APPENDIX C.3

PACKER TEST DATA

NORTH ANNA COL

DATA REPORT REV. 0
JANUARY 23, 2007

MACTEC PROJECT NO. 6468-06-1472

MACTEC

MACTEC ENGINEERING AND CONSULTING, INC.

RALEIGH, NORTH CAROLINA

IN SITU DETERMINATION OF ROCK MASS PERMEABILITY USING WATER PRESSURE TEST IN ACCORDANCE WITH CORPS OF ENGINEERS, (WATERWAYS EXPERIMENT STATION, RTH 381-80

PROJECT NAME: NORTH ANNA COL
PROJECT NUMBER: 6468-06-1472
REPORT DATE: 12/7/2006 Revised 1-13-07
BORING NO: B-901

Given Parameters

Prepared by: ZO Date: 12-7-06
Checked by: Date: 1-17-07

Test Section Length, ℓ, ft:	10		
Radius of Borehole r_0, in:	2.00		
GW Depth, ft:	23.30	(from top of casing)	21.30 (from ground surface)

Test Number	Q (GPM)	P_{Test} (psi)	P_T (psi)	P_M (psi)	P_B (psi)	Q (cfs)	H_M (ft)	K_e (fpy)
Interval 1, ft:	**77 - 87**	(from ground surface)						
1	0	46.51	0.46	27.08	32.05	0.00	107.33	0.00
2	0	65.94	0.46	27.08	32.05	0.00	152.17	0.00
3	0	85.97	0.46	27.08	32.05	0.00	198.39	0.00
4	TNP	56.52	-	-	-	-	130.43	-
5	TNP	85.97	-	-	-	-	198.39	-
							K_e, ft/year:	**0.00**
Interval 2, ft:	**92 - 102**	(from ground surface)						
1	0	53.54	0.17	31.29	36.31	0	123.55	0.00
2	0.4	75.8	0.17	31.29	36.31	0.0008913	174.92	14.81
3	6.2873	98.73	0.17	31.29	36.31	0.0140091	227.84	153.66
4	0.2	65.01	0.17	31.29	36.31	0.0004456	150.02	9.77
5	6.0182	98.73	0.17	31.29	36.31	0.0134095	227.84	147.09
							K_e, ft/year:	**NA**

Report two Ke values: Avg Ke intervals 2+4 = 12.4; Avg Ke intervals 3+5 = 150.4

Interval 3, ft:	**107 - 117**	(from ground surface)						
1	0	63.09	2.27	38.02	43.08	0	145.59	0.00
2	0	88.17	2.27	38.02	43.08	0	203.47	0.00
3	5.2345	114.01	2.27	38.02	43.08	0.0116633	263.10	113.54
4	0	76.01	2.27	38.02	43.08	0	175.41	0.00
5	5.3473	114.01	2.27	38.02	43.08	0.0119147	263.10	116.00
	Report Ke based on intervals 3+5		Ke for intervals 3+5 = 114.8				**K_e, ft/year:**	**0.0**

Notations:

Q = flow rate
P_{Test} = test pressure
P_T = pressure above top packer, near water surface
P_M = pressure in the test section
P_B = pressure below bottom packer
H_M = P_g converted to feet of head (P_g*144in^2/ft^2/γ_W)
K_e = ((Q/H_M)*(1/ℓ))*1/2π*ln(R/r_0)*(525,600 min/year)*(0.1337ft^3/gal)
R = total length between packers, ℓ
TNP = Test not performed
NM = not measured

Note: Pressures Pt, Pm and Pb taken from final data point for transducers after all testing.
Outside diameter of boring is 4 in.

Test Number	Q (GPM)	P_{Test} (psi)	P_T (psi)	P_M (psi)	P_B (psi)	Q (cfs)	H_M (ft)	K_e (fpy)
Interval 4, ft:	**118 - 128**	(from ground surface)						
1	0.1033	82.26	2.74	42.3	NM	0.1033	189.83	6.27
2	0.6455	97.82	3.23	43.02	49.09	0.6455	225.74	19.60
3	3.89	125.79	2.62	42.87	51.71	3.8945	290.28	78.04
4	0.5018	84.66	2.21	42.77	50.45	0.5018	195.37	20.11
5	3.47	125.79	2.01	43.02	53.23	3.4709	290.28	69.55
							K_e, ft/year:	**NA**
Report two Ke values:		Avg Ke intervals 2+4 = 19.8; Avg Ke intervals 3+5 = 73.8						
Interval 5, ft:	**145 - 155**	(from ground surface)						
1	0	90.04	0.19	86.94	NM	0	207.78	0.00
2	0	122.27	0.18	59.43	NM	0	282.16	0.00
3	0.00	155.47	0.2	83.87	60.7	0	358.78	0.00
4	TNP	106.64	-	-	-	-	246.09	-
5	TNP	155.82	-	-	-	-	359.58	-
							K_e, ft/year:	**0.00**
Interval 5-2, ft:	**145 - 155**	(from ground surface)		Second test with higher capacity pump				
1	0.00	87.28	2.84	75.87	60.39	0.00	201.42	0.00
2	1.92	119.5	2.38	87.8	62.22	1.92	275.77	49.02
3*	0.00	152.71	2.25	59.33	62.8	-	352.41	-
4	0.07	103.88	2.54	81.45	61.29	0.07	239.72	2.45
5*	TNP	152.77	-	-	-	-	352.55	-
							K_e, ft/year:	**NA**
Report Avg Ke from intervals 2 and 4: Ke = 25.7								

Notations:

Q = flow rate

P_{Test} = total test pressure

P_T = pressure above top packer, near water surface

P_M = pressure in the test section

P_B = pressure below bottom packer

H_M = P_{Test} converted to feet of head (P_{Test}*144in^2/ft^2/γ_W)

K_e = ((Q/(H_M-P_m))*(1/ℓ))*1/2π*ln(R/r_0)*(525,600 min/year)*(0.1337ft^3/gal)

R = total length between packers, ℓ

TNP = Test not performed

NM = not measured

Note:

Pressures Pt, Pm and Pb taken from initial data for transducers.

Outside diameter of boring is 4 in.

* Pressure pushes packers out. 30GPM/120 psi pump is used

1-17-07

IN SITU DETERMINATION OF ROCK MASS PERMEABILITY USING WATER PRESSURE TEST IN ACCORDANCE WITH CORPS OF ENGINEERS, WATERWAYS EXPERIMENT STATION, RTH 381-80

Project Name: NORTH ANNA COL
Project Number: 6468-06-1472
Date: 8/30/2006
Boring No: B-901
Test Interval: 79 ft to 89 ft (from top casing)
Stick up length: 2 ft
Test Interval: 77.0 ft to 87 ft (from surface)
Test Type: Double Packer Technique

Prepared by: ZO Date: 12-7-06
Checked by: JAZ Date: 1-17-07

Depth of Water
Table= 23.30 ft (from top of casing)
h1= 24.30 (from top of casing)
h2 = 60.7 ft (from top of casing)
ρ_w = 62.4 lb/ft^3

Abreviations:
N.O. Not Observed
N.A. Not Aplicable

Calc P_0 Max= 58.90 psi Value on field data sheet= 58.89

Target excess pressures were 1/3Pmax, 2/3Pmax, Pmax, 1/2 Pmax and Pmax. **Actual** excess pressures given below.

TEST #1

Actual Excess Pressure= 19.43 psi
Initial Middle Transducer Reading= 27.08 psi
Test Pressure= 46.51 psi

Time (min)	Flow Meter Reading (Gal)	Q (GPM)	Surface Gauge (psi)
0	2868.5		2.3
0.5	2869.2	1.4	16.4
1	2869.2	0.0	3.4
1.5	2869.4	0.4	23.2
2	2869.4	0.0	5.0
2.5	2869.4	0.0	11.1
3	2869.4	0.0	11.9
3.5	2869.4	0.0	11.8
4	2869.4	0.0	11.7
4.5	2869.4	0.0	11.7
5	2869.4	0.0	11.6

pressure release at 1 min and 2 min

Average Q: 0.2 gpm
Excess Pore pressure: 19.43 psi

TEST #2

Actual Excess Pressure= 38.86 psi
Initial Middle Transducer Reading= 27.08 psi
Test Pressure= 65.94 psi

Time (min)	Flow Meter Reading (Gal)	Q (GPM)	Surface Gauge (psi)
0	2869.4		3.2
0.5	2869.5	0.2	28.8
1	2869.5	0.0	32
1.5	2869.5	0.0	30.4
2	2869.5	0.0	30.4
2.5	2869.5	0.0	30.5
3	2869.5	0.0	31.2
3.5	2869.5	0.0	29.2
4	2869.5	0.0	31.4
4.5	2869.5	0.0	30.3
5	2869.5	0.0	30.9

Average Q: 0.0 gpm
Excess Pore pressure: 38.86 psi

TEST #3

Actual Excess Pressure= 58.89 psi
Initial Middle Transducer Reading= 27.08 psi
Test Pressure= 85.97 psi

Time (min)	Flow Meter Reading (Gal)	Q (GPM)	Surface Gauge (psi)
0	2869.5		-1.5
0.5	2869.8	0.6	44.8
1	2869.8	0.0	45.3
1.5	2869.8	0.0	51.6
2	2869.8	0.0	51.7
2.5	2869.8	0.0	51.4
3	2869.8	0.0	51.1
3.5	2869.8	0.0	51.5
4	2869.8	0.0	52.1
4.5	2869.8	0.0	51.2
5	2869.8	0.0	52.0

Average Q: 0.0 gpm
Excess Pore pressure: 58.89 psi

1-17-07

TEST #4

Actual Excess Pressure= 29.44 psi
Initial Middle Transducer 27.08 psi
Test Pressure= 56.52 psi

Time (min)	Flow Meter Reading (Gal)	Q (GPM)	Surface Gauge (psi)
Hole not taking any water. Test not performed			

TEST #5

Actual Excess Pressure= 58.89 psi
Initial Middle Transducer 27.08 psi
Test Pressure= 85.97 psi

Time (min)	Flow Meter Reading (Gal)	Q (GPM)	Surface Gauge (psi)
Hole not taking any water. Test not performed			

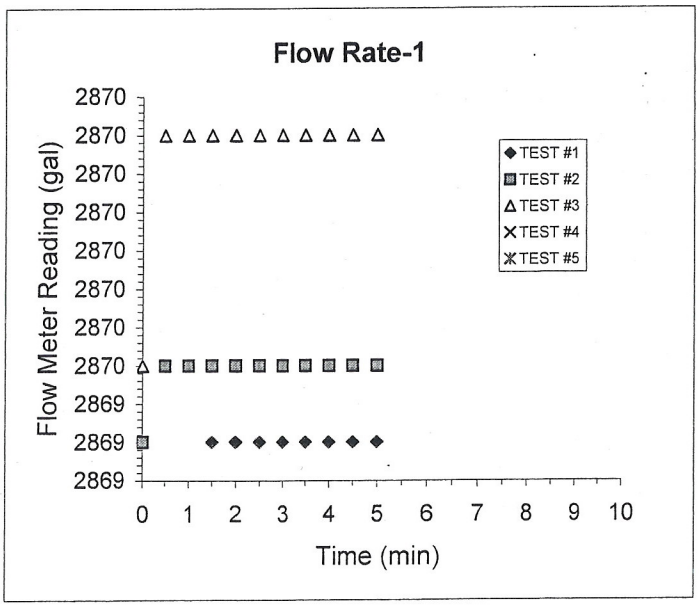
Boring No: B-901
Test Interval: 77 ft to 87 ft
(from surface)

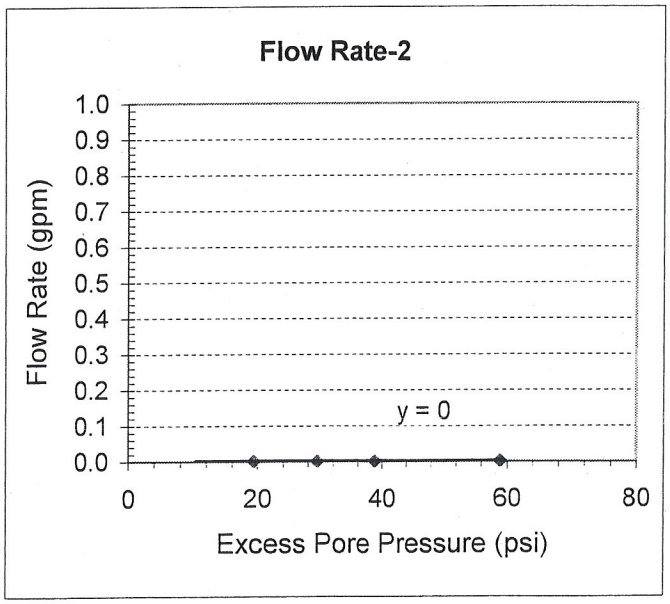
Density of water, ρ_w=62.4 lb/ft^3
= 0.0361 lb/in^3
Length= 10 ft
Borehole radius= 2.00 in
R ranges from 5-10 ft:
choose R= 5 ft

	Excess Pressure (psi)	Q (gpm)	Test Pres. (ft)	k_e (fpy)
1	19.43	0.000	44.84	0.00
2	38.86	0.000	89.68	0.00
3	58.89	0.000	135.90	0.00
4	29.44	-	67.94	
5	58.89	-	135.9	

Average Q: gpm
Excess Pore pressure: 29.44 psi

Average Q: gpm
Excess Pore pressure: 58.89 psi





obtain Q from graph 2 in gpm/psi --> 0.0000 gal/psi

$k_e = Q^* \ln(R/r_0)/(2\pi L H_0)$ k_e= 0.00E+00 cm/sec
= 0.00 ft/year

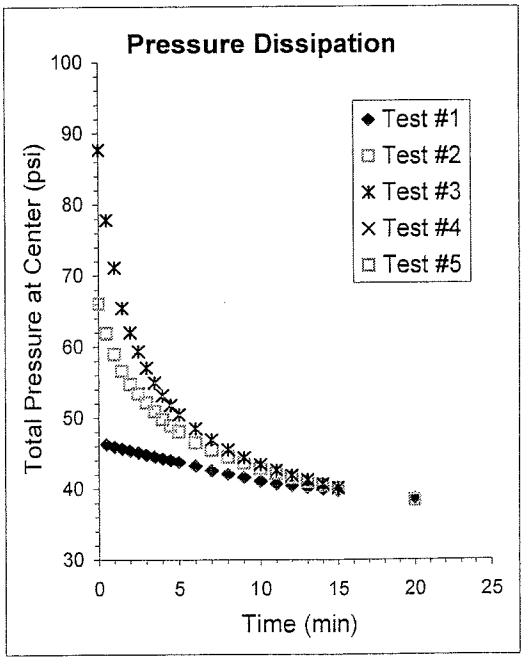
Pressure Decay Test

Prepared by: ZO Date: 12-7-06
Checked by: [illegible] Date: 1-17-07
N.O. Not Observed
N.A. Not Aplicable

Project Name: NORTH ANNA COL
Project Number: 6468-06-1472
Date: 8/30/2006
Boring No: B-901
Test Interval: 77 ft to 87 ft (from surface)

Test #1			Test #2			Test #3		
Time (min)	Surface Gauge (psi)	Center Tranducer (psi)	Time (min)	Surface Gauge (psi)	Center Tranducer (psi)	Time (min)	Surface Gauge (psi)	Center Tranducer (psi)
0.0	11.6	46.49	0.0	30.9	66.05	0.0	52	87.64
0.5	11.2	46.22	0.5	26.7	61.88	0.5	47.8	77.79
1.0	11	45.89	1.0	23.9	58.96	1.0	36	71.10
1.5	10.7	45.6	1.5	21.6	56.61	1.5	30.3	65.40
2.0	10.4	45.31	2.0	19.6	54.67	2.0	26.2	61.97
2.5	10.2	45.04	2.5	18	53.37	2.5	23.7	59.32
3.0	9.9	44.76	3.0	16.8	52.09	3.0	21.3	56.98
3.5	9.6	44.48	3.5	15.7	50.88	3.5	19.2	54.91
4.0	9.3	44.21	4.0	14.6	49.78	4.0	18.0	53.10
4.5	9.1	43.96	4.5	13.7	48.87	4.5	16.5	51.75
5.0	8.9	43.7	5.0	13.1	48.05	5.0	15.2	50.39
6.0	8.4	43.2	6.0	11.7	46.47	6.0	13.4	48.43
7.0	7.8	42.53	7.0	10.5	45.43	7.0	11.9	46.85
8	7.3	42.04	8.0	9.6	44.47	8.0	10.5	45.46
9	6.9	41.58	9.0	8.8	43.60	9.0	9.5	44.35
10	6.4	41.02	10.0	8.1	42.81	10.0	8.6	43.36
11	6.0	40.64	11.0	7.4	42.18	11.0	7.8	42.58
12	5.8	40.38	12.0	6.8	41.57	12.0	7.1	41.83
13	5.5	40.13	13.0	6.4	41.00	13.0	6.5	41.21
14	5.3	39.88	14.0	5.9	40.52	14.0	6.1	40.61
15	5	39.61	15.0	5.5	40.09	15.0	5.5	40.07
20	4.1	38.55	20.0	3.9	38.31			

Test #4			Test #5		
Time (min)	Surface Gauge (psi)	Center Tranducer (psi)	Time (min)	Surface Gauge (psi)	Center Tranducer (psi)
Test not conducted			Test not conducted		



IN SITU DETERMINATION OF ROCK MASS PERMEABILITY USING WATER PRESSURE TEST IN ACCORDANCE WITH CORPS OF ENGINEERS, WATERWAYS EXPERIMENT STATION, RTH 381-80

Project Name: NORTH ANNA COL
Project Number: 6468-06-1472
Date: 8/30/2006
Boring No: B-901
Test Interval: 94 ft to 104 ft
Stick up length: 2 ft
Test Interval: 92.0 ft to 102 ft (from surface)
Test Type: Double Packer Technique

Prepared by: ZO Date: 12-7-06
Checked by: [signature] Date: 1-11-07

Depth of Water Table= 23.30 ft (from top of casing)
h1= 24.30 (from top of casing)
h2 = 75.7 ft (from top of casing)
ρ_w = 62.4 lb/ft^3

Abreviations:
N.O. Not Observed
N.A. Not Aplicable

P_0 Max= 67.45 psi Value on field data sheet= 67.44

Target excess pressures were 1/3Pmax, 2/3Pmax, Pmax, 1/2 Pmax and Pmax. **Actual** excess pressures given below.

TEST #1

Actual Excess Pressure= 22.25 psi
Initial Middle Transducer Reading= 31.29 psi
Test Pressure= 53.54 psi

Time (min)	Flow Meter Reading (Gal)	Q (GPM)	Surface Gauge (psi)
0	2799.9		0.0
0.5	2801.6	3.4	17.3
1	2801.6	0.0	18.2
1.5	2801.8	0.4	20.1
2	2801.8	0.0	18.4
2.5	2801.8	0.0	20.0
3	2801.8	0.0	20.0
3.5	2801.8	0.0	18.1
4	2801.8	0.0	21.0
4.5	2801.8	0.0	19.2
5	2801.8	0.0	19.7

Average Q: 0.4 gpm
Excess Pore pressure: 22.25 psi

TEST #2

Actual Excess Pressure= 44.51 psi
Initial Middle Transducer Reading= 31.29 psi
Test Pressure= 75.80 psi

Time (min)	Flow Meter Reading (Gal)	Q (GPM)	Surface Gauge (psi)
0	2801.9		4.1
0.5	2803.1	2.4	15.1
1	2803.3	0.4	25.9
1.5	2803.9	1.2	38.1
2	2804.2	0.6	39
2.5	2804.4	0.4	38.1
3	2804.4	0.0	39.2
3.5	2804.6	0.4	38.6
4	2804.7	0.2	39
4.5	2804.8	0.2	39.4
5	2805.0	0.4	39.1

Average Q: 0.4 gpm
Excess Pore pressure: 44.51 psi

TEST #3

Actual Excess Pressure= 67.44 psi
Initial Middle Transducer Reading= 31.29 psi
Test Pressure= 98.73 psi

Time (min)	Flow Meter Reading (Gal)	Q (GPM)	Surface Gauge (psi)
0	2804.9		3.6
0.5	2806.8	3.8	45.6
1	2807.4	1.2	48.1
1.5	2811.1	7.4	58.6
2	2815.4	8.6	60.8
2.5	2818.8	6.8	58.6
3	2822.1	6.6	59.3
3.5	2825.2	6.2	59.1
4	2828.4	6.4	59.9
4.5	2831.4	6.0	60
5	2834.8	6.8	57.4

Average Q: 6.9 gpm
Excess Pore pressure: 67.44 psi

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1-17-07

TEST #4

Actual Excess Pressure=	33.72 psi
Initial Middle Transducer	31.29 psi
Test Pressure=	65.01 psi

Time (min)	Flow Meter Reading (Gal)	Q (GPM)	Surface Gauge (psi)
0	2834.8		-8.6
0.5	2835.3	1.0	14.9
1	2835.8	1.0	24.2
1.5	2836	0.4	24.1
2	2836.1	0.2	23.6
2.5	2836.2	0.2	23.4
3	2836.3	0.2	23.4
3.5	2836.4	0.2	23.7
4	2836.5	0.2	23.8
4.5	2836.6	0.2	23.8
5	2836.7	0.2	23.5

TEST #5

Actual Excess Pressure=	67.44 psi
Initial Middle Transducer	31.29 psi
Test Pressure=	98.73 psi

Time (min)	Flow Meter Reading (Gal)	Q (GPM)	Surface Gauge (psi)
0	2836.7		-8.4
0.5	2837.9	2.4	41.6
1	2839.6	3.4	55.6
1.5	2844.9	10.6	60
2	2847.1	4.4	60.4
2.5	2850.3	6.4	60.5
3	2853.1	5.6	58.4
3.5	2856.4	6.6	59.6
4	2859.6	6.4	60
4.5	2862.2	5.2	60.4
5	2865.5	6.6	59.1
5.5	2868.5	6.0	60

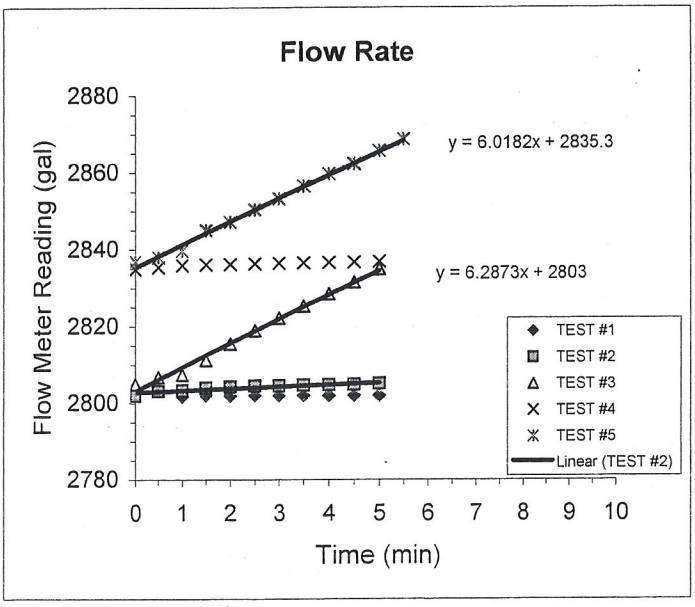
Boring No: B-901
Test Interval: 92 ft to 102 ft
(from surface)

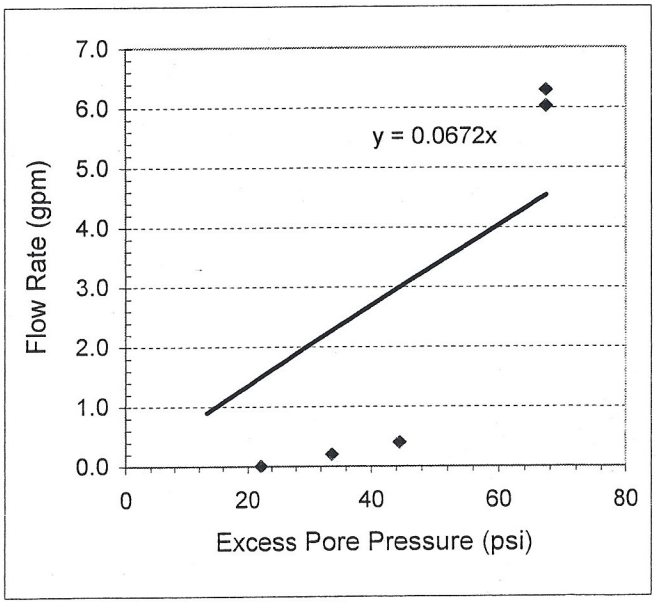
Density of water, ρ_w=62.4 lb/ft^3
= 0.0361 lb/in^3
Length= 10 ft
Borehole radius= 2.00 in
R ranges from 5-10 ft:
choose R= 5 ft

	Excess Pressure (psi)	Q (gpm)	Test Pres. (ft)	k_e (fpy)
1	22.25	0.000	51.35	0.00
2	44.51	0.400	102.72	14.81
3	67.44	6.287	155.63	153.66
4	33.72	0.200	77.83	9.77
5	67.44	6.018	155.6	147.09

