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-949

Given Parameters

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

Test Section Length, ℓ, ft:	5			
Radius of Borehole r_0, in:	2.00			
GW Depth, ft:	23.00	(from top of casing)	21.40	(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:	**84 - 89**	(from ground surface)						
1	TNP					-		-
2	0.6072	39.66	3.06	28.43	31.18	25.91538	91.52	178.24
3	1.7712	60.1	3.06	28.43	31.18	73.08462	138.69	184.36
4	0	30	3.06	28.43	31.18	3.62308	69.23	0.00
5	1.6763	60.1	3.06	28.43	31.18	73.08462	138.69	174.49
							K_e, ft/year:	**173.05**
Interval 2, ft:	**89 - 94**	(from ground surface)						
1	TNP							-
2	25.10769231	41.5	3.22	30.62	33.42	25.1076923	95.77	0.00
3	74.4923	62.9	3.22	30.62	33.42	74.4923077	145.15	38.11
4	1.8	31.4	3.22	30.62	33.42	1.8	72.46	0.00
5	74.4923	62.9	3.22	30.62	33.42	74.4923077	145.15	58.97
	Report Ke as average of intervals 3 and 5 = 48.5						**K_e, ft/year:**	**NA**
Interval 3, ft:	**95 - 99.5**	(from ground surface)						
1	TNP	21.79	3.15	33.01	35.72			-
2	8.05	43.57	3.1	32.75	35.54	0.01793	100.55	2451.8
3	17.52	66.03	3.1	32.75	35.54	0.03903	152.38	3390.4
4	0.00	33.01	3.15	33.01	35.72	0.00000	76.18	NA
5	18.15	66.03	3.15	33.01	35.72	0.04044	152.38	1939.5
							K_e, ft/year:	**2293.2**

Notations:

- Q = flow rate
- P_{Test} = total test pressure
- P_T = pressure above top packer, near water surface
- P_M = initial 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.

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: 8/16/2006
Boring No: B-949
Test Interval: 85.6 ft to 90.6 ft (below top of casing)
Stick up length: 1.6 ft
Test Interval: 84.0 ft to 89 ft (from surface)
Test Type: Double Packer Technique

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

Depth of Water
Table= 23.00 ft (from top of casing)
h1= 23.00 (from top of casing)
h2 = 65.1 ft (from top of casing)
ρ_w = 62.4 lb/ft^3

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

P_0 Max= 60.11 psi Value on field data sheet= 60.1

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

TEST #1

Actual Excess Pressure= -8.63 psi
Initial Middle Transducer Reading= 28.43 psi
Test Pressure= 19.80 psi

Time (min)	Flow Meter Reading (Gal)	Q (GPM)	Surface Gauge (psi)
Test not performed			

Average Q: gpm
Excess Pore pressure: -8.63 psi

TEST #2

Actual Excess Pressure= 11.23 psi
Initial Middle Transducer Reading= 28.43 psi
Test Pressure= 39.66 psi

Time (min)	Flow Meter Reading (Gal)	Q (GPM)	Surface Gauge (psi)
0	2752.2		0.2
0.5	2752.6	0.8	7.3
1	2753.2	1.2	10.1
1.5	2753.5	0.6	5.8
2	2753.7	0.4	8.5
2.5	2754.1	0.8	8.8
3	2754.5	0.8	10.4
3.5	2754.8	0.6	9.1
4	2754.9	0.2	8.2
4.5	2755.2	0.6	8.3
5	2755.4	0.4	8.2
6	2755.9	0.5	8.3

Average Q: 0.54 gpm
Excess Pore pressure: 11.23 psi

TEST #3

Actual Excess Pressure= 31.67 psi
Initial Middle Transducer Reading= 28.43 psi
Test Pressure= 60.10 psi

Time (min)	Flow Meter Reading (Gal)	Q (GPM)	Surface Gauge (psi)
0	2756		0.4
0.5	2757.5	3.0	26
1	2758.7	2.4	27.4
1.5	2759.6	1.8	27.7
2	2760.6	2.0	25.5
2.5	2761.5	1.8	25.3
3	2762.1	1.2	24.8
3.5	2762.9	1.6	24.2
4	2763.7	1.6	24
4.5	2764.5	1.6	23.7
5	2765.3	1.6	23.6
6	2767.2	1.9	23.6

Average Q: 1.7 gpm
Excess Pore pressure: 31.67 psi

JAD 1-17-07

Boring No: B-949
Test Interval: 84 ft to 89 ft
(belwo surface)

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

TEST #4

Actual Excess Pressure= 1.57 psi
Initial Middle Transducer 28.43 psi
Test Pressure= 30.00 psi

Time (min)	Flow Meter Reading (Gal)	Q (GPM)	Surface Gauge (psi)
0	2767.2		
0.5	2767.2	0.0	-2
1	2767.2	0.0	-1
1.5	2767.2	0.0	-0.8
2	2767.2	0.0	-0.8
2.5	2767.2	0.0	-0.5
3	2767.2	0.0	-0.4
3.5	2767.2	0.0	-0.6
4	2767.2	0.0	-0.6
4.5	2767.2	0.0	-0.6
5	2767.2	0.0	-0.6
6	2767.2	0.0	-0.6

TEST #5

Actual Excess Pressure= 31.67 psi
Initial Middle Transducer 28.43 psi
Test Pressure= 60.1 psi

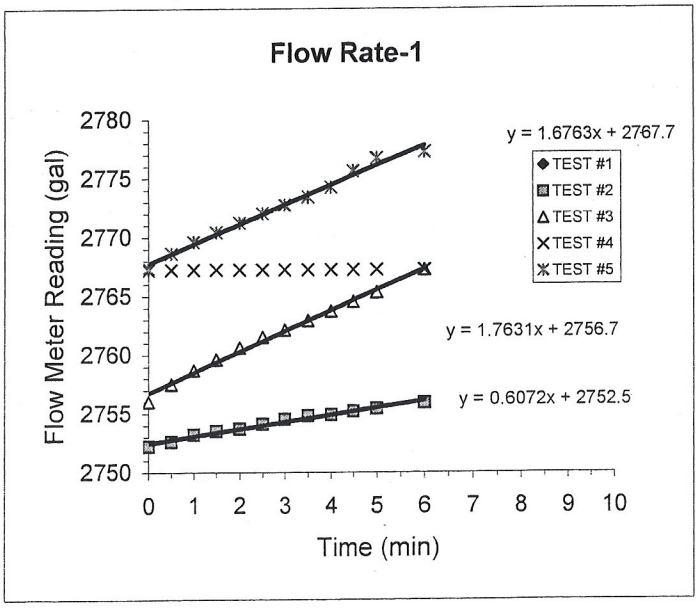
Time (min)	Flow Meter Reading (Gal)	Q (GPM)	Surface Gauge (psi)
0	2767.3		-2
0.5	2768.6	2.6	25.6
1	2769.6	2.0	23.4
1.5	2770.4	1.6	23.9
2	2771.2	1.6	24
2.5	2772	1.6	23.7
3	2772.7	1.4	23.4
3.5	2773.4	1.4	23.4
4	2774.2	1.6	23.3
4.5	2775.6	2.8	23.2
5	2776.7	2.2	23.2
6	2777.2	0.5	22.9

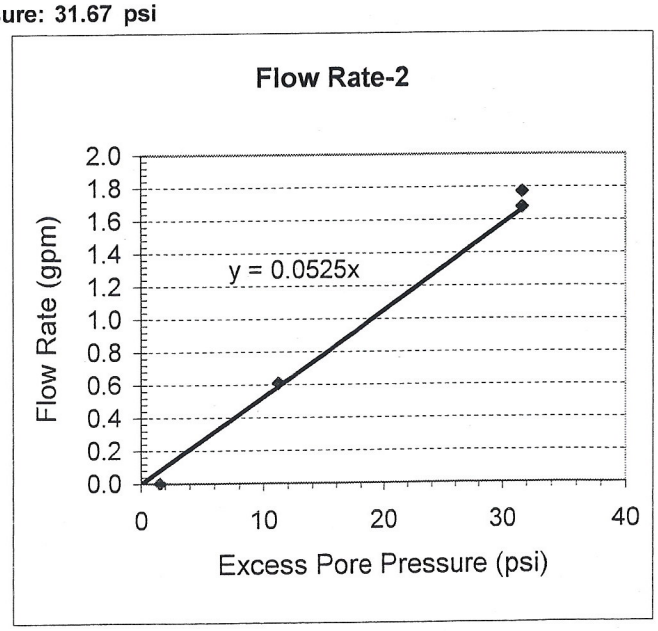
	Excess Pressure (psi)	Q* (gpm)	Test Pres. (ft).	k_e (fpy)
1	-8.63	TNP	-19.92	
2	11.23	0.607	25.92	178.24
3	31.67	1.771	73.08	184.36
4	1.57	0.000	3.62	0.00
5	31.67	1.676	73.1	174.49

* Q obtained from graph Flow Rate-1

Average Q: 0 gpm
Excess Pore pressure: 1.57 psi

Average Q: 1.8 gpm
Excess Pore pressure: 31.67 psi





obtain Q from graph 2 in gpm/psi --> 0.0525 gal/psi

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

k_e= **1.67E-04 cm/sec**
= **173.05 ft/year**

Pressure Decay Test

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

Project Name: NORTH ANNA COL
Project Number: 6468-06-1472
Date: 8/16/2006
Boring No: B-949
Test Interval: 84 ft to 89 ft (below surface)

N.O. Not Observed
N.A. Not Aplicable

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	8.3	39.53
0.5	3.5	33.58
1.0	2.5	31.56
1.5	1.7	33.39
2.0	1.2	29.58
2.5	0.9	29.09
3.0	0.8	28.84
3.5	0.6	28.57
4.0	0.6	28.57
4.5	0.5	28.48
5.0	0.5	28.45
5.5	0.5	28.44
6.0	0.5	28.43
6.5	0.5	28.42

Test #3

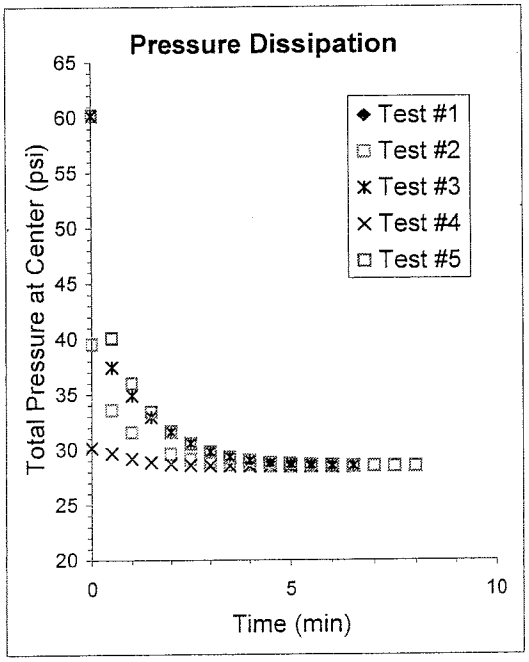
Time (min)	Surface Gauge (psi)	Center Tranducer (psi)
0.0	23.6	60.15
0.5	3	37.42
1.0	1.6	34.87
1.5	0.5	32.94
2.0	0.0	31.56
2.5	-0.6	30.56
3.0	-1.1	29.77
3.5	-1.4	29.30
4.0	-1.7	28.99
4.5	-1.6	28.76
5.0	-1.8	28.66
5.5	-1.9	28.57
6.0	-1.9	28.52
6.5	-1.9	28.48

Test #4

Time (min)	Surface Gauge (psi)	Center Tranducer (psi)
0.0	-0.6	30.14
0.5	-1.1	29.64
1.0	-1.4	29.15
1.5	-1.6	28.84
2.0	-1.7	28.67
2.5	-1.8	28.56
3.0	-1.9	28.50
3.5	-1.9	28.47
4.0	-1.9	28.45
4.5	-1.9	28.44
5.0	-1.9	28.43
5.5	-1.9	28.43
6.0	-1.9	28.43

Test #5

Time (min)	Surface Gauge (psi)	Center Tranducer (psi)
0.0	22.9	60.19
0.5	4.3	40.08
1.0	1	35.98
1.5	-1	33.40
2.0	-1.8	31.61
2.5	-2.6	30.48
3.0	-3.0	29.75
3.5	-3.3	29.28
4.0	-3.5	29.01
4.5	-3.6	28.78
5.0	-3.7	28.68
5.5	-3.7	28.61
6.0	-3.7	28.57
6.5	-3.7	28.52
7.0	-3.8	28.50
7.5	-3.8	28.48
8	-3.7	28.48



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-949
Test Interval: 90.6 ft to 95.6 ft (below top of casing)
Stick up length: 1.6 ft
Test Interval: 89.0 ft to 94 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= 23.00 ft (from top of casing)
h1= 23.00 (from top of casing)
h2 = 70.1 ft (from top of casing)
ρ_w = 62.4 lb/ft^3

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

P_0 Max= 62.96 psi Value on field data sheet= 62.9

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

TEST #1

Actual Excess Pressure= -9.92 psi
Initial Middle Transducer Reading= 30.62 psi
Test Pressure= 20.70 psi

Time (min)	Flow Meter Reading (Gal)	Q (GPM)	Surface Gauge (psi)
Test not performed			

Average Q: gpm
Excess Pore pressure: -9.92 psi

TEST #2

Actual Excess Pressure= 10.88 psi
Initial Middle Transducer Reading= 30.62 psi
Test Pressure= 41.50 psi

Time (min)	Flow Meter Reading (Gal)	Q (GPM)	Surface Gauge (psi)
0	2741		-0.2
0.5	2741.4	0.8	8.2
1	2741.6	0.4	7.6
1.5	2741.6	0.0	7.6
2	2741.6	0.0	7.9
2.5	2741.6	0.0	7.9
3	2741.6	0.0	7.9
3.5	2741.6	0.0	8.1
4	2741.6	0.0	7.9
4.5	2741.6	0.0	8
5	2741.6	0.0	7.9

Average Q: 0.0 gpm
Excess Pore pressure: 10.88 psi

TEST #3

Actual Excess Pressure= 32.28 psi
Initial Middle Transducer Reading= 30.6 psi
Test Pressure= 62.9 psi

Time (min)	Flow Meter Reading (Gal)	Q (GPM)	Surface Gauge (psi)
0	2741.6		0
0.5	2743	2.8	26
1	2743.5	1.0	27.1
1.5	2743.9	0.8	26.8
2	2744.1	0.4	25
2.5	2744.4	0.6	25.7
3	2744.7	0.6	26
3.5	2745	0.6	26
4	2745.3	0.6	25.7
4.5	2745.5	0.4	25.5
5	2745.8	0.6	25.5
6	2746.3	0.5	24.7
7	2746.8	0.5	26.1
8	2747.3	0.5	26.4
9	2747.7	0.4	26.4
10	2748.3	0.6	26.1

Average Q: 0.5 gpm
Excess Pore pressure: 32.28 psi

JAZ 1-17-07

TEST #4

Actual Excess Pressure= 0.78 psi
Initial Middle Transducer 30.62 psi
Test Pressure= 31.40 psi

Time (min)	Flow Meter Reading (Gal)	Q (GPM)	Surface Gauge (psi)
0	2748.5		-1.6
0.5	2748.5	0.0	-1.6
1	2748.5	0.0	-1.5
1.5	2748.6	0.2	-0.5
2	2748.6	0.0	-0.7
2.5	2748.6	0.0	-0.9
3	2748.6	0.0	-1
3.5	2748.6	0.0	-1.2
4	2748.6	0.0	-1.1
4.5	2748.6	0.0	-0.7
5	2748.6	0.0	-0.7

TEST #5

Actual Excess Pressure= 32.28 psi
Initial Middle Transducer 30.62 psi
Test Pressure= 62.9 psi

