Bakersfield (661-746-0511)
Calgary (403-234-7692)
Houston – Headquarters
(281-495-1100)

LUFKIN AUTOMATION

Midland (432-697-2228)
Oklahoma (405-677-0567)
Lufkin Automation Website
http://www.lufkinautomation.com

SROD v6.8.6 - PREDICTION OF ROD PUMPING SYSTEM PERFORMANCE

WELL NAME : Well 1 DATE/TIME : 9/10/2014 4:07:46 PM
ANALYST : Scott Malone COMPANY : Sandia Data
DATA FILE : Sandia Data Well 1(SnapOn).inp6e (BASE C WELL TYPE : Deviated
COMMENTS : Test Number: 01. Test Date March, 1995

** PRIME MOVER **

Mfgr and Type : ROBBINS & MYERS 20 HP FRAME 326U (OLD TYPE)

Max Speed (rpm)	: 1225	Speed Variation (%)	: 10.8
Min Speed (rpm)	: 1093	Cyclic Load Factor	: 1.555
Power Required (hp)	: 14.12	Peak Regenerative Power (hp)	: -8.24
Motor Load (% of Rating)	: 70.6	Prime Mover Output (hp)	: 8.62
Sheave Ratio (Unit/ Prime Mover)	: 3.716		

** PUMPING UNIT **

Mfgr and Type : LUFKIN C228-213-86 WITH 7478B CRANKS (C'WISE)

Actual Max Load (lbs)	: 8661	Actual Min Load (lbs)	: 1600
Average Pumping Speed (spm)	: 11.01	Max Load (% of Rating)	: 40.7
Polished Rod Power (hp)	: 7.76	Unit and Drive Train Loss (hp)	: 0.86
Computed Surface Stroke (in)	: 88.3		

** SUMMARY OF REDUCER LOADING **

	IN BALANCE
Max Torque (m in-lbs)	144.1
Min Torque (m in-lbs)	-49.5
Counterbalance Moment (m in-lbs)	223.7
Counterbalance Effect (X100 lbs)	58.26
Percent of Reducer Rating	63.2

** ROD LOADING **

	Diameter (in)	Length (ft)	Modulus (MM psi)	Fr Coeff	Guides	Loading
1)	0.75	2710	30.5	0.3	M (0)	75

Norris PPS-Standard guide weights has been considered

Max Stress (surf.) (psi) : 19379 Min Stress (surf.) (psi) : 3848

ROD LOADING AT SURFACE AS % OF RATING

Service Factor	Class C,K	Class D	API C
1	75	57	75
0.9	85	65	85
0.8	98	74	98
0.7	116	87	116

** DOWNHOLE PERFORMANCE **

	Stroke (in)	BPD at 100% eff.	BPD at 85% eff.
Gross:	85.1	246 (24h/d)	209 (24h/d)
Net:	85	246 (24h/d)	209 (24h/d)

Tubing Stretch (in)	: 0	Lost Displacement (bpd)	: 0
Loss Along Rod String (hp)	: 2.37	Pump Power (hp)	: 5.39
Tubing Size (in)	: 2.875	Tubing Anchor Location (ft)	: 2647
Pump Spacing Guide (in)	: N/A	Pump Fillage (%)	: 100

** Non-Dimensional Variables **

Fo/S/Kr	: 0.05	N/No'	: 0.12

** OTHER BASIC DATA **

Reducer Rating (in-lbs)	: 228	Crank Rotation	: (C'WISE) - Well to right
Overall Speed Ratio	: 105.7	Rod Damping Factors (up/down)	: 0.05 / 0.15
Min/Max Tubing Head Press. (psi)	: N/A	Buoyant Rod Weight (lbs)	: 3883
Total Load on Pump (lbs)	: 2003	Pump Bore Size (in)	: 1.5
Pump Load Adjustment (lbs)	: 0	Tubing Gradient (psi/ft)	: 0.433
Pump Depth (ft)	: 2710	Pump Intake Pressure (psi)	: 100
Pump Friction (lbs)	: 200	SV Load (lbs)	: 3583
TV Load (lbs)	: 6186		

