



**Anglian Oil Company Ltd.  
Northern Lights  
AA Pad  
AA16, Slot #09  
MWD Run #4**

**Job No. AB-CD-12345678  
Survey Date: 11 January 2013**

## **True North Directional Services Inc. Survey Report**

**17 August 2015**

Surface Coordinates: 6,789,330.21 N, 572,493.04 E (61° 14' 00.2426" N, 109° 38' 59.0443" W)  
Grid Coordinate System: Universal Transverse Mercator, Zone 12 North

Surface Coordinates relative to AA Pad: 27.80 S, 35.03 E (Grid)

RKB Elevation: 629.61m above Mean Sea Level  
RKB Elevation: 1.60m above Ground Level  
Ground Level: 628.01m above Mean Sea Level

Survey Ref: svy41



**True North**  
Directional Services Inc.

**Survey Report for AA Pad, AA16, MWD Run #4**

Survey Depth (m)	Incl. (°)	(Grid) Azim. (°)	Vertical Depth (m)	Northings (m)	Eastings (m)	Vertical Section (m)	Dogleg Rate (°/30m)
<b><u>MWD Run #1</u></b>							
0.00	0.000	0.000	0.00	0.00 N	0.00 E	0.00	
2.14	0.160	85.065	2.14	0.00 N	0.00 E	0.00	2.246
11.00	0.220	120.070	11.00	0.01 S	0.03 E	0.03	0.433
20.32	0.172	210.700	20.32	0.03 S	0.04 E	0.04	0.905
29.29	0.222	129.573	29.29	0.05 S	0.04 E	0.04	0.866
38.49	0.497	99.702	38.49	0.07 S	0.10 E	0.09	1.056
47.35	0.160	271.070	47.35	0.08 S	0.12 E	0.12	2.220
56.52	0.005	285.698	56.52	0.07 S	0.11 E	0.10	0.509
66.14	0.087	77.618	66.14	0.07 S	0.12 E	0.11	0.285
74.53	0.195	96.449	74.53	0.07 S	0.14 E	0.13	0.416
84.42	0.321	254.180	84.42	0.08 S	0.13 E	0.12	1.537
93.63	0.077	200.314	93.63	0.10 S	0.10 E	0.09	0.921
102.67	0.043	237.933	102.67	0.10 S	0.10 E	0.08	0.167
111.16	0.315	263.011	111.16	0.11 S	0.07 E	0.06	0.976
120.68	0.041	187.971	120.68	0.11 S	0.04 E	0.03	0.967
130.28	0.072	34.511	130.28	0.11 S	0.05 E	0.03	0.346
139.35	0.009	172.630	139.35	0.11 S	0.05 E	0.04	0.263
148.09	0.272	203.054	148.09	0.13 S	0.04 E	0.03	0.908
157.83	0.119	55.445	157.83	0.14 S	0.04 E	0.03	1.165
166.89	0.010	1.284	166.88	0.14 S	0.05 E	0.03	0.376
175.22	0.181	196.726	175.22	0.15 S	0.04 E	0.03	0.686
185.26	0.387	141.524	185.26	0.19 S	0.06 E	0.04	0.956
193.83	0.129	279.761	193.83	0.21 S	0.07 E	0.05	1.719
203.14	0.198	145.158	203.14	0.22 S	0.07 E	0.05	0.976
212.53	0.207	266.645	212.53	0.24 S	0.06 E	0.04	1.128
220.97	0.350	227.151	220.97	0.26 S	0.03 E	0.00	0.822
230.66	0.030	72.732	230.66	0.28 S	0.01 E	-0.02	1.167
239.68	0.277	112.688	239.68	0.28 S	0.03 E	0.00	0.846
248.66	1.085	92.716	248.66	0.30 S	0.13 E	0.10	2.772
258.14	2.743	116.334	258.13	0.40 S	0.43 E	0.38	5.709
267.31	4.696	105.565	267.28	0.60 S	0.99 E	0.92	6.753
276.08	6.738	105.408	276.01	0.83 S	1.83 E	1.73	6.989
285.24	8.891	105.634	285.09	1.17 S	3.03 E	2.89	7.047
294.94	11.824	105.995	294.63	1.64 S	4.71 E	4.52	9.074
<b><u>MWD Run #2</u></b>							
304.09	14.327	105.692	303.53	2.21 S	6.70 E	6.44	8.215
312.67	17.060	120.513	311.80	3.13 S	8.81 E	8.44	16.880
321.75	19.466	125.532	320.42	4.69 S	11.18 E	10.65	9.493
330.22	22.145	126.416	328.33	6.46 S	13.62 E	12.89	9.560
339.83	25.116	128.421	337.15	8.80 S	16.67 E	15.70	9.599
349.27	27.949	130.610	345.59	11.48 S	19.92 E	18.66	9.529
357.68	30.685	131.530	352.92	14.19 S	23.03 E	21.47	9.884
367.12	33.310	132.999	360.93	17.56 S	26.73 E	24.81	8.702
375.84	35.822	132.932	368.11	20.93 S	30.35 E	28.07	8.642
385.89	38.360	132.821	376.12	25.05 S	34.79 E	32.07	7.582