Time (min)	Flow Meter Reading (Gal)	Q (GPM)	Surface Gauge (psi)
0	2748.6		-1.6
0.5	2749.5	1.8	26.6
1	2749.7	0.4	25.6
1.5	2749.9	0.4	24.4
2	2750.1	0.4	24.1
2.5	2750.3	0.4	25.5
3	2750.5	0.4	26.1
3.5	2750.8	0.6	24.3
4	2750.9	0.2	22.2
4.5	2751.1	0.4	23.7
5	2751.2	0.2	23.6
5.5	2751.3	0.2	23.2
6	2751.5	0.4	24.6
7	2751.6	0.1	24.5
7.5	2752	0.8	24.7
8	2752.1	0.2	24.7

Boring No: 84
Test Interval: 89 ft to 94 ft
(below surface)

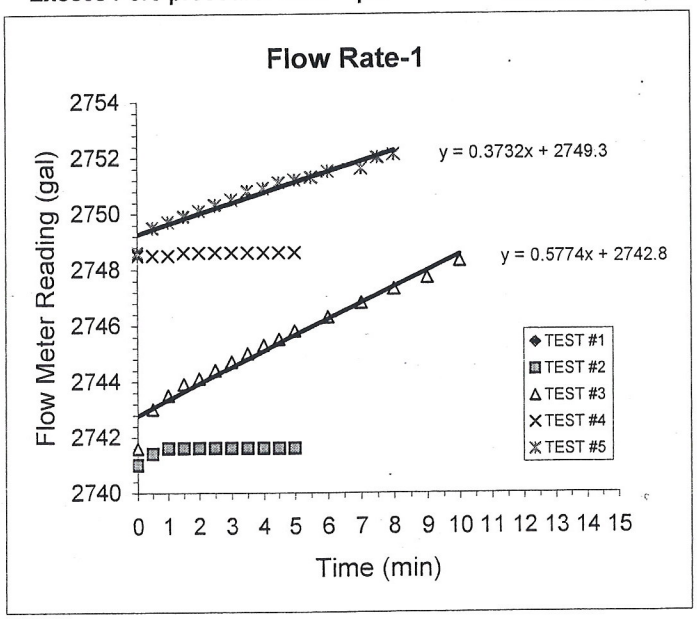
Density of water, ρ_w=62.4 lb/ft^3
= 0.0361 lb/in^3
Length= 5 ft
Borehole radius= 2.00 in
R ranges from 5-10 ft:
choose R= 5 ft

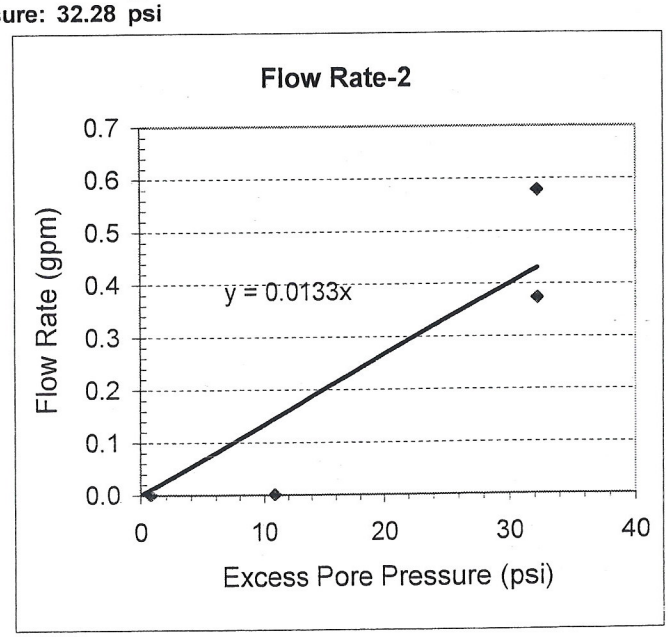
	Excess Pressure (psi)	Q* (gpm)	Test Pres. (ft)	k_e (fpy)
1	-9.92	0.000	-22.89	0
2	10.88	0.000	25.11	0
3	32.28	0.373	74.49	38.11
4	0.78	0.000	1.80	0
5	32.28	0.577	74.5	58.97

* Q obtained from graph Flow Rate-1

Average Q: 0.0 gpm
Excess Pore pressure: 0.78 psi

Average Q: 0.4 gpm
Excess Pore pressure: 32.28 psi





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

Note: Graph 2 not applicable as flow only at one pressure. Use average of Ke for Tests 3 and 5

$k_e = Q^* \ln(R/r_0)/(2\pi L H_0)$ k_e= #VALUE! cm/sec
= NA ft/year

Pressure Decay Test

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

Project Name: NORTH ANNA COL
Project Number: 6468-06-1472
Date: 8/18/2006
Boring No: B-949
Test Interval: 89 ft to 94 ft (below surface)

N.O. Not Observed
N.A. Not Aplicable

Test #1

Time (min)	Surface Gauge (psi)	Center Tranducer (psi)

Test #2

Time (min)	Surface Gauge (psi)	Center Tranducer (psi)
0.0	7.9	41.44
0.5	5.3	38.11
1.0	3.9	36.29
1.5	2.9	34.95
2.0	2.4	33.94
2.5	1.8	33.18
3.0	1.5	32.65
3.5	1.2	32.14
4.0	1	31.8
4.5	0.8	31.52
5.0	0.7	31.29
6.0	0.6	31.12
7.0	0.5	30.97
8.0	0.4	30.89
9.0	0.4	30.81
10.0	0.3	30.76
11.0	0.3	30.72
12.0	0.3	30.7

Test #3

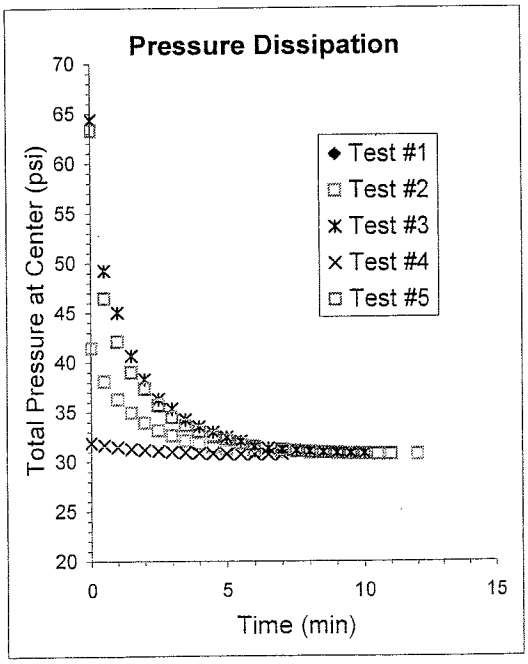
Time (min)	Surface Gauge (psi)	Center Tranducer (psi)
0.0	26.1	64.32
0.5	13.1	49.20
1.0	8.9	45.02
1.5	5.3	40.65
2.0	3.5	38.29
2.5	2	36.29
3.0	1.4	35.32
3.5	0.6	34.24
4.0	0.2	33.54
4.5	-0.1	32.98
5.0	-0.5	32.46
5.5	-0.7	32.05
6.0	-1	31.52
6.5	-1.2	31.33
7.0	-1.2	31.19
7.5	-1.3	31.10
8.0	-1.4	31.02
8.5	-1.4	30.91
9.0	-1.5	30.85
9.5	-1.5	30.82
10.0	-1.5	30.79

Test #4

Time (min)	Surface Gauge (psi)	Center Tranducer (psi)
0.0	-0.7	31.87
0.5	-0.9	31.65
1.0	-1.1	31.45
1.5	-1.2	31.28
2.0	-1.3	31.16
2.5	-1.3	31.06
3.0	-1.4	30.97
3.5	-1.4	30.91
4.0	-1.5	30.85
4.5	-1.5	30.80
5.0	-1.5	30.77
5.5	-1.6	30.75
6.0	-1.6	30.74
6.5	-1.6	30.73
7	-1.6	30.71

Test #5

Time (min)	Surface Gauge (psi)	Center Tranducer (psi)
0.0	24.7	63.27
0.5	9.6	46.44
1.0	5.8	42.11
1.5	3.0	39.00
2.0	2.1	37.36
2.5	0.9	35.71
3.0	0.1	34.49
3.5	-0.3	33.69
4.0	-0.7	33.08
4.5	-1.1	32.54
5.0	-1.3	32.21
5.5	-1.6	31.87
6.0	-1.7	31.54
66.5	-1.9	31.34
7	-2.0	31.21
7.5	-2.0	31.08
8	-2.1	30.98
8.5	-2.1	30.90
9	-2.2	30.85
9.5	-2.3	30.79
10	-2.3	30.74
10.5	-2.3	30.73
11	-2.3	30.71



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: 8/16/2006
Boring No: B-949
Test Interval: 96.1 ft to 101.1 ft (below top of casing)
Stick up length: 1.6 ft
Test Interval: 94.5 ft to 99.5 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= 23.10 ft (from top of casing)
h1= 23.00 (from top of casing)
h2 = 75.50 ft (from top of casing)
ρ_w = 62.4 lb/ft^3

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

P_0 Max= 66.04 psi Value on field data sheet= 66.03

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

TEST #1

Actual Excess Pressure= -11.22 psi
Initial Middle Transducer Reading= 33.01 psi
Test Pressure= 21.79 psi

Time (min)	Flow Meter Reading (Gal)	Q (GPM)	Surface Gauge (psi)
Test not conducted			

TEST #2

Actual Excess Pressure= 10.82 psi
Initial Middle Transducer Reading= 32.75 psi
Test Pressure= 43.57 psi

Time (min)	Flow Meter Reading (Gal)	Q (GPM)	Surface Gauge (psi)
0	2509.7		0
0.5	2509.7	0.0	0.1
1	2510.1	0.8	10.9
1.5	2515.4	10.6	13.4
2	2520.4	10.0	3.6
2.5	2525.3	9.8	3.7
3	2529.7	8.8	3.9
3.5	2532.9	6.4	3.9
4	2538.2	10.6	3.2
4.5	2542.2	8.0	3.2
5	2546.5	8.6	3.4

TEST #3

Actual Excess Pressure= 17.03 psi
Initial Middle Transducer Reading= 32.75 psi
Test Pressure (max achievable)= 49.78 psi

Time (min)	Flow Meter Reading (Gal)	Q (GPM)	Surface Gauge (psi)
0	2548		-10.3
0.5	2549.1	2.2	10.8
1	2556	13.8	14.7
1.5	2566.7	21.4	27.8
2	2575.7	18.0	28.7
2.5	2584.9	18.4	29.6
3	2593.9	18.0	31.3
3.5	2602.9	18.0	31.6
4	2611.6	17.4	31.4
4.5	2621.7	20.2	32.2
5	2631.1	18.8	32.2

Average Q: ##### gpm
Excess Pore pressure: -11.2 psi

Average Q: 9.1 gpm
Excess Pore pressure: 10.82 psi

Average Q: 18.8 gpm
Excess Pore pressure: 17.03 psi

JOZ 1-17-07

TEST #4

Actual Excess Pressure= 0.00 psi
Initial Middle Transducer 33.01 psi
Test Pressure= 33.01 psi

Time (min)	Flow Meter Reading (Gal)	Q (GPM)	Surface Gauge (psi)
0	2632.1		-10.2
0.5	2632.1	0.0	-10.2
1	2632.1	0.0	-10.1
1.5	2632.2	0.2	-9.9
2	2632.3	0.2	-9.6
2.5	2632.6	0.6	-9.5
3	2632.7	0.2	-9.5
3.5	2632.8	0.2	-9.5
4	2632.9	0.2	-9.4
4.5	2633	0.2	-9.4
5	2633	0.0	-9.4
6	2633	0.0	-9.4

Average Q: 0.2 gpm
Excess Pore pressure: 0.00 psi

TEST #5

Actual Excess Pressure= 30.85 psi
Initial Middle Transducer 33.01 psi
Test Pressure (max achievable)= 63.86 psi

Time (min)	Flow Meter Reading (Gal)	Q (GPM)	Surface Gauge (psi)
0	2633		-0.7
0.5	2636.8	7.6	25.2
1	2645.8	18.0	28.1
1.5	2655.9	20.2	30.3
2	2665.9	20.0	31.3
2.5	2674.3	16.8	31.5
3	2684.2	19.8	31.7
3.5	2692.8	17.2	32.5
4	2701.9	18.2	32.4
4.5	2711.3	18.8	33.1
5	2722.9	23.2	33.1
6	2737	14.1	33.1

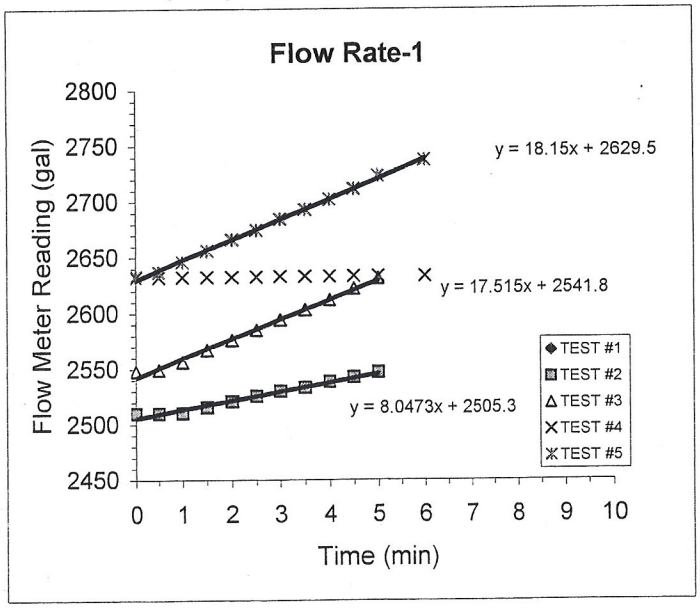
Average Q: 18.7 gpm
Excess Pore pressure: 30.85 psi

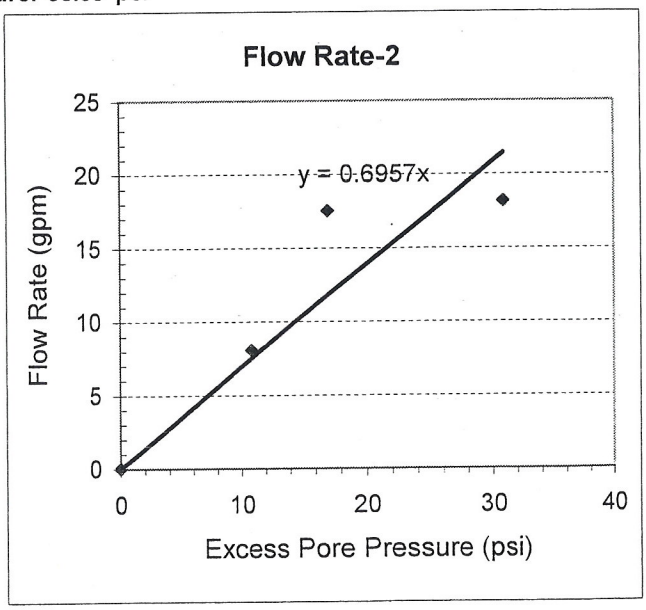
Boring No: B-949
Test Interval: 94.5 ft to 99.5 ft
(below surface)

Density of water, ρ_w=62.4 lb/ft^3
= 0.0361 lb/in^3
Length= 5 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	-11.22	0.000	-25.89	0
2	10.82	8.047	24.97	2452
3	17.03	17.52	39.30	3390
4	0.00	0.000	0.00	#DIV/0!
5	30.85	18.15	71.19	1939

* Q obtained from graph Flow Rate-1





obtain Q from graph 2 in gpm/psi --> 0.6957 gal/psi

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

k_e= 2.22E-03 cm/sec
= 2293.17 ft/year

Pressure Decay Test

Project Name: NORTH ANNA COL
Project Number: 6468-06-1472
Date: 8/16/2006
Boring No: B-949
Test Interval: 94.5 ft to 99.5 ft (from surface)