Average Q: 0.2 gpm
Excess Pore pressure: 33.72 psi

Average Q: 6.4 gpm
Excess Pore pressure: 67.44 psi





obtain Q from graph 2 in gpm/psi --> 0.0000 gal/psi

$k_e = Q^* \ln(R/r_0)/(2\pi L H_0)$

k_e= 0.00E+00 cm/sec
= 0.00 ft/year

Pressure Decay Test

Prepared by: ZO Date: 12-7-06
Checked by: [illegible] Date: 1-17-07
N.O. Not Observed
N.A. Not Aplicable

Project Name: NORTH ANNA COL
Project Number: 6468-06-1472
Date: 8/18/2006
Boring No: B-901
Test Interval: 92 ft to 102 ft (from surface)

Test #1

Time (min)	Surface Gauge (psi)	Center Tranducer (psi)
0.0	19.7	53.73
0.5	18.1	51.77
1.0	16.5	49.85
1.5	15.3	48.33
2.0	14.4	46.97
2.5	13.4	45.72
3.0	12.5	44.73
3.5	11.9	43.94
4.0	11.3	43.03
4.5	10.7	42.25
5.0	10.2	41.37
6.0	9.4	40.2
7.0	8.6	39.06
8	8	38.07
9	7.4	37.29
10	7	36.55
11	6.6	35.94
12	6.3	35.39
13	6	34.89
14	5.7	34.44
15	5.5	34.08
20	4.7	32.72

Test #2

Time (min)	Surface Gauge (psi)	Center Tranducer (psi)
0.0	39.1	75.49
0.5	31.4	67.4
1.0	27.5	63.58
1.5	24.1	58.96
2.0	21.4	55.78
2.5	19.4	55.36
3.0	17.7	51.2
3.5	16.2	49.32
4.0	15	47.82
4.5	14	46.3
5.0	13	44.88
6.0	11.5	42.85
7.0	10.2	41.02
8.0	9.2	39.47
9.0	8.4	38.31
10.0	7.1	37.99
11.0	7.2	36.45
12.0	6.7	35.68
13.0	6.4	35.02
14.0	6	34.5
15.0	5.7	35.98
20.0	4.8	32.47

Test #3

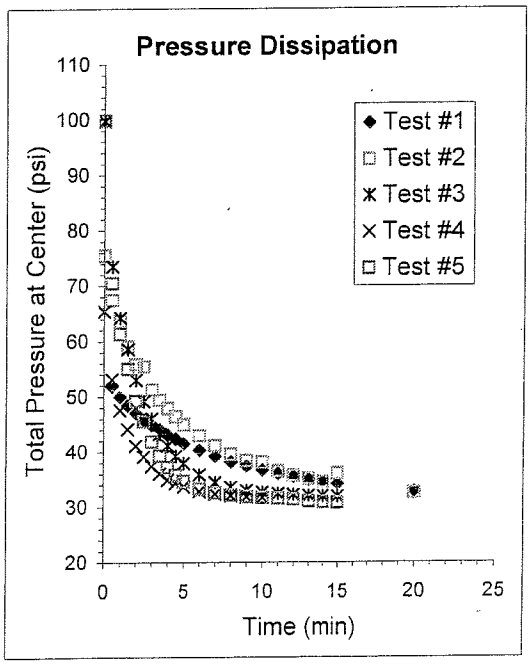
Time (min)	Surface Gauge (psi)	Center Tranducer (psi)
0.0	57.4	99.70
0.5	32.7	73.43
1.0	23.6	64.15
1.5	16.1	58.55
2.0	11.5	52.93
2.5	7.6	49.03
3.0	4.1	45.96
3.5	1.4	43.16
4.0	-0.5	41.06
4.5	-2.2	39.11
5.0	-3.3	37.86
6.0	-5.5	35.74
7.0	-7	34.38
8.0	-7.8	33.49
9.0	-8.2	32.92
10.0	-8.5	32.56
11.0	-8.7	32.33
12.0	-8.7	32.13
13.0	-8.7	31.98
14.0	-8.8	31.86
15.0	-8.8	31.77

Test #4

Time (min)	Surface Gauge (psi)	Center Tranducer (psi)
0.0	23.5	65.32
0.5	10.1	53.04
1.0	6.2	47.51
1.5	2.3	44.08
2.0	-0.2	41.01
2.5	-2.2	39.04
3.0	-3.8	37.34
3.5	-5	35.98
4.0	-5.9	34.81
4.5	-6.5	34.21
5.0	-7.1	33.57
6.0	-7.7	32.72
7.0	-8	32.27
8	-8.2	31.95
9	-8.4	31.75
10	-8.4	31.62

Test #5

Time (min)	Surface Gauge (psi)	Center Tranducer (psi)
0.0	60.0	99.81
0.5	27.3	70.43
1.0	20.6	61.27
1.5	12.5	54.95
2.0	7.8	49.17
2.5	3.5	45.44
3.0	0.4	41.81
3.5	-2.2	39.25
4.0	-4.4	37.16
4.5	-5.7	35.70
5.0	-6.9	34.59
6.0	-8.1	33.17
7.0	-8.7	32.51
8	-9.1	32.09
9	-9.3	31.80
10	-9.4	31.63
11	-9.4	31.48
12	-9.5	31.31
13	-9.7	31.00
14	-9.7	30.78
15	-9.8	30.67



IN SITU DETERMINATION OF ROCK MASS PERMEABILITY USING WATER PRESSURE TEST IN ACCORDANCE WITH CORPS OF ENGINEERS, WATERWAYS EXPERIMENT STATION, RTH 381-80

Project Name: NORTH ANNA COL
Project Number: 6468-06-1472
Date: 8/30/2006
Boring No: B-901
Test Interval: 109 ft to 119 ft
Stick up length: 2 ft
Test Interval: 107.0 ft to 117 ft (from surface)
Test Type: Double Packer Technique

Prepared by: ZC Date: 12-7-06
Checked by: [illegible] Date: 1-17-07

Depth of Water Table= 23.30 ft (from top of casing)
h1= 24.30 (from top of casing)
h2 = 90.70 ft (from top of casing)
ρ_w = 62.4 lb/ft^3

Abreviations:
N.O. Not Observed
N.A. Not Aplicable

P_0 Max= 76.00 psi Value on field data sheet= 75.99

Target excess pressures were 1/3Pmax, 2/3Pmax, Pmax, 1/2 Pmax and Pmax. **Actual** excess pressures given below.

TEST #1

Actual Excess Pressure= 25.07 psi
Initial Middle Transducer Reading= 38.02 psi
Test Pressure= 63.09 psi

Time (min)	Flow Meter Reading (Gal)	Q (GPM)	Surface Gauge (psi)
0	2931.0		0.6
0.5	2931.4	0.8	2.7
1	2933.0	3.2	28.8
1.5	2933.0	0.0	25.7
2	2933.0	0.0	24.2
2.5	2933.0	0.0	24.2
3	2933.0	0.0	24.0
3.5	2933.0	0.0	26.1
4	2933.0	0.0	24.7
4.5	2933.0	0.0	23.6
5	2933.0	0.0	24.5

Average Q: 0.4 gpm
Excess Pore pressure: 25.07 psi

TEST #2

Actual Excess Pressure= 50.15 psi
Initial Middle Transducer Reading= 38.02 psi
Test Pressure= 88.17 psi

Time (min)	Flow Meter Reading (Gal)	Q (GPM)	Surface Gauge (psi)
0	2933.0		9
0.5	2934	2.0	18.6
1	2934.4	0.8	46.8
1.5	2934.5	0.2	46.5
2	2934.5	0.0	47.4
2.5	2934.5	0.0	47.3
3	2934.6	0.2	47.5
3.5	2934.6	0.0	47.4
4	2934.6	0.0	48
4.5	2934.7	0.2	44.5
5	2934.7	0.0	44.9

Average Q: 0.1 gpm
Excess Pore pressure: 50.15 psi

TEST #3

Actual Excess Pressure= 75.99 psi
Initial Middle Transducer Reading= 38.02 psi
Test Pressure= 114.01 psi

Time (min)	Flow Meter Reading (Gal)	Q (GPM)	Surface Gauge (psi)
0	2934.7		7.5
0.5	2935.9	2.4	26.3
1	2936.2	0.6	47.9
1.5	2937.7	3.0	69.2
2	2941.2	7.0	74.8
2.5	2944.2	6.0	69.7
3	2947.2	6.0	68.5
3.5	2950.5	6.6	68.1
4	2953.3	5.6	68.1
4.5	2956.4	6.2	67.9
5	2959.3	5.8	68.7

Average Q: 5.8 gpm
Excess Pore pressure: 75.99 psi

JOZ 1-17-07

TEST #4

Actual Excess Pressure=			37.99 psi
Initial Middle Transducer			38.02 psi
Test Pressure=			76.01 psi
Time (min)	Flow Meter Reading (Gal)	Q (GPM)	Surface Gauge (psi)
0	2959.4		-9.4
0.5	2959.6	0.4	43
1	2959.8	0.4	26.9
1.5	2960.0	0.4	29
2	2960.1	0.2	29
2.5	2960.3	0.4	29
3	2960.5	0.4	29.4
3.5	2960.7	0.4	29.2
4	2960.8	0.2	29.4
4.5	2961	0.4	29.4
5	2961.2	0.4	29.7

TEST #5

Actual Excess Pressure=			75.98 psi
Initial Middle Transducer			38.02 psi
Test Pressure=			114.0 psi
Time (min)	Flow Meter Reading (Gal)	Q (GPM)	Surface Gauge (psi)
0	2961.2		9.6
0.5	2961.5	0.6	45.2
1	2962.3	1.6	60.5
1.5	2965.7	6.8	70.2
2	2969.9	8.4	69.1
2.5	2972	4.2	67.1
3	2974.7	5.4	67.2
3.5	2977	4.6	68.2
4	2980.3	6.6	67.8
4.5	2983.3	6.0	68.0
5	2986.3	6.0	68.3

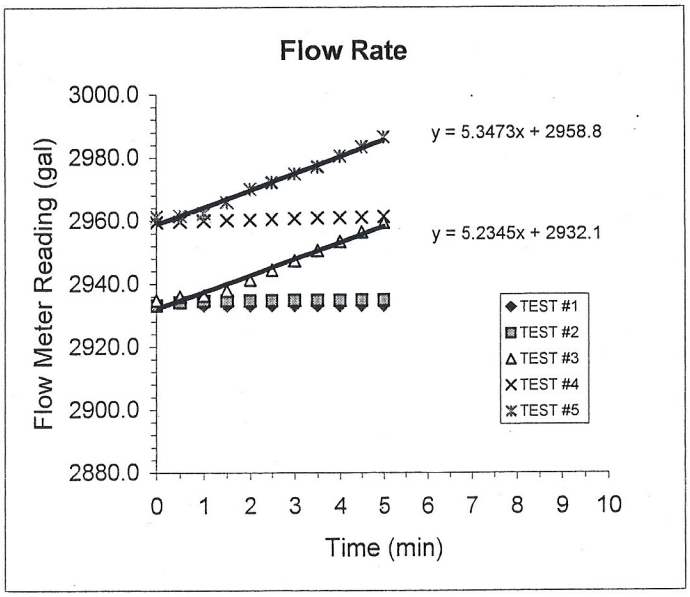
Boring No: B-901
Test Interva 107 ft to 117 ft
(from surface)

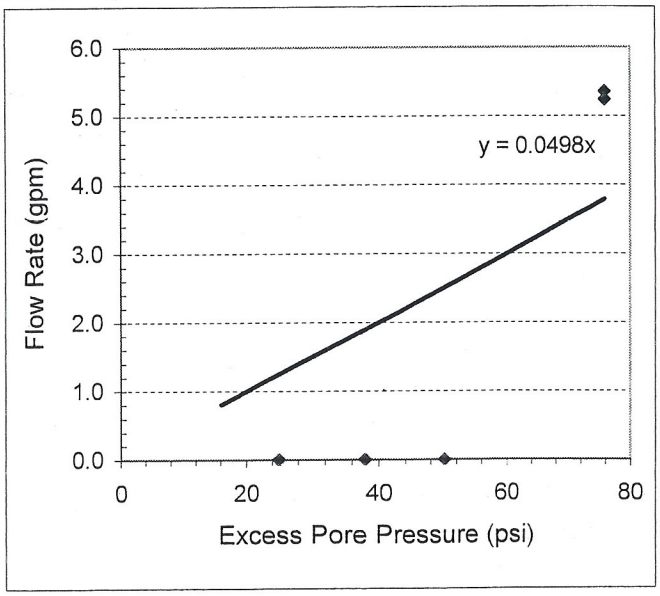
Density of water, ρ_w=62.4 lb/ft^3
= 0.0361 lb/in^3
Length= 10 ft
Borehole radius= 2.00 in
R ranges from 5-10 ft:
choose R= 5 ft

	Excess Pressure (psi)	Q (gpm)	Test Pres. (ft)	k_e (fpy)
1	25.07	0.000	57.85	0.00
2	50.15	0.000	115.73	0.00
3	75.99	5.235	175.36	113.54
4	37.99	0.000	87.67	0.00
5	75.98	5.347	175.3	116.00

Average Q: 0.3 gpm
Excess Pore pressure: 37.99 psi

Average Q: 6.0 gpm
Excess Pore pressure: 75.98 psi





obtain Q from graph 2 in gpm/psi --> 0.0000 gal/psi

$k_e = Q^* \ln(R/r_0)/(2\pi L H_0)$

k_e= **0.00E+00 cm/sec**
= **0.00 ft/year**

Pressure Decay Test

Prepared by: ZO Date: 12-7-06
Checked by: [illegible] Date: 1-17-07
N.O. Not Observed
N.A. Not Aplicable

Project Name: NORTH ANNA COL
Project Number: 6468-06-1472
Date: 8/30/2006
Boring No: B-901
Test Interval: 107 ft to 117 ft (from surface)

Test #1

Time (min)	Surface Gauge (psi)	Center Tranducer (psi)
Test not conducted		

Test #2

Time (min)	Surface Gauge (psi)	Center Tranducer (psi)
0.0	44.9	89.68
0.5	36.6	78
1.0	30.5	71.36
1.5	26.4	66.63
2.0	24.1	63.97
2.5	21.9	61.51
3.0	20.1	59.21
3.5	18.6	57.14
4.0	17.7	55.81
4.5	16.5	54.36
5.0	15.8	53.14
6.0	14.5	51.02
7.0	13.3	49.33
8.0	12.4	48.18
9.0	11.6	46.93
10.0	11	45.98
11.0	10.5	45.15
12.0	10.1	44.43
13.0	9.7	43.84
14.0	9.4	43.28
15.0	9	42.8
20.0	8.1	41.15

Test #3

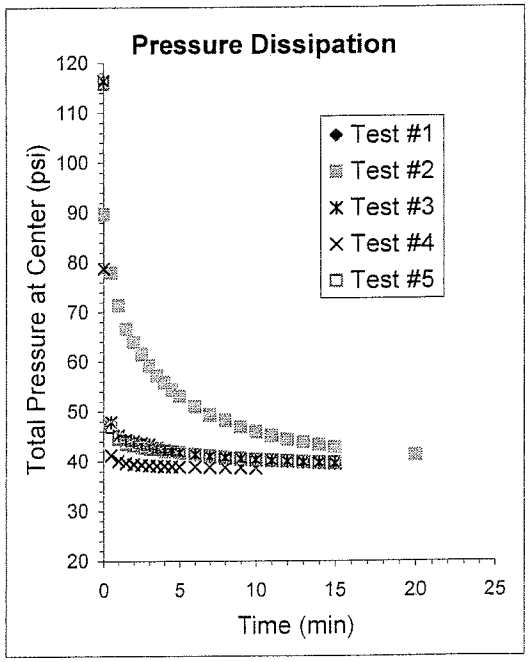
Time (min)	Surface Gauge (psi)	Center Tranducer (psi)
0.0	68.7	116.32
0.5	-1	47.83
1.0	-3.3	45.17
1.5	-4.3	44.23
2.0	-4.6	43.95
2.5	-5.0	43.57
3.0	-5.2	43.31
3.5	-5.9	42.63
4.0	-6.3	42.21
4.5	-6.6	41.95
5.0	-6.8	41.71
6.0	-7.1	41.32
7.0	-7.4	41.00
8.0	-7.7	40.72
9.0	-7.9	40.48
10.0	-8.1	40.28
11.0	-8.3	40.10
12.0	-8.4	39.92
13.0	-8.5	39.78
14.0	-8.6	39.64
15.0	-8.7	39.51

Test #4

Time (min)	Surface Gauge (psi)	Center Tranducer (psi)
0.0	29.7	78.71
0.5	-7.2	41.15
1.0	-8.1	40.1
1.5	-8.6	39.65
2.0	-8.8	39.39
2.5	-9	39.22
3.0	-9.1	39.12
3.5	-9.1	39.06
4.0	-9.1	38.98
4.5	-9.2	38.93
5.0	-9.2	38.88
6.0	-9.3	38.82
7.0	-9.3	38.77
8	-9.3	38.71
9	-9.4	38.67
10	-9.4	38.62

Test #5

Time (min)	Surface Gauge (psi)	Center Tranducer (psi)
0.0	68.3	115.89
0.5	-2.4	46.89
1.0	-4.0	44.53
1.5	5.0	43.57
2.0	-5.5	43.16
2.5	-5.9	42.76
3.0	-6.1	42.55
3.5	-6.3	42.44
4.0	-6.7	41.99
4.5	-6.8	41.88
5.0	-7.0	41.74
6.0	-7.3	41.39
7.0	-7.6	41.08
8	-7.9	40.82
9	-8.1	40.57
10	-8.3	40.40
11	-8.5	40.20
12	-8.6	40.05
13	-8.8	39.90
14	-8.9	39.77
15	-9.0	39.67



IN SITU DETERMINATION OF ROCK MASS PERMEABILITY USING WATER PRESSURE TEST IN ACCORDANCE WITH CORPS OF ENGINEERS, WATERWAYS EXPERIMENT STATION, RTH 381-80

Project Name: NORTH ANNA COL
Project Number: 6468-06-1472
Date: 8/30/2006
Boring No: B-901
Test Interval: 120 ft to 130 ft
Stick up length: 2 ft
Test Interval: 118.0 ft to 128 ft (from surface)
Test Type: Double Packer Technique

Prepared by: ZO Date: 12-7-06
Checked by: [signature] Date: 1-17-07

Depth of Water
Table= 23.30 ft (from top of casing)
h1= 24.30 (from top of casing)
h2 = 101.7 ft (from top of casing)
ρ_w = 62.4 lb/ft^3

Abreviations:
N.O. Not Observed
N.A. Not Aplicable

P_0 Max= 82.27 psi Value on field data sheet= 82.26

Target excess pressures were 1/3Pmax, 2/3Pmax, Pmax, 1/2 Pmax and Pmax. **Actual** excess pressures given below.

TEST #1

Actual Excess Pressure= 27.14 psi
Initial Middle Transducer Reading= 43.53 psi
Test Pressure= 70.67 psi

Time (min)	Flow Meter Reading (Gal)	Q (GPM)	Surface Gauge (psi)
0	2887.8		-1.5
0.5	2889.0	2.4	-29.1
1	2889.0	0.0	23.3
1.5	2889.2	0.4	22.8
2	2889.2	0.0	24.1
2.5	2889.3	0.2	23.7
3	2889.4	0.2	22.2
3.5	2889.4	0.0	22.3
4	2889.4	0.0	22.2
4.5	2889.4	0.0	22.5
5	2889.5	0.2	23.0

Average Q: 0.3 gpm
Excess Pore pressure: 27.14 psi

TEST #2

Actual Excess Pressure= 54.29 psi
Initial Middle Transducer Reading= 43.53 psi
Test Pressure= 97.82 psi

Time (min)	Flow Meter Reading (Gal)	Q (GPM)	Surface Gauge (psi)
0	2889.5		0
0.5	2890.2	1.4	5..7
1	2890.8	1.2	42.6
1.5	2891.1	0.6	45.8
2	2891.4	0.6	46.2
2.5	2891.6	0.4	46.7
3	2891.9	0.6	46.3
3.5	2892.2	0.6	47.2
4	2892.4	0.4	47.5
4.5	2892.7	0.6	47.2
5	2893.1	0.8	47.2

Average Q: 0.6 gpm
Excess Pore pressure: 54.29 psi

TEST #3

Actual Excess Pressure= 82.26 psi
Initial Middle Transducer Reading= 43.53 psi
Test Pressure= 125.8 psi

Time (min)	Flow Meter Reading (Gal)	Q (GPM)	Surface Gauge (psi)
0	2893		-1.1
0.5	2894.1	2.2	45.6
1	2894.4	0.6	48.1
1.5	2895.1	1.4	70
2	2897.1	4.0	74.1
2.5	2899	3.8	74.7
3	2901.2	4.4	75
3.5	2903.2	4.0	74.5
4	2905.4	4.4	74.2
4.5	2907.5	4.2	74.2
5	2909.8	4.6	74.4

Average Q: 3.9 gpm
Excess Pore pressure: 82.26 psi

TEST #4

TEST #5

JAD 1-17-07

Actual Excess Pressure= 41.13 psi Initial Middle Transducer 43.53 psi Test Pressure= 84.66 psi				Actual Excess Pressure= 82.26 psi Initial Middle Transducer 43.53 psi Test Pressure= 125.79 psi			
Time (min)	Flow Meter Reading (Gal)	Q (GPM)	Surface Gauge (psi)	Time (min)	Flow Meter Reading (Gal)	Q (GPM)	Surface Gauge (psi)
0	2909.8		-7.8	0	2912.4		-7.7
0.5	2910.2	0.8	20.8	0.5	2913.1	1.4	45
1	2910.6	0.8	31.5	1	2913.8	1.4	66.1
1.5	2910.8	0.4	31.8	1.5	2915.8	4.0	72.9
2	2911.1	0.6	32	2	2918	4.4	74.4
2.5	2911.3	0.4	32.2	2.5	2920.3	4.6	73.6
3	2911.5	0.4	32.6	3	2922.3	4.0	74.7
3.5	2911.8	0.6	30.0	3.5	2924.5	4.4	74.5
4	2912	0.4	29.9	4	2926.5	4.0	75.1
4.5	2912.2	0.4	29.9	4.5	2928.7	4.4	74.6
5	2912.4	0.4	30.1	5	2930.8	4.2	75

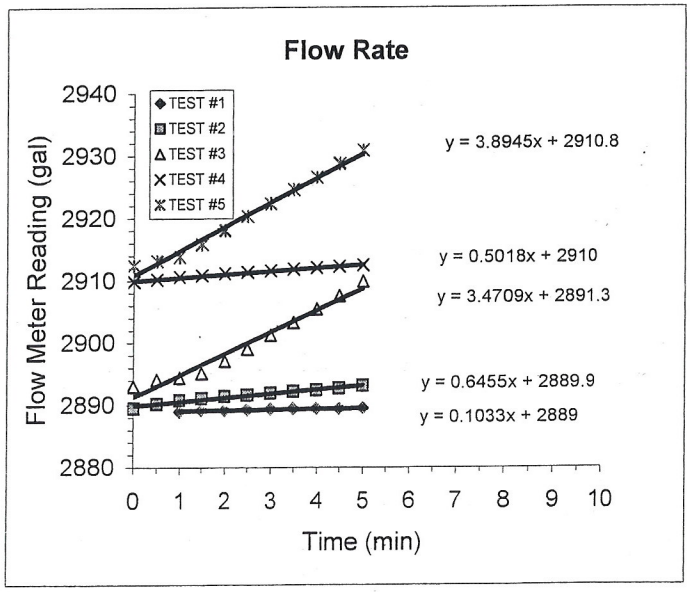
Boring No: B-901
Test Interva 118 ft to 128 ft
(from surface)

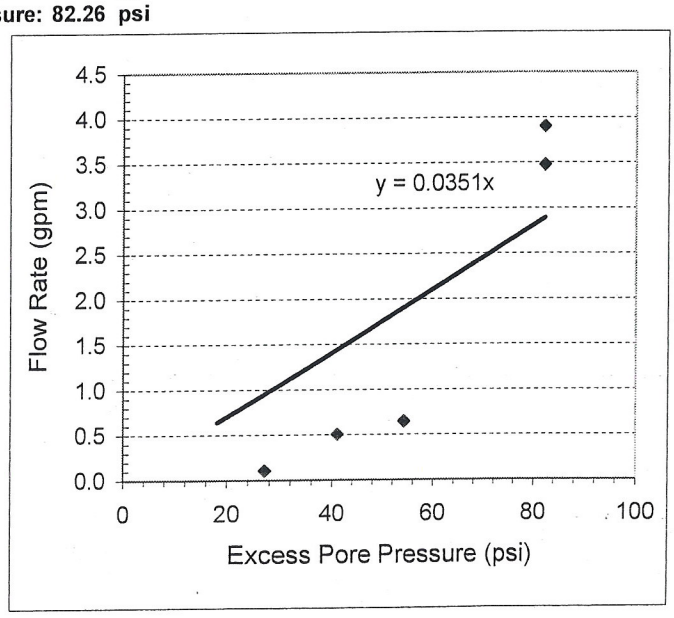
Density of water, ρ_w=62.4 lb/ft^3
= 0.0361 lb/in^3
Length= 10 ft
Borehole radius= 2.00 in
R ranges from 5-10 ft:
choose R= 5 ft