**Survey Report for AA Pad, AA16, MWD Run #4**

Survey Depth (m)	Incl. (°)	(Grid) Azim. (°)	Vertical Depth (m)	Northings (m)	Eastings (m)	Vertical Section (m)	Dogleg Rate (°/30m)
394.71	40.884	132.904	382.92	28.88 S	38.91 E	35.78	8.580
403.20	42.980	133.141	389.23	32.75 S	43.06 E	39.52	7.428
412.91	45.416	133.349	396.19	37.39 S	47.99 E	43.95	7.540
421.59	47.914	133.346	402.15	41.72 S	52.58 E	48.08	8.640
430.74	50.228	132.867	408.14	46.44 S	57.63 E	52.62	7.678
440.59	53.335	132.146	414.23	51.67 S	63.33 E	57.77	9.622
449.22	55.593	132.154	419.25	56.38 S	68.54 E	62.47	7.845
458.13	58.061	132.468	424.13	61.40 S	74.05 E	67.45	8.356
467.53	60.157	132.886	428.95	66.87 S	79.98 E	72.79	6.786
476.77	62.848	132.427	433.36	72.37 S	85.95 E	78.17	8.839
485.84	65.567	132.795	437.30	77.90 S	91.96 E	83.59	9.059
495.64	68.013	132.590	441.17	84.01 S	98.58 E	89.56	7.512
504.82	70.099	132.885	444.45	89.82 S	104.88 E	95.23	6.877
513.39	73.043	132.839	447.16	95.36 S	110.84 E	100.60	10.306
522.42	75.326	132.834	449.62	101.26 S	117.20 E	106.34	7.587
531.45	77.109	132.152	451.77	107.19 S	123.67 E	112.17	6.316
540.60	80.095	132.664	453.58	113.24 S	130.30 E	118.15	9.925
550.24	82.613	132.605	455.03	119.69 S	137.30 E	124.46	7.845
559.15	82.263	132.724	456.20	125.67 S	143.80 E	130.32	1.245
568.30	82.678	132.418	457.40	131.81 S	150.48 E	136.35	1.686
577.75	82.649	132.558	458.60	138.14 S	157.39 E	142.58	0.450
586.51	82.522	132.350	459.74	144.01 S	163.81 E	148.37	0.830
595.97	83.232	132.718	460.91	150.35 S	170.72 E	154.60	2.533
604.70	83.050	131.256	461.95	156.15 S	177.16 E	160.42	5.031
613.82	82.943	131.088	463.06	162.11 S	183.98 E	166.60	0.650
623.37	82.665	132.128	464.26	168.40 S	191.06 E	173.01	3.359
632.02	82.981	130.773	465.34	174.08 S	197.49 E	178.83	4.793
641.55	82.524	131.417	466.54	180.29 S	204.61 E	185.29	2.474
651.14	82.604	132.124	467.78	186.63 S	211.71 E	191.71	2.205
659.65	82.680	130.960	468.87	192.23 S	218.03 E	197.42	4.082
669.32	83.192	130.958	470.06	198.52 S	225.28 E	203.99	1.586
678.07	82.425	130.295	471.16	204.17 S	231.86 E	209.97	3.468
687.13	83.094	128.057	472.30	209.85 S	238.83 E	216.33	7.677
696.91	82.952	125.924	473.49	215.69 S	246.58 E	223.45	6.508
705.77	82.879	122.976	474.58	220.66 S	253.83 E	230.16	9.905
714.92	83.141	120.496	475.69	225.44 S	261.55 E	237.36	8.121
723.87	83.227	119.073	476.76	229.85 S	269.26 E	244.58	4.745
732.69	83.787	115.630	477.75	233.88 S	277.05 E	251.92	11.790
742.30	84.530	113.319	478.73	237.84 S	285.75 E	260.17	7.541
751.58	84.339	110.927	479.63	241.32 S	294.31 E	268.33	7.717
760.95	84.529	109.368	480.54	244.53 S	303.06 E	276.72	5.006
<b>MWD Run #3</b>							
770.02	85.254	106.066	481.35	247.28 S	311.67 E	285.00	11.138
780.58	83.756	104.260	482.36	250.03 S	321.81 E	294.81	6.649
790.25	84.182	101.694	483.38	252.19 S	331.18 E	303.92	8.026
799.78	84.473	99.757	484.32	253.95 S	340.50 E	313.01	6.136
808.44	84.640	98.415	485.14	255.31 S	349.01 E	321.34	4.664