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

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	3.4	43.62
0.5	-8.4	35.31
1.0	-8.3	34.66
1.5	-8.7	34.18
2.0	-9	33.88
2.5	-9.2	33.68
3.0	-9.4	33.52
3.5	-9.5	33.39
4.0	-9.6	33.31
4.5	-9.7	33.21
5.0	-9.8	33.15
5.5	-9.9	33.1
6.0	-9.9	33.05
6.5	-9.9	33.02
7.0	-10.0	32.98
7.5	-10.0	32.95
8.0	-10.0	32.93

Test #3

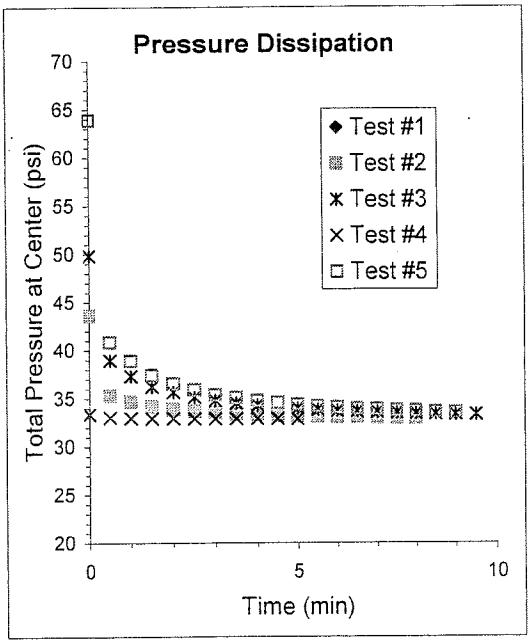
Time (min)	Surface Gauge (psi)	Center Tranducer (psi)
0.0	32.2	49.78
0.5	-3.8	38.94
1.0	-5.6	37.32
1.5	-6.6	36.22
2.0	-7.2	35.66
2.5	-7.8	35.12
3.0	-8.1	34.79
3.5	-8.5	34.50
4.0	-8.7	34.28
4.5	-8.8	
5.0	-9	33.95
5.5	-9.1	33.82
6.0	-9.2	33.69
6.5	-9.3	33.60
7.0	-9.4	33.53
7.5	-9.5	33.47
8.0	-9.5	33.40
8.5	-9.6	33.34
9.0	-9.7	33.3
9.5	-9.7	33.26

Test #4

Time (min)	Surface Gauge (psi)	Center Tranducer (psi)
0.0	-9.4	33.34
0.5	-9.8	33
1.0	-9.9	32.95
1.5	-9.9	32.92
2.0	-9.9	32.9
2.5	-9.9	32.89
3.0	-9.9	32.88
3.5	-9.9	32.88
4.0	-9.9	32.87
4.5	-10	32.86
5.0	-9.9	32.85

Test #5

Time (min)	Surface Gauge (psi)	Center Tranducer (psi)
0.0	33.1	63.86
0.5	-1.9	40.86
1.0	-3.8	38.92
1.5	-5.7	37.40
2.0	-6.3	36.56
2.5	-7.0	35.92
3.0	-7.5	35.37
3.5	-7.8	35.08
4.0	-8.1	34.78
4.5	-8.3	34.55
5.0	-8.5	34.35
5.5	-8.7	34.18
6.0	-8.8	34.05
6.5	-9.0	33.92
7	-9.1	33.83
7.5	-9.2	33.74
8	-9.3	33.67
8.5	-9.3	33.59
9	-9.4	33.52



84.0 89.0
1.6 1.6
85.6 90.6

12-5-06

PACKER TESTING CALCULATIONS FOR P(MAX)

Date: 8-16-06

Boring No. B949

Test Interval: 85.6 to 90.6 feet from Datum

Casing Stickup 1.6 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

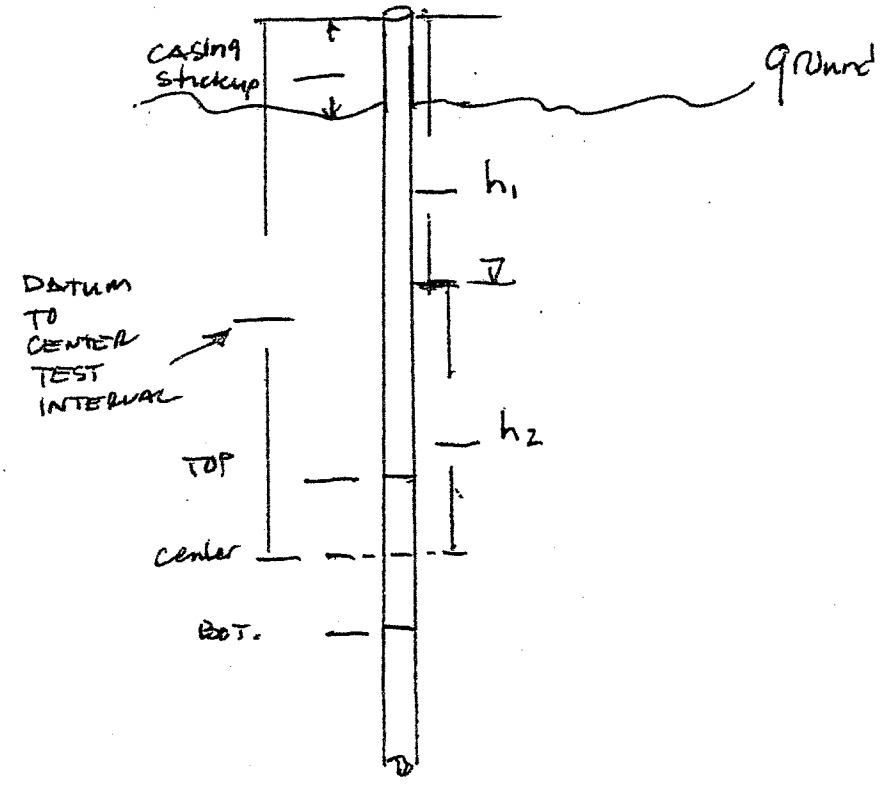
---

h_1 = 23.0

h_2 = 88.1 - 23.0 = 65.1

P MAX = 23.0 + 37.1 = 60.1

SKETCH



DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET

MACTEC ENGINEERING AND CONSULTING, INC.

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

DATA COLLECTED BY: JKovar DATE COLLECTED: 8-16-06

JK 12-5-06

BORING NO. B949 BOREHOLE DIAMETER: 4 IN.

SURFACE CASING HEIGHT ABOVE GROUND: 1.6 FT.

CHECK DATUM USED: TOP OF CASING X GROUND SURFACE ____

DATUM ELEVATION NA

DISTANCE BOTTOM OF TOP PACKER TO TOP OF BOTTOM PACKER 5.0 FT.

TEST INTERVAL DEPTH (FROM DATUM): FROM 85.6 FT. TO 90.6 FT.

TOTAL BORING DEPTH FROM DATUM: 108.0 FT.

(A) DEPTH TO WATER TABLE FROM DATUM: 23.0 FT.

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

(C) DISTANCE WATER TABLE TO CENTER OF TEST INTERVAL: 65.1 FT.

1/3

MAXIMUM TEST PRESSURE, Po 60.1 (Po = [(A+B) *1] + C*.57 psi)

TEST NUMBER: 1 TEST PRESSURE 19.8 psi PACKER PRESSURE: 100 psi

Initial Transducer Readings: Top 3.06, Middle 28.43, Bottom 31.18

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

Test was not performed due to the natural ~~Test~~ pressure by higher than Test pressure

JK 9-17

84.0 89.0
1.6 1.6
85.6 90.6

PACKER TESTING CALCULATIONS FOR P(MAX)

12-5-06

Date: 8-16-06

Boring No. B949

Test Interval: 85.6 to 90.6 feet from Datum

Casing Stickup 1.6 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

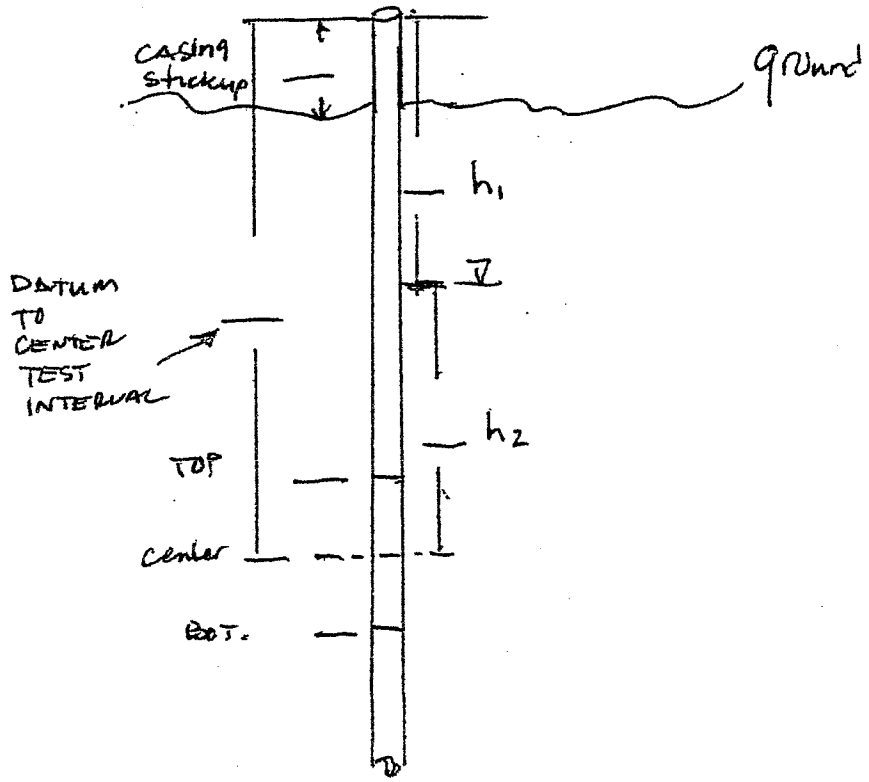
---

h_1 = 23.0

h_2 = 88.1 - 23.0 = 65.1

P MAX = 23.0 + 37.1 = 60.1

SKETCH



DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET

12-5-06

MACTEC ENGINEERING AND CONSULTING, INC.

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

DATA COLLECTED BY: J Howard DATE COLLECTED: 8-16-06

BORING NO. B949 BOREHOLE DIAMETER: 4 IN.

SURFACE CASING HEIGHT ABOVE GROUND: 1.6 FT.

CHECK DATUM USED: TOP OF CASING Y GROUND SURFACE ____

DATUM ELEVATION NA

DISTANCE BOTTOM OF TOP PACKER TO TOP OF BOTTOM PACKER 5.0 FT.

TEST INTERVAL DEPTH (FROM DATUM): FROM 85.6 FT. TO 90.6 FT.

TOTAL BORING DEPTH FROM DATUM: 108.0 FT.

(A) DEPTH TO WATER TABLE FROM DATUM: 23.0 FT.

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

(C) DISTANCE WATER TABLE TO CENTER OF TEST INTERVAL: 65.1 FT.

3/3

MAXIMUM TEST PRESSURE, Po 60.1 (Po = [(A+B) *1] + C*.57 psi)

TEST NUMBER: 2 TEST PRESSURE 39.66 psi PACKER PRESSURE: 100 psi

Initial Transducer Readings: Top 3.06, Middle 28.43, Bottom 31.18

Transducer Readings after initial pressurization:
Top 3.16, Middle 28.58, Bottom 31.23

Transducer Readings after final flow measurement:
Top 2.99, Middle 28.41, Bottom 31.21

TIME (MIN)	FLOW METER READING, (GAL)	Q (GPM)	SURFACE GAUGE, PSI	REMARKS
0.0	2752.2	/	0.2	
0.5	2752.6	.8	7.3	
1.0	2753.2	1.2	10.1	
1.5	2753.5	.6	5.8	
2.0	2753.7	.4	8.5	
2.5	2754.1	.8	8.8	
3.0	2754.5	.8	10.4	
3.5	2754.8	.6	9.1	
4.0	2754.9	.2	8.2	
4.5	2755.2	.6	8.3	
5.0	2755.4	.4	8.2	
6.0	2755.9	1.0	8.3	

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: 8-16-06

BORING NO. B949 BOREHOLE DIAMETER: 4 IN.

SURFACE CASING HEIGHT ABOVE GROUND: 1.6 FT.

CHECK DATUM USED: TOP OF CASING X GROUND SURFACE ____

DATUM ELEVATION NA

DISTANCE BOTTOM OF TOP PACKER TO TOP OF BOTTOM PACKER 5.0 FT.

TEST INTERVAL DEPTH (FROM DATUM): FROM 85.6 FT. TO 90.6 FT.

TOTAL BORING DEPTH FROM DATUM: 108.0 FT.

(A) DEPTH TO WATER TABLE FROM DATUM: 23.0 FT.

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

(C) DISTANCE WATER TABLE TO CENTER OF TEST INTERVAL: 65.1 FT.

1/3

MAXIMUM TEST PRESSURE, Po 60.1 (Po = [(A+B) *1] + C*.57 psi)

TEST NUMBER: 1 TEST PRESSURE 19.8 psi PACKER PRESSURE: 100 psi

Initial Transducer Readings: Top 3.06, Middle 28.43, Bottom 31.18

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

Test was not performed due to the natural ~~Test~~ pressure by higher than Test pressure

JH 12-5-06

JH 2-9-07

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

BORING NO.: B949

DATE: 8-16-06

TEST NUMBER: 2

TEST INTERVAL (FROM DATUM): FROM 85.6 **FT. TO** 90.6 **FT.**

DATA COLLECTED BY: JHoward

12-7-06

SHUT-IN TEST

PRESSURE: _____ **psi**

TIME, MIN	SURFACE GAUGE PRESSURE, PSI	MIDDLE TRANSDUCER PRESSURE, PSI
0.0	8.3	39.53
0.5	3.5	33.58
1.0	2.5	31.56
1.5	1.7	33.39
2.0	1.2	29.58
2.5	.9	29.09
3.0	.8	28.84
3.5	.6	28.57
4.0	.6	28.57
4.5	.5	28.48
5.0	.5	28.45
5.5	.5	28.44
6.0	.5	28.43
6.5	.5	28.42

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: B949-M285-90
" B285- "
" T285- "

DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET

JJ 12-5-06

MACTEC ENGINEERING AND CONSULTING, INC.

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

DATA COLLECTED BY: J Howard DATE COLLECTED: 8-16-06

BORING NO. B94B BOREHOLE DIAMETER: 4 IN.

SURFACE CASING HEIGHT ABOVE GROUND: 1.6 FT.

CHECK DATUM USED: TOP OF CASING X GROUND SURFACE ____

DATUM ELEVATION NA

DISTANCE BOTTOM OF TOP PACKER TO TOP OF BOTTOM PACKER 5.0 FT.

TEST INTERVAL DEPTH (FROM DATUM): FROM 85.6 FT. TO 90.6 FT.

TOTAL BORING DEPTH FROM DATUM: 108.0 FT.

(A) DEPTH TO WATER TABLE FROM DATUM: 27.0 FT.

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

(C) DISTANCE WATER TABLE TO CENTER OF TEST INTERVAL: 60.1 FT.