** ROD LOADING AT SPECIAL DEPTHS (Top of Lower Interval) **

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COMMENTS : Test Number: 01. Test Date March, 1995

Interval : 1

Depth (ft)	: 0	Rod Diameter (in)	: 0.75
Max Stress (psi)	: 19379	Min Stress (psi)	: 3848
Min Stress at Bottom (psi)	: -1686	Rod Weight (lbs/ft)	: 1.634

ROD LOADING AS % OF RATING

Service Factor	Class C,K	Class D	User Defined API C
1	75	57	75
0.9	85	65	85
0.8	98	74	98
0.7	116	87	116

**** SUGGESTED ROD GUIDES ****

WELL NAME : Well 1 DATE/TIME : 9/10/2014 4:07:46 PM
ANALYST : Scott Malone COMPANY : Sandia Data
DATA FILE : Sandia Data Well 1(SnapOn).inp6e (BASE C WELL TYPE : Deviated
COMMENTS : Test Number: 01. Test Date March, 1995

Rod Number From Surface	Interval From (ft) - To (ft)	Max Side Load in Interval (lbs/rod)	Molded Guides (number/rod)	Wheeled Guides (number/rod)	Rod Taper Index

**** ROD GUIDE DESIGN ****

WELL NAME : Well 1 DATE/TIME : 9/10/2014 4:07:46 PM
ANALYST : Scott Malone COMPANY : Sandia Data
DATA FILE : Sandia Data Well 1(SnapOn).inp6e (BASE C WELL TYPE : Deviated
COMMENTS : Test Number: 01. Test Date March, 1995

Rod Number From Surface	Interval From (ft) - To (ft)		Max Side Load in Interval (lbs/rod)	Molded Guides (number/rod)	Wheeled Guides (number/rod)	Rod Taper Index
1	0	10	0	0	0	1
2	10	35	0	0	0	1
3	35	60	0	0	0	1
4	60	85	0	0	0	1
5	85	110	0	0	0	1
6	110	135	0	0	0	1
7	135	160	0	0	0	1
8	160	185	0	0	0	1
9	185	210	0	0	0	1
10	210	235	0	0	0	1
11	235	260	0	0	0	1
12	260	285	0	0	0	1
13	285	310	0	0	0	1
14	310	335	0	0	0	1
15	335	360	0	0	0	1
16	360	385	0	0	0	1
17	385	410	0	0	0	1
18	410	435	0	0	0	1
19	435	460	0	0	0	1
20	460	485	0	0	0	1
21	485	510	0	0	0	1
22	510	535	0	0	0	1
23	535	560	0	0	0	1
24	560	585	0	0	0	1
25	585	610	0	0	0	1
26	610	635	0	0	0	1
27	635	660	0	0	0	1
28	660	685	0	0	0	1
29	685	710	0	0	0	1
30	710	735	0	0	0	1
31	735	760	0	0	0	1
32	760	785	0	0	0	1
33	785	810	0	0	0	1
34	810	835	0	0	0	1
35	835	860	0	0	0	1
36	860	885	0	0	0	1
37	885	910	0	0	0	1
38	910	935	0	0	0	1
39	935	960	0	0	0	1
40	960	985	0	0	0	1
41	985	1010	0	0	0	1
42	1010	1035	0	0	0	1
43	1035	1060	0	0	0	1
44	1060	1085	0	0	0	1
45	1085	1110	0	0	0	1
46	1110	1135	0	0	0	1
47	1135	1160	0	0	0	1
48	1160	1185	0	0	0	1
49	1185	1210	0	0	0	1
50	1210	1235	0	0	0	1
51	1235	1260	0	0	0	1
52	1260	1285	0	0	0	1
53	1285	1310	0	0	0	1
54	1310	1335	0	0	0	1
55	1335	1360	0	0	0	1
56	1360	1385	0	0	0	1
57	1385	1410	0	0	0	1
58	1410	1435	0	0	0	1
59	1435	1460	0	0	0	1
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61	1485	1510	0	0	0	1
62	1510	1535	0	0	0	1
63	1535	1560	0	0	0	1
64	1560	1585	0	0	0	1