**Survey Report for AA Pad, AA16, MWD Run #4**

Survey Depth (m)	Incl. (°)	(Grid) Azim. (°)	Vertical Depth (m)	Northings (m)	Eastings (m)	Vertical Section (m)	Dogleg Rate (°/30m)
817.84	85.151	95.377	485.98	256.44 S	358.31 E	330.47	9.794
826.81	85.082	92.691	486.74	257.06 S	367.22 E	339.28	8.954
835.97	85.763	89.679	487.47	257.25 S	376.35 E	348.34	10.083
845.07	86.519	87.974	488.08	257.07 S	385.43 E	357.39	6.137
854.11	86.425	85.883	488.64	256.58 S	394.44 E	366.40	6.933
863.31	87.095	82.878	489.16	255.68 S	403.58 E	375.58	10.024
872.33	87.165	81.353	489.61	254.45 S	412.50 E	384.58	5.071
881.27	87.274	77.691	490.05	252.83 S	421.28 E	393.48	12.280
890.60	87.855	75.041	490.44	250.63 S	430.34 E	402.72	8.716
900.49	87.958	73.069	490.80	247.91 S	439.84 E	412.45	5.986
908.72	88.982	69.434	491.02	245.27 S	447.63 E	420.46	13.761
918.20	89.261	67.190	491.17	241.77 S	456.43 E	429.58	7.155
927.32	89.392	64.065	491.28	238.00 S	464.74 E	438.22	10.288
936.60	89.555	64.589	491.36	233.98 S	473.10 E	446.95	1.774
945.42	89.624	65.968	491.42	230.30 S	481.12 E	455.30	4.696
954.88	89.726	65.523	491.48	226.41 S	489.74 E	464.27	1.448
963.82	90.184	65.162	491.49	222.68 S	497.86 E	472.73	1.957
973.34	89.450	65.211	491.52	218.68 S	506.51 E	481.73	2.318
982.40	89.918	64.536	491.57	214.84 S	514.71 E	490.28	2.720
991.17	90.157	65.016	491.56	211.10 S	522.64 E	498.55	1.834
1,001.10	90.201	65.587	491.53	206.95 S	531.66 E	507.95	1.730
1,009.96	89.725	65.715	491.53	203.30 S	539.74 E	516.35	1.669
1,018.97	90.373	64.186	491.53	199.48 S	547.90 E	524.86	5.529
1,028.00	90.204	65.084	491.48	195.61 S	556.06 E	533.37	3.036
1,036.87	90.075	64.831	491.46	191.86 S	564.09 E	541.74	0.961
1,046.69	90.305	64.147	491.43	187.63 S	572.96 E	550.99	2.205
1,055.52	90.276	64.903	491.38	183.83 S	580.93 E	559.30	2.570
1,064.96	89.817	65.398	491.38	179.87 S	589.49 E	568.23	2.145
1,073.96	89.523	64.999	491.43	176.09 S	597.66 E	576.74	1.652
1,083.34	90.354	64.814	491.44	172.11 S	606.16 E	585.59	2.723
1,091.68	90.197	65.890	491.40	168.63 S	613.74 E	593.48	3.911
1,101.02	90.096	65.969	491.37	164.83 S	622.27 E	602.35	0.412
1,110.03	89.802	65.183	491.38	161.10 S	630.47 E	610.89	2.794
1,119.22	89.416	65.064	491.44	157.23 S	638.81 E	619.58	1.319
1,128.59	89.568	65.230	491.53	153.30 S	647.31 E	628.44	0.721
1,137.54	89.564	64.178	491.59	149.47 S	655.40 E	636.87	3.526
1,146.56	89.910	64.369	491.64	145.56 S	663.52 E	645.35	1.314
1,156.25	89.806	64.567	491.66	141.38 S	672.27 E	654.48	0.692
1,165.52	89.506	64.038	491.72	137.36 S	680.62 E	663.19	1.968
1,174.55	89.676	64.305	491.78	133.43 S	688.75 E	671.68	1.052
1,183.99	90.043	64.840	491.80	129.37 S	697.27 E	680.57	2.062
1,192.39	90.249	65.097	491.78	125.82 S	704.89 E	688.50	1.176