	Excess Pressure (psi)	Q (gpm)	Test Pres. (ft)	k_e (fpy)
1	27.14	0.103	62.63	6.27
2	54.29	0.646	125.28	19.60
3	82.26	3.895	189.83	78.04
4	41.13	0.502	94.93	20.11
5	82.26	3.471	189.83	69.55

Average Q: 0.5 gpm
Excess Pore pressure: 41.13 psi

Average Q: 4.3 gpm
Excess Pore pressure: 82.26 psi





obtain Q from graph 2 in gpm/psi --> 0.0000 gal/psi

$k_e = Q^* \ln(R/r_0)/(2\pi L H_0)$

k_e= 0.00E+00 cm/sec
= 0.00 ft/year

Pressure Decay Test

Prepared by: ZO Date: 12-7-06
Checked by: [illegible] Date: 1-17-07
N.O. Not Observed
N.A. Not Aplicable

Project Name: NORTH ANNA COL
Project Number: 6468-06-1472
Date: 8/18/2006
Boring No: B-901
Test Interval: 118 ft to 128 ft (from surface)

Test #1

Time (min)	Surface Gauge (psi)	Center Tranducer (psi)
0.0	23	21.5
0.5	16.6	64.17
1.0	13.1	60.72
1.5	11	57.48
2.0	9	54.86
2.5	7.8	53.19
3.0	6.6	51.83
3.5	5.8	50.58
4.0	5.2	49.61
4.5	4.7	48.77
5.0	4.2	48.04
6.0	3.5	46.77
7.0	2.9	45.98
8	2.6	45.31
9	2.2	44.78
10	1.9	44.34
11	1.8	43.97
12	1.6	43.69
13	1.4	43.46
14	1.3	43.23
15	1.2	43.08
20	0.9	42.55

Test #2

Time (min)	Surface Gauge (psi)	Center Tranducer (psi)
0.0	47.2	97.26
0.5	19.4	68.95
1.0	13.1	62.05
1.5	8.7	57.72
2.0	6.9	54.2
2.5	5.2	52.30
3.0	4.3	51.23
3.5	3.3	49.96
4.0	2.7	49.03
4.5	2.1	48.2
5.0	1.7	47.51
6.0	1.1	46.54
7.0	0.5	45.56
8.0	0.2	44.98
9.0	0	44.53
10.0	-0.2	44.18
11.0	-0.4	43.87
12.0	-0.5	43.61
13.0	-0.7	43.44
14.0	-0.7	43.27
15.0	-0.8	43.13

Test #3

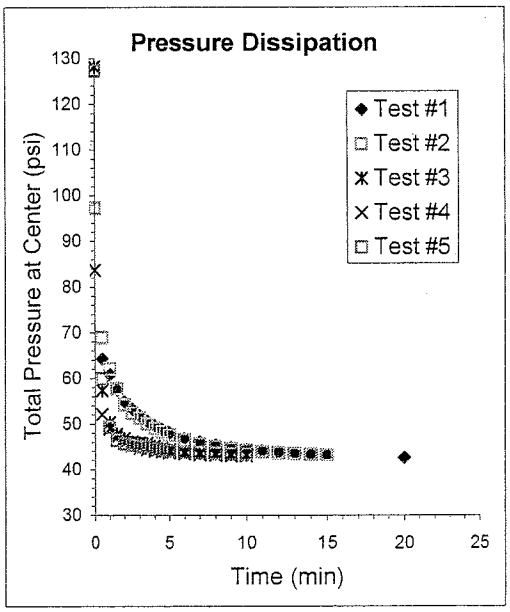
Time (min)	Surface Gauge (psi)	Center Tranducer (psi)
0.0	74.4	128.07
0.5	4.6	57.30
1.0	-3.3	50.30
1.5	-5.3	47.72
2.0	-5.8	46.78
2.5	-6.2	46.07
3.0	-6.4	45.81
3.5	-6.3	45.69
4.0	-6.8	45.03
4.5	-7.1	44.58
5.0	-7.4	44.26
6.0	-7.6	43.86
7.0	-7.7	43.60
8.0	-7.8	43.41
9.0	-7.8	43.28
10.0	-7.9	43.16

Test #4

Time (min)	Surface Gauge (psi)	Center Tranducer (psi)
0.0	3.01	83.63
0.5	-0.2	52.00
1.0	-3.3	48.91
1.5	-5	47.08
2.0	-5.8	45.96
2.5	-6.3	45.26
3.0	-6.6	44.73
3.5	-6.9	44.37
4.0	-7.1	44.06
4.5	-7.3	43.86
5.0	-7.3	43.68
6.0	-7.5	43.42
7.0	-7.6	43.23
8	-7.6	43.09
9	-7.7	42.98
10	-7.7	42.92

Test #5

Time (min)	Surface Gauge (psi)	Center Tranducer (psi)
0.0	75.0	127.35
0.5	1.3	59.90
1.0	-4.0	49.30
1.5	-6.8	46.37
2.0	-7.5	45.62
2.5	-8.0	45.27
3.0	-8.2	44.97
3.5	-8.0	44.99
4.0	-8.3	44.59
4.5	-8.5	44.27
5.0	-8.7	44.07
6.0	-8.8	43.80
7.0	-8.9	43.63
8	-8.9	43.50
9	-8.9	43.38
10	-8.9	43.27



IN SITU DETERMINATION OF ROCK MASS PERMEABILITY USING WATER PRESSURE TEST IN ACCORDANCE WITH CORPS OF ENGINEERS, WATERWAYS EXPERIMENT STATION, RTH 381-80

Project Name: NORTH ANNA COL
Project Number: 6468-06-1472
Date: 8/30/2006
Boring No: B-901
Test Interval: 147 ft to 157 ft
Stick up length: 2 ft
Test Interval: 145.0 ft to 155 ft (from surface)
Test Type: Double Packer Technique

Prepared by: ZO Date: 12-7-06
Checked by: JC Date: 1-17-07

Depth of Water
Table= 23.30 ft (from top of casing)
h1= 24.30 (from top of casing)
h2 = 128.7 ft (from top of casing)
ρ_w = 62.4 lb/ft^3

Abreviations:
N.O. Not Observed
N.A. Not Aplicable

P_0 Max= 97.66 psi Value on field data sheet= 97.65

Target excess pressures were 1/3Pmax, 2/3Pmax, Pmax, 1/2 Pmax and Pmax. **Actual** excess pressures given below.

TEST #1

Actual Excess Pressure= 32.22 psi
Initial Middle Transducer Reading= 57.82 psi
Test Pressure= 90.04 psi

Time (min)	Flow Meter Reading (Gal)	Q (GPM)	Surface Gauge (psi)
0	2795.7		0.1
0.5	2796.7	2.0	4.8
1	2797.6	1.8	24.5
1.5	2797.7	0.2	29.2
2	2797.8	0.2	31.7
2.5	2797.8	0.0	31.8
3	2797.8	0.0	31.7
3.5	2797.8	0.0	31.7
4	2797.8	0.0	32.0
4.5	2797.8	0.0	32.1
5	2797.8	0.0	32.1

Average Q: 0.4 gpm
Excess Pore pressure: 32.22 psi

TEST #2

Actual Excess Pressure= 64.45 psi
Initial Middle Transducer Reading= 57.82 psi
Test Pressure= 122.27 psi

Time (min)	Flow Meter Reading (Gal)	Q (GPM)	Surface Gauge (psi)
0	2797.8		0.1
0.5	2798.8	2.0	24.7
1	2798.9	0.2	34.3
1.5	2798.9	0.0	36
2	2798.9	0.0	36.8
2.5	2798.9	0.0	37.1
3	2798.9	0.0	37.4
3.5	2798.9	0.0	38.6
4	2798.9	0.0	38.4
4.5	2798.9	0.0	38.3
5	2798.9	0.0	39.3

Average Q: 0.0 gpm
Excess Pore pressure: 64.45 psi

TEST #3

Actual Excess Pressure= 97.65 psi
Initial Middle Transducer Reading= 57.82 psi
Test Pressure= 155.47 psi

Time (min)	Flow Meter Reading (Gal)	Q (GPM)	Surface Gauge (psi)
0	2798.9		0.4
0.5	2799.7	1.6	24.8
1	2799.9	0.4	35.3
1.5	2799.9	0.0	37..0
2	2799.9	0.0	37.4
2.5	2799.9	0.0	38
3	2799.9	0.0	38.6
3.5	2799.9	0.0	39.4
4	2799.9	0.0	38
4.5	2799.9	0.0	37.8
5	2799.9	0.0	38.4

Average Q: 0.0 gpm
Excess Pore pressure: 97.65 psi

JB 1-17-07

TEST #4

Actual Excess Pressure=	48.82 psi		
Initial Middle Transducer	57.82 psi		
Test Pressure=	106.64 psi		
Time (min)	Flow Meter Reading (Gal)	Q (GPM)	Surface Gauge (psi)
	Test not Conducted		

TEST #5

Actual Excess Pressure=	97.65 psi		
Initial Middle Transducer	57.82 psi		
Test Pressure=	155.5 psi		
Time (min)	Flow Meter Reading (Gal)	Q (GPM)	Surface Gauge (psi)
	Test not Conducted		

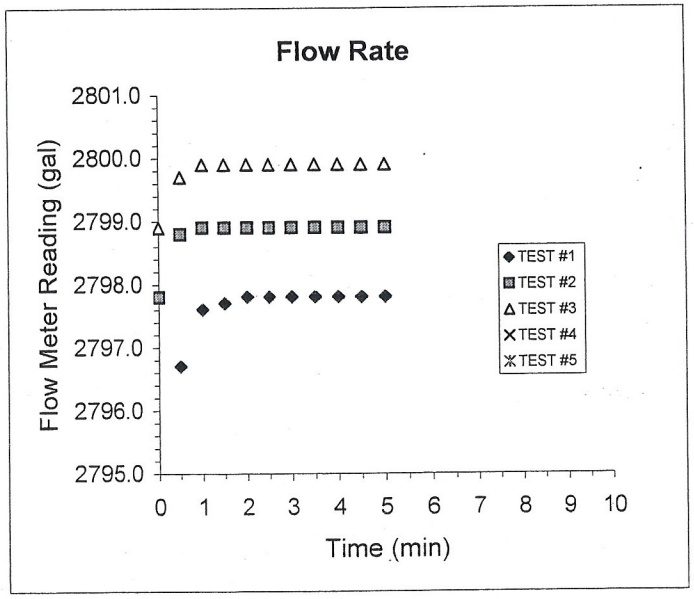
Boring No: B-901
Test Interva 145 ft to 155 ft
(from surface)

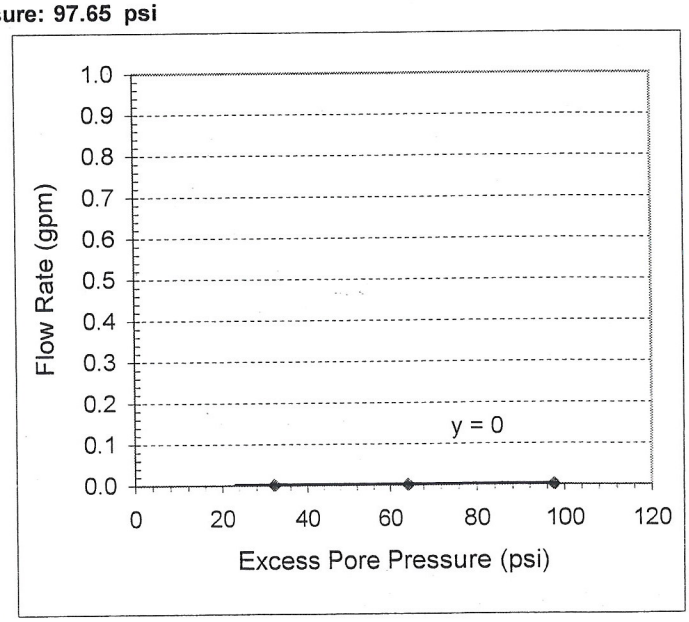
Density of water, ρ_w=62.4 lb/ft^3
= 0.0361 lb/in
Length= 10 ft
Borehole radius= 2.00 in
R ranges from 5-10 ft:
choose R= 5 ft

	Excess Pressure (psi)	Q (gpm)	Test Pres. (ft)	k_e (fpy)
1	32.22	0.000	74.35	0.00
2	64.45	0.000	148.73	0.00
3	97.65	0.000	225.35	0.00
4	48.82		112.66	
5	97.65		225.3	

Average Q: gpm
Excess Pore pressure: 48.82 psi

Average Q: gpm
Excess Pore pressure: 97.65 psi





obtain Q from graph 2 in gpm/psi --> 0.0000 gal/psi

$$k_e = Q^* \ln(R/r_0)/(2\pi L H_0)$$

k_e= 0.00E+00 cm/sec
= 0.00 ft/year

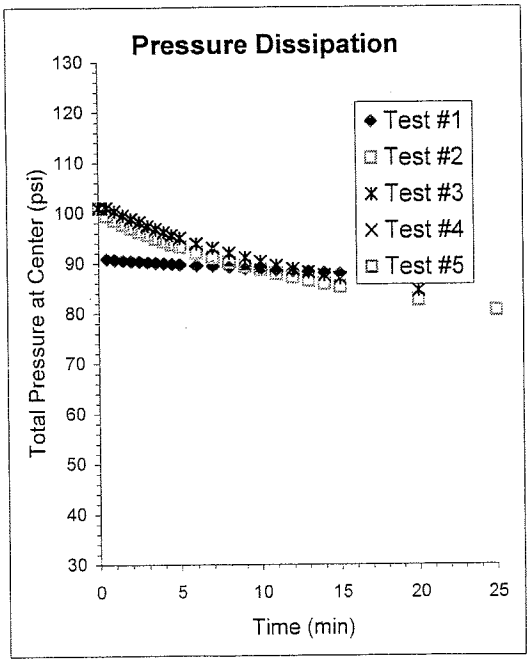
Pressure Decay Test

Prepared by: ZO Date: 12-7-06
Checked by: [illegible] Date: 1-17-07
N.O. Not Observed
N.A. Not Aplicable

Project Name: NORTH ANNA COL
Project Number: 6468-06-1472
Date: 8/30/2006
Boring No: B-901
Test Interval: 145 ft to 155 ft

Test #1			Test #2			Test #3		
Time (min)	Surface Gauge (psi)	Center Tranducer (psi)	Time (min)	Surface Gauge (psi)	Center Tranducer (psi)	Time (min)	Surface Gauge (psi)	Center Tranducer (psi)
0.0	32.1	90.66	0.0	39.3	100.88	0.0	38.4	101.00
0.5	32.1	90.78	0.5	37.8	99.41	0.5	38.8	101.00
1.0	31.9	90.64	1.0	37.2	98.57	1.0	38.8	100.32
1.5	31.8	90.5	1.5	36.4	97.71	1.5	37.5	99.47
2.0	31.7	90.38	2.0	35.7	96.96	2.0	36.8	98.82
2.5	31.6	90.27	2.5	35.1	96.24	2.5	36.2	98.14
3.0	31.7	90.15	3.0	34.4	95.6	3.0	35.5	97.42
3.5	31.3	90.02	3.5	33.8	94.92	3.5	34.9	96.74
4.0	31.3	89.93	4.0	33.3	94.28	4.0	34.3	96.09
4.5	31.2	89.81	4.5	32.6	93.7	4.5	33.7	95.53
5.0	31.1	89.64	5.0	32.3	93.18	5.0	33.2	94.94
6.0	30.9	89.47	6.0	31.3	92.07	6.0	32.1	93.82
7.0	30.7	89.25	7.0	30.4	91.12	7.0	31.2	92.91
8	30.6	89.06	8.0	29.6	90.17	8.0	30.4	91.89
9	30.4	88.85	9.0	28.8	89.34	9.0	29.5	91.00
10	30.2	88.68	10.0	28.2	88.55	10.0	28.9	90.20
11	30.1	88.52	11.0	27.5	87.83	11.0	28.1	89.43
12	30.0	88.35	12.0	26.9	87.07	12.0	27.5	88.76
13	29.8	88.18	13.0	26.3	86.46	13.0	226.9	88.13
14	29.7	88.02	14.0	25.7	85.81	14.0	26.4	87.46
15	29.5	87.88	15.0	25.2	85.23	15.0	25.8	86.88
			20.0	22.8	82.57	20.0	23.5	84.38
			25.0	21.1	80.49			

Test #4			Test #5		
Time (min)	Surface Gauge (psi)	Center Tranducer (psi)	Time (min)	Surface Gauge (psi)	Center Tranducer (psi)
Test not Conducted			Test not Conducted		



IN SITU DETERMINATION OF ROCK MASS PERMEABILITY USING WATER PRESSURE TEST IN ACCORDANCE WITH CORPS OF ENGINEERS, WATERWAYS EXPERIMENT STATION, RTH 381-80

Project Name: NORTH ANNA COL
Project Number: 6468-06-1472
Date: 9/6/2006
Boring No: B-901
Test Interval: 147.0 ft to 157 ft (from Datum)
Stick up length: 2 ft
Test Interval: 145.0 ft to 155.0 ft (from surface)
Test Type: Double Packer Technique

Prepared by: ZO Date: 12-7-06
Checked by: [signature] Date: 1-17-07

Note: This is a retest using higher capacity pump

Depth of Water Table= 23.30 ft (from top of casing)
h1= 24.30 (from top of casing)
h2 = 128.7 ft (from top of casing)
ρ_w = 62.4 lb/ft^3

Abreviations:
N.O. Not Observed
N.A. Not Aplicable

P_0 Max= 97.66 psi Value on field data sheet= 97.65

Target excess pressures were 1/3Pmax, 2/3Pmax, Pmax, 1/2 Pmax and Pmax. **Actual** excess pressures given below.

TEST #1

Actual Excess Pressure= 32.22 psi
Initial Middle Transducer Reading= 55 psi
Test Pressure= 87.28 psi

Time (min)	Flow Meter Reading (Gal)	Q (GPM)	Surface Gauge (psi)
0	2871		0.1
0.5	2871.5	1.0	2
1	2873.1	3.2	28.3
1.5	2873.3	0.4	31.6
2	2873.3	0.0	30.8
2.5	2873.3	0.0	30.3
3	2873.3	0.0	29.8
3.5	2873.3	0.0	29.1
4	2873.3	0.0	30.6
4.5	2873.3	0.0	30.1
5	2873.3	0.0	29.6

Average Q: 0.0 gpm
Excess Pore pressure: 32.22 psi

TEST #2

Actual Excess Pressure= 64.44 psi
Initial Middle Transducer Reading= 55 psi
Test Pressure= 119.5 psi

Time (min)	Flow Meter Reading (Gal)	Q (GPM)	Surface Gauge (psi)
0	2875		1.8
0.5	2876.7	3.4	44.3
1	2876.8	0.2	52.11
1.5	2877.1	0.6	58.8
2	2878.2	2.2	60.2
2.5	2879.4	2.4	59.4
3	2880.4	2.0	59.6
3.5	2881.6	2.4	59.9
4	2882.7	2.2	58.7
4.5	2883.7	2.0	58.2
5	2884.7	2.0	58.9

Average Q: 2.2 gpm
Excess Pore pressure: 64.44 psi

TEST #3

Actual Excess Pressure= 97.65 psi
Initial Middle Transducer Reading= 55 psi
Test Pressure= 152.7 psi

Time (min)	Flow Meter Reading (Gal)	Q (GPM)	Surface Gauge (psi)
	Pressure pushes packers out of place-Test is not performed		

Average Q: gpm
Excess Pore pressure: 97.65 psi

JDJ 1-17-07

TEST #4

Actual Excess Pressure= 48.82 psi
Initial Middle Transducer 55 psi
Test Pressure= 103.90 psi

Time (min)	Flow Meter Reading (Gal)	Q (GPM)	Surface Gauge (psi)
0	2887		2.8
0.5	2887.8	1.6	48.7
1	2887.8	0.0	46.1
1.5	2887.8	0.0	44.1
2	2887.8	0.0	42.6
2.5	2887.8	0.0	41.3
3	2887.8	0.0	44.6
3.5	2887.8	0.0	43.1
4	2887.8	0.0	41.8
4.5	2887.8	0.0	40.4
5	2887.8	0.0	39.5

Average Q: 0.2 gpm
Excess Pore pressure: 48.82 psi

TEST #5

Actual Excess Pressure= 97.65 psi
Initial Middle Transducer 55 psi
Test Pressure= 152.7 psi

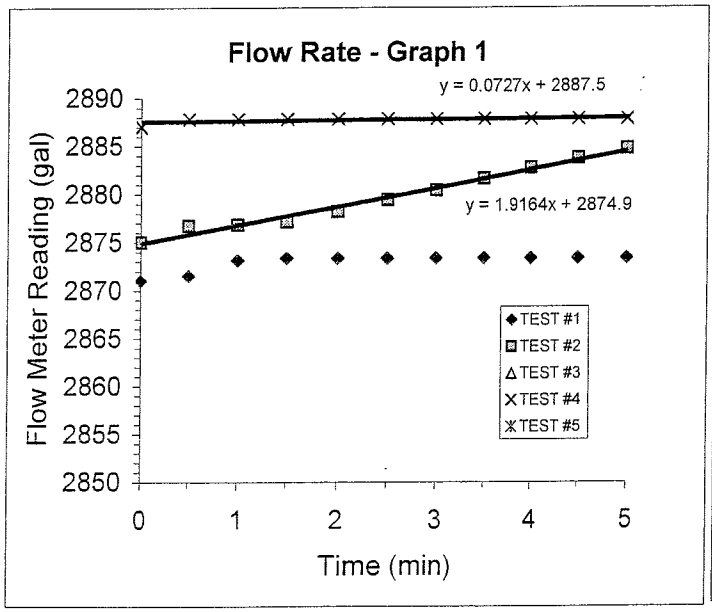
Time (min)	Flow Meter Reading (Gal)	Q (GPM)	Surface Gauge (psi)
	Pressure pushes packers out of place-Test is not performed		

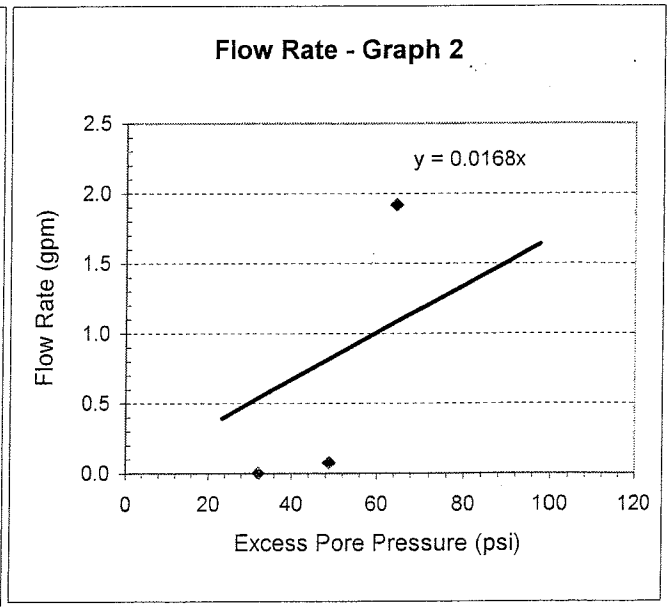
Average Q: gpm
Excess Pore pressure: 97.65 psi

Boring No: B-901
Test Interva 145 ft to 155 ft
(from surface)

Density of water, ρ_w=62.4 lb/ft^3
= 0.0361 lb/in
Length= 10 ft
Borehole radius= 2.00 in
R ranges from 5-10 ft:
choose R= 5 ft

	Excess Pressure (psi)	Q (gpm)	Test Pres. (ft)	k_e (fpy)
1	32.22	0.00	74.35	0.00
2	64.44	1.92	148.71	49.02
3	97.65		225.35	
4	48.82	0.07	112.66	2.45
5	97.65		225.3	





obtain Q from graph 2 in gpm/psi --> 0.0000 gal/psi

$k_e = Q^* \ln(R/r_0)/(2\pi L H_0)$ k_e= 0.00E+00 cm/sec
= 0.00 ft/year

Pressure Decay Test

Prepared by: ZQ Date: 12-7-06
Checked by: [illegible] Date: 1-17-07
N.O. Not Observed
N.A. Not Aplicable

Project Name: NORTH ANNA COL
Project Number: 6468-06-1472
Date: 9/6/2006
Boring No: B-901
Test Interval: 145 ft to 155 ft (from surface)

Test #1

Time (min)	Surface Gauge (psi)	Center Tranducer (psi)
0.0	29.6	87.13
0.5	28.9	86.35
1.0	28.7	86.04
1.5	28.3	85.59
2.0	27.9	85.13
2.5	22.6	84.76
3.0	27.2	84.31
3.5	26.8	83.91
4.0	26.6	83.54
4.5	26.3	83.17
5.0	26	82.83
6.0	25.4	82.11
7.0	24.9	81.5
8.0	24.4	80.97
9.0	24.1	80.48
10.0	23.7	79.98
11.0	23.3	79.5
12.0	23	79.07
13.0	22.6	78.64
14.0	22.3	78.23
15.0	22	77.84
20.0	20.7	76.15