65	1585	1610	0	0	0	1
66	1610	1635	0	0	0	1
67	1635	1660	0	0	0	1
68	1660	1685	0	0	0	1
69	1685	1710	0	0	0	1
70	1710	1735	0	0	0	1
71	1735	1760	0	0	0	1
72	1760	1785	0	0	0	1
73	1785	1810	0	0	0	1
74	1810	1835	0	0	0	1
75	1835	1860	0	0	0	1
76	1860	1885	0	0	0	1
77	1885	1910	0	0	0	1
78	1910	1935	0	0	0	1
79	1935	1960	0	0	0	1
80	1960	1985	0	0	0	1
81	1985	2010	0	0	0	1
82	2010	2035	0	0	0	1
83	2035	2060	0	0	0	1
84	2060	2085	0	0	0	1
85	2085	2110	0	0	0	1
86	2110	2135	0	0	0	1
87	2135	2160	0	0	0	1
88	2160	2185	0	0	0	1
89	2185	2210	0	0	0	1
90	2210	2235	0	0	0	1
91	2235	2260	0	0	0	1
92	2260	2285	0	0	0	1
93	2285	2310	0	0	0	1
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95	2335	2360	0	0	0	1
96	2360	2385	0	0	0	1
97	2385	2410	0	0	0	1
98	2410	2435	0	0	0	1
99	2435	2460	0	0	0	1
100	2460	2485	0	0	0	1
101	2485	2510	0	0	0	1
102	2510	2535	0	0	0	1
103	2535	2560	0	0	0	1
104	2560	2585	0	0	0	1
105	2585	2610	0	0	0	1
106	2610	2635	0	0	0	1
107	2635	2660	0	0	0	1
108	2660	2685	0	0	0	1
109	2685	2710	0	0	0	1

**** INPUT DATA SUMMARY ****

WELL NAME : Well 1 DATE/TIME : 9/10/2014 4:07:47 PM
ANALYST : Scott Malone COMPANY : Sandia Data
DATA FILE : Sandia Data Well 1(SnapOn).inp6e (BASE C WELL TYPE : Deviated
COMMENTS : Test Number: 01. Test Date March, 1995

WELL NAME	: Well 1
ANALYST	: Scott Malone
COMPANY	: Sandia Data
PUMPING UNIT ID	: LC228-213-86
(Description)	(LUFKIN C228-213-86 WITH 7478B CRANKS)
MOTOR ID	: RM20HP
(Description)	(ROBBINS & MYERS 20 HP FRAME 326U (OLD TYPE))
C'BAL OPTION	: SROD Defined
COUNTERBALANCE MOMENT (in-lbs)	: 0
CRANK HOLE	: 1 - 88.3 (in)
ROTATION OF UNIT	: C'WISE
SPEED VARIATION	: VARIED
PUMP DEPTH (ft)	: 2710
PUMP DIAMETER (in)	: 1.5
PUMP INTAKE PRESSURE (psi)	: 100
PERCENT COMPLETE PUMP FILLAGE	: 100
PUMPING SPEED (SPM)	: 11
TUBINGHEAD PRESSURE (psi)	: 60
TUBING ANCHOR DEPTH (ft)	: 2647
TUBING GRADIENT (psi/ft)	: 0.433
TUBING SIZE	: 3 - 2 7/8 in.