**MWD Run #4**

1,201.65	89.898	65.117	491.77	121.92 S	713.29 E	697.25	1.139
1,209.07	90.297	64.086	491.76	118.74 S	719.99 E	704.25	4.470
1,218.13	89.773	64.811	491.75	114.83 S	728.16 E	712.77	2.962
1,227.07	89.724	64.118	491.79	110.98 S	736.23 E	721.19	2.331
1,236.77	90.171	64.624	491.80	106.78 S	744.97 E	730.31	2.088

**Survey Report for AA Pad, AA16, MWD Run #4**

Survey Depth (m)	Incl. (°)	(Grid) Azim. (°)	Vertical Depth (m)	Northings (m)	Eastings (m)	Vertical Section (m)	Dogleg Rate (°/30m)
1,246.15	89.618	65.206	491.82	102.81 S	753.47 E	739.17	2.568
1,254.90	89.847	65.035	491.86	99.12 S	761.41 E	747.44	0.980
1,263.61	89.636	65.193	491.90	95.46 S	769.31 E	755.67	0.908
1,273.43	90.278	64.659	491.90	91.30 S	778.20 E	764.94	2.551
1,282.22	90.010	65.819	491.88	87.62 S	786.18 E	773.26	4.063
1,291.43	89.774	65.540	491.90	83.82 S	794.58 E	781.99	1.190
1,300.61	89.790	65.152	491.94	79.99 S	802.92 E	790.68	1.269
1,309.48	90.261	64.863	491.93	76.25 S	810.96 E	799.06	1.869
1,318.75	89.986	65.465	491.91	72.35 S	819.37 E	807.82	2.142
1,327.67	90.332	64.326	491.89	68.57 S	827.45 E	816.24	4.004
1,337.31	89.917	64.119	491.87	64.38 S	836.13 E	825.30	1.443
1,346.04	89.730	64.487	491.89	60.59 S	844.00 E	833.51	1.419
1,355.95	90.268	65.517	491.89	56.40 S	852.98 E	842.87	3.518
1,364.27	89.659	65.902	491.90	52.98 S	860.56 E	850.76	2.598
1,373.76	89.660	64.691	491.95	49.01 S	869.18 E	859.74	3.828
1,382.74	89.579	65.369	492.01	45.22 S	877.32 E	868.22	2.281
1,392.49	89.747	65.583	492.07	41.18 S	886.19 E	877.46	0.837
1,401.52	89.403	64.071	492.14	37.34 S	894.37 E	885.98	5.151
1,410.19	90.142	65.588	492.17	33.65 S	902.21 E	894.16	5.839
1,419.74	90.241	64.967	492.14	29.65 S	910.89 E	903.19	1.975
1,428.48	89.679	64.413	492.15	25.92 S	918.79 E	911.43	2.709
1,437.46	90.103	65.204	492.16	22.10 S	926.91 E	919.90	2.998
1,446.55	89.805	65.818	492.17	18.33 S	935.19 E	928.51	2.252
1,455.99	90.212	65.891	492.17	14.47 S	943.80 E	937.47	1.314
1,465.61	90.142	65.307	492.14	10.49 S	952.56 E	946.59	1.834
1,474.27	89.838	64.029	492.14	6.79 S	960.39 E	954.75	4.551
1,483.36	89.478	64.824	492.20	2.86 S	968.59 E	963.31	2.880
1,492.75	89.811	65.429	492.25	1.09 N	977.11 E	972.18	2.206
1,501.67	89.739	63.519	492.29	4.93 N	985.15 E	980.58	6.428
1,510.91	90.111	65.407	492.30	8.91 N	993.49 E	989.28	6.248
1,519.76	89.712	63.647	492.31	12.72 N	1,001.48 E	997.61	6.117
1,529.35	90.199	64.087	492.32	16.94 N	1,010.09 E	1,006.61	2.053