Test #2

Time (min)	Surface Gauge (psi)	Center Tranducer (psi)
0.0	58.9	120.19
0.5	47	108.75
1.0	46.4	107.8
1.5	46	107.16
2.0	45.5	106.54
2.5	44.8	105.69
3.0	43.8	104.64
3.5	42.6	103.55
4.0	41.6	102.17
4.5	40.6	101.28
5.0	39.7	100.4
6.0	38.5	98.94
7.0	37.3	97.63
8.0	36.4	96.52
9.0	35.4	95.44
10.0	34.3	94.3
11.0	33.8	93.71
12.0	33.1	92.88
13.0	32.4	92.15
14.0	31.9	91.49
15.0	31.3	90.77
20.0	28.9	88.07

Test #3

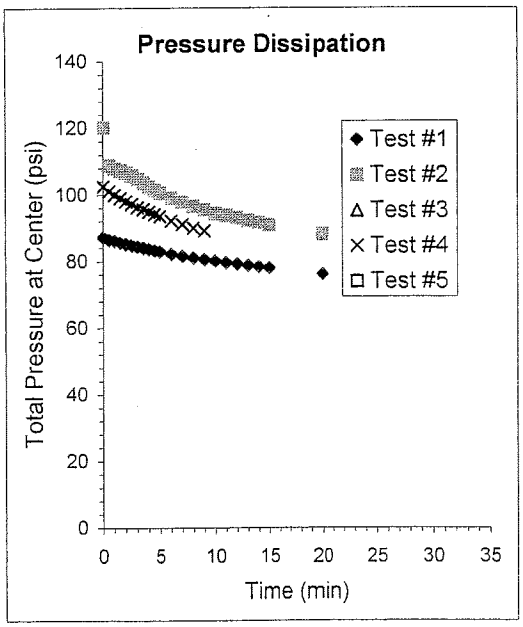
Time (min)	Surface Gauge (psi)	Center Tranducer (psi)
No data Test not conducted		

Test #4

Time (min)	Surface Gauge (psi)	Center Tranducer (psi)
0.0	39.5	102.33
0.5	38.3	100.9
1.0	37.4	99.9
1.5	36.4	98.89
2.0	35.5	97.93
2.5	34.7	97.17
3.0	34	96.12
3.5	33.1	95.49
4.0	32.4	94.79
4.5	31.8	93.95
5.0	31.1	93.38
6.0	30.1	92.01
7.0	29.1	90.97
8.0	28.1	89.93
9.0	27.2	89.02
10.0	26.4	88.15
11.0	25.8	87.35
12.0	25.1	86.54
13.0	24.3	85.81
14.0	23.8	85.15
15.0	23.2	84.53
20.0	20.7	81.21

Test #5

Time (min)	Surface Gauge (psi)	Center Tranducer (psi)
No data Test not conducted		



PACKER TESTING CALCULATIONS FOR P(MAX)

Date: 8.30-06

Boring No. 6468-06-1472

Test Interval: 79.0 to 89.0 feet from Datum

Casing Stickup 2.0 feet

PoMAX = (h_1 x 1) + (h_2 x 0.57). h_1 and h_2 are in feet, see sketch. PoMAX is in psi

h_1 = Distance from the datum to the water level
h_2 = Distance from the water level to the center of the test interval

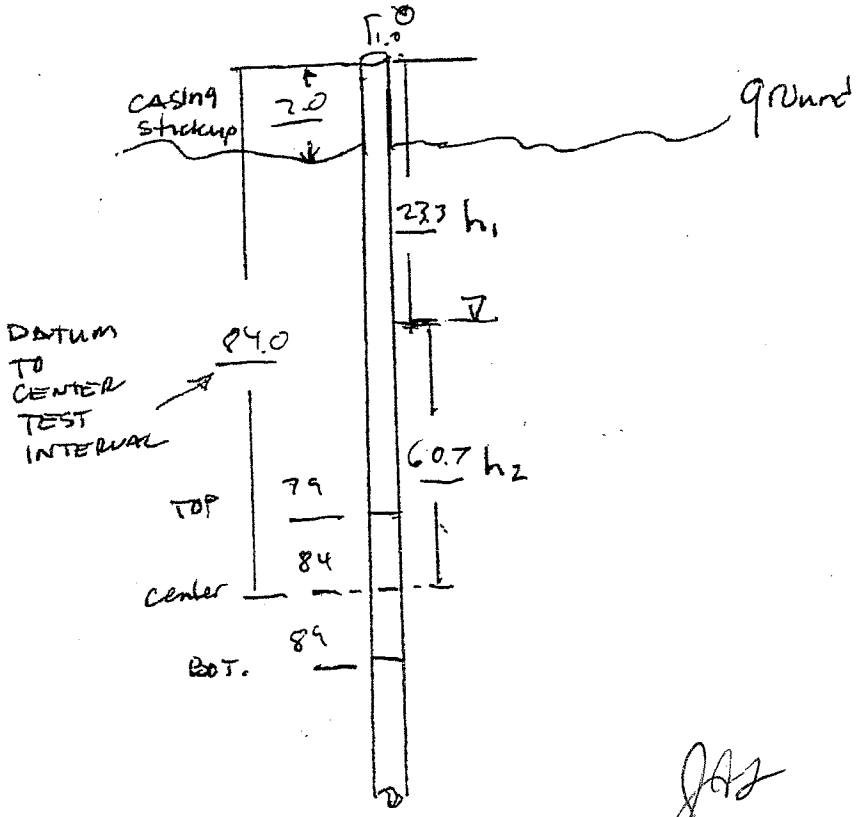
---

h_1 = 24.3

h_2 = 84.0 - 23.3 = 60.7

P MAX = 24.3 + 34.59 = 58.89

SKETCH



JAJ 12-6-06

12-6-06

DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET

MACTEC ENGINEERING AND CONSULTING, INC.

PROJECT: NORTH ANNA COL PROJECT NO.: 6468-06-1472

DATA COLLECTED BY: JHoward DATE COLLECTED: 8-30-06

BORING NO. BA01 BOREHOLE DIAMETER: 4 IN.

SURFACE CASING HEIGHT ABOVE GROUND: 2.0 FT.

CHECK DATUM USED: TOP OF CASING X GROUND SURFACE ____

DATUM ELEVATION NA

DISTANCE BOTTOM OF TOP PACKER TO TOP OF BOTTOM PACKER 10.0 FT.

TEST INTERVAL DEPTH (FROM DATUM): FROM 79.0 FT. TO 89.0 FT.

TOTAL BORING DEPTH FROM DATUM: 302.0 FT.

(A) DEPTH TO WATER TABLE FROM DATUM: 23.3 FT.

(B) SURFACE GAUGE HEIGHT ABOVE DATUM: 1.0 FT.

(C) DISTANCE WATER TABLE TO CENTER OF TEST INTERVAL: 60.7 FT.

1/3 MAXIMUM TEST PRESSURE, Po 58.89 (Po = [(A+B) *1] + C*.57 psi)

19.43 TEST NUMBER: 1 TEST PRESSURE 46.5 psi PACKER PRESSURE: ~~100~~ 125 psi 5th 8/31

Initial Transducer Readings: Top .46, Middle 27.08, Bottom 32.05

Transducer Readings after initial pressurization:
Top 1.05, Middle 30.84, Bottom 31.89

Transducer Readings after final flow measurement:
Top .40, Middle 38.17, Bottom 31.12

TIME (MIN)	FLOW METER READING, (GAL)	Q (GPM)	SURFACE GAUGE, PSI	REMARKS
0.0	2868.5	/	2.3	
0.5	2869.2	1.4	46.4	
1.0	2869.2	Ø	3.4	Release Pressure
1.5	2869.4	0.4	23.2	
2.0	2869.4	Ø	5.0	Release Pressure
2.5	2869.4	Ø	11.1	
3.0	2869.4	Ø	11.9	
3.5	2869.4	Ø	11.8	
4.0	2869.4	Ø	11.7	
4.5	2869.4	Ø	11.7	
5.0	2899.4	Ø	11.6	

Using 30 gpm/120 psi pump

DOUBLE PACKER TEST DATA SHEET, MACTEC PROJECT NO. 6468-06-1472 **PAGE 1 of 2**

BORING NO.: B901
DATE: 8-30-06
TEST NUMBER: 1
TEST INTERVAL (FROM DATUM): FROM 79 **FT. TO** 89 **FT.**
DATA COLLECTED BY: JMD

JMD 12-6-06

Page 2 Not used

SHUT-IN TEST

PRESSURE: _____ **psi**

TIME, MIN	SURFACE GAUGE PRESSURE, PSI	MIDDLE TRANSDUCER PRESSURE, PSI
0.0	11.6	46.49
0.5	11.2	46.22
1.0	11.0	45.89
1.5	10.7	45.60
2.0	10.4	45.31
2.5	10.2	45.04
3.0	9.9	44.76
3.5	9.6	44.48
4.0	9.3	44.21
4.5	9.1	43.96
5.0	8.9	43.70
6.0	8.4	43.20
7.0	7.8	42.53
8.0	7.3	42.04
9.0	6.9	41.58
10.0	6.4	41.02
11.0	6.0	40.64
12.0	5.8	40.38
13.0	5.5	40.13
14.0	5.3	39.88
15.0	5.0	39.61
20.0	4.1	38.35

EQUIPMENT USED
Transducers: Mini Troll Serial Numbers: 10417 (Top), 10191 (Middle), ~~10036~~ (Bottom) 017423
Surface Pressure Gauge: Omega DPG serial number 2634708001 548-30
Flow Meter Omega FTB-4110 serial number 32019518
Stop Watch: serial number SW1

Above calibrated 5-5-06 or 5-18-06

Tests: B901-M1 79-89
" -B1 79-"
" -T1 79-"

DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET

JoJ 12-6-06

MACTEC ENGINEERING AND CONSULTING, INC.

PROJECT: NORTH ANNA COL PROJECT NO.: 6468-06-1472

DATA COLLECTED BY: J Howard DATE COLLECTED: 8-30-06

BORING NO. B901 BOREHOLE DIAMETER: 4 IN.

SURFACE CASING HEIGHT ABOVE GROUND: 2.0 FT.

CHECK DATUM USED: TOP OF CASING X GROUND SURFACE ____

DATUM ELEVATION NA

DISTANCE BOTTOM OF TOP PACKER TO TOP OF BOTTOM PACKER 10.0 FT.

TEST INTERVAL DEPTH (FROM DATUM): FROM 79.0 FT. TO 89.0 FT.

TOTAL BORING DEPTH FROM DATUM: 302.0 FT.

(A) DEPTH TO WATER TABLE FROM DATUM: 23.3 FT.

(B) SURFACE GAUGE HEIGHT ABOVE DATUM: 1.0 FT.

(C) DISTANCE WATER TABLE TO CENTER OF TEST INTERVAL: 60.7 FT.

MAXIMUM TEST PRESSURE, Po 58.89 (Po = [(A+B) *1] + C*.57 psi)

2/3 TEST NUMBER: 2 TEST PRESSURE 65.94 psi PACKER PRESSURE: 100 psi

38.86 Initial Transducer Readings: Top .46, Middle 27.08, Bottom 32.05

Transducer Readings after initial pressurization:
Top .40, Middle 38.17, Bottom 31.~~89~~ 5+8-31 12

Transducer Readings after final flow measurement:
Top *, Middle 37.12, Bottom 30.75

TIME (MIN)	FLOW METER READING, (GAL)	Q (GPM)	SURFACE GAUGE, PSI	REMARKS
0.0	2869.4	/	3.2	
0.5	2869.5	0.2	28.8	
1.0	2869.5	~~0.2~~ 30 31	32.0	
1.5	2869.5	Ø	30.4	
2.0	2869.5	Ø	30.4	
2.5	2869.5	Ø	30.5	
3.0	2869.5	Ø	31.2	
3.5	2869.5	Ø	29.2	
4.0	2869.5	Ø	31.4	
4.5	2869.5	Ø	30.3	
5.0	2869.5	Ø	30.9	

* Batteries died in top transducer

using 30 gpm/120 psi pump

DOUBLE PACKER TEST DATA SHEET, MACTEC PROJECT NO. 6468-06-1472 PAGE ~~3~~ 2

BORING NO.: B901

DATE: 8-30-06

TEST NUMBER: 2

TEST INTERVAL (FROM DATUM): FROM 79 FT. TO 89 FT.

DATA COLLECTED BY: J Howard

JHJ 12-4-06 Page 2 not used

SHUT-IN TEST

PRESSURE: _____ psi

TIME, MIN	SURFACE GAUGE PRESSURE, PSI	MIDDLE TRANSDUCER PRESSURE, PSI
0.0	30.9	66.05
0.5	26.7	61.88
1.0	23.9	58.96
1.5	21.6	56.61
2.0	19.6	54.67
2.5	18.0	53.37
3.0	16.8	52.09
3.5	15.7	50.88
4.0	14.6	49.79
4.5	13.7	48.87
5.0	13.1	48.05
6.0	11.7	46.47
7.0	10.5	45.43
8.0	9.6	44.47
9.0	8.8	43.60
10.0	8.1	42.81
11.0	7.4	42.18
12.0	6.8	41.57
13.0	6.4	41.00
14.0	5.9	40.52
15.0	5.5	40.09
	3.9	38.31

EQUIPMENT USED

Transducers: Mini Troll Serial Numbers: 10417 (Top), 10191 (Middle), ~~10036 (~~Bottom) 017423

Surface Pressure Gauge: Omega DPG serial number 2634708001 SH 8-31

Flow Meter Omega FTB-4110 serial number 32019518

Stop Watch: serial number SW1

Above calibrated 5-5-06 or 5-18-06

Tests: B901-M279-89

" -B279- "

" -T279- "

DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET

12-6-06

MACTEC ENGINEERING AND CONSULTING, INC.

PROJECT: NORTH ANNA COL PROJECT NO.: 6468-06-1472

DATA COLLECTED BY: Howard DATE COLLECTED: 8-30-06

BORING NO. B401 BOREHOLE DIAMETER: 4 IN.

SURFACE CASING HEIGHT ABOVE GROUND: 2.0 FT.

CHECK DATUM USED: TOP OF CASING X GROUND SURFACE ____

DATUM ELEVATION NA

DISTANCE BOTTOM OF TOP PACKER TO TOP OF BOTTOM PACKER 10.0 FT.

TEST INTERVAL DEPTH (FROM DATUM): FROM 79.0 FT. TO 89.0 FT.

TOTAL BORING DEPTH FROM DATUM: 302.0 FT.

(A) DEPTH TO WATER TABLE FROM DATUM: 23.3 FT.

(B) SURFACE GAUGE HEIGHT ABOVE DATUM: 1.0 FT.

(C) DISTANCE WATER TABLE TO CENTER OF TEST INTERVAL: 60.7 FT.

MAXIMUM TEST PRESSURE, Po 58.89 (Po = [(A+B) *1] + C*.57 psi)

TEST NUMBER: 3 TEST PRESSURE 85.97 psi PACKER PRESSURE: 100 psi

Initial Transducer Readings: Top .46, Middle 27.08, Bottom 32.05

Transducer Readings after initial pressurization: Top .14, Middle 32.21, Bottom 30.51

Transducer Readings after final flow measurement: Top .13, Middle 39.83, Bottom 30.44

TIME (MIN)	FLOW METER READING, (GAL)	Q (GPM)	SURFACE GAUGE, PSI	REMARKS
0.0	2869.5	~	-1.5	
0.5	2869.8	0.6	44.8	
1.0	2869.8	Ø	45.3	
1.5	2869.8	Ø	51.6	
2.0	2869.8	Ø	51.7	
2.5	2869.8	Ø	51.4	
3.0	2869.8	Ø	51.1	
3.5	2869.8	Ø	51.5	
4.0	2869.8	Ø	52.1	
4.5	2869.8	Ø	51.2	
5.0	2869.8	Ø	52.0	

DOUBLE PACKER TEST DATA SHEET, MACTEC PROJECT NO. 6468-06-1472 PAGE 3/2

BORING NO.: B901

DATE: 8-30-06

TEST NUMBER: 3

TEST INTERVAL (FROM DATUM): FROM 79 FT. TO 89 FT.

DATA COLLECTED BY: J Howard

JJ 12-6-06 Page 2 not used

SHUT-IN TEST

PRESSURE: _____ psi

TIME, MIN	SURFACE GAUGE PRESSURE, PSI	MIDDLE TRANSDUCER PRESSURE, PSI
0.0	52.0	87.64
0.5	47.8	77.79
1.0	36.0	71.10
1.5	30.3	65.40
2.0	26.2	61.97
2.5	23.7	59.32
3.0	21.3	56.98
3.5	19.2	54.91
4.0	18.0	53.10
4.5	16.5	51.75
5.0	15.2	50.39
6.0	13.4	48.43
7.0	11.9	46.85
8.0	10.5	45.46
9.0	9.5	44.35
10.0	8.6	43.36
11.0	7.8	42.58
12.0	7.1	41.83
13.0	6.5	41.21
14.0	6.1	40.61
15.0	5.5	40.07

EQUIPMENT USED

Transducers: Mini Troll Serial Numbers: ~~10417~~ 10036 JH 8-31 (Top), 10191 (Middle), ~~10036~~ 017423 (Bottom) JH 8-31

Surface Pressure Gauge: Omega DPG serial number 2634708001

Flow Meter Omega FTB-4110 serial number 32019518

Stop Watch: serial number SW1

Above calibrated 5-5-06 or 5-18-06

Tests: B901-M 379 - 89

" - B 379 - "

" - T 379 - "

DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET

JAJ 12.4.06

MACTEC ENGINEERING AND CONSULTING, INC.

PROJECT: NORTH ANNA COL PROJECT NO.: 6468-06-1472

DATA COLLECTED BY: JHoward DATE COLLECTED: 8-30-06

BORING NO. BA01 BOREHOLE DIAMETER: 4 IN.

SURFACE CASING HEIGHT ABOVE GROUND: 2.0 FT.

CHECK DATUM USED: TOP OF CASING X GROUND SURFACE ____

DATUM ELEVATION NA

DISTANCE BOTTOM OF TOP PACKER TO TOP OF BOTTOM PACKER 10.0 FT.

TEST INTERVAL DEPTH (FROM DATUM): FROM 79.0 FT. TO 89.0 FT.

TOTAL BORING DEPTH FROM DATUM: 302.0 FT.

(A) DEPTH TO WATER TABLE FROM DATUM: 23.3 FT.

(B) SURFACE GAUGE HEIGHT ABOVE DATUM: 1.0 FT.

(C) DISTANCE WATER TABLE TO CENTER OF TEST INTERVAL: 60.7 FT.

MAXIMUM TEST PRESSURE, Po 58.89 (Po = [(A+B) *1] + C*.57 psi)

1/2 TEST NUMBER: 4 TEST PRESSURE 56.52 psi PACKER PRESSURE: 100 psi

Initial Transducer Readings: Top .46, Middle 27.08, Bottom 32.05

29.44 Transducer Readings after initial pressurization:

Top ____, Middle ____, Bottom ____

Transducer Readings after final flow measurement:

Top ____, Middle ____, Bottom ____

TIME (MIN)	FLOW METER READING, (GAL)	Q (GPM)	SURFACE GAUGE, PSI	REMARKS
0.0				
0.5				
1.0				
1.5				
2.0				
2.5				
3.0				
3.5				
4.0				
4.5				
5.0				

Hole not taking water, testing abandoned per AI Fick's instructions

DOUBLE PACKER TEST DATA SHEET, MACTEC PROJECT NO. 6468-06-1472 PAGE 3 of 2

BORING NO.: B901

DATE: 8-30-06

TEST NUMBER: 4

TEST INTERVAL (FROM DATUM): FROM 79 FT. TO 89 FT.

DATA COLLECTED BY: JHoward

JAZ 12-6-06
Page 2 notated

SHUT-IN TEST

PRESSURE:_____ psi

TIME, MIN	SURFACE GAUGE PRESSURE, PSI	MIDDLE TRANSDUCER PRESSURE, PSI
0.0		
0.5		
1.0		
1.5		
2.0		
2.5		
3.0		
3.5		
4.0		
4.5		
5.0		

EQUIPMENT USED 017423

Transducers: Mini Troll Serial Numbers: 10417 (Top), 10191 (Middle), ~~10036~~ (Bottom)

Surface Pressure Gauge: Omega DPG serial number 2634708001 5148-31

Flow Meter Omega FTB-4110 serial number 32019518

Stop Watch: serial number SW1

Above calibrated 5-5-06 or 5-18-06

Tests: B901-M 4 79 - 89

11 - B 4 79 - 11

11 - T 4 79 - 11

DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET

12-6-06

MACTEC ENGINEERING AND CONSULTING, INC.

PROJECT: NORTH ANNA COL PROJECT NO.: 6468-06-1472

DATA COLLECTED BY: JHoward DATE COLLECTED: 8-30-06

BORING NO. BA01 BOREHOLE DIAMETER: 4 IN.

SURFACE CASING HEIGHT ABOVE GROUND: 2.0 FT.

CHECK DATUM USED: TOP OF CASING X GROUND SURFACE ____

DATUM ELEVATION NA

DISTANCE BOTTOM OF TOP PACKER TO TOP OF BOTTOM PACKER 10.0 FT.

TEST INTERVAL DEPTH (FROM DATUM): FROM 79.0 FT. TO 89.0 FT.

TOTAL BORING DEPTH FROM DATUM: 302.0 FT.

(A) DEPTH TO WATER TABLE FROM DATUM: 23.3 FT.

(B) SURFACE GAUGE HEIGHT ABOVE DATUM: 1.0 FT.

(C) DISTANCE WATER TABLE TO CENTER OF TEST INTERVAL: 60.7 FT.

MAXIMUM TEST PRESSURE, Po 58.89 (Po = [(A+B) *1] + C*.57 psi)

TEST NUMBER: 5 TEST PRESSURE 85.07 psi PACKER PRESSURE: 100 psi

Initial Transducer Readings: Top .46, Middle 27.08, Bottom 32.05

Transducer Readings after initial pressurization:

Top ____, Middle ____, Bottom ____

Transducer Readings after final flow measurement:

Top ____, Middle ____, Bottom ____

TIME (MIN)	FLOW METER READING, (GAL)	Q (GPM)	SURFACE GAUGE, PSI	REMARKS
0.0				
0.5				
1.0				
1.5				
2.0				
2.5				
3.0				
3.5				
4.0				
4.5				
5.0				

Hole not taking water, testing abandoned per AlTires instructions

PACKER TESTING CALCULATIONS FOR P(MAX)

Date: 9-30-06

Boring No. B901

Test Interval: 94.0 to 104.0 feet from Datum

Casing Stickup 2.0 feet

PoMAX = $(h_1 \times 1) + (h_2 \times 0.57)$. h_1 and h_2 are in feet, see sketch. PoMAX is in psi

h_1 = Distance from the ~~datum~~ Gauge 5-18-30 to the water level

h_2 = Distance from the water level to the center of the test interval

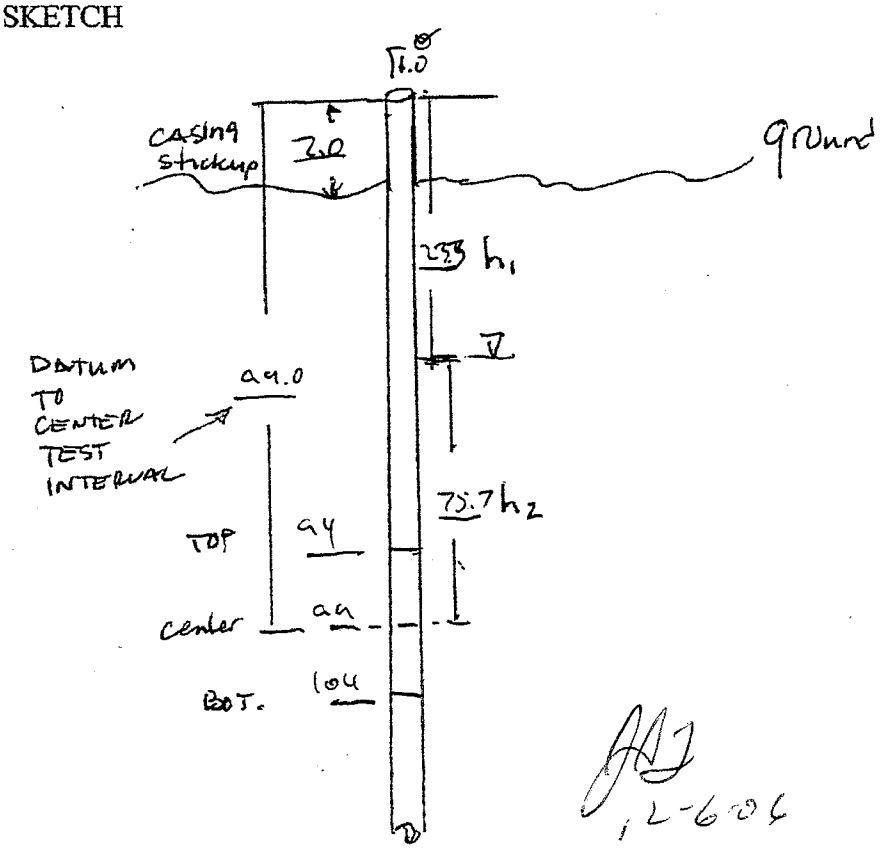
---

h_1 = 24.3

h_2 = 94.0 - 23.3 = 75.7

P MAX = 24.3 + 43.14 = 67.44

SKETCH



12-6-06

DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET

JAB 12-6-06

MACTEC ENGINEERING AND CONSULTING, INC.

