

# DIRECTIONAL SURVEY CALCULATION

## MINIMUM CURVATURE METHOD

Well Name		Target Direction		Slot	N / S	E / W	Hole Size	Calculation by		Date
Ferris 1-5H		179.17		Coordinate						2/28/12
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 >>		
15	0	179	15	15.00	0.00	0.00	0.00	0.00	0.00	1,194.47
692	0	189	677	691.99	2.56	-2.57	-0.39	0.06	0.06	1.40
875	0	213	183	874.99	3.64	-3.65	-0.75	0.12	-0.08	13.55
1150	0	145	275	1,149.99	4.91	-4.92	-0.66	0.13	0.02	-24.83
1618	1	190	468	1,617.97	8.58	-8.59	-0.28	0.10	0.06	9.55
2097	1	273	479	2,096.94	10.90	-10.96	-4.06	0.20	0.04	17.38
2577	1	227	480	2,576.90	12.90	-13.04	-9.87	0.13	0.00	-9.53
3057	1	274	480	3,056.84	14.70	-14.95	-17.18	0.18	0.08	9.76
3535	1	292	478	3,534.78	13.29	-13.64	-24.37	0.13	-0.12	3.71
3598	2	201	63	3,597.76	14.36	-14.73	-25.14	3.89	2.78	-144.92
3630	5	191	32	3,629.70	16.26	-16.63	-25.62	7.49	7.28	-30.41
3662	8	188	32	3,661.51	19.61	-20.00	-26.16	8.96	8.91	-9.47
3694	10	186	32	3,693.13	24.46	-24.85	-26.75	7.89	7.84	-5.34
3726	12	181	32	3,724.53	30.64	-31.04	-27.13	7.64	7.09	-14.69
3759	14	178	33	3,756.68	38.05	-38.44	-27.11	4.51	3.94	-9.82
3791	16	175	32	3,787.63	46.16	-46.55	-26.58	7.48	6.88	-11.63
3823	18	175	32	3,818.25	55.44	-55.82	-25.74	6.81	6.78	1.97
3855	20	176	32	3,848.46	65.96	-66.33	-24.93	7.76	7.72	2.53
3887	23	176	32	3,878.18	77.79	-78.15	-24.08	8.06	8.06	-0.47
3919	26	175	32	3,907.29	91.05	-91.40	-23.00	9.45	9.38	-2.84
3951	29	176	32	3,935.62	105.90	-106.23	-21.88	10.58	10.38	4.47
3983	32	176	32	3,963.20	122.10	-122.41	-20.80	6.89	6.88	-1.00
4015	33	174	32	3,990.28	139.09	-139.39	-19.35	4.83	3.88	-5.41
4047	34	177	32	4,016.96	156.73	-157.01	-18.05	6.75	4.56	9.00
4078	37	176	31	4,042.16	174.76	-175.03	-17.03	8.76	8.65	-2.45
4110	39	177	32	4,067.47	194.32	-194.57	-15.83	4.94	4.94	0.44
4142	39	178	32	4,092.39	214.39	-214.62	-14.84	3.23	2.13	3.87
4174	41	179	32	4,116.93	234.92	-235.15	-14.19	4.82	4.56	2.44
4206	41	177	32	4,141.05	255.93	-256.16	-13.40	3.90	2.50	-4.56
4237	45	179	31	4,163.68	277.12	-277.33	-12.75	11.83	10.77	7.16
4270	47	180	33	4,186.57	300.88	-301.09	-12.56	7.69	7.64	1.24
4302	49	179	32	4,207.92	324.72	-324.93	-12.38	5.29	5.22	-1.13
4347	51	179	45	4,236.97	359.08	-359.29	-12.00	3.56	3.56	-0.02
4398	51	180	51	4,269.37	398.46	-398.67	-11.63	0.29	-0.14	0.33
4443	50	178	45	4,298.19	433.02	-433.23	-11.01	2.45	-1.51	-2.51
4494	49	179	51	4,331.48	471.66	-471.85	-10.04	2.36	-2.31	0.61
4526	50	178	32	4,352.38	495.89	-496.08	-9.43	3.69	3.59	-1.09
4558	53	179	32	4,372.38	520.86	-521.04	-8.80	9.35	9.31	1.12