1,538.23	89.552	64.665	492.34	20.78 N	1,018.10 E	1,014.96	2.931
1,548.03	89.993	65.116	492.38	24.94 N	1,026.97 E	1,024.21	1.931
1,556.91	90.356	63.581	492.35	28.79 N	1,034.97 E	1,032.56	5.329
1,566.22	89.643	63.609	492.35	32.93 N	1,043.31 E	1,041.28	2.299
1,575.55	90.340	64.629	492.35	37.00 N	1,051.71 E	1,050.04	3.972
1,584.10	89.514	64.130	492.37	40.70 N	1,059.42 E	1,058.09	3.386
1,593.46	90.384	64.325	492.37	44.77 N	1,067.85 E	1,066.88	2.858
1,602.15	90.033	64.520	492.34	48.52 N	1,075.68 E	1,075.06	1.386
1,611.85	89.999	64.967	492.34	52.66 N	1,084.46 E	1,084.21	1.386
1,620.78	90.303	64.402	492.32	56.47 N	1,092.53 E	1,092.63	2.155
1,630.48	89.975	64.145	492.29	60.68 N	1,101.27 E	1,101.75	1.289
1,638.78	89.645	63.648	492.32	64.34 N	1,108.72 E	1,109.53	2.156

## Survey Report for AA Pad, AA16, MWD Run #4

All data is in Metres unless otherwise stated. Directions and coordinates are relative to Grid North. Vertical depths are relative to RKB. Northings and Eastings are relative to Well AA16.

The dogleg severity is in Degrees per 30 metres.  
 Vertical Section is from Well AA16 calculated along an azimuth of 84.183° (Grid).

Based upon minimum curvature calculations, at a measured depth of 1,638.78m, the bottom hole displacement is 1,110.59m, in the direction of 86.679° (Grid).

The along-hole displacement is 1,269.52m. The total accumulated dogleg is 170.490°.  
 The measured tortuosity is 3.441°/30m. The directional difficulty index is 5.9.

The survey penetrates target AA16 LP at a measured depth of 986.71m at a distance of 5.28m from the target centre. The survey penetrates target AA16 LP (1) at a measured depth of 555.55m at a distance of 3.29m from the target centre. The survey penetrates target AA16 LP (2) at a measured depth of 926.71m at a distance of 5.03m from the target centre.

### Casing Program for AA16, MWD Run #4

From		To		Casing Description
Measured Depth (m)	Vertical Depth (m)	Measured Depth (m)	Vertical Depth (m)	
<Surface>	<Surface>	250.00	250.00	13 3/8in Casing
<Surface>	<Surface>	500.00	442.76	9 5/8in Casing
<Surface>	<Surface>	1,000.00	491.53	7in Casing

### Survey Tool Program for AA16, MWD Run #4

From		To		Survey Tool Description
Measured Depth (m)	Vertical Depth (m)	Measured Depth (m)	Vertical Depth (m)	
0.00	0.00	240.00	240.00	North Seeking Gyro MS (GYRO-NS)
240.00	240.00	1,638.78	492.32	MWD