MAXIMUM TEST PRESSURE, Po 60.1 (Po = [(A+B) *1] + C*.57 psi)

TEST NUMBER: 3 TEST PRESSURE 60.1 psi PACKER PRESSURE: 100 psi

Initial Transducer Readings: Top 3.06, Middle 28.43, Bottom 31.18

Transducer Readings after initial pressurization:

Top 2.99, Middle 28.41, Bottom 31.21

Transducer Readings after final flow measurement:

Top 2.95, Middle 28.42, Bottom 31.22

TIME (MIN)	FLOW METER READING, (GAL)	Q (GPM)	SURFACE GAUGE, PSI	REMARKS
0.0	2756.0	/	.4	
0.5	2757.5	3.0	26.0	
1.0	2758.7	2.4	27.4	
1.5	2759.6	1.8	27.7	
2.0	2760.6	2.0	25.5	
2.5	2761.5	1.8	25.3	
3.0	2762.1	1.2	24.8	
3.5	2762.9	1.6	24.2	
4.0	2763.7	1.6	24.0	
4.5	2764.5	1.6	23.7	
5.0	2765.3	1.6	23.6	
6.0	2767.2	1.8	23.6	

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

BORING NO.: B949

DATE: 8-16-06

TEST NUMBER: 3

TEST INTERVAL (FROM DATUM): FROM 85.6 **FT. TO** 90.6 **FT.**

DATA COLLECTED BY: J Howard

2
JC2
12-5-06

SHUT-IN TEST

PRESSURE:_____ **psi**

TIME, MIN	SURFACE GAUGE PRESSURE, PSI	MIDDLE TRANSDUCER PRESSURE, PSI
0.0	23.6	60.15
0.5	3.0	37.42
1.0	1.6	34.87
1.5	.5	32.94
2.0	0	31.56
2.5	-.6	30.56
3.0	-1.1	29.77
3.5	-1.4	29.30
4.0	-1.7	28.99
4.5	-1.6	28.76
5.0	-1.8	28.66
5.5	-1.9	28.57
6.0	-1.9	28.52
6.5	-1.9	28.48

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: B949-M385-90
" B385 "
" T385 "

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: 8-16-06

BORING NO. B949 BOREHOLE DIAMETER: 4 IN.

SURFACE CASING HEIGHT ABOVE GROUND: 1.6 FT.

CHECK DATUM USED: TOP OF CASING ✓ GROUND SURFACE ____

DATUM ELEVATION na

DISTANCE BOTTOM OF TOP PACKER TO TOP OF BOTTOM PACKER 5.0 FT.

TEST INTERVAL DEPTH (FROM DATUM): FROM 85.6 FT. TO 90.6 FT.

TOTAL BORING DEPTH FROM DATUM: 108.0 FT.

(A) DEPTH TO WATER TABLE FROM DATUM: 23.0 FT.

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

(C) DISTANCE WATER TABLE TO CENTER OF TEST INTERVAL: 65.1 FT.

MAXIMUM TEST PRESSURE, Po ~~32.5~~ 65.1 ~~-27~~ 8-16 (Po = [(A+B) *1] + C*.57 psi)

1/2 TEST NUMBER: 4 TEST PRESSURE ~~32.5~~ 8-17 30.0 psi PACKER PRESSURE: 100 psi

Initial Transducer Readings: Top 3.06, Middle 28.43, Bottom 31.18

Transducer Readings after initial pressurization:
Top 2.95, Middle 28.42, Bottom 31.22

Transducer Readings after final flow measurement:
Top 2.95, Middle 28.45, Bottom 31.22

TIME (MIN)	FLOW METER READING, (GAL)	Q (GPM)	SURFACE GAUGE, PSI	REMARKS
0.0	2767.2	/	-2.0	
0.5	2767.2	Ø	-1.0	
1.0	2767.2	Ø	-0.8	
1.5	2767.2	Ø	-0.8	
2.0	2767.2	Ø	-0.5	
2.5	2767.2	Ø	-0.4	
3.0	2767.2	Ø	-0.6	
3.5	2767.2	Ø	-0.6	
4.0	2767.2	Ø	-0.6	
4.5	2767.2	Ø	-0.6	
5.0	2767.2	Ø	-0.6	

Flow during this test was lower than the Flowmeter could Read

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

BORING NO.: B949
DATE: 8-16-06
TEST NUMBER: 4
TEST INTERVAL (FROM DATUM): FROM 85.6 **FT. TO** 90.6 **FT.**
DATA COLLECTED BY: J Howard

2
Jr 12-2006

SHUT-IN TEST

PRESSURE:_____ **psi**

TIME, MIN	SURFACE GAUGE PRESSURE, PSI	MIDDLE TRANSDUCER PRESSURE, PSI
0.0	-.6	30.14
0.5	-1.1	29.64
1.0	-1.4	29.15
1.5	-1.6	28.84
2.0	-1.7	28.67
2.5	-1.8	28.56
3.0	-1.9	28.50
3.5	-1.9	28.47
4.0	-1.9	28.45
4.5	-1.9	28.44
5.0	-1.9	28.43
5.5	-1.9	28.43
6.0	-1.9	28.43

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: B949-M485-90
" B485 "
" T485 "

DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET

JAJ 12-5-06

MACTEC ENGINEERING AND CONSULTING, INC.

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

DATA COLLECTED BY: S Howard DATE COLLECTED: 8-16-06

BORING NO. B949 BOREHOLE DIAMETER: 4 IN.

SURFACE CASING HEIGHT ABOVE GROUND: 1.6 FT.

CHECK DATUM USED: TOP OF CASING X GROUND SURFACE ____

DATUM ELEVATION NA

DISTANCE BOTTOM OF TOP PACKER TO TOP OF BOTTOM PACKER 5.0 FT.

TEST INTERVAL DEPTH (FROM DATUM): FROM 85.6 FT. TO 90.6 FT.

TOTAL BORING DEPTH FROM DATUM: 108.0 FT.

(A) DEPTH TO WATER TABLE FROM DATUM: 23.0 FT.

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

(C) DISTANCE WATER TABLE TO CENTER OF TEST INTERVAL: 65.1 FT.

MAXIMUM TEST PRESSURE, Po 60.1 (Po = [(A+B) *1] + C*.57 psi)

TEST NUMBER: 5 TEST PRESSURE 60.1 psi PACKER PRESSURE: 100 psi

Initial Transducer Readings: Top 3.06, Middle 28.13, Bottom 31.18

Transducer Readings after initial pressurization:
Top 2.95, Middle 28.41, Bottom 31.22

Transducer Readings after final flow measurement:
Top 2.95, Middle 28.45, Bottom 31.25

TIME (MIN)	FLOW METER READING, (GAL)	Q (GPM)	SURFACE GAUGE, PSI	REMARKS
0.0	2767.3	/	22.0	
0.5	2768.6	2.6	25.6	
1.0	2769.6	2.0	23.4	
1.5	2770.4	1.6	23.9	
2.0	2771.2	1.6	24.0	
2.5	2772.0	1.6	23.7	
3.0	2772.7	1.4	23.4	
3.5	2773.4	1.4	23.4	
4.0	2774.2	1.6	23.3	
4.5	2775.0	~~1.6~~ 2.8	23.2	
5.0	2776.7	2.2	23.2	
6.0	2777.2	1.0	22.9	

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

BORING NO.: B949

DATE: 8-16-06

TEST NUMBER: ~~TSB816~~ 5

TEST INTERVAL (FROM DATUM): FROM 85.5 **FT. TO** 90.5 **FT.**

DATA COLLECTED BY: S Howard

Jo 9 12-6-06

SHUT-IN TEST

PRESSURE:_____ **psi**

TIME, MIN	SURFACE GAUGE PRESSURE, PSI	MIDDLE TRANSDUCER PRESSURE, PSI
0.0	22.9	60.19
0.5	4.3	40.08
1.0	1.0	35.98
1.5	-1.0	33.40
2.0	-1.8	31.61
2.5	-2.6	30.48
3.0	-3.0	29.75
3.5	-3.3	29.28
4.0	-3.5	29.01
4.5	-3.6	28.78
5.0	-3.7	28.68
5.5	-3.7	28.61
6.0	-3.7	28.57
6.5	-3.7	28.52
7.0	-3.8	28.50
7.5	-3.8	28.48
8.0	-3.7	28.48

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: B949-M585-90
" - T585-"
" - B585-"

12-5-06

PACKER TESTING CALCULATIONS FOR P(MAX)

Date: 8-16-06

Boring No. B9c9

Test Interval: 95.6 to 90.6 feet from Datum

Casing Stickup 1.6 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 = 23.0

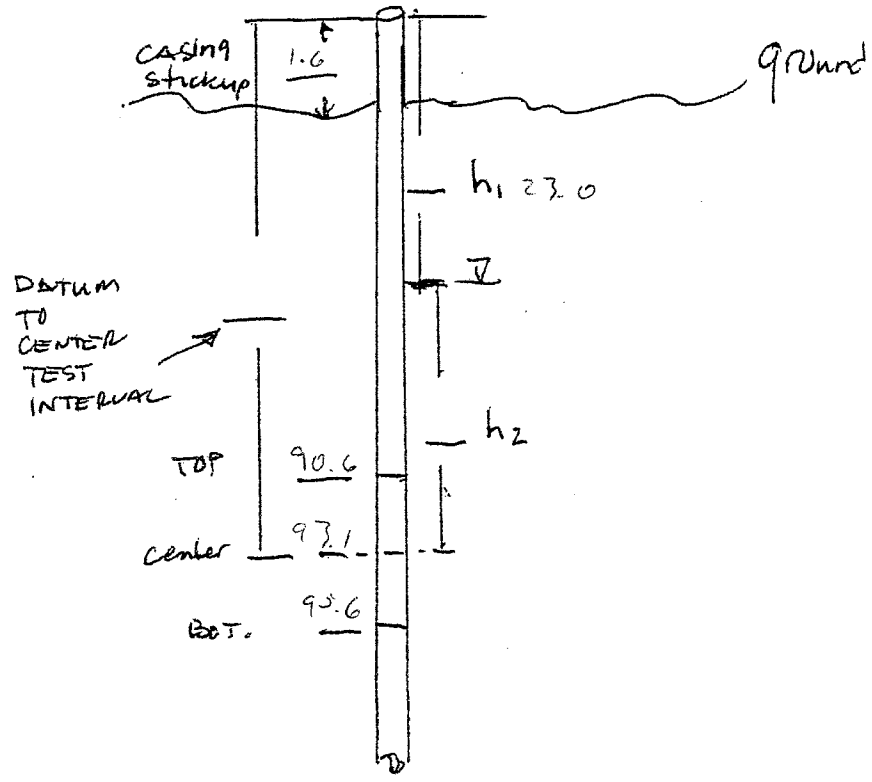
h_2 = 93.1 - 23.0 = 70.1

P MAX = 23.0 + 39.96 = 62.9

24.0
93.1 - 23.0 - 70.1
24.

63.9

SKETCH



DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET

AIA 12-5-06

MACTEC ENGINEERING AND CONSULTING, INC.

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

DATA COLLECTED BY: S Howard DATE COLLECTED: 8-17-06 8-17

BORING NO. B949 BOREHOLE DIAMETER: 4 IN.

SURFACE CASING HEIGHT ABOVE GROUND: 1.6 FT.

CHECK DATUM USED: TOP OF CASING X GROUND SURFACE__

DATUM ELEVATION NA

DISTANCE BOTTOM OF TOP PACKER TO TOP OF BOTTOM PACKER 5.0 FT.

TEST INTERVAL DEPTH (FROM DATUM): FROM 95.6 FT. TO 90.6 FT.

TOTAL BORING DEPTH FROM DATUM: 108.0 FT.

(A) DEPTH TO WATER TABLE FROM DATUM: 23.0 FT.

(B) SURFACE GAUGE HEIGHT ABOVE DATUM: ~~1.6~~ 1.0 FT. 8-16

(C) DISTANCE WATER TABLE TO CENTER OF TEST INTERVAL: 70.1 FT.

1/3 MAXIMUM TEST PRESSURE, Po 62.9 (Po = [(A+B) *1] + C*.57 psi)

TEST NUMBER: 1 TEST PRESSURE 20.7 psi PACKER PRESSURE: 100 psi

Initial Transducer Readings: Top 3.22, Middle 30.62, Bottom 33.42

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

Test Couldn't be done due to the natural pressure being greater than the test pressure

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

BORING NO.: B449

DATE: 8-17-06

TEST NUMBER: 2

TEST INTERVAL (FROM DATUM): FROM 95.6 **FT. TO** 90.6 **FT.**

DATA COLLECTED BY: Howard

2

JLY 12-5-06

SHUT-IN TEST

PRESSURE: _____ **psi**

TIME, MIN	SURFACE GAUGE PRESSURE, PSI	MIDDLE TRANSDUCER PRESSURE, PSI
0.0	7.9	41.44
0.5	5.3	38.11
1.0	3.9	36.29
1.5	2.9	34.95
2.0	2.4	33.94
2.5	1.8	33.18
3.0	1.5	32.65
3.5	1.2	32.14
4.0	1.0	31.80
4.5	0.8	31.52
5.0	.7	31.29
5.5	.6	31.12
6.0	.5	30.97
6.5	.4	30.89
	.4	30.81
	.3	30.76
	.3	30.72
	.3	30.70

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: B449-M2 90 min 5-17 @5'

" B2 "

" T2 "

DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET

12-5-06

MACTEC ENGINEERING AND CONSULTING, INC.

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

DATA COLLECTED BY: J Howard DATE COLLECTED: 8-17-06

BORING NO. B949 BOREHOLE DIAMETER: 4 IN.

SURFACE CASING HEIGHT ABOVE GROUND: 1.6 FT.

CHECK DATUM USED: TOP OF CASING X GROUND SURFACE ____

DATUM ELEVATION NA

DISTANCE BOTTOM OF TOP PACKER TO TOP OF BOTTOM PACKER 5.0 FT.

TEST INTERVAL DEPTH (FROM DATUM): FROM 95.6 FT. TO 90.6 FT.

TOTAL BORING DEPTH FROM DATUM: ~~95.6~~ 108.0 FT. 108.0

(A) DEPTH TO WATER TABLE FROM DATUM: 23.0 FT.

(B) SURFACE GAUGE HEIGHT ABOVE DATUM: ~~1.6~~ 1.0 FT.

(C) DISTANCE WATER TABLE TO CENTER OF TEST INTERVAL: 70.1 FT.

2/3 MAXIMUM TEST PRESSURE, Po 62.9 (Po = [(A+B) *1] + C*.57 psi)

2/3 TEST NUMBER: 2 TEST PRESSURE 41.5 psi PACKER PRESSURE: 100 psi

Initial Transducer Readings: Top 3.27, Middle 30.62, Bottom 33.42

Transducer Readings after initial pressurization:
Top 3.19, Middle ~~30.85~~ 30.69, Bottom 33.43

Transducer Readings after final flow measurement:
Top 3.12, Middle 30.36, Bottom 33.47

TIME (MIN)	FLOW METER READING, (GAL)	Q (GPM)	SURFACE GAUGE, PSI	REMARKS
0 0	27 41.0	/	-0.2	
0.5	27 41.4	.8	8.2	
1.0	27 41.6	.4	7.6	
1.5	27 41.6	Ø	7.6	
2.0	27 41.6	Ø	7.9	
2.5	27 41.6	Ø	7.9	
3.0	27 41.6	Ø	7.9	
3.5	27 41.6	Ø	8.1	
4.0	27 41.6	Ø	7.9	
4.5	27 41.6	Ø	8.0	
5.0	27 41.6	Ø	7.9	
6.0				

DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET

#07 12-5-06

MACTEC ENGINEERING AND CONSULTING, INC.

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

DATA COLLECTED BY: S Howard DATE COLLECTED: 8-17-06

BORING NO. B949 BOREHOLE DIAMETER: 4 IN.

SURFACE CASING HEIGHT ABOVE GROUND: 1.6 FT.

CHECK DATUM USED: TOP OF CASING X GROUND SURFACE ____

DATUM ELEVATION NA

DISTANCE BOTTOM OF TOP PACKER TO TOP OF BOTTOM PACKER 5.0 FT.

TEST INTERVAL DEPTH (FROM DATUM): FROM 95.6 FT. TO 90.6 FT.

TOTAL BORING DEPTH FROM DATUM: 108.0 FT.

(A) DEPTH TO WATER TABLE FROM DATUM: 23.0 FT.

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

(C) DISTANCE WATER TABLE TO CENTER OF TEST INTERVAL: 70.1 FT.