4591	55	180	33	4,391.87	547.49	-547.67	-8.53	7.02	6.18	4.12
4623	58	180	32	4,409.57	574.14	-574.32	-8.57	9.81	9.81	-0.03
4654	62	180	31	4,425.19	600.91	-601.10	-8.62	11.42	11.42	0.23
4686	64	181	32	4,439.86	629.34	-629.53	-8.96	8.16	7.59	3.37
4718	67	184	32	4,453.02	658.45	-658.67	-10.18	12.81	11.06	7.09
4750	71	181	32	4,464.30	688.34	-688.58	-11.43	13.31	11.69	-6.81
4782	74	181	32	4,473.79	718.88	-719.13	-11.99	9.65	9.53	-1.59
4814	78	179	32	4,481.44	749.94	-750.20	-11.96	13.00	11.91	-5.38
4846	82	179	32	4,486.92	781.46	-781.71	-11.37	12.86	12.81	-1.09
4877	85	180	31	4,490.31	812.27	-812.52	-10.93	10.41	10.00	2.90
4909	87	179	32	4,492.58	844.19	-844.43	-10.44	5.17	4.03	-3.25
4967	90	177	58	4,494.35	902.14	-902.35	-8.23	6.41	5.81	-2.71
5028	90	177	61	4,494.53	963.09	-963.26	-4.87	0.72	-0.36	-0.62
5089	90	177	61	4,494.90	1,024.03	-1,024.16	-1.37	0.30	-0.21	0.21
5150	90	176	61	4,495.31	1,084.94	-1,085.02	2.71	2.03	0.07	-2.03
5211	90	177	61	4,495.74	1,145.85	-1,145.87	6.95	1.58	-0.11	1.57
5302	89	175	91	4,496.54	1,236.70	-1,236.63	13.44	1.30	-0.13	-1.30
5394	90	175	92	4,497.16	1,328.47	-1,328.30	21.24	0.55	0.37	-0.40
5486	89	176	92	4,498.25	1,420.28	-1,420.02	28.21	1.82	-0.99	1.53

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Ferris 1-5H		179.17	Coordinate					2/28/12			
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 >>			
5579	89	175	93	4,500.22	1,513.10	-1,512.75	35.07	1.28	-0.18	-1.27	
5671	89	177	92	4,502.19	1,604.95	-1,604.52	41.13	2.27	0.15	2.26	
5763	88	175	92	4,504.36	1,696.80	-1,696.30	47.06	2.12	-0.41	-2.08	
5854	88	178	91	4,507.22	1,787.66	-1,787.08	52.56	2.65	-0.57	2.59	
5946	89	179	92	4,509.65	1,879.61	-1,879.02	54.82	2.26	1.20	1.92	
6036	90	178	90	4,510.62	1,969.61	-1,968.99	56.61	1.58	0.76	-1.39	
6128	90	179	92	4,510.89	2,061.60	-2,060.95	59.19	0.43	0.24	0.36	
6223	90	179	95	4,510.60	2,156.59	-2,155.94	61.04	0.84	0.49	0.68	
6319	90	179	96	4,509.90	2,252.59	-2,251.92	62.50	0.17	0.02	-0.17	
6415	91	180	96	4,508.36	2,348.57	-2,347.90	62.92	1.77	1.02	1.45	
6511	91	178	96	4,506.39	2,444.54	-2,443.87	64.37	2.76	-0.49	-2.72	
6606	91	177	95	4,504.75	2,539.49	-2,538.77	68.27	0.39	0.11	-0.38	
6702	88	180	96	4,505.79	2,635.46	-2,634.72	70.31	4.41	-3.46	2.73	
6798	87	179	96	4,510.21	2,731.36	-2,730.62	70.76	1.05	-0.75	-0.74	
6895	88	179	97	4,514.84	2,828.25	-2,827.50	71.92	0.57	0.55	-0.14	
6991	87	181	96	4,519.68	2,924.10	-2,923.37	71.42	2.38	-0.89	2.21	
7087	89	179	96	4,523.27	3,020.01	-3,019.29	71.44	3.77	2.46	-2.85	
7184	91	180	97	4,523.63	3,117.00	-3,116.28	72.34	2.33	1.54	1.75	
7280	91	179	96	4,522.30	3,212.98	-3,212.26	73.01	1.60	0.55	-1.50	