Rod/Taper Information:

ROD STRING DESIGN OPTION : SPECIFY ROD DESIGN

	Diameter (in)	Length (ft)	Tensile (psi)	Modulus (MM psi)	Weight (lbs/ft)	Guide Type
1)	API C					
	0.75	2710	90000	30.5	1.634	M

SERVICE FACTOR	: 1.
ELECTRIC COST (cents/kwh)	: 10
UPSTROKE DAMPING FACTOR	: 0.05
DOWNSTROKE DAMPING FACTOR	: 0.15
PUMP FRICTION (lbs)	: 200
STUFFING BOX FRICTION (lbs)	: 100
PUMP LOAD ADJUSTMENT (lbs)	: 0
BUOYANT WEIGHT ADJUSTMENT (lbs)	: 0
PUMP LOAD COEFFICIENT (lbs/ft/sec)	: 5
Run Time (h/d)	: 24
MAX SIDE LOAD FOR BASE ROD (lbs/rod)	: 50
MAX SIDE LOAD FOR MOLDED GUIDE (lbs/rod)	: 40
MAX SIDE LOAD FOR WHEELED GUIDE (lbs/rod)	: 200
ROD FRICTION COEFFICIENT	: 0.2
MOLDED GUIDE FRICTION RATIO	: 1.5
WHEELED GUIDE FRICTION RATIO	: 0.1
OTHER GUIDE FRICTION RATIO	: 2
WELL DEVIATION SURVEY	: See Well Deviation Report

Auto Add Rod Guide Weights

**** DYNO GRAPH ****

WELL NAME : Well 1 DATE/TIME : 9/10/2014 4:07:47 PM
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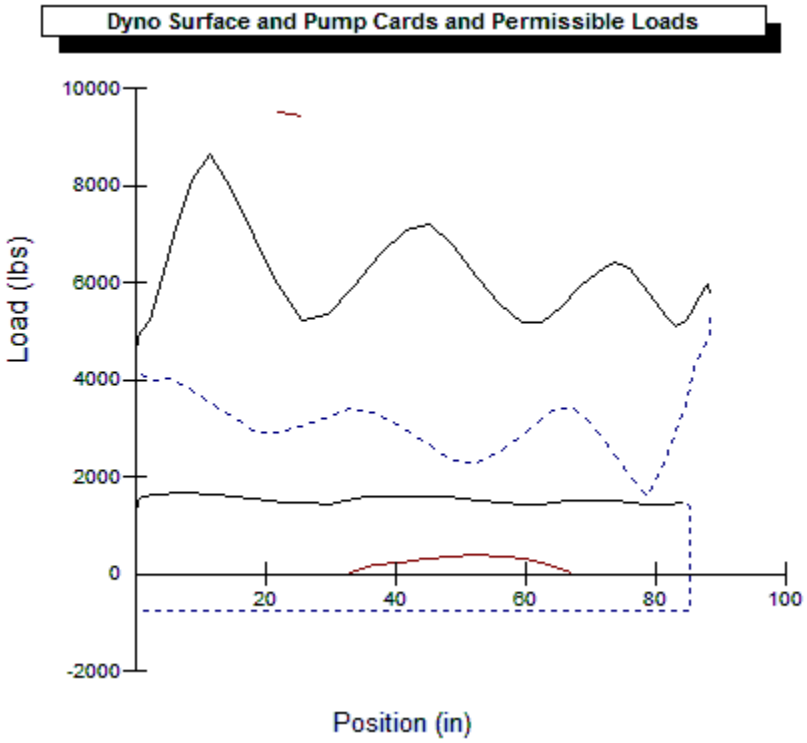

