3.39	0.32	0.00	0.32	
8140	91	2	32	5,271.05	3,211.56	3,211.57	4.53	1.33	0.94	-0.94	
8171	90	1	31	5,270.95	3,242.55	3,242.56	5.37	2.97	-1.94	-2.26	
8203	90	1	32	5,270.92	3,274.54	3,274.55	6.04	0.94	0.94	0.00	
8234	91	1	31	5,270.73	3,305.54	3,305.55	6.53	2.16	0.97	-1.94	
8266	91	0	32	5,270.31	3,337.53	3,337.55	6.78	1.82	1.56	-0.94	
8297	91	1	31	5,269.69	3,368.53	3,368.54	7.00	1.16	0.97	0.65	
8329	91	1	32	5,268.96	3,400.52	3,400.53	7.30	0.31	0.00	0.31	
8360	91	1	31	5,268.45	3,431.51	3,431.52	7.66	2.28	-2.26	0.32	
8392	91	1	32	5,268.09	3,463.50	3,463.52	8.10	0.70	0.31	0.63	
8423	91	1	31	5,267.60	3,494.49	3,494.51	8.64	1.44	1.29	0.65	
8455	90	0	32	5,267.43	3,526.49	3,526.50	8.98	5.90	-5.00	-3.13	
8486	89	360	31	5,267.78	3,557.49	3,557.50	8.93	1.61	-0.97	1,160.00	
8518	90	359	32	5,268.15	3,589.49	3,589.50	8.67	1.33	0.94	-0.94	
8549	90	359	31	5,268.33	3,620.48	3,620.50	8.30	1.16	0.97	-0.65	
8581	90	359	32	5,268.45	3,652.48	3,652.49	7.82	0.31	0.00	-0.31	
8613	90	359	32	5,268.56	3,684.48	3,684.49	7.23	0.94	0.00	-0.94	
8644	90	360	31	5,268.53	3,715.47	3,715.48	6.86	3.61	1.61	3.23	
8697	90	0	53	5,268.25	3,768.47	3,768.48	6.81	0.57	0.00	-678.68	
8729	91	0	32	5,267.95	3,800.47	3,800.48	6.87	1.56	1.56	0.00	
8760	90	0	31	5,267.73	3,831.47	3,831.48	6.92	2.58	-2.58	0.00	
8792	90	360	32	5,267.62	3,863.47	3,863.48	6.92	1.40	1.25	1,124.38	
8823	89	0	31	5,267.70	3,894.47	3,894.48	6.95	3.68	-3.55	#####	
8855	89	1	32	5,268.20	3,926.46	3,926.47	7.25	2.52	-1.25	2.19	
8886	89	1	31	5,268.77	3,957.45	3,957.46	7.88	1.64	0.32	1.61	
8918	89	2	32	5,269.30	3,989.43	3,989.45	8.68	0.44	0.31	0.31	
8950	88	2	32	5,270.11	4,021.41	4,021.42	9.63	3.66	-3.44	1.25	
8981	87	2	31	5,271.49	4,052.35	4,052.37	10.77	3.78	-3.55	1.29	
9013	87	2	32	5,273.16	4,084.28	4,084.30	12.05	0.62	0.62	0.00	
9044	87	3	31	5,274.65	4,115.22	4,115.24	13.35	1.16	0.97	0.65	
9076	88	3	32	5,276.05	4,147.16	4,147.18	14.74	0.62	0.62	0.00	
9107	88	2	31	5,277.26	4,178.10	4,178.13	16.04	1.16	0.97	-0.65	
9139	88	2	32	5,278.41	4,210.06	4,210.08	17.32	0.31	0.31	0.00	
9170	89	2	31	5,279.33	4,241.01	4,241.04	18.57	1.94	1.94	0.00	
9202	89	2	32	5,279.89	4,272.98	4,273.01	19.82	2.52	2.50	-0.31	
9233	90	2	31	5,280.10	4,303.96	4,303.99	21.04	1.33	1.29	0.32	
9265	89	2	32	5,280.52	4,335.93	4,335.96	22.21	3.66	-3.44	-1.25	
9296	89	2	31	5,281.20	4,366.91	4,366.94	23.19	0.72	0.32	-0.65	
9327	88	1	31	5,282.17	4,397.88	4,397.92	23.78	5.47	-3.87	-3.87	
9359	88	0	32	5,283.54	4,429.85	4,429.89	23.95	1.29	-0.31	-1.25	