MAXIMUM TEST PRESSURE, Po 62.9 (Po = [(A+B) *1] + C*.57 psi)

TEST NUMBER: 3 TEST PRESSURE 62.9 psi PACKER PRESSURE: 100 psi

Initial Transducer Readings: Top 3.22, Middle 30.62, Bottom 33.42

Transducer Readings after initial pressurization:
Top 3.12, Middle 30.63, Bottom 33.47

Transducer Readings after final flow measurement:
Top 3.03, Middle 30.70, Bottom 33.40

TIME (MIN)	FLOW METER READING, (GAL)	Q (GPM)	SURFACE GAUGE, PSI	REMARKS
0.0	27 41.6	/	0.0	
0.5	27 43.0	2.8	26.0	
1.0	27 43.5	1.0	27.1	
1.5	27 43.9	.8	26.8	
2.0	2744.1	.4	25.0	
2.5	2744.4	.6	25.7	
3.0	2744.7	.6	26.0	
3.5	2745.0	.6	26.0	
4.0	27 45.3	.6	25.7	
4.5	27 45.5	.4	25.5	
5.0	27 45.8	.6	25.5	
6.0	2746.3	1.0	24.7	
7.0	2746.8	1.0	26.1	

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

BORING NO: B44

DATE: ~~8-17~~-06 17 ~~8-17~~

TEST NUMBER: 3

TEST INTERVAL (FROM DATUM): FROM 95.6 **FT. TO** 90.6 **FT.**

DATA COLLECTED BY: JHoward

JCJ 12-5-06

TIME (MIN)	FLOW METER READING, (GAL)	Q (GPM)	SURFACE GAUGE, PSI	REMARKS
8.0	2747.3	1.0	26.4	
9.0	2747.7	.8	26.4	
10.0	2748.3	1.2	26.1	

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

BORING NO.: B949

DATE: 8-17-06

TEST NUMBER: 3

TEST INTERVAL (FROM DATUM): FROM 95.6 **FT. TO** 90.6 **FT.**

DATA COLLECTED BY: SHoman

12-5-06

SHUT-IN TEST

PRESSURE: _____ **psi**

TIME, MIN	SURFACE GAUGE PRESSURE, PSI	MIDDLE TRANSDUCER PRESSURE, PSI
0.0	26.1	64.32
.5	13.1	49.20
1.0	8.9	45.02
1.5	5.3	40.65
2.0	3.5	38.29
2.5	2.0	36.29
3.0	1.4	35.32
3.5	.6	34.24
4.0	.2	33.54
4.5	-.1	32.98
5.0	-.5	32.46
5.5	-.7	32.05
6.0	-1.0	31.52
6.5	-1.2	31.33
7.0	-1.2	31.19
7.5	-1.3	31.10
8.0	-1.4	31.02
8.5	-1.4	30.91
9.0	-1.5	30.85
9.5	-1.5	30.82
10.0	-1.5	30.79

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: B949-M390-95

" B390 "

" T390 "

DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET

JAZ 12-5-06

MACTEC ENGINEERING AND CONSULTING, INC.

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

DATA COLLECTED BY: J Howard DATE COLLECTED: 8-16-06

BORING NO. B-49 BOREHOLE DIAMETER: 4 IN.

SURFACE CASING HEIGHT ABOVE GROUND: 1.6 FT.

CHECK DATUM USED: TOP OF CASING X GROUND SURFACE ____

DATUM ELEVATION NA

DISTANCE BOTTOM OF TOP PACKER TO TOP OF BOTTOM PACKER 5.0 FT.

TEST INTERVAL DEPTH (FROM DATUM): FROM 95.6 FT. TO 90.6 FT.

TOTAL BORING DEPTH FROM DATUM: 108.0 FT.

(A) DEPTH TO WATER TABLE FROM DATUM: 23.0 FT.

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

(C) DISTANCE WATER TABLE TO CENTER OF TEST INTERVAL: 70.1 FT.

1/2 MAXIMUM TEST PRESSURE, Po 62.4 (Po = [(A+B) *1] + C*.57 psi)

TEST NUMBER: 4 TEST PRESSURE 31.4 psi PACKER PRESSURE: 100 psi

Initial Transducer Readings: Top 3.22, Middle 30.62, Bottom 33.42

Transducer Readings after initial pressurization:

Top 3.03, Middle 30.70, Bottom 33.40

Transducer Readings after final flow measurement:

Top ____, Middle ____, Bottom ____

TIME (MIN)	FLOW METER READING, (GAL)	Q (GPM)	SURFACE GAUGE, PSI	REMARKS
0.0	2748.5	/	-1.6	
0.5	2748.5	Ø	-1.6	
1.0	2748.5	Ø	-1.5	
1.5	2748.6	.2	-0.5	
2.0	2748.6	Ø	-0.7	
2.5	2748.6	Ø	-0.9	
3.0	2748.6	Ø	-1.0	
3.5	2748.6	Ø	-1.2	
4.0	2748.6	Ø	-1.1	
4.5	2748.6	Ø	-0.7	
5.0	2748.6		-0.7	

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

BORING NO.: B949

DATE: 8-17-06

TEST NUMBER: 4

TEST INTERVAL (FROM DATUM): FROM 95.6 **FT. TO** 90.6 **FT.**

DATA COLLECTED BY: JHowar

2
P.J 12-5-06

SHUT-IN TEST

PRESSURE: _____ **psi**

TIME, MIN	SURFACE GAUGE PRESSURE, PSI	MIDDLE TRANSDUCER PRESSURE, PSI
0.0	-0.7	31.87
0.5	-0.9	31.65
1.0	-1.1	31.45
1.5	-1.2	31.28
2.0	-1.3	31.16
2.5	-1.3	31.06
3.0	-1.4	30.97
3.5	-1.4	30.91
4.0	-1.5	30.85
4.5	-1.5	30.80
5.0	-1.5	30.77
5.5	-1.6	30.75
6.0	-1.6	30.74
6.5	-1.6	30.73
7.0	-1.6	30.71

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: B949-M490-95
" B490 "
" T490 "

DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET

JDJ 12-5-06

MACTEC ENGINEERING AND CONSULTING, INC.

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

DATA COLLECTED BY: S Howard DATE COLLECTED: 8-17-06

BORING NO. B419 BOREHOLE DIAMETER: 4 IN.

SURFACE CASING HEIGHT ABOVE GROUND: 1.6 FT.

CHECK DATUM USED: TOP OF CASING X GROUND SURFACE ____

DATUM ELEVATION NA

DISTANCE BOTTOM OF TOP PACKER TO TOP OF BOTTOM PACKER 5.0 FT.

TEST INTERVAL DEPTH (FROM DATUM): FROM 95.6 FT. TO 90.6 FT.

TOTAL BORING DEPTH FROM DATUM: 108.0 FT.

(A) DEPTH TO WATER TABLE FROM DATUM: 23.0 FT.

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

(C) DISTANCE WATER TABLE TO CENTER OF TEST INTERVAL: 70.1 FT.

MAXIMUM TEST PRESSURE, Po 62.9 (Po = [(A+B) *1] + C*.57 psi)

TEST NUMBER: 5 TEST PRESSURE 62.9 psi PACKER PRESSURE: 100 psi

Initial Transducer Readings: Top 3.22, Middle 30.62, Bottom 33.42

Transducer Readings after initial pressurization:
Top 3.06, Middle 30.70, Bottom 33.42

Transducer Readings after final flow measurement:
Top 2.98, Middle 30.66, Bottom 33.44

TIME (MIN)	FLOW METER READING, (GAL)	Q (GPM)	SURFACE GAUGE, PSI	REMARKS
0.0	2748.6	/	-1.6	
0.5	2749.5	1.8	26.6	
1.0	2749.7	.4	25.6	
1.5	2749.9	.4	24.4	
2.0	2750.1	.4	24.1	
2.5	2750.3	.4	25.5	
3.0	2750.5	.4	26.1	
3.5	2750.8	.6	24.3	
4.0	2750.9	.2	27.2	
4.5	2751.1	.4	23.7	
5.0	2751.2	.2	23.6	
~~6.0~~ 5.5	2751.3	.2	23.2	
6.0	2751.5	.4	24.6	

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

JAJ 12-5-06

BORING NO: S Howard

DATE: 8-17-06

TEST NUMBER: 5

TEST INTERVAL (FROM DATUM): FROM 95.6 **FT. TO** 90.6 **FT.**

DATA COLLECTED BY: SHoward

TIME (MIN)	FLOW METER READING, (GAL)	Q (GPM)	SURFACE GAUGE, PSI	REMARKS
7.0	2751.6	.2	24.5	
7.5	2752.0	.8	24.7	
8.0	2752.1	.2	24.7	

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

BORING NO.: ~~B-16-06~~ B949

DATE: 8-12-06

TEST NUMBER: 5

TEST INTERVAL (FROM DATUM): FROM 95.6 **FT. TO** 90.6 **FT.**

DATA COLLECTED BY: SHoward

12-5-06

SHUT-IN TEST

PRESSURE: _____ **psi**

TIME, MIN	SURFACE GAUGE PRESSURE, PSI	MIDDLE TRANSDUCER PRESSURE, PSI
0.0	24.7	67.27
0.5	9.6	46.44
1.0	5.8	42.11
1.5	3.0	39.00
2.0	2.1	37.36
2.5	0.9	35.71
3.0	0.1	34.49
3.5	-.3	33.69
4.0	-.7	33.08
4.5	-1.1	32.54
5.0	-1.3	32.21
5.5	-1.6	31.87
6.0	-1.7	31.59
6.5	-1.9	31.34
7.0	-2.0	31.21
7.5	-2.0	31.08
8.0	-2.1	30.98
8.5	-2.1	30.90
9.0	-2.2	30.85
9.5	-2.3	30.79
10.0	-2.3	30.74
10.5	-2.3	30.73
11.0	-2.3	30.71

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: B949 - MS90-95
" B590 "
" T590 "

JAT 12-5-06

PACKER TESTING CALCULATIONS FOR P(MAX)

Date: 8-16-06

Boring No. B-949

Test Interval: ~~94.5~~ 8.5 to ~~99.5~~ 8.5 feet from Datum 96.1 - 101.1

Casing Stickup 1.6 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

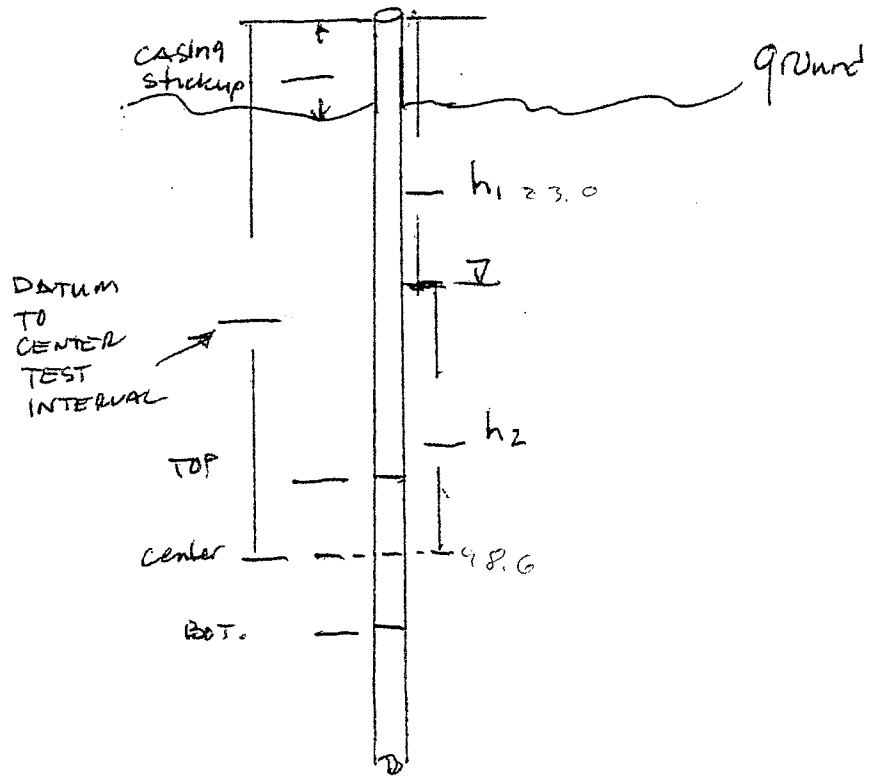
---

h_1 = 23.0

h_2 = 23.1 - 98.6 = 75.5

P MAX = 23.0 + 43.03 = 66.03

SKETCH



DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET

JAB 12-5-06

MACTEC ENGINEERING AND CONSULTING, INC.

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

DATA COLLECTED BY: ~~BJH~~ S Hannan DATE COLLECTED: 8-16-06

BORING NO. B94a BOREHOLE DIAMETER: 4 IN.

SURFACE CASING HEIGHT ABOVE GROUND: 1.6 FT.

CHECK DATUM USED: TOP OF CASING X GROUND SURFACE ____

DATUM ELEVATION NA

DISTANCE BOTTOM OF TOP PACKER TO TOP OF BOTTOM PACKER 5.0 FT.

TEST INTERVAL DEPTH (FROM DATUM): FROM 96.1 FT. TO 101.1 FT.

TOTAL BORING DEPTH FROM DATUM: 108.0 FT.

(A) DEPTH TO WATER TABLE FROM DATUM: 23.0 FT.

(B) SURFACE GAUGE HEIGHT ABOVE DATUM: ~~75.05~~ FT. 8-16 ~~1.6~~ 1.0

(C) DISTANCE WATER TABLE TO CENTER OF TEST INTERVAL: 75.5 FT.

1/3 MAXIMUM TEST PRESSURE, Po 66.03 (Po = [(A+B) *1] + C*.57 psi)

TEST NUMBER: 1 TEST PRESSURE 21.79 psi PACKER PRESSURE: 100 psi

Initial Transducer Readings: Top ~~2.63~~ JH 3.15, Middle ~~23.00~~ 33.01 (32.78), Bottom 35.72

Transducer Readings after initial pressurization:

Top ____, Middle 32.90 (32.81), Bottom ____

Transducer Readings after final flow measurement:

Top ____, Middle ____, Bottom ____

TIME (MIN)	FLOW METER READING, (GAL)	Q (GPM)	SURFACE GAUGE, PSI	REMARKS
0.0	25197		0.0	
0.5				
1.0				
1.5				
2.0				
2.5				
3.0				
3.5				
4.0				
4.5				
5.0				

Test Pressure is exceeded by natural Pressure

Skip & go to test 2

DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET

JH 12-06

MACTEC ENGINEERING AND CONSULTING, INC.