PROJECT: NORTH ANNA COL PROJECT NO.: 6468-06-1472

DATA COLLECTED BY: J Howard DATE COLLECTED: 8-30-06

BORING NO. B901 BOREHOLE DIAMETER: 4 IN.

SURFACE CASING HEIGHT ABOVE GROUND: 2.0 FT.

CHECK DATUM USED: TOP OF CASING X GROUND SURFACE ____

DATUM ELEVATION NA

DISTANCE BOTTOM OF TOP PACKER TO TOP OF BOTTOM PACKER 10.0 FT.

TEST INTERVAL DEPTH (FROM DATUM): FROM 94.0 FT. TO 104.0 FT.

TOTAL BORING DEPTH FROM DATUM: 302.0 FT.

(A) DEPTH TO WATER TABLE FROM DATUM: 23.3 FT.

(B) SURFACE GAUGE HEIGHT ABOVE DATUM: 1.0 FT.

(C) DISTANCE WATER TABLE TO CENTER OF TEST INTERVAL: 75.7 FT.

1/3 MAXIMUM TEST PRESSURE, Po 67.44 (Po = [(A+B) *1] + C*.57 psi)

TEST NUMBER: 1 TEST PRESSURE 53.54 psi PACKER PRESSURE: 120 psi

22.25

Initial Transducer Readings: Top .17, Middle 31.29, Bottom 36.31

Transducer Readings after initial pressurization:
Top .16, Middle 32.25, Bottom 36.75

Transducer Readings after final flow measurement:
Top .15, Middle 32.63, Bottom 37.05

TIME (MIN)	FLOW METER READING, (GAL)	Q (GPM)	SURFACE GAUGE, PSI	REMARKS
0.0	27999	—	0.0	
0.5	2801.6	3.~~2~~4 JH 8-31	17.3	
1.0	2801.6	Ø	18.2	
1.5	2801.8	.4	20.1	
2.0	2801.8	Ø	18.4	
2.5	2801.8	Ø	20.0	
3.0	2801.8	Ø	20.0	
3.5	2801.8	Ø	18.1	
4.0	2801.9	.2	21.0	
4.5	2801.9	Ø	19.2	
5.0	2801.9	Ø	19.7	

DOUBLE PACKER TEST DATA SHEET, MACTEC PROJECT NO. 6468-06-1472 **PAGE 3**

BORING NO.: B901
DATE: 8-30-06
TEST NUMBER: 1
TEST INTERVAL (FROM DATUM): FROM 94 **FT. TO** 104 **FT.**
DATA COLLECTED BY: JMcLeod

12/6/06
Page 2 not used

SHUT-IN TEST

PRESSURE:_____ **psi**

TIME, MIN	SURFACE GAUGE PRESSURE, PSI	MIDDLE TRANSDUCER PRESSURE, PSI
0.0	19.7	53.73
0.5	18.1	51.77
1.0	16.5	49.85
1.5	15.3	48.33
2.0	14.1	46.97
2.5	13.4	45.72
3.0	12.5	44.73
3.5	11.9	43.94
4.0	11.3	43.03
4.5	10.7	42.25
5.0	10.2	41.37
6.0	9.4	40.20
7.0	8.6	39.06
8.0	8.0	38.07
9.0	7.4	37.29
10.0	7.0	36.55
11.0	6.6	35.94
12.0	6.3	35.39
13.0	6.0	34.89
14.0	5.7	34.41
15.0	5.5	34.08
20.0	4.7	32.72

EQUIPMENT USED
Transducers: Mini Troll Serial Numbers: 10417 (Top), 10191 (Middle), ~~10036~~ (Bottom)
S/N 8-21 017423
Surface Pressure Gauge: Omega DPG serial number 2634708001
Flow Meter Omega FTB-4110 serial number 32019518
Stop Watch: serial number SW1

Above calibrated 5-5-06 or 5-18-06

Tests: B901-M 94 - 104
" - B 94 - "
" - T 94 - "

DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET

12-6-06

MACTEC ENGINEERING AND CONSULTING, INC.

PROJECT: NORTH ANNA COL PROJECT NO.: 6468-06-1472

DATA COLLECTED BY: JHoward DATE COLLECTED: 8-30-06

BORING NO. B401 BOREHOLE DIAMETER: 4 IN.

SURFACE CASING HEIGHT ABOVE GROUND: 2.0 FT.

CHECK DATUM USED: TOP OF CASING X GROUND SURFACE ____

DATUM ELEVATION NA

DISTANCE BOTTOM OF TOP PACKER TO TOP OF BOTTOM PACKER 10.0 FT.

TEST INTERVAL DEPTH (FROM DATUM): FROM 94.0 FT. TO 104.0 FT.

TOTAL BORING DEPTH FROM DATUM: 302.0 FT.

(A) DEPTH TO WATER TABLE FROM DATUM: 23.3 FT.

(B) SURFACE GAUGE HEIGHT ABOVE DATUM: 1.0 FT.

(C) DISTANCE WATER TABLE TO CENTER OF TEST INTERVAL: 75.7 FT.

2/3 MAXIMUM TEST PRESSURE, Po 67.44 (Po = [(A+B) *1] + C*.57 psi)

TEST NUMBER: 2 TEST PRESSURE 75.8 psi PACKER PRESSURE: 120 psi

44.51 Initial Transducer Readings: Top .17, Middle 31.29, Bottom 36.31

Transducer Readings after initial pressurization: Top .15, Middle 32.63, Bottom 37.05

Transducer Readings after final flow measurement: Top .17, Middle 32.23, Bottom 37.20

TIME (MIN)	FLOW METER READING, (GAL)	Q (GPM)	SURFACE GAUGE, PSI	REMARKS
0.0	2801.9	/	4.1	
0.5	2803.1	4.4	15.1	
1.0	2803.5	0.4	25.9	
1.5	2803.9	1.2	38.1	
2.0	2804.2	0.6	39.0	
2.5	2804.4	.4	38.1	
3.0	2804.4	0	39.2	
3.5	2804.6	.4	38.6	
4.0	2804.7	.2	39.0	
4.5	2804.8	.2	39.4	
5.0	2805.0	.4	39.1	

DOUBLE PACKER TEST DATA SHEET, MACTEC PROJECT NO. 6468-06-1472 PAGE 3 2

BORING NO.: B901

DATE: 8-30-06

TEST NUMBER: 2

TEST INTERVAL (FROM DATUM): FROM 94 FT. TO 104 FT.

DATA COLLECTED BY: Sound

JCJ 12-6-06 Page 2 not a seal

SHUT-IN TEST

PRESSURE:_____ psi

TIME, MIN	SURFACE GAUGE PRESSURE, PSI	MIDDLE TRANSDUCER PRESSURE, PSI
0.0	39.1	75.49
0.5	~~38.4~~ 71.11	67.40
1.0	~~8-51~~ 27.5	63.58
1.5	24.1	58.96
2.0	21.4	55.78
2.5	19.4	~~53~~ 53.36
3.0	17.7	51.20
3.5	16.2	49.32
4.0	15.0	4782
4.5	14.0	46.30
5.0	13.0	44.88
6.0	11.5	42.85
7.0	10.2	41.02
8.0	9.2	39.47
9.0	8.4	38.21
10.0	7.7	37.99
11.0	7.2	36.45
12.0	6.7	35.68
13.0	6.4	35.02
14.0	6.0	34.50
15.0	5.7	~~35~~ 34.98
20.0	4.8	32.47

EQUIPMENT USED

Transducers: Mini Troll Serial Numbers: 10417 (Top), 10191 (Middle), ~~10036~~ 017427 (Bottom) SN 8-4

Surface Pressure Gauge: Omega DPG serial number 2634708001

Flow Meter Omega FTB-4110 serial number 32019518

Stop Watch: serial number SW1

Above calibrated 5-5-06 or 5-18-06

Tests: B901-M294-104

11-B294-11

11-T294-11

DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET

12-6-06

MACTEC ENGINEERING AND CONSULTING, INC.

PROJECT: NORTH ANNA COL PROJECT NO.: 6468-06-1472

DATA COLLECTED BY: Howard DATE COLLECTED: 8-30-06

BORING NO. BA01 BOREHOLE DIAMETER: 4 IN.

SURFACE CASING HEIGHT ABOVE GROUND: 2.0 FT.

CHECK DATUM USED: TOP OF CASING X GROUND SURFACE ____

DATUM ELEVATION NA

DISTANCE BOTTOM OF TOP PACKER TO TOP OF BOTTOM PACKER 10.0 FT.

TEST INTERVAL DEPTH (FROM DATUM): FROM 94.0 FT. TO 104.0 FT.

TOTAL BORING DEPTH FROM DATUM: 302.0 FT.

(A) DEPTH TO WATER TABLE FROM DATUM: 23.3 FT.

(B) SURFACE GAUGE HEIGHT ABOVE DATUM: 1.5 FT.

(C) DISTANCE WATER TABLE TO CENTER OF TEST INTERVAL: 75.7 FT.

MAXIMUM TEST PRESSURE, Po 67.444 (Po = [(A+B) *1] + C*.57 psi)

TEST NUMBER: 3 TEST PRESSURE 98.77 psi PACKER PRESSURE: 120 psi

Initial Transducer Readings: Top .17, Middle 31.29, Bottom 36.31

Transducer Readings after initial pressurization:
Top .17, Middle 32.23, Bottom 37.20

Transducer Readings after final flow measurement:
Top .19, Middle 31.72, Bottom 40.56

TIME (MIN)	FLOW METER READING, (GAL)	Q (GPM)	SURFACE GAUGE, PSI	REMARKS
0.0	28049	/	3.6	
0.5	2806.8	3.8	45.6	
1.0	2807.4	1.2	48.1	
1.5	2811.1	7.4	58.6	
2.0	2815.4	8.6	60.8	
2.5	2818.8	6.8	58.6	
3.0	2822.1	6.6	59.3	
3.5	2825.2	6.2	59.1	
4.0	2828.4	6.4	59.9	
4.5	2831.4	6.0	60.0	
5.0	2834.8	6.8	57.4	

Change to 30 GPM/120 psi pump

DOUBLE PACKER TEST DATA SHEET, MACTEC PROJECT NO. 6468-06-1472 PAGE ~~3~~ 2

BORING NO.: B901

DATE: 8-30-06

TEST NUMBER: 3

TEST INTERVAL (FROM DATUM): FROM 94 FT. TO 104 FT.

DATA COLLECTED BY: J Howard

JJ 12-6-06

SHUT-IN TEST

PRESSURE:_____ psi

TIME, MIN	SURFACE GAUGE PRESSURE, PSI	MIDDLE TRANSDUCER PRESSURE, PSI
0.0	57.4	99.70
0.5	32.7	73.43
1.0	23.6	64.15
1.5	16.1	58.55
2.0	11.5	52.93
2.5	7.6	49.03
3.0	4.1	45.96
3.5	1.4	43.16
4.0	-0.5	41.06
4.5	-2.2	39.41
5.0	-3.3	37.86
6.0	-5.5	35.74
7.0	-7.0	34.38
8.0	-7.8	33.49
9.0	-8.2	32.92
10.0	-8.5	32.56
11.0	-8.7	32.33
12.0	-8.7	32.13
13.0	-8.7	31.98
14.0	-8.8	31.86
15.0	-8.8	31.77

EQUIPMENT USED

Transducers: Mini Troll Serial Numbers: 10417 (Top), 10191 (Middle), ~~10036~~ 017423 (Bottom) JH 8-31

Surface Pressure Gauge: Omega DPG serial number 2634708001

Flow Meter Omega FTB-4110 serial number 32019518

Stop Watch: serial number SW1

Above calibrated 5-5-06 or 5-18-06

Tests: B901-M3 94 - 104
" - B3 94 - "
" - T3 94 - "

DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET

JGJ 12-6-06

MACTEC ENGINEERING AND CONSULTING, INC.

PROJECT: NORTH ANNA COL PROJECT NO.: 6468-06-1472

DATA COLLECTED BY: J Howard DATE COLLECTED: 8-30-06

BORING NO. B401 BOREHOLE DIAMETER: 4 IN.

SURFACE CASING HEIGHT ABOVE GROUND: 2.0 FT.

CHECK DATUM USED: TOP OF CASING X GROUND SURFACE ____

DATUM ELEVATION NA

DISTANCE BOTTOM OF TOP PACKER TO TOP OF BOTTOM PACKER 10.0 FT.

TEST INTERVAL DEPTH (FROM DATUM): FROM 94.0 FT. TO 104.0 FT.

TOTAL BORING DEPTH FROM DATUM: 302.0 FT.

(A) DEPTH TO WATER TABLE FROM DATUM: 23.3 FT.

(B) SURFACE GAUGE HEIGHT ABOVE DATUM: 1.0 FT.

(C) DISTANCE WATER TABLE TO CENTER OF TEST INTERVAL: 75.7 FT.

MAXIMUM TEST PRESSURE, Po 67.44 (Po = [(A+B) *1] + C*.57 psi)

½ TEST NUMBER: 5H 830 ~~8~~ 4 TEST PRESSURE 65.01 psi PACKER PRESSURE: 120 psi

33.72 Initial Transducer Readings: Top .17, Middle 31.24, Bottom 36.31

Transducer Readings after initial pressurization:
Top .19, Middle 32.23, Bottom 40.56

Transducer Readings after final flow measurement:
Top .19, Middle 31.40, Bottom 38.44

TIME (MIN)	FLOW METER READING, (GAL)	Q (GPM)	SURFACE GAUGE, PSI	REMARKS
0.0	2834.8	/	-8.6	
0.5	2835.3	1.0	14.9	
1.0	2835.8	1.0	24.2	
1.5	2836.0	0.4	24.1	
2.0	2836.1	0.2	23.6	
2.5	2836.2	0.2	23.4	
3.0	2836.3	0.2	23.4	
3.5	2836.4	0.2	23.7	
4.0	2836.5	0.2	23.8	
4.5	2836.6	0.2	23.8	
5.0	2836.7	0.2	23.5	

using 30 GPM/120 psi pump

DOUBLE PACKER TEST DATA SHEET, MACTEC PROJECT NO. 6468-06-1472 PAGE 8 2

BORING NO.: B901

DATE: 8-30-06

TEST NUMBER: 4

TEST INTERVAL (FROM DATUM): FROM 94 FT. TO 104 FT.

DATA COLLECTED BY: SHoward

JH 12-4-06

SHUT-IN TEST

PRESSURE:_____ psi

TIME, MIN	SURFACE GAUGE PRESSURE, PSI	MIDDLE TRANSDUCER PRESSURE, PSI
0.0	23.5	63.32
0.5	10.1	53.04
1.0	6.2	47.57
1.5	2.3	44.08
2.0	-0.2	41.01
2.5	-2.2	39.04
3.0	-3.8	37.34
3.5	-5.0	35.98
4.0	-5.9	34.89
4.5	-6.5	34.21
5.0	-7.1	33.57
6.0	-7.7	32.72
7.0	-8.0	32.27
8.0	-8.2	31.95
9.0	-8.4	31.75
10.0	-8.4	31.62

EQUIPMENT USED 017423

Transducers: Mini Troll Serial Numbers: 10417 (Top), 10191 (Middle), ~~10036~~ (Bottom)

Surface Pressure Gauge: Omega DPG serial number 2634708001 JH 8-31

Flow Meter Omega FTB-4110 serial number 32019518

Stop Watch: serial number SW1

Above calibrated 5-5-06 or 5-18-06

Tests: B901-M 94-104

11 - B 94 - 11

11 - T 94 - 11

DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET

JAJ 12-6-06

MACTEC ENGINEERING AND CONSULTING, INC.

PROJECT: NORTH ANNA COL PROJECT NO.: 6468-06-1472

DATA COLLECTED BY: Howard DATE COLLECTED: 8-30-06

BORING NO. B401 BOREHOLE DIAMETER: 4 IN.

SURFACE CASING HEIGHT ABOVE GROUND: 2.0 FT.

CHECK DATUM USED: TOP OF CASING X GROUND SURFACE ____

DATUM ELEVATION NA

DISTANCE BOTTOM OF TOP PACKER TO TOP OF BOTTOM PACKER 10.0 FT.

TEST INTERVAL DEPTH (FROM DATUM): FROM 94.0 FT. TO 104.0 FT.

TOTAL BORING DEPTH FROM DATUM: 307.0 FT.

(A) DEPTH TO WATER TABLE FROM DATUM: 23.3 FT.

(B) SURFACE GAUGE HEIGHT ABOVE DATUM: 1.0 FT.

(C) DISTANCE WATER TABLE TO CENTER OF TEST INTERVAL: 75.7 FT.

MAXIMUM TEST PRESSURE, Po 67.44 (Po = [(A+B) *1] + C*.57 psi)

TEST NUMBER: 5 TEST PRESSURE 98.73 psi PACKER PRESSURE: 120 psi

Initial Transducer Readings: Top .17, Middle 31.29, Bottom 36.31

Transducer Readings after initial pressurization: Top .19, Middle 31.40, Bottom 38.44

Transducer Readings after final flow measurement: Top .19, Middle 30.60, Bottom 41.37

TIME (MIN)	FLOW METER READING, (GAL)	Q (GPM)	SURFACE GAUGE, PSI	REMARKS
0.0	2836.7	/	-8.4	
0.5	2837.9	2.4	41.6	
1.0	2839.6	3.4	55.6	
1.5	2841.9	10.6	60.0	
2.0	2847.1	4.4	60.4	
2.5	2850.3	6.4	60.5	
3.0	2853.1	5.6	58.4	
3.5	2856.4	6.6	59.6	
4.0	2859.6	6.4	60.0	
4.5	2862.2	5.2	60.4	
5.0	2865.5	6.6	59.1	
5.5	2868.5	6.0	60.0	

Using 30 gpm/120 psi

DOUBLE PACKER TEST DATA SHEET, MACTEC PROJECT NO. 6468-06-1472 **PAGE 3**

BORING NO.: B901

DATE: 8-30-06

TEST NUMBER: 5

TEST INTERVAL (FROM DATUM): FROM 94 **FT. TO** 104 **FT.**

DATA COLLECTED BY: SHW

12-6-06

SHUT-IN TEST

PRESSURE:_____ **psi**

TIME, MIN	SURFACE GAUGE PRESSURE, PSI	MIDDLE TRANSDUCER PRESSURE, PSI
0.0	69.0	99.81
0.5	27.3	70.43
1.0	20.6	61.27
1.5	12.5	54.95
2.0	7.8	49.17
2.5	3.5	45.44
3.0	0.4	41.81
3.5	-2.2	39.25
4.0	-4.4	37.16
4.5	-5.7	35.70
5.0	-6.9	34.59
6.0	-8.1	33.17
7.0	-8.7	32.57
8.0	-9.1	32.09
9.0	-9.3	31.80
10.0	-9.4	31.63
11.0	-9.4	31.48
12.0	~~-6.5~~ -9.5	31.31
13.0	-9.7	31.0
14.0	-9.7	30.78
15.0	-9.8	30.67

EQUIPMENT USED

Transducers: Mini Troll Serial Numbers: 10417 (Top), 10191 (Middle), ~~10036~~ (Bottom) 01742

Surface Pressure Gauge: Omega DPG serial number 2634708001 SH 8-31

Flow Meter Omega FTB-4110 serial number 32019518

Stop Watch: serial number SW1

Above calibrated 5-5-06 or 5-18-06

Tests: B901-M 94 - 104
" - B 94 - "
" - T 94 - "

PACKER TESTING CALCULATIONS FOR P(MAX)

Date: 8-30-06

Boring No. B901

JH 12-6-06

Test Interval: 109.0 to 119.0 feet from Datum

Casing Stickup 2.0 feet

PoMAX = (h_1 x 1) + (h_2 x 0.57). h_1 and h_2 are in feet, see sketch. PoMAX is in psi

h_1 = Distance from the datum to the water level
h_2 = Distance from the water level to the center of the test interval

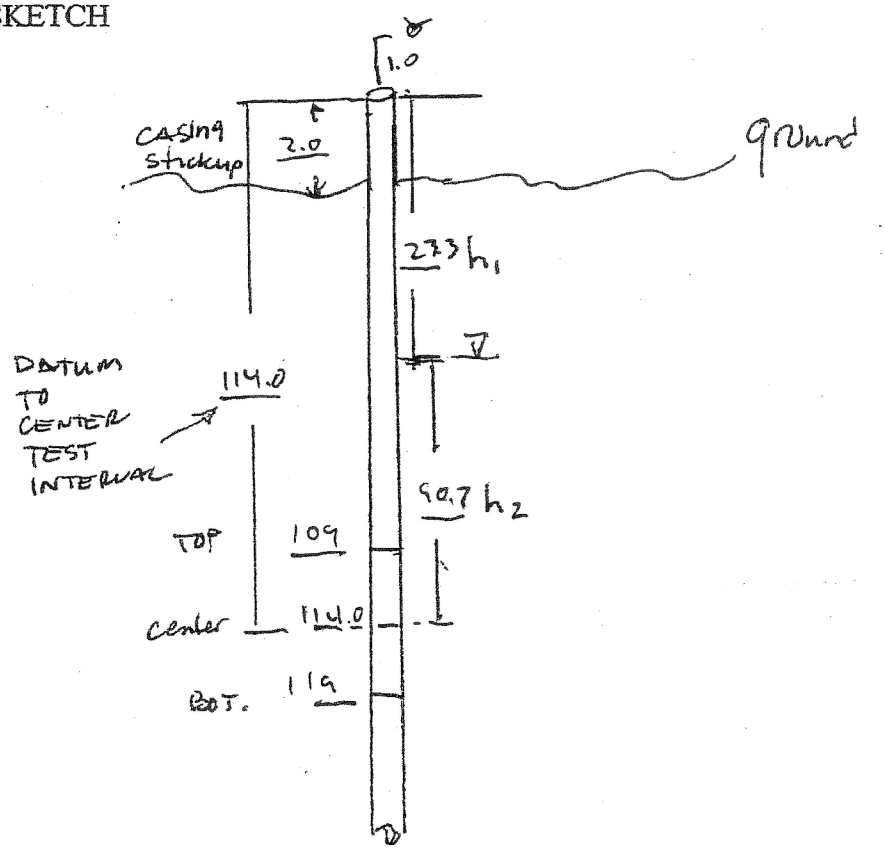
---

h_1 = 24.3

h_2 = 114.0 - 23.3 = 90.7

P MAX = 24.3 + 51.69 = 75.99

SKETCH



12-6-01

DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET

MACTEC ENGINEERING AND CONSULTING, INC.

PROJECT: NORTH ANNA COL PROJECT NO.: 6468-06-1472

DATA COLLECTED BY: JHoward DATE COLLECTED: 9-7 ~~8-30~~ -06 JH

BORING NO. BA01 BOREHOLE DIAMETER: 4 IN.

SURFACE CASING HEIGHT ABOVE GROUND: 2.0 FT.

CHECK DATUM USED: TOP OF CASING X GROUND SURFACE ____

DATUM ELEVATION NA

DISTANCE BOTTOM OF TOP PACKER TO TOP OF BOTTOM PACKER 10.0 FT.

TEST INTERVAL DEPTH (FROM DATUM): FROM 109.0 FT. TO 119.0 FT.

TOTAL BORING DEPTH FROM DATUM: 302.0 FT.

(A) DEPTH TO WATER TABLE FROM DATUM: 23.3 FT.

(B) SURFACE GAUGE HEIGHT ABOVE DATUM: 1.0 FT.

(C) DISTANCE WATER TABLE TO CENTER OF TEST INTERVAL: 90.7 FT.

MAXIMUM TEST PRESSURE, Po 75.99 (Po = [(A+B) *1] + C*.57 psi)

1/3 TEST NUMBER: 1 TEST PRESSURE 63.09 psi PACKER PRESSURE: ~~100~~ 140 psi JH 9-7

25.07 Initial Transducer Readings: Top 2.27, Middle 38.02, Bottom 43.08

Transducer Readings after initial pressurization:
Top 2.81, Middle 39.91, Bottom 43.58

Transducer Readings after final flow measurement:
Top 1.82, Middle 42.53, Bottom 43.94

TIME (MIN)	FLOW METER READING, (GAL)	Q (GPM)	SURFACE GAUGE, PSI	REMARKS
0.0	2931.0	✓	.6	
0.5	2931.4	.8	2.7	
1.0	2933.0	3.2	28.8	
1.5	2933.0	Ø	25.7	
2.0	2933.0	Ø	24.2	
2.5	2933.0	Ø	24.2	
3.0	2933.0	Ø	24.0	
3.5	2933.0	Ø	26.1	
4.0	2933.0	Ø	24.7	
4.5	2933.0	Ø	23.6	
5.0	2933.0	Ø	24.5	

used 30 GPM / 120 psi pump

JAS 12-6-06

DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET

MACTEC ENGINEERING AND CONSULTING, INC.