DIRECTIONAL SURVEY CALCULATION

MINIMUM CURVATURE METHOD

Well Name		Target Direction		Slot	N / S	E / W	Hole Size	Calculation by		Date
James 2922 1-13H		359.93		Coordinate						1/22/13
Job Number		Type of Survey		Tie-in Point				Directional Co.		
0										
Measured Depth	Hole Angle	Hole Direction	Course Length	True Vertical Depth	Vertical Section	Total Coordinate		Dogleg Severity	Build Up %/100 ft	Walk/ %/100 ft
						N + / S -	E + / W -			
0	0	0	0	0.00	0.00			<< TIE-IN POINT >>		
9390	88	0	31	5,284.76	4,460.83	4,460.86	24.06	1.74	1.61	0.65
9422	88	0	32	5,285.76	4,492.81	4,492.85	24.17	1.40	1.25	-0.63
9453	88	360	31	5,286.74	4,523.80	4,523.83	24.19	1.33	-1.29	1,160.97
9485	88	360	32	5,287.85	4,555.78	4,555.81	24.17	0.31	0.00	-0.31
9516	89	360	31	5,288.77	4,586.76	4,586.80	24.09	1.96	1.94	-0.32
9548	89	359	32	5,289.36	4,618.76	4,618.79	23.83	2.69	2.19	-1.56
9579	90	359	31	5,289.63	4,649.75	4,649.79	23.40	1.44	1.29	-0.65
9611	89	359	32	5,289.88	4,681.75	4,681.78	22.76	1.82	-0.94	-1.56
9642	89	358	31	5,290.34	4,712.73	4,712.76	21.84	2.52	-1.61	-1.94
9674	89	358	32	5,290.98	4,744.71	4,744.74	20.78	0.70	-0.31	0.62
9705	90	358	31	5,291.39	4,775.69	4,775.72	19.70	3.18	2.90	-1.29
9737	91	357	32	5,291.22	4,807.66	4,807.69	18.33	4.06	3.75	-1.56
9768	91	357	31	5,290.63	4,838.62	4,838.65	16.87	1.29	1.29	0.00
9800	92	357	32	5,289.73	4,870.58	4,870.60	15.39	1.90	1.88	0.31
9831	92	358	31	5,288.65	4,901.53	4,901.55	14.04	0.91	0.65	0.65
9862	92	357	31	5,287.49	4,932.48	4,932.50	12.69	0.72	0.32	-0.65
9907	93	358	45	5,285.60	4,977.40	4,977.42	10.77	1.11	0.89	0.67
9957	92	358	50	5,283.60	5,027.33	5,027.34	8.85	1.26	-1.20	0.40
10001	92	358	44	5,281.91	5,071.27	5,071.28	7.24	0.91	0.91	0.00
10051	92	358	50	5,279.81	5,121.18	5,121.20	5.23	0.80	0.00	-0.80
10096	93	358	45	5,277.66	5,166.09	5,166.10	3.31	1.57	1.56	0.22
10146	93	358	50	5,275.21	5,216.00	5,216.00	1.35	1.34	-1.20	0.60
10210	93	358	64	5,272.42	5,279.90	5,279.90	-0.99	0.00	0.00	0.00
0	0	0		5,272.42	5,279.90	5,279.90	-0.99			
0	0	0		5,272.42	5,279.90	5,279.90	-0.99			
0	0	0		5,272.42	5,279.90	5,279.90	-0.99			
0	0	0		5,272.42	5,279.90	5,279.90	-0.99			