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

DATA COLLECTED BY: S Howard **DATE COLLECTED:** 8-16.06

BORING NO. B949 **BOREHOLE DIAMETER:** 4" **IN.**

SURFACE CASING HEIGHT ABOVE GROUND: 1.6 **FT.**

CHECK DATUM USED: TOP OF CASING X **GROUND SURFACE** ____

DATUM ELEVATION NA

DISTANCE BOTTOM OF TOP PACKER TO TOP OF BOTTOM PACKER 5.0 **FT.**

TEST INTERVAL DEPTH (FROM DATUM): FROM 96.1 **FT. TO** 101.1 **FT.**

TOTAL BORING DEPTH FROM DATUM: 108.0 **FT.**

(A) DEPTH TO WATER TABLE FROM DATUM: 23.0 **FT.**

(B) SURFACE GAUGE HEIGHT ABOVE DATUM: ~~1.6~~ 8-16 **FT.** 1.0

(C) DISTANCE WATER TABLE TO CENTER OF TEST INTERVAL: 75.6 **FT.**

2/3 **MAXIMUM TEST PRESSURE, Po** 66.03 **(Po = [(A+B) *1] + C*.57 psi)**

TEST NUMBER: 2 **TEST PRESSURE** 43.57 **psi PACKER PRESSURE:** 100 **psi**

Initial Transducer Readings: Top 3.151 **, Middle** 37.01 2.75 **Bottom** 35.77 5.41

Transducer Readings after initial pressurization:

Top 3.08 **, Middle** 32.75 **, Bottom** 35.56

Transducer Readings after final flow measurement:

Top 3.00 **, Middle** 32.76 **, Bottom** 35.63

TIME (MIN)	FLOW METER READING, (GAL)	Q (GPM)	SURFACE GAUGE, PSI	REMARKS
0.0	25 09.7	/	0.0	
0.5	25 09.7	0	.1	
1.0	25 10.1	0.8	10.9	
1.5	25 15.4	10.6	13.4	
2.0	25 20.4	10.0	3.6	
2.5	25 25.3	9.8	3.7	
3.0	25 29.7	8.8	3.9	
3.5	25 32.9	6.4	3.9	
4.0	25 38.2	10.6	3.2	
4.5	25 42.2	8.0	3.2	
5.0	25 46.5	8.6	3.4	

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

BORING NO.: B949

DATE: 8-16-06

TEST NUMBER: 2

TEST INTERVAL (FROM DATUM): FROM 96.1 **FT. TO** 101.1 **FT.**

DATA COLLECTED BY: S. Howell

2
JJ 8-16-06

SHUT-IN TEST

PRESSURE: 43.62 **psi**

TIME, MIN	SURFACE GAUGE PRESSURE, PSI	MIDDLE TRANSDUCER PRESSURE, PSI
0.0	3.4	43.62
0.5	-8.4	35.31
1.0	-8.3	34.66
1.5	-8.7	34.18
2.0	-9.0	33.88
2.5	-9.2	33.68
3.0	-9.4	33.52
3.5	-9.5	33.39
4.0	-9.6	33.31
4.5	-9.7	33.21
5.0	-9.8	33.15
5.5	-9.9	33.10
6.0	-9.9	33.05
6.5	-9.9	33.02
7.0	-10.0	32.98
7.5	-10.0	32.95
8.0	-10.0	32.93

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: B949-MZ96-101

B949-TZ96-101

B949-BZ96-101

DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET

JH 12-5-06

MACTEC ENGINEERING AND CONSULTING, INC.

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

DATA COLLECTED BY: J Howard **DATE COLLECTED:** 8-16-06

BORING NO. B949 **BOREHOLE DIAMETER:** 4 **IN.**

SURFACE CASING HEIGHT ABOVE GROUND: 1.6 **FT.**

CHECK DATUM USED: TOP OF CASING X **GROUND SURFACE** ____

DATUM ELEVATION NA

DISTANCE BOTTOM OF TOP PACKER TO TOP OF BOTTOM PACKER 5.0 **FT.**

TEST INTERVAL DEPTH (FROM DATUM): FROM 96.1 **FT. TO** 101.1 **FT.**

TOTAL BORING DEPTH FROM DATUM: 108.0 **FT.**

(A) DEPTH TO WATER TABLE FROM DATUM: 23.0 **FT.**

(B) SURFACE GAUGE HEIGHT ABOVE DATUM: ~~1.6~~ 1.0 **FT.** 8-16

(C) DISTANCE WATER TABLE TO CENTER OF TEST INTERVAL: 75.1 **FT.**

MAXIMUM TEST PRESSURE, Po 66.03 **(Po = [(A+B) *1] + C*.57 psi)**

TEST NUMBER: 3 **TEST PRESSURE** 66.03 **psi PACKER PRESSURE:** 100 **psi**

Initial Transducer Readings: Top 3.15 8-17 5:17, **Middle** ~~35.01~~ 27.5 8-17 7:22, **Bottom** ~~35.72~~ 35.54 8-17 8:13

Transducer Readings after initial pressurization:

Top 3.00, **Middle** 32.76, **Bottom** 35.63

Transducer Readings after final flow measurement:

Top 2.97, **Middle** 32.88, **Bottom** 35.84

TIME (MIN)	FLOW METER READING, (GAL)	Q (GPM)	SURFACE GAUGE, PSI	REMARKS
0.0	2548.0	/	-10.3	
0.5	2549.1	2.2	+10.8	
1.0	2556.0	13.8	14.7	
1.5	2566.7	21.4	27.8	
2.0	2575.7	18.0	28.7	
2.5	2584.9	18.4	29.6	
3.0	2593.9	18.0	31.3	
3.5	2602.9	18.0	31.6	
4.0	2611.6	~~17.4~~ 17.3 8-17 8:14	31.4	
4.5	2621.7	20.2	32.2	
5.0	2631.1	18.8	32.2	
6.0				

Flow was maxed & couldnot match stabilization stopped @ 5 min

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

BORING NO.: B-44-4

DATE: 8-16-06

TEST NUMBER: 3

TEST INTERVAL (FROM DATUM): FROM 96.1 **FT. TO** 101.1 **FT.**

DATA COLLECTED BY: J Howard

SHUT-IN TEST

PRESSURE: 49.78 **psi**

use this for calculation for

TIME, MIN	SURFACE GAUGE PRESSURE, PSI	MIDDLE TRANSDUCER PRESSURE, PSI
0.0	32.2	49.78
0.5	- 7.8	38.94
1.0	- 5.6	37.32
1.5	- 6.6	36.22
2.0	- 7.2	35.66
2.5	- 7.8	35.12
3.0	- 8.1	34.79
3.5	- 8.5	34.50
4.0	- 8.7	34.28
4.5	- 8.8	~~37.90~~ 8.17 missed
5.0	- 9.0	33.95
5.5	- 9.1	33.82
6.0	- 9.2	33.69
6.5	- 9.3	33.60
7.0	- 9.4	33.53
7.5	- 9.5	33.47
8.0	- 9.5	33.40
8.5	- 9.6	33.34
9.0	- 9.7	33.30
9.5	- 9.7	33.26

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

Test: B44-M3 96-101
B44a-B3 96-101
B44a T3 96-101

DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET

JBJ 12-5-06

MACTEC ENGINEERING AND CONSULTING, INC.

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

DATA COLLECTED BY: S Howard DATE COLLECTED: 8-16-06

BORING NO. B49 BOREHOLE DIAMETER: 4 IN.

SURFACE CASING HEIGHT ABOVE GROUND: 1.6 FT.

CHECK DATUM USED: TOP OF CASING X GROUND SURFACE ____

DATUM ELEVATION NA

DISTANCE BOTTOM OF TOP PACKER TO TOP OF BOTTOM PACKER 5.0 FT.

TEST INTERVAL DEPTH (FROM DATUM): FROM 96.1 FT. TO 101.1 FT.

TOTAL BORING DEPTH FROM DATUM: 108.0 FT.

(A) DEPTH TO WATER TABLE FROM DATUM: 23.0 FT.

(B) SURFACE GAUGE HEIGHT ABOVE DATUM: ~~1.6~~ 1.0 FT.

(C) DISTANCE WATER TABLE TO CENTER OF TEST INTERVAL: 75.5 FT.

1/2 MAXIMUM TEST PRESSURE, Po 66.03 (Po = [(A+B) *1] + C*.57 psi)

TEST NUMBER: 4 TEST PRESSURE 33.01* psi PACKER PRESSURE: 100 psi

Initial Transducer Readings: Top 3.15, Middle 33.01, Bottom 35.72

Transducer Readings after initial pressurization:
Top 2.97, Middle 32.88, Bottom 35.84

Transducer Readings after final flow measurement:
Top 2.94, Middle 32.84, Bottom 35.64

TIME (MIN)	FLOW METER READING, (GAL)	Q (GPM)	SURFACE GAUGE, PSI	REMARKS
0.0	~~26~~ 2632.1	/	-10.2	
0.5	2632.1	0	-10.2	
1.0	2632.1	0	-10.1	
1.5	2632.2	.2	-9.9	
2.0	2632.3	.2	-9.6	
2.5	2632.6	.6	-9.5	
3.0	2632.7	.2	-9.5	
3.5	2632.8	.2	-9.5	
4.0	2632.9	.2	-9.4	
4.5	2633.0	.2	-9.4	
5.0	2633.0	0	9.4	
6.0	2633.0	0	-9.4	

Tried to keep Mid Transducer @ 33.4 or 33.5 since the test was so close to the natural pressure

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

BORING NO.: B949
DATE: 8-16-06
TEST NUMBER: 4
TEST INTERVAL (FROM DATUM): FROM 96.1 **FT. TO** 101.1 **FT.**
DATA COLLECTED BY: J Howard

2
12-5-06

SHUT-IN TEST

PRESSURE: _____ **psi**

TIME, MIN	SURFACE GAUGE PRESSURE, PSI	MIDDLE TRANSDUCER PRESSURE, PSI
0.0	-9.6	33.34
0.5	-9.8	33.00
1.0	-9.9	32.95
1.5	-9.9	32.92
2.0	-9.9	32.90
2.5	-9.9	32.89
3.0	-9.9	32.88
3.5	-9.9	32.88
4.0	-9.9	32.87
4.5	-10.0	32.86
5.0	-9.9	32.85

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

Test: B949-M496-101
B949-B496-101
B949-T496-101

DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET

JHJ 12-5-06

MACTEC ENGINEERING AND CONSULTING, INC.

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

DATA COLLECTED BY: S Howard DATE COLLECTED: 8-16-06

BORING NO. B949 BOREHOLE DIAMETER: 4 IN.

SURFACE CASING HEIGHT ABOVE GROUND: 1.6 FT.

CHECK DATUM USED: TOP OF CASING X GROUND SURFACE ____

DATUM ELEVATION NA

DISTANCE BOTTOM OF TOP PACKER TO TOP OF BOTTOM PACKER 5.0 FT.

TEST INTERVAL DEPTH (FROM DATUM): FROM 96.1 FT. TO 101.1 FT.

TOTAL BORING DEPTH FROM DATUM: 108.0 FT.

(A) DEPTH TO WATER TABLE FROM DATUM: 23.0 FT.

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

(C) DISTANCE WATER TABLE TO CENTER OF TEST INTERVAL: 75.5 FT.

MAXIMUM TEST PRESSURE, Po 66.03 (Po = [(A+B) *1] + C*.57 psi)

TEST NUMBER: 5 TEST PRESSURE 66.03 psi PACKER PRESSURE: 100 psi

Initial Transducer Readings: Top 3.15, Middle 33.01, Bottom 35.72

Transducer Readings after initial pressurization:

Top 2.94, Middle 32.84, Bottom 35.64

Transducer Readings after final flow measurement:

Top 3.02, Middle 33.33, Bottom 36.22

TIME (MIN)	FLOW METER READING, (GAL)	Q (GPM)	SURFACE GAUGE, PSI	REMARKS
0.0	2633.0	/	-0.7	
0.5	2636.8	7.6	25.2	
1.0	2645.8	18.0	28.1	
1.5	2655.9	20.2	30.3	
2.0	2665.9	20.0	31.3	
2.5	2674.3	16.8	31.5	
3.0	2684.2	19.8	31.7	
3.5	2692.8	17.2	32.5	
4.0	2701.9	18.2	32.4	
4.5	2711.3	18.8	33.1	
5.0	2721.9	21.2	33.1	
6.0	2737.0	30.2	33.1	

JHJ * same as test 3, couldnot reach max pressure

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

BORING NO.: B949

DATE: 8-16-06

TEST NUMBER: 5

TEST INTERVAL (FROM DATUM): FROM 96.1 **FT. TO** 101.1 **FT.**

DATA COLLECTED BY: J Howard

Jer 12-5-06

SHUT-IN TEST

use this for calculator

PRESSURE: _____ **psi**

TIME, MIN	SURFACE GAUGE PRESSURE, PSI	MIDDLE TRANSDUCER PRESSURE, PSI
0.0	33.1	63.86
0.5	-1.4	40.86
1.0	-3.8	38.92
1.5	-5.7	37.40
2.0	-6.3	36.56
2.5	-7.0	35.92
3.0	-7.5	35.37
3.5	-7.8	35.08
4.0	-8.1	34.78
4.5	-8.3	34.55
5.0	-8.5	34.35
5.5	-8.7	34.18
6.0	-8.8	34.05
6.5	-9.0	33.92
7.0	-9.1	33.83
7.5	-9.2	33.74
8.0	-9.3	33.67
8.5	-9.3	33.54
9.0	-9.4	33.52

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

Test: B949 - M596 - 101
B949 - B596 - 101
B949 - T596 - 101

(2)

511

8-15-06

James Howard

700 Arrive
730 safty meet
8am - 1245 Ready Packer tests
~~Work Engt~~
1245 - 1 Safty meet
1 - 1730 Packer Stand by & setup 3949

.5 hrs stand by

(E)

5 1+

8-16-06

James Howard

Miller, Mark Hughs, Tim Garland

7am	Arrive
730-740	Safety meeting
745-10	Setup For Packers-B449
10-1130	Water Run
1130-1245	Standby
1245-115	Water run
115-430	More setup
430-445	Break Down for night

Had issues w/ Packers & Pressure test & talked w/ Garrett ~~Ratliff~~ Jan 8-16

Also had issue w Nitrogen Leak

Garrett will look at pressure issue tonight & will run test tomorrow at 2 yards max

445-5 Paperwork

(HJ)

8-17-06

Sames Howard

Miller, Mark Hughes, Tim Garland

B949

7am arrive

730 saftymeeting

745-8 Setup

815-10 Test B949 101-96'

10-1030 Move up to next interval

1030-1 Stand by Drillers looking for space for Nitrogen line

1-130 Fix line

130-345 Packer 90-95'

345-5 Packer 85-90

5-530 Paperwork

8.17

Found water level @ 23.0 from datum.

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-950

Given Parameters

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

Test Section Length, t, ft:	5			
Radius of Borehole r_0, in:	2.00			
GW Depth, ft:	23.00	(from top of casing)	21.00	(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:	**55 - 60**	(from ground surface)						
1	0.00	17.41	0.03	7.41	10.11	0.00	40.18	0.00
2	0.00	34.82	0.03	7.41	10.11	0.00	80.35	0.00
3	0.00	52.77	0.03	7.41	10.11	0.00	121.78	0.00
4	TNP	26.3					60.69	
5	TNP	52.77					121.78	
							K_e, ft/year:	**0.00**
Interval 2, ft:	**60 - 65**	(from ground surface)						
1	0.00	18.35	0.24	9.64	12.42	0.00	42.35	0.00
2	0.00	36.17	0.24	9.64	12.42	0.00	83.47	0.00
3	0.00	55.62	0.24	9.64	12.42	0.00	128.35	0.00
4	0.00	27.81	0.24	9.64	12.42	0.00	64.18	0.00
5	0.00	55.62	0.24	9.64	12.42	0.00	128.35	0.00
							K_e, ft/year:	**0.00**
Interval 3, ft:	**82 - 87**	(from ground surface)						
1	0.00	30.96	8.52	26.36	29.14			0.00
2	0.00	44.98	8.52	26.49	29.14	0.00000	103.80	0.00
3	0.00	68.16	8.52	26.36	29.14	0.00000	157.29	0.00
4	0.00	34.08	8.52	26.36	29.14	0.00000	78.65	0.00
5	0.00	68.16	8.52	26.36	29.14	0.00000	157.29	0.00
							K_e, ft/year:	**0.0**

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/t))*1/2π*ln(R/r_0)*(525,600 min/year)*(0.1337ft^3/gal)
R = total length between packers, t
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.