**** REDUCER TORQUE ****

WELL NAME : Well 1 DATE/TIME : 9/10/2014 4:07:47 PM
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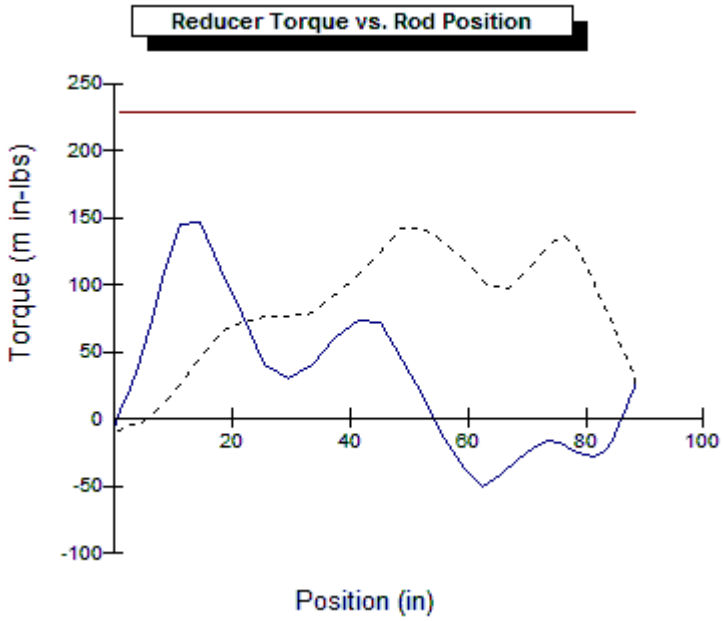
DATA FILE : Sandia Data Well 1(SnapOn).inp6e (BASE C WELL TYPE : Deviated
COMMENTS : Test Number: 01. Test Date March, 1995



**** AXIAL LOAD ~ BUCKLING TENDENCY ****

WELL NAME : Well 1 DATE/TIME : 9/10/2014 4:07:47 PM
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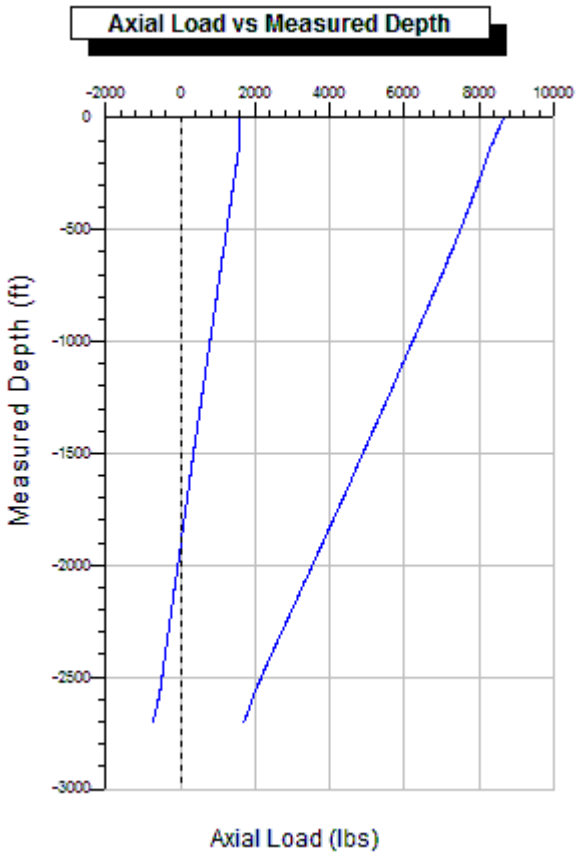