PROJECT: NORTH ANNA COL PROJECT NO.: 6468-06-1472

DATA COLLECTED BY: JHoward DATE COLLECTED: ~~9-78-50~~ . 06 JH

BORING NO. BA01 BOREHOLE DIAMETER: 4 IN.

SURFACE CASING HEIGHT ABOVE GROUND: 2.0 FT.

CHECK DATUM USED: TOP OF CASING X GROUND SURFACE ____

DATUM ELEVATION NA

DISTANCE BOTTOM OF TOP PACKER TO TOP OF BOTTOM PACKER 10.0 FT.

TEST INTERVAL DEPTH (FROM DATUM): FROM 109.0 FT. TO 119.0 FT.

TOTAL BORING DEPTH FROM DATUM: 302.0 FT.

(A) DEPTH TO WATER TABLE FROM DATUM: 23.3 FT.

(B) SURFACE GAUGE HEIGHT ABOVE DATUM: 1.60 FT.

(C) DISTANCE WATER TABLE TO CENTER OF TEST INTERVAL: 75.99 FT.

MAXIMUM TEST PRESSURE, Po 75.99 (Po = [(A+B) *1] + C*.57 psi)

2/3 TEST NUMBER: 2 TEST PRESSURE 88.17 psi PACKER PRESSURE: ~~100~~ 140 psi SB9-7

50.15 Initial Transducer Readings: Top 2.27, Middle 38.02, Bottom 43.08

Transducer Readings after initial pressurization:
Top 1.82, Middle 42.53, Bottom 43.91

Transducer Readings after final flow measurement:
Top 1.37, Middle 41.15, Bottom 44.22

TIME (MIN)	FLOW METER READING, (GAL)	Q (GPM)	SURFACE GAUGE, PSI	REMARKS
0.0	2933.0	/	9.0	
0.5	2934.0	2.0	18.6	
1.0	2934.4	.8	46.8	
1.5	2934.5	.2	46.5	
2.0	2934.5	Ø	47.4	
2.5	2934.5	Ø	47.3	
3.0	2934.6	.2	47.5	
3.5	2934.6	Ø	47.4	
4.0	2934.6	Ø	48.0	
4.5	2934.7	.2	44.5	
5.0	2934.7	Ø	44.9	

Used 30GPM/120psi pump

DOUBLE PACKER TEST DATA SHEET, MACTEC PROJECT NO. 6468-06-1472 PAGE 3

BORING NO.: B901

DATE: 9-~~7~~~~8~~-~~30~~-06 54

TEST NUMBER: 2

TEST INTERVAL (FROM DATUM): FROM 109 FT. TO 119 FT.

DATA COLLECTED BY: SHW and

2
JJ
12-4-06

SHUT-IN TEST

PRESSURE:_____ psi

TIME, MIN	SURFACE GAUGE PRESSURE, PSI	MIDDLE TRANSDUCER PRESSURE, PSI
0.0	44.9	89.68
0.5	36.6	78.00
1.0	30.5	71.36
1.5	26.4	66.63
2.0	24.1	63.97
2.5	21.9	61.51
3.0	20.1	59.21
3.5	18.6	57.14
4.0	17.7	55.81
4.5	16.5	54.36
5.0	15.8	53.14
6.0	14.5	51.02
7.0	13.3	49.33
8.0	12.4	48.18
9.0	11.6	46.93
10.0	11.0	45.98
11.0	10.5	45.15
12.0	10.1	44.43
13.0	9.7	43.84
14.0	9.4	43.28
15.0	9.0	42.80
20.0	8.1	41.15

EQUIPMENT USED

Transducers: Mini Troll Serial Numbers: ~~10417~~ 10036 54G-7 (Top), 10191 (Middle), ~~10036~~ 017423 54G-7 (Bottom)

Surface Pressure Gauge: Omega DPG serial number 2634708001

Flow Meter Omega FTB-4110 serial number 32019518

Stop Watch: serial number SW1

Above calibrated 5-5-06 or 5-18-06

Tests: B901-M2 109 - 119

" - B2 109 - "

" - T2 109 - "

DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET

MACTEC ENGINEERING AND CONSULTING, INC.

PROJECT: NORTH ANNA COL PROJECT NO.: 6468-06-1472

DATA COLLECTED BY: JHoward DATE COLLECTED: ~~9-28-30~~ · 06-14

BORING NO. BA01 BOREHOLE DIAMETER: 4 IN.

SURFACE CASING HEIGHT ABOVE GROUND: 2.0 FT.

CHECK DATUM USED: TOP OF CASING X GROUND SURFACE ____

DATUM ELEVATION NA

DISTANCE BOTTOM OF TOP PACKER TO TOP OF BOTTOM PACKER 10.0 FT.

TEST INTERVAL DEPTH (FROM DATUM): FROM 109.0 FT. TO 119.0 FT.

TOTAL BORING DEPTH FROM DATUM: 302.0 FT.

(A) DEPTH TO WATER TABLE FROM DATUM: 23.3 FT.

(B) SURFACE GAUGE HEIGHT ABOVE DATUM: 1.0 FT.

(C) DISTANCE WATER TABLE TO CENTER OF TEST INTERVAL: 90.7 FT.

MAXIMUM TEST PRESSURE, Po 75.06 (Po = [(A+B) *1] + C*.57 psi)

TEST NUMBER: 3 TEST PRESSURE 114.01 psi PACKER PRESSURE: ~~100~~ 140 psi JH 6-7

Initial Transducer Readings: Top 2.27, Middle 38.02, Bottom 43.08

Transducer Readings after initial pressurization:

Top 1.37, Middle 41.15, Bottom 44.22

Transducer Readings after final flow measurement:

Top 1.53, Middle 38.86, Bottom 43.46

TIME (MIN)	FLOW METER READING, (GAL)	Q (GPM)	SURFACE GAUGE, PSI	REMARKS
0.0	2934.7	/	7.5	
0.5	2935.9	2.4	26.3	
1.0	2936.2	.6	47.9	
1.5	2937.7	3.0	69.2	
2.0	2941.2	7.0	74.8	
2.5	2944.2	6.0	69.7	
3.0	2947.2	6.0	68.5	
3.5	2950.5	6.6	68.1	
4.0	2953.3	5.6	68.1	
4.5	2956.4	6.2	67.9	
5.0	2959.3	5.8	68.7	

Rock fractured at this pressure & drained slot of water.

Used 30 GPM/120psi pump

DOUBLE PACKER TEST DATA SHEET, MACTEC PROJECT NO. 6468-06-1472 PAGE 3 of 5

BORING NO.: B901

DATE: ~~9-7 8-30-06~~ 5H

TEST NUMBER: 3

TEST INTERVAL (FROM DATUM): FROM 109 FT. TO 119 FT.

DATA COLLECTED BY: SHOund

12-4-06

SHUT-IN TEST

PRESSURE:_____ psi

TIME, MIN	SURFACE GAUGE PRESSURE, PSI	MIDDLE TRANSDUCER PRESSURE, PSI
0.0	~~5H 46.32~~ 68.7	~~5H9-7 68.7~~ 116.32
0.5	-1.0	47.83
1.0	-3.3	45.17
1.5	-4.3	44.23
2.0	-4.6	43.95
2.5	-5.0	43.57
3.0	-5.2	43.31
3.5	-5.4	43.03
4.0	-6.3	42.21
4.5	-6.6	41.95
5.0	-6.8	41.71
6.0	-7.1	41.32
7.0	-7.4	41.00
8.0	-7.7	40.72
9.0	-7.9	40.45
10.0	-8.1	40.20
11.0	-8.3	40.10
12.0	-8.4	39.92
13.0	-8.5	39.78
14.0	-8.6	39.64
15.0	-8.7	39.57

EQUIPMENT USED 100365H9-7 017423 5H9-7

Transducers: Mini Troll Serial Numbers: ~~10417~~ (Top), 10191 (Middle), ~~10036~~ (Bottom)

Surface Pressure Gauge: Omega DPG serial number 2634708001

Flow Meter Omega FTB-4110 serial number 32019518

Stop Watch: serial number SW1

Above calibrated 5-5-06 or 5-18-06

Tests: B901-M3 109 - 119

11 - B3 109 - 11

11 - T3 109 - 11

JAJ 12-6-06

DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET

MACTEC ENGINEERING AND CONSULTING, INC.

PROJECT: NORTH ANNA COL PROJECT NO.: 6468-06-1472

DATA COLLECTED BY: J Howard DATE COLLECTED: ~~6-28-30~~ . 06 J4

BORING NO. B401 BOREHOLE DIAMETER: 4 IN.

SURFACE CASING HEIGHT ABOVE GROUND: 2.0 FT.

CHECK DATUM USED: TOP OF CASING X GROUND SURFACE ____

DATUM ELEVATION NA

DISTANCE BOTTOM OF TOP PACKER TO TOP OF BOTTOM PACKER 10.0 FT.

TEST INTERVAL DEPTH (FROM DATUM): FROM 109.0 FT. TO 119.0 FT.

TOTAL BORING DEPTH FROM DATUM: 302.0 FT.

(A) DEPTH TO WATER TABLE FROM DATUM: 23.3 FT.

(B) SURFACE GAUGE HEIGHT ABOVE DATUM: 1.0 FT.

(C) DISTANCE WATER TABLE TO CENTER OF TEST INTERVAL: 90.7 FT.

1/2 MAXIMUM TEST PRESSURE, Po 75.99 (Po = [(A+B) *1] + C*.57 psi)

37.99 TEST NUMBER: 4 TEST PRESSURE 76.01 psi PACKER PRESSURE: ~~100~~ 140 psi JH9-7

Initial Transducer Readings: Top 2.27, Middle 38.02, Bottom 43.08

Transducer Readings after initial pressurization:
Top 1.53, Middle 38.86, Bottom 45.46

Transducer Readings after final flow measurement:
Top 1.43, Middle 38.48, Bottom 44.74

TIME (MIN)	FLOW METER READING, (GAL)	Q (GPM)	SURFACE GAUGE, PSI	REMARKS
0.0	2959.4	/	-9.4	
0.5	2959.6	.4	43.0	
1.0	2959.8	.4	26.9	
1.5	2960.0	.4	29.0	
2.0	2960.1	.2	29.0	
2.5	2960.3	.4	29.0	
3.0	2960.5	.4	29.4	
3.5	2960.7	.4	29.2	
4.0	2960.8	.2	29.4	
4.5	2961.0	.4	29.4	
5.0	2961.2	.4	29.7	

Used 30 GPM/120 psi 3/23/07

DOUBLE PACKER TEST DATA SHEET, MACTEC PROJECT NO. 6468-06-1472 PAGE 3

BORING NO.: B901

DATE: 9-7 ~~8-30-06~~ JH

TEST NUMBER: 4

TEST INTERVAL (FROM DATUM): FROM 109 FT. TO 119 FT.

DATA COLLECTED BY: JHow and

2

JH 11-6-06

SHUT-IN TEST

PRESSURE:_____ psi

TIME, MIN	SURFACE GAUGE PRESSURE, PSI	MIDDLE TRANSDUCER PRESSURE, PSI
0.0	24.7	78.71
0.5	-7.7	41.16
1.0	-8.1	40.10
1.5	-8.6	39.65
2.0	-8.8	39.34
2.5	-9.0	39.22
3.0	-9.1	39.12
3.5	-9.1	39.03
4.0	-9.1	38.98
4.5	-9.2	38.93
5.0	-9.2	38.88
6.0	-9.3	38.82
7.0	-9.3	38.77
8.0	-9.3	38.71
9.0	-9.4	38.67
10.0	-9.4	38.62

EQUIPMENT USED 10036 JH 9-7 017427 JH 9-7

Transducers: Mini Troll Serial Numbers: ~~10417~~ (Top), 10191 (Middle), ~~10036~~ (Bottom)

Surface Pressure Gauge: Omega DPG serial number 2634708001

Flow Meter Omega FTB-4110 serial number 32019518

Stop Watch: serial number SW1

Above calibrated 5-5-06 or 5-18-06

Tests: B901-M4109-119
" B4109 "
" +4109 "

DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET

JHO 12-6-06

MACTEC ENGINEERING AND CONSULTING, INC.

PROJECT: NORTH ANNA COL PROJECT NO.: 6468-06-1472

DATA COLLECTED BY: J Howard DATE COLLECTED: ~~8-30~~ 9-7 .06 JH

BORING NO. B901 BOREHOLE DIAMETER: 4 IN.

SURFACE CASING HEIGHT ABOVE GROUND: 2.0 FT.

CHECK DATUM USED: TOP OF CASING X GROUND SURFACE ____

DATUM ELEVATION NA

DISTANCE BOTTOM OF TOP PACKER TO TOP OF BOTTOM PACKER 10.0 FT.

TEST INTERVAL DEPTH (FROM DATUM): FROM 109.0 FT. TO 119.0 FT.

TOTAL BORING DEPTH FROM DATUM: 302.0 FT.

(A) DEPTH TO WATER TABLE FROM DATUM: 23.3 FT.

(B) SURFACE GAUGE HEIGHT ABOVE DATUM: 1.0 FT.

(C) DISTANCE WATER TABLE TO CENTER OF TEST INTERVAL: 90.7 FT.

MAXIMUM TEST PRESSURE, Po 75.99 (Po = [(A+B) *1] + C*.57 psi)

TEST NUMBER: 5 TEST PRESSURE 114.0 psi PACKER PRESSURE: ~~100~~ 140 psi JH 9-7

Initial Transducer Readings: Top 2.27, Middle 38.02, Bottom 43.08

Transducer Readings after initial pressurization:

Top 1.43, Middle 38.48, Bottom 44.74

Transducer Readings after final flow measurement:

Top 1.62, Middle 39.00, Bottom 45.91

TIME (MIN)	FLOW METER READING, (GAL)	Q (GPM)	SURFACE GAUGE, PSI	REMARKS
0.0	2961.2	–	-9.6	
0.5	2961.5	.6	45.2	
1.0	2962.3	1.6	60.5	
1.5	2965.7	6.8	70.2	
2.0	2969.9	8.4	69.1	
2.5	2972.0	4.2	67.1	
3.0	2974.7	5.4	67.2	
3.5	2977.0	4.6	68.2	
4.0	2980.3	6.6	67.8	
4.5	2983.3	6.0	68.0	
5.0	2986.3	6.0	68.3	

Used 30 GPM/120 psi pump

DOUBLE PACKER TEST DATA SHEET, MACTEC PROJECT NO. 6468-06-1472 PAGE 3 of 3

BORING NO.: B901

DATE: ~~8-30-06~~ 5/4

TEST NUMBER: 5

TEST INTERVAL (FROM DATUM): FROM 109 FT. TO 119 FT.

DATA COLLECTED BY: SMW

JJ 12-4-06

SHUT-IN TEST

PRESSURE:_____ psi

TIME, MIN	SURFACE GAUGE PRESSURE, PSI	MIDDLE TRANSDUCER PRESSURE, PSI
0.0	68.3	115.89
0.5	-2.4	46.89
1.0	-4.0	44.53
1.5	-5.0	43.57
2.0	-5.5	43.16
2.5	-5.9	42.76
3.0	-6.1	42.55
3.5	-6.3	42.114
4.0	-6.7	41.99
4.5	-6.8	41.88
5.0	-7.0	41.74
6.0	-7.3	41.39
7.0	-7.6	41.08
8.0	-7.9	40.82
9.0	-8.1	40.57
10.0	-8.3	40.40
11.0	-8.5	40.20
12.0	-8.6	40.05
13.0	-8.8	39.90
14.0	-8.9	39.77
15.0	-9.0	39.67

EQUIPMENT USED 100365449-7 017423 5#9-7

Transducers: Mini Troll Serial Numbers: ~~10417~~ (Top), 10191 (Middle), ~~10036~~ (Bottom)

Surface Pressure Gauge: Omega DPG serial number 2634708001

Flow Meter Omega FTB-4110 serial number 32019518

Stop Watch: serial number SW1

Above calibrated 5-5-06 or 5-18-06

Tests: B901-MS 109 - 119.

11 - BS 109 - 11

11 - TS 109 - 11

PACKER TESTING CALCULATIONS FOR P(MAX)

JJ 12-6-06

Date: 8-30-06

Boring No. B901

Test Interval: 120.0 to ~~125.0~~ 130.0 SHEET-30 feet from Datum

Casing Stickup 2.0 feet

PoMAX = (h_1 x 1) + (h_2 x 0.57). h_1 and h_2 are in feet, see sketch. PoMAX is in psi

h_1 = Distance from the ~~datum~~ CASE SHEET-30 to the water level

h_2 = Distance from the water level to the center of the test interval

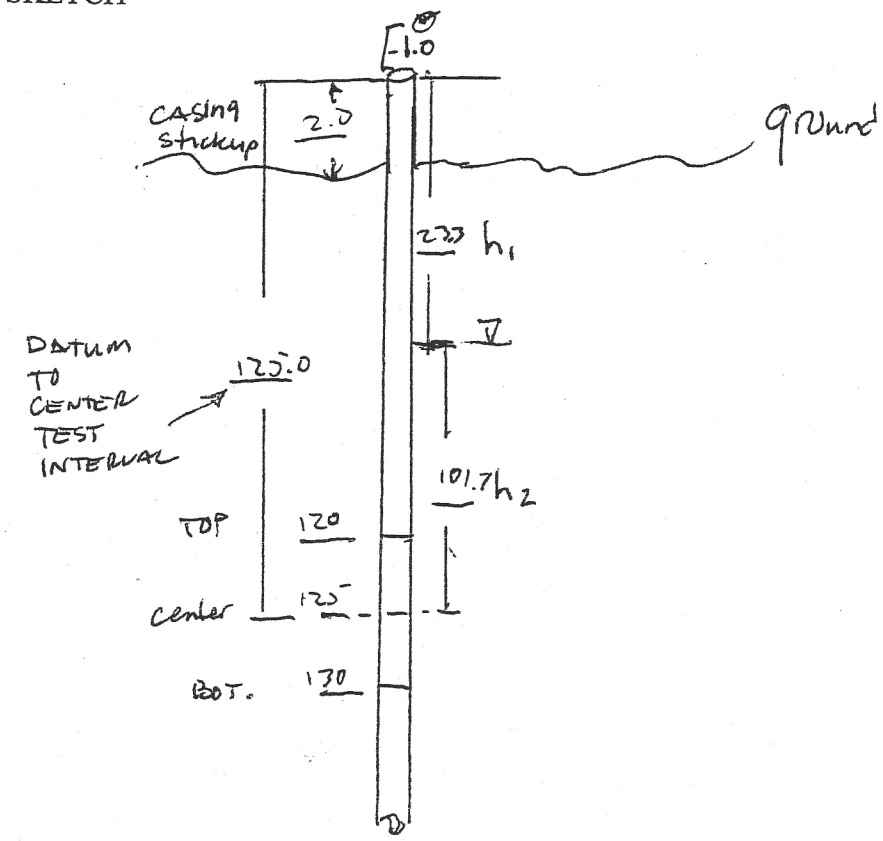
---

h_1 = 24.3

h_2 = 125.0 - 23.3 = 101.7

P MAX = 24.3 + 57.96 = 82.26

SKETCH



DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET

12-6-06

MACTEC ENGINEERING AND CONSULTING, INC.

PROJECT: NORTH ANNA COL PROJECT NO.: 6468-06-1472 SH 9-C

DATA COLLECTED BY: J Howard DATE COLLECTED: ~~8-30~~ 06

BORING NO. BA01 BOREHOLE DIAMETER: 4 IN.

SURFACE CASING HEIGHT ABOVE GROUND: 2.0 FT.

CHECK DATUM USED: TOP OF CASING X GROUND SURFACE ____

DATUM ELEVATION NA

DISTANCE BOTTOM OF TOP PACKER TO TOP OF BOTTOM PACKER 10.0 FT.

TEST INTERVAL DEPTH (FROM DATUM): FROM 120.0 FT. TO 130.0 FT.

TOTAL BORING DEPTH FROM DATUM: 302.0 FT.

(A) DEPTH TO WATER TABLE FROM DATUM: 27.3 FT.

(B) SURFACE GAUGE HEIGHT ABOVE DATUM: 1.0 FT.

(C) DISTANCE WATER TABLE TO CENTER OF TEST INTERVAL: 101.7 FT.

MAXIMUM TEST PRESSURE, Po 82.26 (Po = [(A+B) *1] + C*.57 psi)

1/3 TEST NUMBER: 1 TEST PRESSURE 70.67 psi PACKER PRESSURE: 100 psi

27.14 Initial Transducer Readings: Top 3.0, Middle 43.53, Bottom 48.51

Transducer Readings after initial pressurization:
Top 3.73, Middle 44.04, Bottom 48.93

Transducer Readings after final flow measurement:
Top 2.74, Middle 42.30, Bottom *

TIME (MIN)	FLOW METER READING, (GAL)	Q (GPM)	SURFACE GAUGE, PSI	REMARKS
0.0	2887.8	/	-1.5	
0.5	2889.0	4.4	29.1	
1.0	2889.0	Ø	23.3	
1.5	2889.2	.4	23.8	
2.0	2889.2	Ø	24.1	
2.5	2889.3	.2	23.7	
3.0	2889.4	.2	22.2	
3.5	2889.4	Ø	22.3	
4.0	2889.4	Ø	22.2	
4.5	2889.4	Ø	22.5	
5.0	2889.5	.2	23.0	

* Bottom Transducer stopped working during test

Using 30 GPM/120 psi pump

DOUBLE PACKER TEST DATA SHEET, MACTEC PROJECT NO. 6468-06-1472 PAGE ~~3~~ 2

BORING NO.: B901

DATE: 9-6~~8-30~~-06 JH

TEST NUMBER: 1

TEST INTERVAL (FROM DATUM): FROM 120.0 FT. TO 130.0 FT.

DATA COLLECTED BY: JHoward

JA 2-12-6-06

SHUT-IN TEST

PRESSURE:_____ psi

TIME, MIN	SURFACE GAUGE PRESSURE, PSI	MIDDLE TRANSDUCER PRESSURE, PSI
0.0	23.0	71.5
0.5	16.6	64.17
1.0	13.1	60.72
1.5	11.0	57.48
2.0	9.0	54.86
2.5	7.8	53.19
3.0	6.6	51.83
3.5	5.8	50.58
4.0	5.2	49.61
4.5	4.7	48.77
5.0	4.2	48.04
6.0	3.5	46.77
7.0	2.9	45.98
8.0	2.6	45.31
9.0	2.2	44.78
10.0	1.9	44.34
11.0	1.8	43.97
12.0	1.6	43.69
13.0	1.4	43.46
14.0	1.3	43.23
15.0	1.2	43.08
20.0	.9	42.55

EQUIPMENT USED

Transducers: Mini Troll Serial Numbers: ~~10417~~ 10036 JH6-9 (Top), 10191 (Middle), ~~10036~~ 017423 (Bottom) JH9-6

Surface Pressure Gauge: Omega DPG serial number 2634708001

Flow Meter Omega FTB-4110 serial number 32019518

Stop Watch: serial number SW1

Above calibrated 5-5-06 or 5-18-06

Tests: B901-M 1 120-130

" - B 1 120 - "

" - T 1 120 - "

DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET

JH 12-6-06

MACTEC ENGINEERING AND CONSULTING, INC.

PROJECT: NORTH ANNA COL PROJECT NO.: 6468-06-1472

DATA COLLECTED BY: JHoward DATE COLLECTED: ~~8-30~~ 9-6 .06 JH

BORING NO. B901 BOREHOLE DIAMETER: 4 IN.

SURFACE CASING HEIGHT ABOVE GROUND: 2.0 FT.

CHECK DATUM USED: TOP OF CASING X GROUND SURFACE ____

DATUM ELEVATION NA

DISTANCE BOTTOM OF TOP PACKER TO TOP OF BOTTOM PACKER 10.0 FT.

TEST INTERVAL DEPTH (FROM DATUM): FROM 120 FT. TO 130 FT.

TOTAL BORING DEPTH FROM DATUM: 302.0 FT.

(A) DEPTH TO WATER TABLE FROM DATUM: 23.3 FT.

(B) SURFACE GAUGE HEIGHT ABOVE DATUM: 1.0 FT.

(C) DISTANCE WATER TABLE TO CENTER OF TEST INTERVAL: 107 FT.

2/3

MAXIMUM TEST PRESSURE, Po 82.26 (Po = [(A+B) *1] + C*.57 psi)

TEST NUMBER: 2 TEST PRESSURE 97.82 psi PACKER PRESSURE: ~~100~~ 140 psi JH 9-6

54.29

Initial Transducer Readings: Top 3.0, Middle 43.53, Bottom 48.51

Transducer Readings after initial pressurization:

Top 4.15, Middle 44.61, Bottom 49.07

Transducer Readings after final flow measurement:

Top 3.23, Middle 43.02, Bottom 49.04

TIME (MIN)	FLOW METER READING, (GAL)	Q (GPM)	SURFACE GAUGE, PSI	REMARKS
0.0	2889.5	/	0.0	
0.5	2890.2	1.4	5.7	
1.0	2890.8	1.2	42.6	
1.5	2891.1	.6	45.8	
2.0	2891.4	.6	46.2	
2.5	2891.6	.4	46.7	
3.0	2891.9	.6	46.3	
3.5	2892.2	.6	47.2	
4.0	2892.4	.4	47.5	
4.5	2892.7	.6	47.2	
5.0	2893.1	.8	47.2	

30 GPM/120 psi pump

DOUBLE PACKER TEST DATA SHEET, MACTEC PROJECT NO. 6468-06-1472 PAGE 3

BORING NO.: B901

DATE: 9-6 ~~8-30~~-06 SH

TEST NUMBER: 2

TEST INTERVAL (FROM DATUM): FROM 120.0 FT. TO 130.0 FT.