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: 8/21/2006
Boring No: B-950
Test Interval: 57.0 ft to 62 ft (from Datum)
Stick up length: 2 ft
Test Interval: 55.0 ft to 60 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= 42.70 ft (from top of casing)
h1= 43.20 (from top of casing)
h2 = 16.80 ft (from top of casing)
ρ_w = 62.4 lb/ft^3

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

P_0 Max= 52.78 psi Value on field data sheet=

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

TEST #1

Actual Excess Pressure= 10.00 psi
Initial Middle Transducer Reading= 7.41 psi
Test Pressure= 17.41 psi

Time (min)	Flow Meter Reading (Gal)	Q (GPM)	Surface Gauge (psi)
0	2792.6		1.5
0.5	2792.6	0.0	1.5
1	2793.1	1.0	7.1
1.5	2793.1	0.0	7.1
2	2793.1	0.0	7.1
2.5	2793.1	0.0	7.0
3	2793.1	0.0	7.0
3.5	2793.1	0.0	6.9
4	2793.1	0.0	6.9
4.5	2793.1	0.0	6.9
5	2793.1	0.0	6.8

Average Q: 0.0 gpm
Excess Pore pressure: 10.00 psi

TEST #2

Actual Excess Pressure= 27.41 psi
Initial Middle Transducer Reading= 7.41 psi
Test Pressure= 34.82 psi

Time (min)	Flow Meter Reading (Gal)	Q (GPM)	Surface Gauge (psi)
0	2793.1		6
0.5	2793.2	0.2	6
1	2793.5	0.6	15.6
1.5	2793.5	0.0	16.9
2	2793.5	0.0	16.9
2.5	2793.5	0.0	16.9
3	2793.5	0.0	16.9
3.5	2793.5	0.0	16.9
4	2793.5	0.0	16.9
4.5	2793.5	0.0	16.9
5	2793.5	0.0	16.9

Average Q: 0.0 gpm
Excess Pore pressure: 27.41 psi

TEST #3

Actual Excess Pressure= 45.36 psi
Initial Middle Transducer Reading= 7.41 psi
Test Pressure= 52.77 psi

Time (min)	Flow Meter Reading (Gal)	Q (GPM)	Surface Gauge (psi)
0	2793.5		15.8
0.5	2793.9	0.8	29.8
1	2793.9	0.0	29.9
1.5	2793.9	0.0	29.9
2	2793.9	0.0	31.5
2.5	2793.9	0.0	31.5
3	2793.9	0.0	31.2
3.5	2793.9	0.0	32.1
4	2793.9	0.0	32.2
4.5	2793.9	0.0	32.1
5	2793.9	0.0	32.1

Average Q: 0.0 gpm
Excess Pore pressure: 45.36 psi

JA2 1-17-07

TEST #4

Actual Excess Pressure= NA psi
Initial Middle Transducer 7.41 psi
Test Pressure= psi

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

Average Q: gpm
Excess Pore pressure: psi

TEST #5

Actual Excess Pressure= NA psi
Initial Middle Transducer 7.41 psi
Test Pressure= psi

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

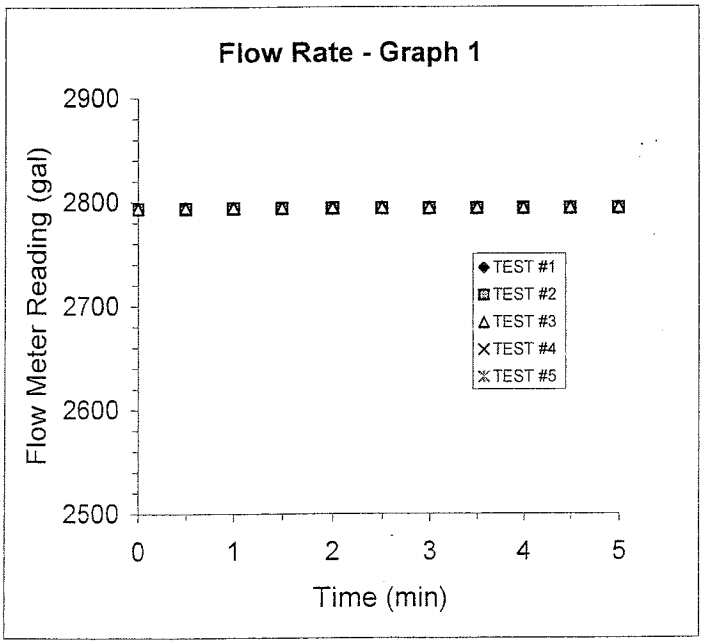
Average Q: gpm
Excess Pore pressure: psi

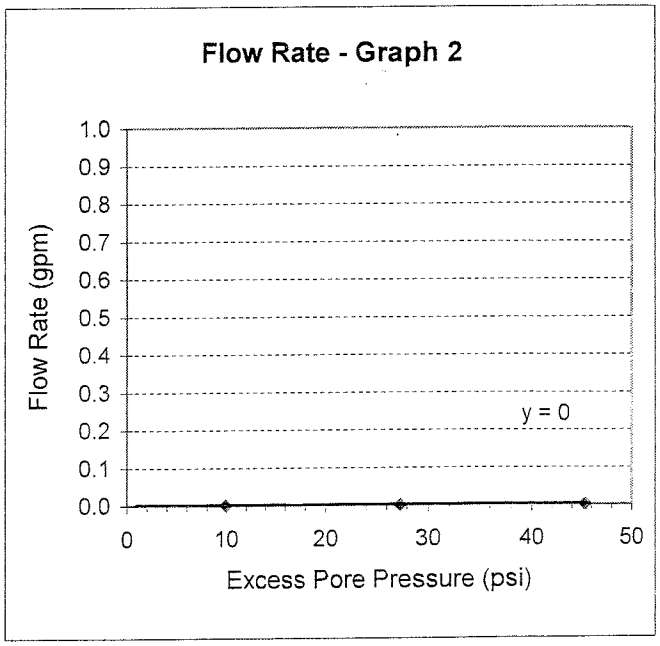
Boring No: B-950
Test Interval: 55 ft to 60 ft
(from surface)

Density of water, ρ_w=62.4 lb/ft^3
= 0.0361 lb/in
Length= 5 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	10.00	0.00	23.08	0.00
2	27.41	0.00	63.25	0.00
3	45.36	0.00	104.68	0.00
4				
5				

* Q obtained from graph Flow Rate-1





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: 8/21/2006
Boring No: B-950
Test Interval: 55 ft to 60 ft (from surface)

Test #1

Time (min)	Surface Gauge (psi)	Center Tranducer (psi)
0.0	6.8	20
0.5	6.8	19.97
1.0	6.8	19.96
1.5	6.7	19.94
2.0	6.7	19.92
2.5	6.7	19.9
3.0	6.7	19.87
3.5	6.7	19.85
4.0	6.6	19.83
4.5	6.6	19.8
5.0	6.6	19.79
6.0	6.6	19.75
7.0	6.5	19.72
8.0	6.5	19.68
9.0	6.5	19.65
10.0	6.4	19.62
11.0	6.4	19.58
12.0	6.4	19.56
13.0	6.3	19.53
14.0	6.3	19.5
15.0	6.3	19.47
20.0	6.2	19.38
25.0	6.1	19.31
30.0	6.1	19.24
35.0	6.0	19.19

Test #2

Time (min)	Surface Gauge (psi)	Center Tranducer (psi)
0.0	16.9	34.26
0.5	16.9	34.23
1.0	16.7	34.2
1.5	16.7	34.16
2.0	16.7	34.12
2.5	16.6	34.08
3.0	16.6	34.04
3.5	16.6	34.00
4.0	16.5	33.98
4.5	16.5	33.94
5.0	16.5	33.91
6.0	16.4	33.85
7.0	16.4	33.79
8.0	16.3	33.74
9.0	16.3	33.69
10.0	16.2	33.64
11.0	16.2	33.61
12.0	16.1	33.52
13.0	16.1	33.53
14.0	16.1	33.51
15.0	16.0	33.48

Test #3

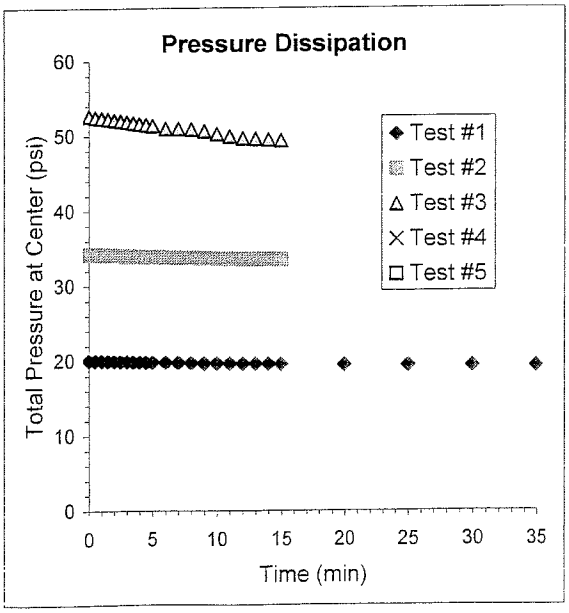
Time (min)	Surface Gauge (psi)	Center Tranducer (psi)
0.0	32.1	52.67
0.5	31.9	52.50
1.0	31.8	52.40
1.5	31.7	52.27
2.0	31.6	52.14
2.5	31.5	52.02
3.0	31.4	51.88
3.5	31.2	51.76
4.0	31.1	51.64
4.5	31.0	51.51
5.0	30.9	51.37
6.0	30.6	51.00
7.0	30.5	50.96
8.0	30.4	50.87
9.0	30.2	50.63
10.0	29.9	50.25
11.0	29.5	49.90
12.0	29.3	49.65
13.0	29.2	49.54
14.0	29.1	49.44
15.0	29.1	49.34

Test #4

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

Test #5

Time (min)	Surface Gauge (psi)	Center Tranducer (psi)
No data 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: 8/18/2006
Boring No: B-950
Test Interval: 62 ft to 67 ft
Stick up length: 2 ft
Test Interval: 60.0 ft to 65 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= 42.70 ft (from top of casing)
h1= 43.20 (from top of casing)
h2 = 21.80 ft (from top of casing)
ρ_w = 62.4 lb/ft^3

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

P_0 Max= 55.63 psi Value on field data sheet=

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

TEST #1

Actual Excess Pressure= 8.71 psi
Initial Middle Transducer Reading= 9.64 psi
Test Pressure= 18.35 psi

Time (min)	Flow Meter Reading (Gal)	Q (GPM)	Surface Gauge (psi)
0	2787		1.0
0.5	2787	0.0	1.0
1	2787.4	0.8	1.4
1.5	2788.1	1.4	10.6
2	2788.1	0.0	10.5
2.5	2788.1	0.0	6.1
3	2788.1	0.0	5.9
3.5	2788.1	0.0	5.8
4	2788.1	0.0	5.8
4.5	2788.1	0.0	5.8
5	2788.1	0.0	5.7

Average Q: 0.2 gpm
Excess Pore pressure: 8.71 psi

TEST #2

Actual Excess Pressure= 32.25 psi
Initial Middle Transducer Reading= 9.64 psi
Test Pressure= 41.89 psi

Time (min)	Flow Meter Reading (Gal)	Q (GPM)	Surface Gauge (psi)
0	2788.1		4.1
0.5	2788.8	1.4	8.9
1	2789.1	0.6	18.9
1.5	2789.2	0.2	17.9
2	2789.2	0.0	17.6
2.5	2789.2	0.0	17.3
3	2789.2	0.0	17.1
3.5	2789.2	0.0	16.9
4	2789.2	0.0	16.7
4.5	2789.2	0.0	17.4
5	2789.2	0.0	17.3

Average Q: 0.0 gpm
Excess Pore pressure: 32.25 psi

TEST #3

Actual Excess Pressure= 45.98 psi
Initial Middle Transducer Reading= 9.64 psi
Test Pressure= 55.62 psi

Time (min)	Flow Meter Reading (Gal)	Q (GPM)	Surface Gauge (psi)
0	2789.2		8.3
0.5	2790.4	2.4	39.3
1	2790.4	0.0	38.2
1.5	2790.5	0.2	31.1
2	2790.5	0.0	32.9
2.5	2790.5	0.0	33.2
3	2790.5	0.0	33.3
3.5	2790.5	0.0	32.6
4	2790.5	0.0	32.5
4.5	2790.5	0.0	33.1
5	2790.5	0.0	33.2

Average Q: 0.0 gpm
Excess Pore pressure: 45.98 psi

JAS 1-17-07

TEST #4

Actual Excess Pressure= 18.17 psi
Initial Middle Transducer 9.64 psi
Test Pressure= 27.81 psi

Time (min)	Flow Meter Reading (Gal)	Q (GPM)	Surface Gauge (psi)
0	2790.5		2.2
0.5	2791.2	1.4	10.6
1	2791.2	0.0	10.8
1.5	2791.2	0.0	10.6
2	2791.2	0.0	10.5
2.5	2791.2	0.0	10.7
3	2791.2	0.0	10.9
3.5	2791.2	0.0	11.0
4	2791.2	0.0	11.1
4.5	2791.2	0.0	11.3
5	2791.2	0.0	11.4

TEST #5

Actual Excess Pressure= 45.98 psi
Initial Middle Transducer 9.64 psi
Test Pressure= 55.62 psi

Time (min)	Flow Meter Reading (Gal)	Q (GPM)	Surface Gauge (psi)
0	2791.2		2.9
0.5	2792.6	2.8	32.8
1	2792.6	0.0	37.2
1.5	2792.6	0.0	35.7
2	2792.6	0.0	34.2
2.5	2792.6	0.0	32.6
3	2792.6	0.0	33.5
3.5	2792.6	0.0	34
4	2792.6	0.0	33.8
4.5	2792.6	0.0	33.9
5	2792.6	0.0	33.4

Boring No: B-950
Test Interval: 60 ft to 65 ft
(from surface)

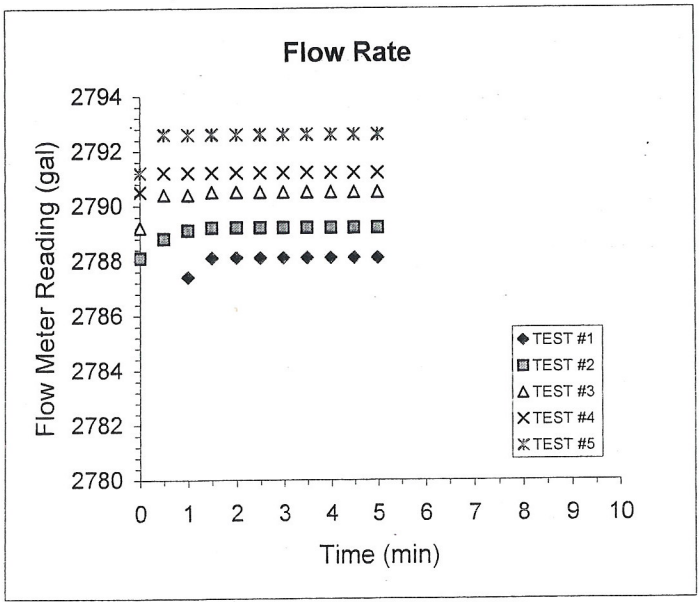
Density of water, ρ_w=62.4 lb/ft^3
= 0.0361 lb/in^3
Length= 5 ft
Borehole radius= 2.00 in
R ranges from 5-10 ft:
choose R= 5 ft

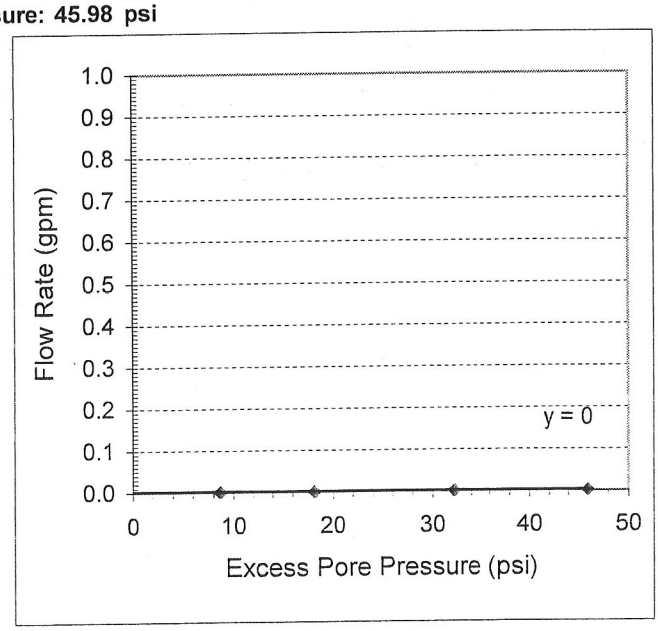
	Excess Pressure (psi)	Q* (gpm)	Test Pres. (ft)	k_e (fpy)
1	8.71	0.000	20.10	0.00
2	32.25	0.000	74.42	0.00
3	45.98	0.000	106.11	0.00
4	18.17	0.000	41.93	0.00
5	45.98	0.000	106.1	0.00