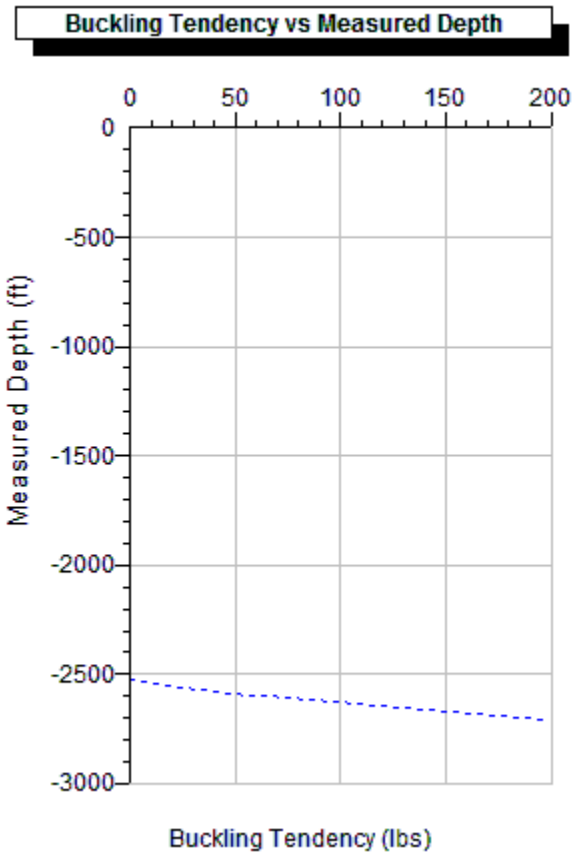

	Rod Type	Rod Diam in (in)	Max Load (lbs)	Min Load (lbs)	Max Stress (psi)	Min Stress (psi)	Rod Load @ 1 %
1.	API C	0.75	8561	1700	19379	3848	75

Max Buckling (lbs) : 200
Location of Max Buckling (ft) : 2710
Buckling Starts at (ft) : 2525
Buckling tendency does not include buoyancy forces because buoyancy forces do not cause buckling.

*** Neutral Point in Rod String (Buoyancy Considered) ***
Measured Depth (ft) : 1920
Rod Diameter (in) : 0.75
Max/Min Load (lbs) : 3754/-2
Buckling Tendency (lbs) : 0

**** SIDE/DRAG LOAD ****

WELL NAME : Well 1 DATE/TIME : 9/10/2014 4:07:47 PM
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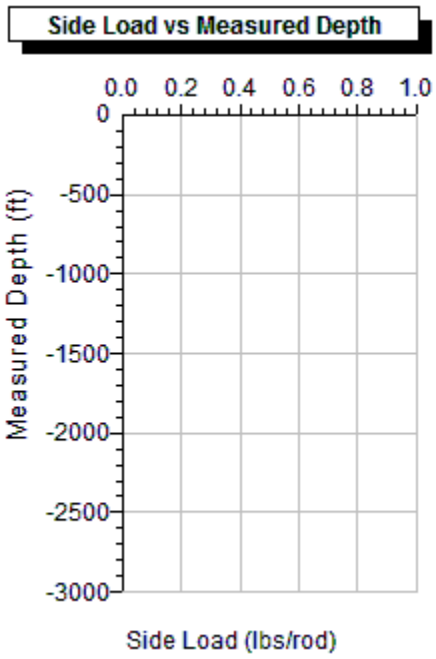
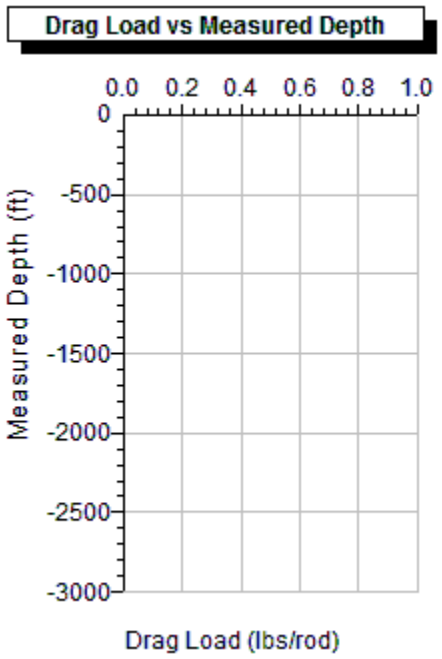
COMMENTS : Test Number: 01. Test Date March, 1995