### Targets associated with AA16, MWD Run #4

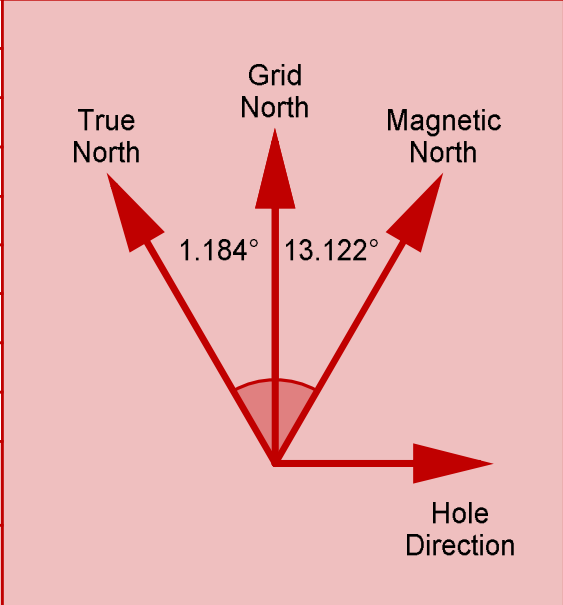
Target Name	Target Entry Coordinates				Target Type (Shape)
	Vertical Depth (m)	Sub-Sea Depth (m)	Northings (m)	Eastings (m)	
AA16 LP	486.60	-143.01	214.62 S 6,789,115.59 N 61° 13' 52.9605" N	519.36 E 573,012.40 E 109° 38' 24.5299" W	Current Target (Polygon) (Map Coordinates) (Geographical Coordinates)
AA16 LP (1)	453.14	-176.47	124.98 S 6,789,205.23 N 61° 13' 56.1109" N	140.08 E 572,633.12 E 109° 38' 49.8278" W	Current Target (Circle) (Map Coordinates) (Geographical Coordinates)
AA16 LP (2)	486.60	-143.01	239.97 S 6,789,090.24 N 61° 13' 52.1778" N	464.98 E 572,958.02 E 109° 38' 28.2101" W	Current Target (Circle) (Map Coordinates) (Geographical Coordinates)
AA16 TD	486.60	-143.01	123.48 N 6,789,453.69 N 61° 14' 03.3942" N	1,244.41 E 573,737.45 E 109° 37' 35.4558" W	Current Target (Polygon) (Map Coordinates) (Geographical Coordinates)

**Survey Report for AA Pad, AA16, MWD Run #4**

REFERENCE DATA			
Ellipsoid	Clarke - 1866	Unit System	Metres
Coord. System	Universal Transverse Mercator, Zone 12 North	North Ref.	Grid North
Mag. Model	International Geomagnetic Reference Field 2010	Vertical Ref.	Mean Sea Level
Calc. Date	11 Jan, 2013		

LOCATION DATA			
RKB Elevation	629.61m above MSL	Total Field	59.0729 T
Map North	6,789,330.21 N	Magnetic Dip	81.047°
Map East	572,493.04 E	Declination	14.306°
Latitude	61° 14' 00.2426" N	Convergence	1.184°
Longitude	109° 38' 59.0443" W		

NORTH REFERENCE DATA	
Magnetic Model	national Geomagnetic Reference Field 2010
Calculation Date	11 January 2013
Declination	14.306°
Inclination/Dip	81.047°
Horizontal Component	9.1936 T
Northerly Component	8.9090 T
Easterly Component	2.2731 T
Vertical Component	58.3532 T
Total Field Strength	59.0729 T
Grid North is 1.184 degrees East of True North (Grid Convergence) Magnetic North is 14.306 degrees East of True North (Magnetic Declination) Magnetic North is 13.122 degrees East of Grid North (Magnetic Convergence)	
To convert a True Direction to a Grid Direction, Subtract 1.184 degrees. To convert a Magnetic Direction to a True Direction, Add 14.306 degrees. To convert a Magnetic Direction to a Grid Direction, Add 13.122 degrees.	



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