DATA COLLECTED BY: SHoward

2 JS 2 12-6-06

SHUT-IN TEST

PRESSURE: _____ psi

TIME, MIN	SURFACE GAUGE PRESSURE, PSI	MIDDLE TRANSDUCER PRESSURE, PSI
0.0	47.2	97.26
0.5	19.4	68.95
1.0	13.1	62.05
1.5	8.7	57.72
2.0	6.9	54.20
2.5	5.2	52.30
3.0	4.3	51.23
3.5	3.3	49.96
4.0	2.7	49.03
4.5	2.1	48.20
5.0	1.7	47.51
6.0	1.1	46.54
7.0	.5	45.56
8.0	.2	44.98
9.0	0.0	44.53
10.0	-.2	44.18
11.0	-.4	43.87
12.0	-.5	43.61
13.0	-.7	43.44
14.0	-.7	43.27
15.0	-.8	43.13

EQUIPMENT USED

Transducers: Mini Troll Serial Numbers: ~~10417~~ 10036 SH 9-6 (Top), 10191 (Middle), ~~10036~~ 017423 (Bottom) SH 9-6

Surface Pressure Gauge: Omega DPG serial number 2634708001

Flow Meter Omega FTB-4110 serial number 32019518

Stop Watch: serial number SW1

Above calibrated 5-5-06 or 5-18-06

Tests: B901-M2 120 - 130

" - B2 120 - "

" - T2 120 - "

DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET

JH 12-6-06

MACTEC ENGINEERING AND CONSULTING, INC.

PROJECT: NORTH ANNA COL PROJECT NO.: 6468-06-1472

DATA COLLECTED BY: SHoward DATE COLLECTED: SH 9-6 ~~8-30~~ .06

BORING NO. B401 BOREHOLE DIAMETER: 4 IN.

SURFACE CASING HEIGHT ABOVE GROUND: 2.0 FT.

CHECK DATUM USED: TOP OF CASING X GROUND SURFACE ____

DATUM ELEVATION NA

DISTANCE BOTTOM OF TOP PACKER TO TOP OF BOTTOM PACKER 10.0 FT.

TEST INTERVAL DEPTH (FROM DATUM): FROM 120.0 FT. TO 130.0 FT.

TOTAL BORING DEPTH FROM DATUM: 302.0 FT.

(A) DEPTH TO WATER TABLE FROM DATUM: 27.3 FT.

(B) SURFACE GAUGE HEIGHT ABOVE DATUM: 1.0 FT.

(C) DISTANCE WATER TABLE TO CENTER OF TEST INTERVAL: 101.7 FT.

MAXIMUM TEST PRESSURE, Po 82.26 (Po = [(A+B) *1] + C*.57 psi)

82.26 TEST NUMBER: 3 TEST PRESSURE 125.79 psi PACKER PRESSURE: ~~100~~ 150 SH 9-6 psi

Initial Transducer Readings: Top 3.0, Middle 48.53, Bottom 48.51

Transducer Readings after initial pressurization:
Top 3.23, Middle 47.02, Bottom 49.09

Transducer Readings after final flow measurement:
Top 2.62, Middle 42.87, Bottom 51.71

TIME (MIN)	FLOW METER READING, (GAL)	Q (GPM)	SURFACE GAUGE, PSI	REMARKS
0.0	2893.0	/	-1.1	
0.5	2894.1	2.2	45.6	
1.0	2894.4	.6	48.1	
1.5	2895.1	1.4	70.0	
2.0	2897.1	4.0	74.1	
2.5	2899.0	3.8	74.7	
3.0	2901.2	4.4	75.0	
3.5	2903.2	4.0	74.5	
4.0	2905.4	4.4	74.2	
4.5	2907.5	4.2	74.2	
5.0	2909.8	4.6	74.4	

using 30GPM/120psi pump

DOUBLE PACKER TEST DATA SHEET, MACTEC PROJECT NO. 6468-06-1472 **PAGE 3** 2

BORING NO.: B901

DATE: 9-6 ~~8-30-06~~ JH

TEST NUMBER: 3

TEST INTERVAL (FROM DATUM): FROM 120.0 **FT. TO** 130.0 **FT.**

DATA COLLECTED BY: JHoward

JH 12-6-06

SHUT-IN TEST

PRESSURE:_____ **psi**

TIME, MIN	SURFACE GAUGE PRESSURE, PSI	MIDDLE TRANSDUCER PRESSURE, PSI
0.0	14.4	128.07
0.5	4.6	57.30
1.0	- 3.3	50.30
1.5	-5.3	47.72
2.0	-6.8	46.78
2.5	-6.2	46.07
3.0	-6.4	45.89
3.5	-6.3	45.64
4.0	-6.8	45.03
4.5	-7.1	44.58
5.0	-7.4	44.26
6.0	-7.6	43.86
7.0	-7.7	43.60
8.0	-7.8	43.41
9.0	-7.8	43.28
10.0	-7.9	43.16

EQUIPMENT USED 100306JH9-6 017423

Transducers: Mini Troll Serial Numbers: ~~10417~~ (Top), 10191 (Middle), ~~10036~~ (Bottom)

Surface Pressure Gauge: Omega DPG serial number 2634708001 JH 9-6

Flow Meter Omega FTB-4110 serial number 32019518

Stop Watch: serial number SW1

Above calibrated 5-5-06 or 5-18-06

Tests: B901-M3 120 - 130

" - B3 120 - "

" - T3 120 - "

12-6-06

DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET

MACTEC ENGINEERING AND CONSULTING, INC.

PROJECT: NORTH ANNA COL PROJECT NO.: 6468-06-1472

DATA COLLECTED BY: S Howard DATE COLLECTED: 9-6 & 9-7-06

BORING NO. BA01 BOREHOLE DIAMETER: 4 IN.

SURFACE CASING HEIGHT ABOVE GROUND: 2.0 FT.

CHECK DATUM USED: TOP OF CASING X GROUND SURFACE ____

DATUM ELEVATION NA

DISTANCE BOTTOM OF TOP PACKER TO TOP OF BOTTOM PACKER 10.0 FT.

TEST INTERVAL DEPTH (FROM DATUM): FROM 120.0 FT. TO 130.0 FT.

TOTAL BORING DEPTH FROM DATUM: 302.0 FT.

(A) DEPTH TO WATER TABLE FROM DATUM: 23.3 FT.

(B) SURFACE GAUGE HEIGHT ABOVE DATUM: 1.0 FT.

(C) DISTANCE WATER TABLE TO CENTER OF TEST INTERVAL: 197 FT.

½ MAXIMUM TEST PRESSURE, Po 82.26 (Po = [(A+B) *1] + C*.57 psi)

41.13 TEST NUMBER: 4 TEST PRESSURE 84.66 psi PACKER PRESSURE: 100 psi

Initial Transducer Readings: Top 3.0, Middle 43.53, Bottom 48.51

Transducer Readings after initial pressurization:
Top 2.62, Middle 42.87, Bottom 51.71

Transducer Readings after final flow measurement:
Top 2.21, Middle 42.77, Bottom 50.45

TIME (MIN)	FLOW METER READING, (GAL)	Q (GPM)	SURFACE GAUGE, PSI	REMARKS
0.0	2909.8	/	-7.8	
0.5	2910.2	.8	20.9	
1.0	2910.6	.8	31.5	
1.5	2910.8	.4	31.8	
2.0	2911.1	.6	32.0	
2.5	2911.3	.4	32.2	
3.0	2911.5	.4	32.6	
3.5	2911.8	.6	30.0	
4.0	2912.0	.4	29.9	
4.5	2912.2	.4	29.9	
5.0	2912.4	.4	30.1	

using 30 GPM/120psi pump

DOUBLE PACKER TEST DATA SHEET, MACTEC PROJECT NO. 6468-06-1472 PAGE ~~3~~ 2

BORING NO.: B901

DATE: 9-6 ~~8-30~~-06 JH

TEST NUMBER: SH 9-6 ~~7~~ 4

TEST INTERVAL (FROM DATUM): FROM 120.0 FT. TO 130.0 FT.

DATA COLLECTED BY: J Howard

JJ 12-6-06

SHUT-IN TEST

PRESSURE:_____ psi

TIME, MIN	SURFACE GAUGE PRESSURE, PSI	MIDDLE TRANSDUCER PRESSURE, PSI
0.0	3.0.1	83.67
0.5	-.2	52.00
1.0	-3.3	48.91
1.5	-5.0	47.08
2.0	-5.8	45.96
2.5	-6.3	45.26
3.0	-6.6	44.73
3.5	-6.9	44.37
4.0	-7.1	44.06
4.5	-7.3	43.86
5.0	-7.3	43.68
6.0	-7.5	43.42
7.0	-7.6	43.23
8.0	-7.6	43.09
9.0	-7.7	42.98
10.0	-7.7	42.92

EQUIPMENT USED

Transducers: Mini Troll Serial Numbers: ~~10417~~ 10036 SH 9-6 (Top), 10191 (Middle), ~~10036~~ 017423 (Bottom) SH 9-6

Surface Pressure Gauge: Omega DPG serial number 2634708001

Flow Meter Omega FTB-4110 serial number 32019518

Stop Watch: serial number SW1

Above calibrated 5-5-06 or 5-18-06

Tests: B901-M4 120-130

" - B4 120 - "

" - T4 120 - "

DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET

JHJ 12-6-06

MACTEC ENGINEERING AND CONSULTING, INC.

PROJECT: NORTH ANNA COL PROJECT NO.: 6468-06-1472 9-6-

DATA COLLECTED BY: JHoward DATE COLLECTED: ~~8-30~~ 9-5-06

BORING NO. BA01 BOREHOLE DIAMETER: 4 IN.

SURFACE CASING HEIGHT ABOVE GROUND: 2.0 FT.

CHECK DATUM USED: TOP OF CASING X GROUND SURFACE ____

DATUM ELEVATION NA

DISTANCE BOTTOM OF TOP PACKER TO TOP OF BOTTOM PACKER 10.0 FT.

TEST INTERVAL DEPTH (FROM DATUM): FROM 120.0 FT. TO 130.0 FT.

TOTAL BORING DEPTH FROM DATUM: 302.0 FT.

(A) DEPTH TO WATER TABLE FROM DATUM: 23.3 FT.

(B) SURFACE GAUGE HEIGHT ABOVE DATUM: 1.0 FT.

(C) DISTANCE WATER TABLE TO CENTER OF TEST INTERVAL: 101.7 FT.

MAXIMUM TEST PRESSURE, Po 82.26 (Po = [(A+B) *1] + C*.57 psi)

TEST NUMBER: 5 TEST PRESSURE 125.79 psi PACKER PRESSURE: 100 psi

Initial Transducer Readings: Top 3.0, Middle 43.53, Bottom ~~458.61~~ 51.8 9-6

Transducer Readings after initial pressurization:
Top 2.62, Middle 42.87, Bottom ~~51.8~~ 51.71 5th 9-6

Transducer Readings after final flow measurement:
Top 2.01, Middle 43.02, Bottom 53.23

TIME (MIN)	FLOW METER READING, (GAL)	Q (GPM)	SURFACE GAUGE, PSI	REMARKS
0.0	2912.4	/	-7.7	
0.5	2913.1	1.4	45.0	
1.0	2913.8	1.4	66.1	
1.5	2915.8	4.0	72.9	
2.0	2918.0	4.6	74.4	
2.5	2920.3	4.6	73.6	
3.0	2922.3	4.0	74.7	
3.5	2924.5	4.4	74.5	
4.0	2926.5	4.0	75.1	
4.5	2928.7	4.4	74.6	
5.0	2930.8	4.2	75.0	

using 30 GPM/120 psi pump

DOUBLE PACKER TEST DATA SHEET, MACTEC PROJECT NO. 6468-06-1472 PAGE 5 2

BORING NO.: B901

DATE: 9-~~08-30~~-06 12-6-06

TEST NUMBER: 5

TEST INTERVAL (FROM DATUM): FROM 120.0 FT. TO 130.0 FT.

DATA COLLECTED BY: SHW

SHUT-IN TEST

PRESSURE:_____ psi

TIME, MIN	SURFACE GAUGE PRESSURE, PSI	MIDDLE TRANSDUCER PRESSURE, PSI
0.0	75.0	127.35
0.5	1.3	59.90
1.0	-4.0	49.30
1.5	-6.8	46.37
2.0	-7.5	45.62
2.5	-8.0	45.27
3.0	-8.2	44.94
3.5	-8.0	44.99
4.0	-8.3	44.59
4.5	-8.5	44.27
5.0	-8.7	44.07
6.0	-8.8	43.80
7.0	-8.4	43.63
8.0	-8.9	43.50
9.0	-8.4	43.38
10.0	-8.9	43.27

EQUIPMENT USED 10036 SH9-6 D17423

Transducers: Mini Troll Serial Numbers: ~~10417~~ (Top), 10191 (Middle), ~~10036~~ (Bottom)

Surface Pressure Gauge: Omega DPG serial number 2634708001 SH9-6

Flow Meter Omega FTB-4110 serial number 32019518

Stop Watch: serial number SW1

Above calibrated 5-5-06 or 5-18-06

Tests: B901-MS 120-130

" - BS - 120 - "

" - TS - 120 - "

145-155

JAJ 12-6-06

PACKER TESTING CALCULATIONS FOR P(MAX)

Date: 8-30-06

Boring No. B901

Test Interval: 147.0 to 157.0 feet from Datum

Casing Stickup 2.0 feet

PoMAX = (h_1 x 1) + (h_2 x 0.57). h_1 and h_2 are in feet, see sketch. PoMAX is in psi

h_1 = Distance from the ~~datum~~ gage to the water level
h_2 = Distance from the water level to the center of the test interval

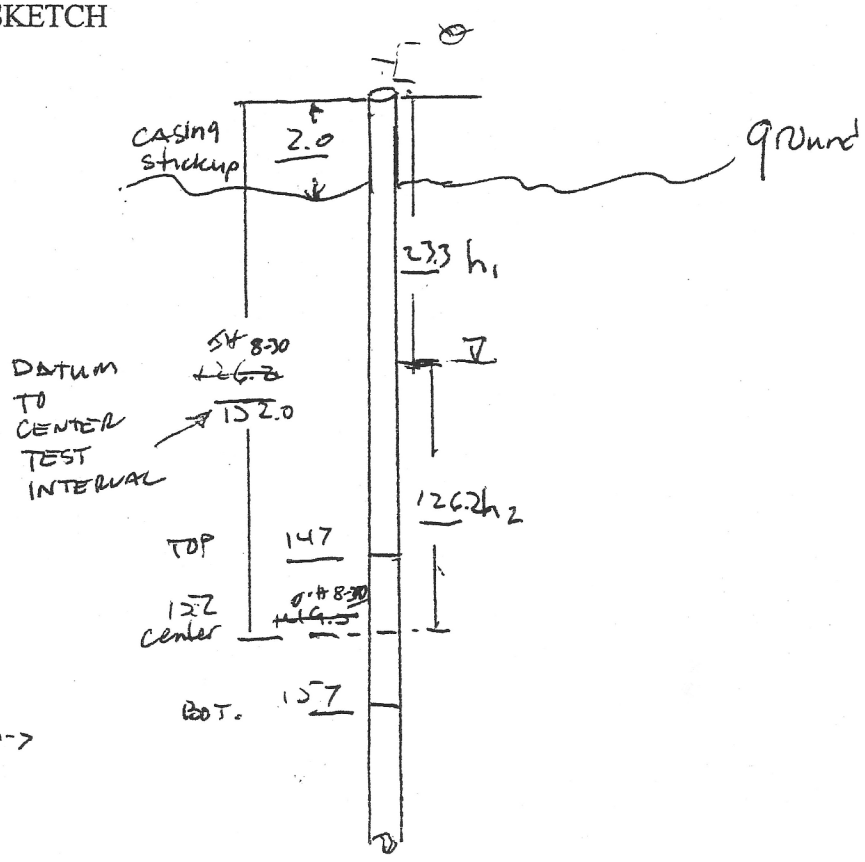
---

h_1 = 24.3

h_2 = ~~149.5~~ 152.0 SH 8-30 - 23.3 = ~~126.2~~ SH 8-30 128.7

P MAX = 24.3 + SH 8-30 ~~71.93~~ 73.35 = ~~96.23~~ 97.65 SH 8-30

SKETCH



Original test done @ 147-157 w/ ~~150~~ SH 9-7
50GPM/100psi pump

DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET

JLH 12-6-06

MACTEC ENGINEERING AND CONSULTING, INC.

PROJECT: NORTH ANNA COL PROJECT NO.: 6468-06-1472

DATA COLLECTED BY: JHoward DATE COLLECTED: 8-30-06

BORING NO. B901 BOREHOLE DIAMETER: 4 IN.

SURFACE CASING HEIGHT ABOVE GROUND: 1.0 FT.

CHECK DATUM USED: TOP OF CASING X GROUND SURFACE ____

DATUM ELEVATION NA

DISTANCE BOTTOM OF TOP PACKER TO TOP OF BOTTOM PACKER 10.0 FT.

TEST INTERVAL DEPTH (FROM DATUM): FROM 147.0 FT. TO 157.0 FT.

TOTAL BORING DEPTH FROM DATUM: 302.0 FT.

(A) DEPTH TO WATER TABLE FROM DATUM: 23.3 FT.

(B) SURFACE GAUGE HEIGHT ABOVE DATUM: 1.0 FT.

(C) DISTANCE WATER TABLE TO CENTER OF TEST INTERVAL: 126.2 FT.

MAXIMUM TEST PRESSURE, Po ~~46.83~~ 97.63 (Po = [(A+B) *1] + C*.57 psi)

TEST NUMBER: 1 TEST PRESSURE 90.04 psi PACKER PRESSURE: 100 psi

Initial Transducer Readings: Top 1.53, Middle 57.82, Bottom 62.6

Transducer Readings after initial pressurization: Top .55, Middle 58.70, Bottom 61.39

Transducer Readings after final flow measurement: Top .19, Middle 86.94, Bottom *

TIME (MIN)	FLOW METER READING, (GAL)	Q (GPM)	SURFACE GAUGE, PSI	REMARKS
0.0	2795.7	/	.1	
0.5	2796.7	2.0	4.8	
1.0	2797.6	1.8	24.5	
1.5	2797.7	.2	29.2	
2.0	2797.8	.2	31.7	
2.5	2797.8	Ø	31.8	
3.0	2797.8	Ø	31.7	
3.5	2797.8	Ø	31.7	
4.0	2797.8	Ø	32.0	
4.5	2797.8	Ø	32.1	
5.0	2797.8	Ø	32.1	

* Technical error, computer could find/Read Bottom transducer

DOUBLE PACKER TEST DATA SHEET, MACTEC PROJECT NO. 6468-06-1472 PAGE 2

BORING NO.: B901

DATE: 8-30-06

TEST NUMBER: 1

TEST INTERVAL (FROM DATUM): FROM 147.0 FT. TO 157.0 FT.

DATA COLLECTED BY: Howard

12-6-06

SHUT-IN TEST

PRESSURE:_____ psi

TIME, MIN	SURFACE GAUGE PRESSURE, PSI	MIDDLE TRANSDUCER PRESSURE, PSI
0.0	32.1	90.66
0.5	32.1	90.78
1.0	31.9	90.64
1.5	31.8	90.50
2.0	31.7	90.38
2.5	31.6	90.27
3.0	31.7	90.15
3.5	31.3	90.02
4.0	31.3	89.93
4.5	31.2	89.81
5.0	31.1	89.69
6.0	30.9	89.47
7.0	30.7	89.25
8.0	30.6	89.06
9.0	30.4	88.85
10.0	30.2	88.68
11.0	30.1	88.52
12.0	30.0	88.35
13.0	29.8	88.18
14.0	29.7	88.02
15.0	29.5	87.88

EQUIPMENT USED

Transducers: Mini Troll Serial Numbers: 10417 (Top), 10191 (Middle), 10036 (Bottom)

Surface Pressure Gauge: Omega DPG serial number 2634708001

Flow Meter Omega FTB-4110 serial number 32019518

Stop Watch: serial number SW1

Above calibrated 5-5-06 or 5-18-06

Tests: B901-M1147-157
" -B1147- "
" -T1147- "

DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET

JBT 12-6-06

MACTEC ENGINEERING AND CONSULTING, INC.

PROJECT: NORTH ANNA COL PROJECT NO.: 6468-06-1472

DATA COLLECTED BY: J Howard DATE COLLECTED: 8-30-06

BORING NO. B901 BOREHOLE DIAMETER: 4 IN.

SURFACE CASING HEIGHT ABOVE GROUND: 1.0 FT.

CHECK DATUM USED: TOP OF CASING X GROUND SURFACE ____

DATUM ELEVATION NA

DISTANCE BOTTOM OF TOP PACKER TO TOP OF BOTTOM PACKER 10.0 FT.

TEST INTERVAL DEPTH (FROM DATUM): FROM 147.0 FT. TO 157.0 FT.

TOTAL BORING DEPTH FROM DATUM: ~~300.2~~ 302.0 FT. JH 8-30

(A) DEPTH TO WATER TABLE FROM DATUM: 23.3 FT.

(B) SURFACE GAUGE HEIGHT ABOVE DATUM: 1.0 FT.

(C) DISTANCE WATER TABLE TO CENTER OF TEST INTERVAL: 126.2 FT.

MAXIMUM TEST PRESSURE, Po ~~96.27~~ 97.65 JH 8-30 (Po = [(A+B) *1] + C*.57 psi)

JH 8-30 ~~63.5~~ 64.45 2/3

TEST NUMBER: 2 TEST PRESSURE 122.27 psi PACKER PRESSURE: ~~102~~ 140 psi JH 8-30

Initial Transducer Readings: Top 1.53, Middle 57.82, Bottom 62.6

Transducer Readings after initial pressurization:

Top .57, Middle 59.52, Bottom 60.96

Transducer Readings after final flow measurement:

Top .18, Middle 79.43, Bottom *

TIME (MIN)	FLOW METER READING, (GAL)	Q (GPM)	SURFACE GAUGE, PSI	REMARKS
0.0	2797.8	/	0.1	
0.5	2798.8	2.0	24.7	
1.0	2798.9	.2	34.3	
1.5	2798.9	Ø	36.0	
2.0	2798.9	Ø	36.8	
2.5	2798.9	Ø	37.1	
3.0	2798.9	Ø	37.4	
3.5	2798.9	Ø	38.6	
4.0	2798.9	Ø	38.4	
4.5	2798.9	Ø	38.3	
5.0	2798.9	Ø	39.3	

* Bottom transducer not working again, stopped during test

DOUBLE PACKER TEST DATA SHEET, MACTEC PROJECT NO. 6468-06-1472 PAGE 3 2

BORING NO.: B901

DATE: 8-30-06

TEST NUMBER: 2

TEST INTERVAL (FROM DATUM): FROM 147.0 FT. TO 157.0 FT.

DATA COLLECTED BY: Howard

12-6-06

SHUT-IN TEST

PRESSURE:_____ psi

TIME, MIN	SURFACE GAUGE PRESSURE, PSI	MIDDLE TRANSDUCER PRESSURE, PSI
0.0	39.3	100.88
0.5	37.8	99.41
1.0	37.2	98.57
1.5	36.4	97.71
2.0	35.7	96.96
2.5	35.1	96.24
3.0	34.4	95.60
3.5	33.8	94.92
4.0	33.3	94.28
4.5	32.6	93.70
5.0	32.3	93.18
6.0	31.3	92.07
7.0	30.4	91.12
8.0	29.6	90.17
9.0	28.8	89.34
10.0	28.2	88.55
11.0	27.5	87.83
12.0	26.9	87.07
13.0	26.3	86.46
14.0	25.7	85.81
15.0	25.2	85.23
20.0	22.8	82.57
25.0	21.1	80.49

EQUIPMENT USED

Transducers: Mini Troll Serial Numbers: 10417 (Top), 10191 (Middle), 10036 (Bottom)

Surface Pressure Gauge: Omega DPG serial number 2634708001

Flow Meter Omega FTB-4110 serial number 32019518

Stop Watch: serial number SW1

Above calibrated 5-5-06 or 5-18-06

Tests B901 - M2147 - 157

" - B2147 - "

" - T2147 - "

DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET

12-6-06

MACTEC ENGINEERING AND CONSULTING, INC.

PROJECT: NORTH ANNA COL PROJECT NO.: 6468-06-1472

DATA COLLECTED BY: J Howard DATE COLLECTED: 8-30-06

BORING NO. B901 BOREHOLE DIAMETER: 4 IN.

SURFACE CASING HEIGHT ABOVE GROUND: 1.0 FT.

CHECK DATUM USED: TOP OF CASING X GROUND SURFACE ____

DATUM ELEVATION NA

DISTANCE BOTTOM OF TOP PACKER TO TOP OF BOTTOM PACKER 10.0 FT.