7376	91	179	96	4,520.40	3,308.96	-3,308.22	74.84	0.16	0.16	0.05	
7473	91	179	97	4,518.46	3,405.94	-3,405.19	76.39	0.35	-0.13	0.32	
7568	90	179	95	4,517.53	3,500.94	-3,500.18	77.72	1.10	-1.09	-0.08	
7664	91	179	96	4,517.07	3,596.94	-3,596.16	79.41	0.60	0.49	-0.35	
7760	89	177	96	4,517.21	3,692.90	-3,692.08	83.23	2.61	-1.24	-2.29	
7855	88	177	95	4,519.58	3,787.80	-3,786.91	88.20	1.76	-1.57	0.80	
7951	90	176	96	4,521.73	3,883.69	-3,882.75	93.33	2.06	1.84	-0.93	
8018	90	178	67	4,522.17	3,950.65	-3,949.66	96.66	1.97	0.07	1.97	
8110	89	179	92	4,523.26	4,042.63	-4,041.61	99.61	1.05	-0.72	0.76	
8201	89	182	91	4,524.99	4,133.58	-4,132.58	99.30	3.71	-0.18	3.70	
8293	91	181	92	4,525.50	4,225.52	-4,224.55	97.32	2.33	1.86	-1.40	
8385	91	180	92	4,524.46	4,317.50	-4,316.54	97.10	1.00	0.23	-0.98	
8478	90	180	93	4,524.01	4,410.49	-4,409.54	97.64	1.01	-1.01	-0.05	
8569	90	182	91	4,523.93	4,501.46	-4,500.53	96.60	2.29	0.53	2.23	
8661	90	182	92	4,523.59	4,593.37	-4,592.49	93.89	0.18	-0.17	0.04	
8753	89	180	92	4,523.94	4,685.33	-4,684.47	92.76	2.32	-0.75	-2.20	
8844	89	182	91	4,525.01	4,776.29	-4,775.46	91.80	2.03	-0.25	2.01	
8935	91	182	91	4,524.88	4,867.20	-4,866.42	89.24	1.92	1.91	0.21	
9026	92	183	91	4,522.53	4,958.02	-4,957.30	85.34	2.01	1.16	1.64	
9119	92	182	93	4,519.35	5,050.82	-5,050.16	81.52	1.81	-0.11	-1.81	
9222	91	180	103	4,516.94	5,153.75	-5,153.12	80.28	1.96	-1.11	-1.62	
9302	91	181	80	4,515.92	5,233.72	-5,233.11	79.64	1.53	-0.09	1.53	
9405	90	179	103	4,515.14	5,336.70	-5,336.10	80.00	2.52	-0.52	-2.47	
9492	90	176	87	4,515.35	5,423.66	-5,423.01	83.86	2.55	-0.68	-2.46	
9588	89	179	96	4,516.55	5,519.60	-5,518.90	88.09	2.34	-0.60	2.26	
9683	89	179	95	4,518.14	5,614.58	-5,613.87	89.98	0.64	0.12	0.63	
9778	89	178	95	4,519.85	5,709.56	-5,708.81	92.74	1.77	-0.28	-1.75	
9873	88	180	95	4,522.35	5,804.51	-5,803.75	94.51	3.10	-0.71	3.02	
9969	89	179	96	4,525.10	5,900.46	-5,899.71	94.74	1.14	0.41	-1.06	
10064	84	179	95	4,531.42	5,995.23	-5,994.46	96.28	5.00	-4.97	-0.59	
10160	85	179	96	4,540.38	6,090.80	-6,090.02	97.87	1.77	1.69	0.53	
10254	91	182	94	4,542.90	6,184.69	-6,183.94	97.09	6.88	6.41	2.50	
10349	91	182	95	4,540.99	6,279.59	-6,278.88	94.46	0.70	-0.68	-0.13	
10445	91	182	96	4,539.67	6,375.50	-6,374.84	91.88	0.10	-0.09	0.02	
10540	92	181	95	4,537.51	6,470.39	-6,469.78	89.39	1.18	1.18	-0.11	
10636	92	182	96	4,534.33	6,566.25	-6,565.69	86.66	0.38	0.08	0.38	
10732	91	182	96	4,531.63	6,662.10	-6,661.59	83.42	0.74	-0.69	0.26	
10828	90	181	96	4,530.90	6,758.02	-6,757.56	81.18	2.30	-1.75	-1.50	