Max Side Load (lbs/rod) : 0
Max Drag Load (lbs/rod) : 0
Rod Length for Steel/Fiberglass (ft/ft) : 25/37.5

**** WELL DEVIATION ****

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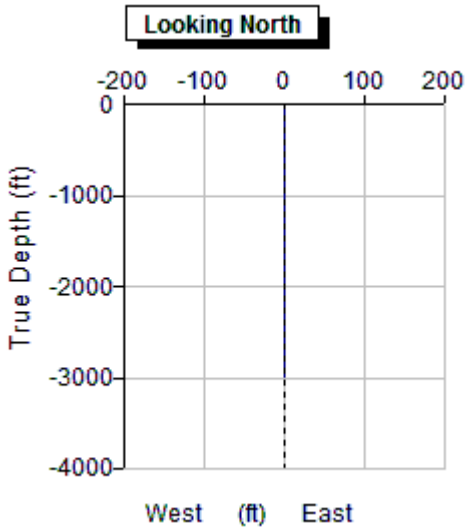

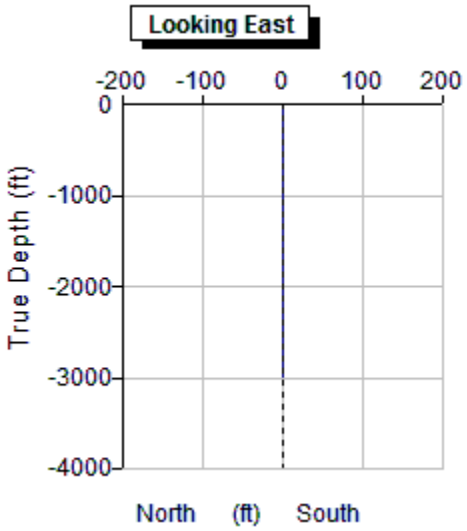

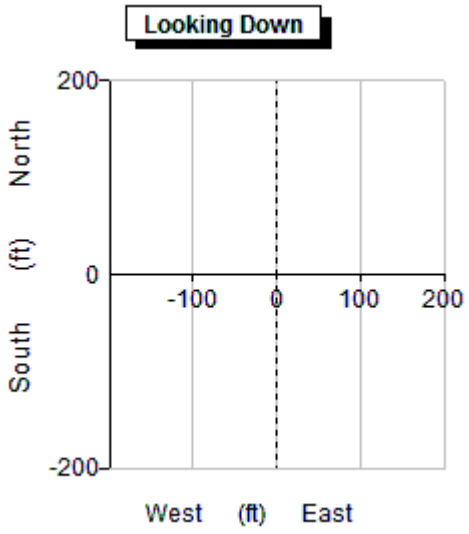

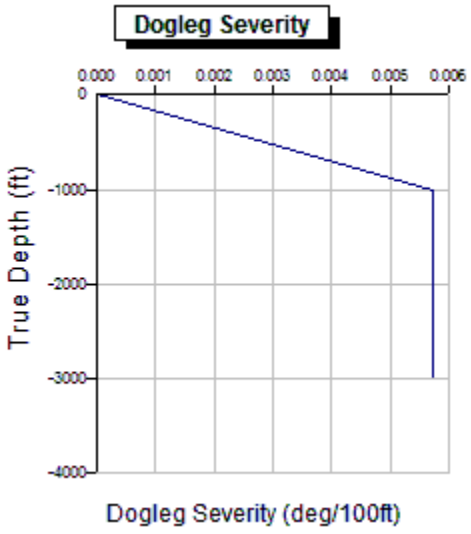

MD (ft)	INC (deg)	Azimuth (deg)	TVD (ft)	N-S (ft)	E-W (ft)	Dogleg Severity (deg/100ft)
0.00	0.00	0.00	0.00	0.00N	0.00E	0.00
1000.00	0.00	0.00	1000.00	0.00N	0.00E	0.01
3000.00	0.00	0.00	3000.00	0.00N	0.00E	0.01