TEST INTERVAL DEPTH (FROM DATUM): FROM 147.0 FT. TO 157.0 FT.

TOTAL BORING DEPTH FROM DATUM: 302.0 FT.

(A) DEPTH TO WATER TABLE FROM DATUM: 23.3 FT.

(B) SURFACE GAUGE HEIGHT ABOVE DATUM: 1.0 FT.

(C) DISTANCE WATER TABLE TO CENTER OF TEST INTERVAL: 126.2 FT.

MAXIMUM TEST PRESSURE, Po 47.65 56.23 (Po = [(A+B) *1] + C*.57 psi) 8-30

TEST NUMBER: 3 TEST PRESSURE 155.47 psi PACKER PRESSURE: 140 psi

Initial Transducer Readings: Top 153, Middle 57.82, Bottom 62.6

Transducer Readings after initial pressurization:
Top .19, Middle 59.39, Bottom 60.75

Transducer Readings after final flow measurement:
Top .20, Middle 83.87, Bottom 60.70

TIME (MIN)	FLOW METER READING, (GAL)	Q (GPM)	SURFACE GAUGE, PSI	REMARKS
0.0	27 99 9	/	0.4	
0.5	27 99.7	1.6	24.8	
1.0	27 99.9	.4	35.3	
1.5	27 99.9	0	37.0	
2.0	27 99.9	0	37.4	
2.5	27 99.9	0	38.0	
3.0	27 99.9	0	38.6	
3.5	27 99.9	0	39.4	
4.0	27 99 9	0	38.0	
4.5	27 99 9	0	37.8	
5.0	27 99 9	0	38.4	

DOUBLE PACKER TEST DATA SHEET, MACTEC PROJECT NO. 6468-06-1472 PAGE 3 2

BORING NO.: B901

DATE: 8-30-06

TEST NUMBER: 3

TEST INTERVAL (FROM DATUM): FROM 147.0 FT. TO 157.0 FT.

DATA COLLECTED BY: Howard

JD 9.26.06

SHUT-IN TEST

PRESSURE:_____ psi

TIME, MIN	SURFACE GAUGE PRESSURE, PSI	MIDDLE TRANSDUCER PRESSURE, PSI
0.0	38.4	101.0
0.5	38.8	101.0
1.0	38.8	100.32
1.5	37.5	99.47
2.0	36.8	98.82
2.5	36.7	98.14
3.0	35.5	97.42
3.5	34.9	96.74
4.0	34.3	96.06
4.5	33.7	95.53
5.0	33.2	94.94
6.0	32.1	93.82
7.0	31.2	92.91
8.0	30.4	91.89
9.0	29.5	91.00
10.0	28.9	90.20
11.0	28.1	89.43
12.0	27.5	88.76
13.0	26.9	88.13
14.0	26.4	87.46
15.0	25.8	86.88
20.0	23.5	84.38

EQUIPMENT USED

Transducers: Mini Troll Serial Numbers: 10417 (Top), 10191 (Middle), ~~10036~~ (Bottom) 017423 change out Transducer

Surface Pressure Gauge: Omega DPG serial number 2634708001

Flow Meter Omega FTB-4110 serial number 32019518

Stop Watch: serial number SW1

Above calibrated 5-5-06 or 5-18-06

Tests: B901 - M3147-157
" - B3147 - "
" - T3147 - "

PACKER TESTING CALCULATIONS FOR P(MAX)

Date: 9-6-06

Boring No. B901

Test Interval: 147.0 to 157.0 feet from Datum

Casing Stickup 2.0 feet

PoMAX = (h_1 x 1) + (h_2 x 0.57). h_1 and h_2 are in feet, see sketch. PoMAX is in psi

JKT 12-6-06

h_1 = Distance from the ~~datum~~ GSC to the water level

h_2 = Distance from the water level to the center of the test interval

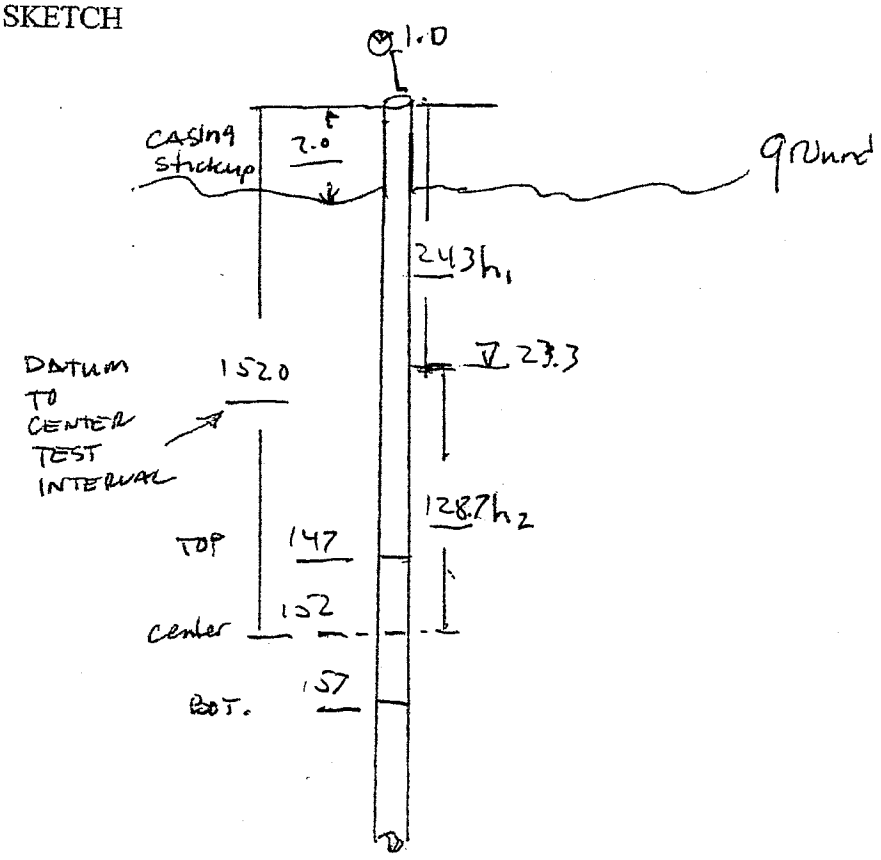
---

h_1 = 24.3

h_2 = 152 - 23.3 = 128.7

P MAX = 24.3 + 73.35 = 97.65

SKETCH



DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET

JAZ 12-6-06

MACTEC ENGINEERING AND CONSULTING, INC.

PROJECT: NORTH ANNA COL PROJECT NO.: 6468-06-1472

DATA COLLECTED BY: J Howard DATE COLLECTED: ~~8-30~~ 9-6 JH .06

BORING NO. B401 BOREHOLE DIAMETER: 4 IN.

SURFACE CASING HEIGHT ABOVE GROUND: 2.0 FT.

CHECK DATUM USED: TOP OF CASING X GROUND SURFACE ____

DATUM ELEVATION NA

DISTANCE BOTTOM OF TOP PACKER TO TOP OF BOTTOM PACKER 10.0 FT.

TEST INTERVAL DEPTH (FROM DATUM): FROM 147.0 FT. TO 157.0 FT.

TOTAL BORING DEPTH FROM DATUM: 302.0 FT.

(A) DEPTH TO WATER TABLE FROM DATUM: 24.3 FT.

(B) SURFACE GAUGE HEIGHT ABOVE DATUM: 1.0 FT.

(C) DISTANCE WATER TABLE TO CENTER OF TEST INTERVAL: 128.7 FT.

1/3 MAXIMUM TEST PRESSURE, Po 97.65 (Po = [(A+B) *1] + C*.57 psi)

TEST NUMBER: 1 TEST PRESSURE 87.28 psi PACKER PRESSURE: ~~100~~ 120 JH 9-6 psi

32.22 Initial Transducer Readings: Top ~~9-6 .14~~ JH 3.0, Middle 55.06, Bottom 60.11

Transducer Readings after initial pressurization:

Top 3.70, Middle 57.00, Bottom 60.30

Transducer Readings after final flow measurement:

Top 2.84, Middle 75.87, Bottom 60.39

TIME (MIN)	FLOW METER READING, (GAL)	Q (GPM)	SURFACE GAUGE, PSI	REMARKS
0.0	2871.0	–	0.1	
0.5	2871.5	1.0	2.0	
1.0	2873.1	3.2	28.3	
1.5	2873.3	0.4	31.6	
2.0	2873.3	Ø	30.8	
2.5	2873.3	Ø	30.3	
3.0	2873.3	Ø	29.8	
3.5	2873.3	Ø	29.1	
4.0	2873.3	Ø	30.6	
4.5	2873.3	Ø	30.1	
5.0	2873.3	Ø	29.6	

30 GPM/120 psi pump used.

DOUBLE PACKER TEST DATA SHEET, MACTEC PROJECT NO. 6468-06-1472 PAGE 3

BORING NO.: B901

DATE: 9-6 ~~8-30~~-06 JH

TEST NUMBER: 1

TEST INTERVAL (FROM DATUM): FROM 147 FT. TO 157 FT.

DATA COLLECTED BY: J Howard

2

12-6-06

SHUT-IN TEST

PRESSURE: _____ psi

TIME, MIN	SURFACE GAUGE PRESSURE, PSI	MIDDLE TRANSDUCER PRESSURE, PSI
0.0	29.6	87.13
0.5	28.9	86.35
1.0	28.7	86.04
1.5	28.3	85.59
2.0	27.9	85.13
2.5	27.6	84.76
3.0	27.2	84.31
3.5	26.8	83.91
4.0	26.6	83.54
4.5	26.3	83.17
5.0	26.0	82.83
6.0	25.4	82.11
7.0	24.9	81.50
8.0	24.4	80.97
9.0	24.1	80.48
10.0	23.7	79.98
11.0	23.3	79.50
12.0	23.0	79.07
13.0	22.6	78.64
14.0	22.3	78.23
15.0	22.0	77.84
	20.7	76.15

EQUIPMENT USED

Transducers: Mini Troll Serial Numbers: ~~10417~~ 10036 (Top), 10191 (Middle), ~~10036~~ 17423 (Bottom)

JH 9-6 JH 9-6

Surface Pressure Gauge: Omega DPG serial number 2634708001

Flow Meter Omega FTB-4110 serial number 32019518

Stop Watch: serial number SW1

Above calibrated 5-5-06 or 5-18-06

Tests: B901-M1147-157

" - B1147 - "

" - T1147 - "

DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET

12-6-06

MACTEC ENGINEERING AND CONSULTING, INC.

PROJECT: NORTH ANNA COL PROJECT NO.: 6468-06-1472

DATA COLLECTED BY: J Howard DATE COLLECTED: 9-6-06

BORING NO. B901 BOREHOLE DIAMETER: 4 IN.

SURFACE CASING HEIGHT ABOVE GROUND: 2.0 FT.

CHECK DATUM USED: TOP OF CASING X GROUND SURFACE ____

DATUM ELEVATION NA

DISTANCE BOTTOM OF TOP PACKER TO TOP OF BOTTOM PACKER 10.0 FT.

TEST INTERVAL DEPTH (FROM DATUM): FROM 147.0 FT. TO 157.0 FT.

TOTAL BORING DEPTH FROM DATUM: 302.0 FT.

(A) DEPTH TO WATER TABLE FROM DATUM: 24.3 FT.

(B) SURFACE GAUGE HEIGHT ABOVE DATUM: 1.0 FT.

(C) DISTANCE WATER TABLE TO CENTER OF TEST INTERVAL: 128.7 FT.

MAXIMUM TEST PRESSURE, Po 97.65 (Po = [(A+B) *1] + C*.57 psi)

2/3 TEST NUMBER: 2 TEST PRESSURE 119.5 psi PACKER PRESSURE: 150 psi

Initial Transducer Readings: Top 3.0, Middle 55.06, Bottom 60.11

64.44 Transducer Readings after initial pressurization:
Top 2.84, Middle 75.87, Bottom 60.39

Transducer Readings after final flow measurement:
Top 2.38, Middle 87.80, Bottom 62.22

Packers Failed, test restarted

TIME (MIN)	FLOW METER READING, (GAL)	Q (GPM)	SURFACE GAUGE, PSI	REMARKS
0.0	~~2873.3~~ 2875.0		~~19.7~~ 1.8	
0.5	~~2874.0~~ 2876.7	~~1.4~~ ~~1.4~~	~~34.4~~ 44.3	
1.0	~~76.1~~ 2876.8	.2	~~51.5~~ 52.4	
1.5	2877.1	.6	58.8	
2.0	2878.2	2.2	60.2	
2.5	2879.4	2.4	59.4	
3.0	2880.4	2.0	59.6	
3.5	2881.6	2.4	59.9	
4.0	2882.7	2.2	58.7	
4.5	2883.7	2.0	58.2	
5.0	2884.7	2.0	58.9	

30 GPM / 120 psi Pump used

DOUBLE PACKER TEST DATA SHEET, MACTEC PROJECT NO. 6468-06-1472 PAGE 3 2

BORING NO.: B 901

DATE: 9-6-06

TEST NUMBER: ~~OH 147~~ 2

TEST INTERVAL (FROM DATUM): FROM 147 FT. TO 157 FT.

DATA COLLECTED BY: OHoward

12-6-06

SHUT-IN TEST

PRESSURE:_____ psi

TIME, MIN	SURFACE GAUGE PRESSURE, PSI	MIDDLE TRANSDUCER PRESSURE, PSI
0.0	58.9	120.19
0.5	47.0	108.75
1.0	46.4	107.80
1.5	46.0	107.16
2.0	45.5	106.54
2.5	44.8	105.69
3.0	43.8	104.64
3.5	42.6	103.55
4.0	41.6	102.17
4.5	40.6	101.28
5.0	39.7	100.40
6.0	38.5	98.94
7.0	37.3	97.63
8.0	36.4	96.52
9.0	35.4	95.44
10.0	34.3	94.30
11.0	33.8	93.71
12.0	33.1	92.88
13.0	32.4	92.15
14.0	31.9	91.49
15.0	31.3	90.77
20.0	28.9	88.07

EQUIPMENT USED

Transducers: Mini Troll Serial Numbers: ~~10417~~ 10036 JH 9-6 (Top), 10191 (Middle), ~~10036~~ 017423 (Bottom) JH 8-6

Surface Pressure Gauge: Omega DPG serial number 2634708001

Flow Meter Omega FTB-4110 serial number 32019518

Stop Watch: serial number SW1

Above calibrated 5-5-06 or 5-18-06

Test: B901 - M2147 - 157

" - B2147 - "

" - T2147 - "

DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET

12-6-06

MACTEC ENGINEERING AND CONSULTING, INC.

PROJECT: NORTH ANNA COL PROJECT NO.: 6468-06-1472

DATA COLLECTED BY: JHoward DATE COLLECTED: 9-6-06

BORING NO. B401 BOREHOLE DIAMETER: 4 IN.

SURFACE CASING HEIGHT ABOVE GROUND: 2.0 FT.

CHECK DATUM USED: TOP OF CASING X GROUND SURFACE ____

DATUM ELEVATION NA

DISTANCE BOTTOM OF TOP PACKER TO TOP OF BOTTOM PACKER 10.0 FT.

TEST INTERVAL DEPTH (FROM DATUM): FROM 147.0 FT. TO 157.0 FT.

TOTAL BORING DEPTH FROM DATUM: 302.0 FT.

(A) DEPTH TO WATER TABLE FROM DATUM: 24.3 FT.

(B) SURFACE GAUGE HEIGHT ABOVE DATUM: 1.0 FT.

(C) DISTANCE WATER TABLE TO CENTER OF TEST INTERVAL: 128.7 FT.

MAXIMUM TEST PRESSURE, Po 97.65 (Po = [(A+B) *1] + C*.57 psi) Max

TEST NUMBER: 3 TEST PRESSURE 152.71 psi PACKER PRESSURE: 150 psi

Initial Transducer Readings: Top 3.00, Middle 55.06, Bottom 60.11

Transducer Readings after initial pressurization:
Top 2.38, Middle 87.80, Bottom 62.22

Transducer Readings after final flow measurement:
Top 2.25, Middle 59.33, Bottom 62.80

TIME (MIN)	FLOW METER READING, (GAL)	Q (GPM)	SURFACE GAUGE, PSI	REMARKS
0.0	2847	/	27.6	
0.5	2850	.6	49.1	
1.0	2866	.	67.5	
1.5				
2.0				
2.5				
3.0				
3.5				
4.0				
4.5				
5.0				

Pressure up to 127psi Cant Test at this range, the pressure pushes our packers out.

30 GPM / 120 psi pumped

DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET

JJJ 12-6-06

MACTEC ENGINEERING AND CONSULTING, INC.

PROJECT: NORTH ANNA COL PROJECT NO.: 6468-06-1472

DATA COLLECTED BY: J Howard DATE COLLECTED: 9-6-06

BORING NO. B901 BOREHOLE DIAMETER: 4 IN.

SURFACE CASING HEIGHT ABOVE GROUND: 2.0 FT.

CHECK DATUM USED: TOP OF CASING X GROUND SURFACE ____

DATUM ELEVATION NA

DISTANCE BOTTOM OF TOP PACKER TO TOP OF BOTTOM PACKER 10.0 FT.

TEST INTERVAL DEPTH (FROM DATUM): FROM 147.0 FT. TO 157.0 FT.

TOTAL BORING DEPTH FROM DATUM: 302.0 FT.

(A) DEPTH TO WATER TABLE FROM DATUM: 24.3 FT.

(B) SURFACE GAUGE HEIGHT ABOVE DATUM: 1.0 FT.

(C) DISTANCE WATER TABLE TO CENTER OF TEST INTERVAL: 128.7 FT.

MAXIMUM TEST PRESSURE, Po 97.65 (Po = [(A+B) *1] + C*.57 psi)

1/2

TEST NUMBER: 4 TEST PRESSURE 103.82 psi PACKER PRESSURE: 150.0 psi

48.82

Initial Transducer Readings: Top 3.0, Middle 55.06, Bottom 60.11

Transducer Readings after initial pressurization:

Top 3.21, Middle 59.55, Bottom 61.75

Transducer Readings after final flow measurement:

Top 2.54, Middle 81.45, Bottom 61.29

TIME (MIN)	FLOW METER READING, (GAL)	Q (GPM)	SURFACE GAUGE, PSI	REMARKS
0.0	2887.0	/	2.8	
0.5	2887.8	1.6	48.7	
1.0	2887.8	Ø	46.1	
1.5	2887.8	Ø	44.1	
2.0	2887.8	Ø	42.6	
2.5	2887.8	Ø	41.3	
3.0	2887.8	Ø	44.6	
3.5	2887.8	Ø	43.1	
4.0	2887.8	Ø	41.8	
4.5	2887.8	Ø	40.4	
5.0	2887.8	Ø	39.5	

50 GPM/120psi Pump used

DOUBLE PACKER TEST DATA SHEET, MACTEC PROJECT NO. 6468-06-1472 PAGE 3

BORING NO.: B 901

DATE: 9-6-06

TEST NUMBER: 4

TEST INTERVAL (FROM DATUM): FROM 147 FT. TO 157 FT.

DATA COLLECTED BY: J Howard

JCJ 12-6-06

SHUT-IN TEST

PRESSURE:_____ psi

TIME, MIN	SURFACE GAUGE PRESSURE, PSI	MIDDLE TRANSDUCER PRESSURE, PSI
0.0	39.5	102.33
0.5	38.7	100.90
1.0	37.4	99.90
1.5	36.4	98.89
2.0	35.5	97.93
2.5	34.7	97.17
3.0	34.0	96.12
3.5	33.1	95.49
4.0	32.4	94.79
4.5	31.8	93.95
5.0	31.1	93.38
6.0	30.1	92.01
7.0	29.1	90.97
8.0	28.1	89.93
9.0	27.2	89.02
10.0	26.4	88.15
11.0	25.8	87.35
12.0	25.1	86.54
13.0	24.3	85.81
14.0	23.8	85.15
15.0	23.2	84.53
20.0	20.7	81.71

EQUIPMENT USED 10036 SH 9-6 017423

Transducers: Mini Troll Serial Numbers: ~~10417~~ (Top), 10191 (Middle), ~~10036~~ (Bottom)

Surface Pressure Gauge: Omega DPG serial number 2634708001 SH 9-6

Flow Meter Omega FTB-4110 serial number 32019518

Stop Watch: serial number SW1

Above calibrated 5-5-06 or 5-18-06

Tests: B901 - M4 147 - 157

" - B4 147 - "

" - T4 147 - "

DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET

JDZ 12-6-06

MACTEC ENGINEERING AND CONSULTING, INC.

PROJECT: NORTH ANNA COL PROJECT NO.: 6468-06-1472

DATA COLLECTED BY: J Howard DATE COLLECTED: 9-6.00

BORING NO. B901 BOREHOLE DIAMETER: 4 IN.

SURFACE CASING HEIGHT ABOVE GROUND: 2.0 FT.

CHECK DATUM USED: TOP OF CASING X GROUND SURFACE ____

DATUM ELEVATION NA

DISTANCE BOTTOM OF TOP PACKER TO TOP OF BOTTOM PACKER 10.0 FT.

TEST INTERVAL DEPTH (FROM DATUM): FROM 147 FT. TO 157 FT.

TOTAL BORING DEPTH FROM DATUM: 302.0 FT.

(A) DEPTH TO WATER TABLE FROM DATUM: 24.3 FT.

(B) SURFACE GAUGE HEIGHT ABOVE DATUM: 1.0 FT.

(C) DISTANCE WATER TABLE TO CENTER OF TEST INTERVAL: 128.7 FT.

max MAXIMUM TEST PRESSURE, Po 97.65 (Po = [(A+B) *1] + C*.57 psi)

TEST NUMBER: 5 TEST PRESSURE 152.77 psi PACKER PRESSURE: ____ psi

Initial Transducer Readings: Top 3.0, Middle 55.06, Bottom 60.11

Transducer Readings after initial pressurization:

Top ____, Middle ____, Bottom ____

Transducer Readings after final flow measurement:

Top ____, Middle ____, Bottom ____

TIME (MIN)	FLOW METER READING, (GAL)	Q (GPM)	SURFACE GAUGE, PSI	REMARKS
0.0				
0.5				
1.0				
1.5				
2.0				
2.5				
3.0				
3.5				
4.0				
4.5				
5.0				

Test can't be performed, see test 3

30 GPM/120psi pump used

(2)

511

8-15-06
James Howard

700 Arrive
730 Saftymeet
8am - 1245 Ready Packer tests
~~Work Inst~~ 8-15
~~8~~ 8-15 1245 - 1 Saftymeet
1 - 4:30 Packer Stand by & setup B949

1.5 hrs stand by

(13) 5H

8-30-06

James Howard

Miller: Mark Hughes Jeremy Johnson

B901

7 am Arrive

730 safty meeting

8-830 Drillers setup & do paperwork

830-115 setup packers

115-1145 lunch

1145-1 Run tests at 147-157'

1-2 Technical problems new batten for Bottom Transducer

2-3 Fix Tee transducer

3-430 Run tests

430-? clean up & paperwork

24 water B914 230

3 stage sets run 50 Gal/min @ 100 psi

7 stage 30 gall/min @ 120 psi

(14) JK

8-31-06

James Howard

Miller: Mark Hughes, Jeremy Johnson

Bail, Packer tests

7am arrive

~~8~~ 30 safty meeting

8-8:30 Meet about pump issues

830-11 Packer tests @ 94' to 104'

11-1130 lunch

1130-2 Finish tests at 94'-104'

2-5 ~~5~~ 4:30 Test at 79' to 89'

4:30-5' Pack up

5-530 paperwork

Water @ 24.3

(15)

9-1-06

James Howard

Miller: Mark Hughes, Jeremy ~~Miller~~ JH 9-1 Johnson

B9C1

7 arrive

730 Safty meeting

8-815 Clean up site

DATA REPORT Rev. 0 MACTEC ENGINEERING & CONSULTING, INC. 1/23/07

(17)

9-6-06

James Howard

~~Mactec~~ SH 9-6 Miller; M. Hughes, J Johnson

B901

Arrive @ 7am

saftymeeting 7.30

8-1130 Packer test 147-157

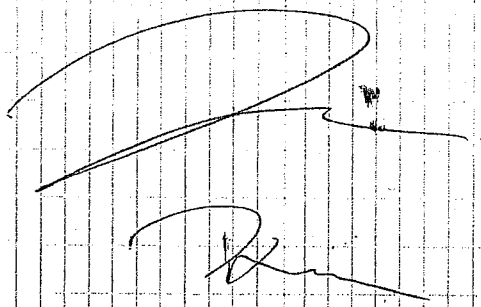
1130-12 lunch

12-4 Packer test 120-130

4-430 Paperwork

JH

water @ 23.5



DATA REPORT Rev. 0 MACTEC ENGINEERING & CONSULTING, INC.

(18)

9-7.06

James Howard

Miller ° Mark Hughs, Jeremy Johnson

B901

Arrive @ 7 am

Safety meeting 7:30

Packer Test B98, 109-119' 8-1130

1130-12 Lunch

12-2 Pack up

2-3 Paperwork for packers

3-430 Setup on B833 w/ G. Akins

430-5 Paperwork

5/4

Water @ 22.8 B901