* Q obtained from graph Flow Rate-1

Average Q: 0.0 gpm
Excess Pore pressure: 18.17 psi

Average Q: 0.0 gpm
Excess Pore pressure: 45.98 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: 8/18/2006
Boring No: B-950
Test Interval: 60 ft to 65 ft

Test #1

Time (min)	Surface Gauge (psi)	Center Tranducer (psi)
0.0	5.7	19.07
0.5	5.7	19.00
1.0	5.7	18.93
1.5	5.6	18.85
2.0	5.6	18.79
2.5	5.6	18.71
3.0	5.5	18.65
3.5	5.4	18.57
4.0	5.4	18.5
4.5	5.4	18.46
5.0	5.4	18.4
6.0	5.3	18.28
7.0	5.2	18.17
8	5.2	18.07
9	5.1	17.98
10	5.1	17.88
11	5.0	17.78
12	5.0	17.69
13	4.9	17.59
14	4.9	17.5
15	4.8	17.4
16	4.8	17.31
20	4.6	16.95
25	4.3	16.54

Test #2

Time (min)	Surface Gauge (psi)	Center Tranducer (psi)
0.0	17.3	36.29
0.5	17.0	36.04
1.0	16.8	35.68
1.5	16.6	35.47
2.0	16.3	35.19
2.5	16.1	35.00
3.0	16.0	34.68
3.5	15.7	34.31
4.0	15.5	34.16
4.5	15.4	33.9
5.0	15.4	33.48
6.0	14.8	33.15
7.0	14.4	32.65
8.0	14.1	32.22
9.0	13.8	31.82
10.0	13.5	31.34
11.0	13.2	30.94
12.0	12.9	30.52
13.0	12.6	30.11
14.0	12.4	29.75
15.0	12.1	29.39
20.0	10.9	27.68
25.0	9.9	26.18

Test #3

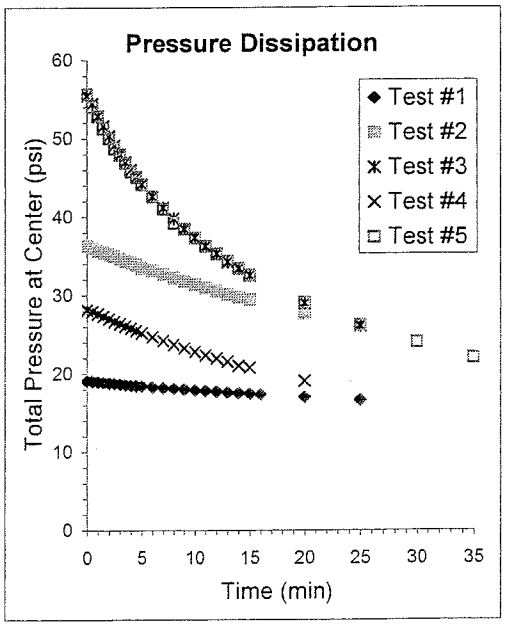
Time (min)	Surface Gauge (psi)	Center Tranducer (psi)
0.0	33.2	55.42
0.5	31.8	54.44
1.0	30.4	52.83
1.5	29.3	51.55
2.0	28.1	50.28
2.5	27.2	49.08
3.0	26.2	47.96
3.5	25.3	46.98
4.0	24.5	45.99
4.5	23.6	45.07
5.0	22.8	44.15
6.0	21.7	42.60
7.0	20.5	41.13
8.0	19.3	39.74
9.0	18.3	38.43
10.0	17.3	37.32
11.0	16.5	36.25
12.0	15.8	35.29
13.0	15.0	34.23
14.0	14.4	33.4
15.0	13.7	32.52
20.0	11.1	28.93
25.0	9.0	26.02

Test #4

Time (min)	Surface Gauge (psi)	Center Tranducer (psi)
0.0	11.4	28.1
0.5	11.2	27.92
1.0	11	27.62
1.5	10.8	27.29
2.0	10.5	26.98
2.5	10.3	26.62
3.0	10.1	26.35
3.5	9.9	26.07
4.0	9.7	25.76
4.5	9.4	25.49
5.0	9.3	25.18
6.0	9	24.69
7.0	8.6	24.16
8	8.3	23.69
9	8.1	23.23
10	7.7	22.78
11	7.4	22.34
12	7.1	21.92
13	6.1	21.51
14	6.6	21.00
15	6.4	20.74
20	5.4	19.00

Test #5

Time (min)	Surface Gauge (psi)	Center Tranducer (psi)
0.0	33.4	55.64
0.5	32.0	54.03
1.0	30.9	52.81
1.5	29.5	51.22
2.0	28.5	49.99
2.5	27.7	48.70
3.0	26.6	47.91
3.5	25.7	46.85
4.0	24.6	45.79
4.5	24.0	45.04
5.0	23.4	44.10
6.0	22.1	42.58
7.0	20.9	41.00
8	19.9	39.20
9	18.8	38.46
10	17.9	37.29
11	17.2	36.28
12	16.4	35.30
13	15.8	34.35
14	15.1	33.40
15	14.4	32.58
20	11.9	29.06
25	9.8	26.14
30	8.4	23.98
35	2.1	22.02



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: 8/18/2006
Boring No: B-950
Test Interval: 84 ft to 89 ft
Stick up length: 2 ft
Test Interval: 82.0 ft to 87 ft (from surface)
Test Type: Double Packer Technique

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

Depth of Water
Table= 42.70 ft (from top of casing)
h1= 43.20 (from top of casing)
h2 = 43.80 ft (from top of casing)
ρ_w = 62.4 lb/ft^3

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

P_0 Max= 68.17 psi Value on field data sheet=

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

TEST #1

Actual Excess Pressure= 4.60 psi
Initial Middle Transducer Reading= 26.36 psi
Test Pressure= 30.96 psi

Time (min)	Flow Meter Reading (Gal)	Q (GPM)	Surface Gauge (psi)
0	2777.6		-1.4
0.5	2777.6	0.0	-1.0
1	2779.1	3.0	8.2
1.5	2779.3	0.4	9.1
2	2779.3	0.0	8.9
2.5	2779.3	0.0	8.6
3	2779.3	0.0	8.4
3.5	2779.3	0.0	8.1
4	2779.3	0.0	7.8
4.5	2779.3	0.0	7.6
5	2779.3	0.0	7.4

Average Q: 0.3 gpm
Excess Pore pressure: 4.60 psi

TEST #2

Actual Excess Pressure= 18.49 psi
Initial Middle Transducer Reading= 26.49 psi
Test Pressure= 44.98 psi

Time (min)	Flow Meter Reading (Gal)	Q (GPM)	Surface Gauge (psi)
0	2780.3		2.1
0.5	2781.0	1.4	4.5
1	2781.0	0.0	23.3
1.5	2781.0	0.0	21.1
2	2781.0	0.0	19.4
2.5	2781.0	0.0	17.8
3	2781.0	0.0	16.3
3.5	2781.0	0.0	15.5
4	2781.0	0.0	14.7
4.5	2781.0	0.0	19.7
5	2781.0	0.0	18.8
6	2781.0	0.0	18.7

Average Q: 0.0 gpm
Excess Pore pressure: 18.49 psi

TEST #3

Actual Excess Pressure= 29.26 psi
Initial Middle Transducer Reading= 26.36 psi
Test Pressure= 55.62 psi

Time (min)	Flow Meter Reading (Gal)	Q (GPM)	Surface Gauge (psi)
0	2781.3		3.8
0.5	2783	3.4	33.9
1	2783.1	0.2	38.2
1.5	2783.2	0.2	35.5
2	2783.3	0.2	39
2.5	2783.3	0.0	36.3
3	2783.3	0.0	37.1
3.5	2783.3	0.0	38.1
4	2783.3	0.0	35.9
4.5	2783.3	0.0	37.8
5	2783.4	0.2	37.1
6	2783.5	0.1	34.4
7	2783.5	0.0	38.1

Average Q: NA gpm
Excess Pore pressure: 29.26 psi

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TEST #4

Actual Excess Pressure= 7.72 psi
Initial Middle Transducer 26.36 psi
Test Pressure= 34.08 psi

Time (min)	Flow Meter Reading (Gal)	Q (GPM)	Surface Gauge (psi)
0	2783.5		2.8
0.5	2783.9	0.8	6.5
1	2784.7	1.6	16.7
1.5	2784.7	0.0	15.7
2	2784.7	0.0	14.5
2.5	2784.7	0.0	13.4
3	2784.7	0.0	12.5
3.5	2784.7	0.0	11.7
4	2784.7	0.0	11.1
4.5	2784.7	0.0	10.5
5	2784.7	0.0	10.0

TEST #5

Actual Excess Pressure= 41.80 psi
Initial Middle Transducer 26.36 psi
Test Pressure= 68.16 psi

Time (min)	Flow Meter Reading (Gal)	Q (GPM)	Surface Gauge (psi)
0	2784.7		2.3
0.5	2785.6	1.8	14
1	2786.6	2.0	34.3
1.5	2786.6	0.0	35.6
2	2786.7	0.2	38.1
2.5	2786.8	0.2	40
3	2786.8	0.0	36.6
3.5	2786.8	0.0	36.9
4	2786.9	0.2	38
4.5	2786.9	0.0	38.1
5	2786.9	0.0	37.7
6	2787.0	0.1	37.3

Boring No: B-950
Test Interva 82 ft to 87 ft
(from surface)

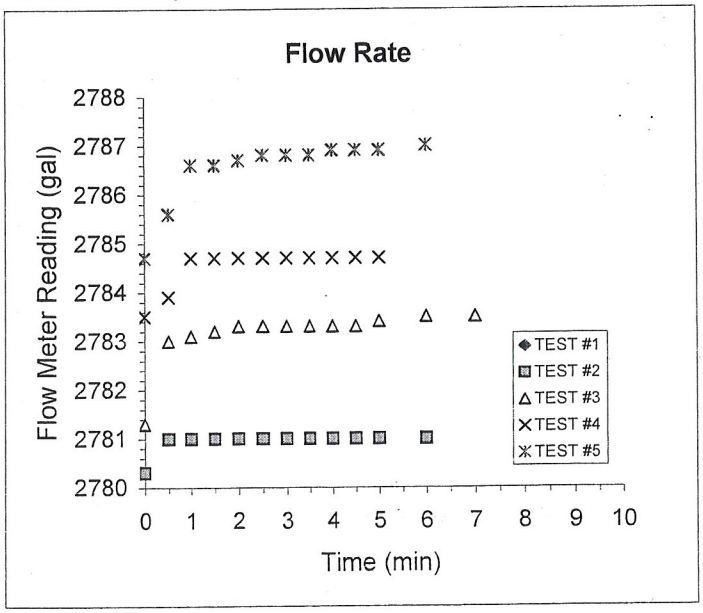
Density of water, ρ_w=62.4 lb/ft^3
= 0.0361 lb/in^3
Length= 5 ft
Borehole radius= 2.00 in
R ranges from 5-10 ft:
choose R= 5 ft

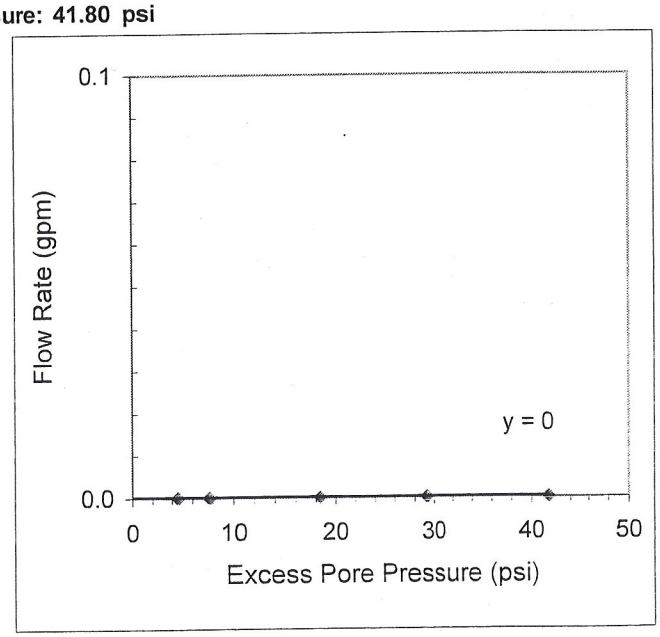
	Excess Pressure (psi)	Q* (gpm)	Test Pres. (ft)	k_e (fpy)
1	4.60	0.000	10.62	0.00
2	18.49	0.000	42.67	0.00
3	29.26	0.000	67.52	0.00
4	7.72	0.000	17.82	0.00
5	41.80	0.000	96.5	0.00

* Q obtained from graph Flow Rate-1

Average Q: 0.0 gpm
Excess Pore pressure: 7.72 psi

Average Q: NA gpm
Excess Pore pressure: 41.80 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-950
Test Interval: 82 ft to 87 ft (from surface)

Test #1

Time (min)	Surface Gauge (psi)	Center Tranducer (psi)
0.0	7.4	31.39
0.5	7.1	30.87
1.0	7	30.53
1.5	6.8	30.15
2.0	6.6	29.75
2.5	6.4	29.34
3.0	6.2	28.96
3.5	6	28.62
4.0	6	28.38
4.5	5.8	28.05
5.0	5.7	27.77
6.0	5.4	27.26
7.0	5.2	26.77
8	4.9	26.36
9	4.7	25.94
10	4.6	25.56
11	4.4	25.2
12	4.3	24.85
13	4.1	24.54
14	3.9	24.21
15	3.8	23.91
16	3.6	23.64
20	3.1	22.66

Test #2

Time (min)	Surface Gauge (psi)	Center Tranducer (psi)
0.0	18.7	45.29
0.5	17.8	44.03
1.0	16.6	42.47
1.5	15.6	41.08
2.0	14.7	39.92
2.5	13.9	38.69
3.0	13.1	37.58
3.5	12.5	36.65
4.0	11.9	35.77
4.5	11.4	34.89
5.0	10.9	34.24
6.0	10	32.84
7.0	9.3	31.67
8.0	8.7	30.65
9.0	8.1	29.71
10.0	7.6	28.9
11.0	7.2	28.15
12.0	6.9	27.47
13.0	6.5	26.87
14.0	6.2	26.3
15.0	5.9	25.78
16.0	5.6	25.31
20.0	4.8	23.76

Test #3

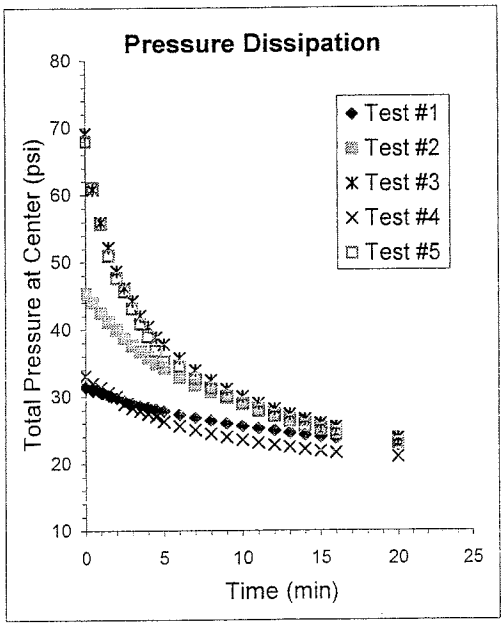
Time (min)	Surface Gauge (psi)	Center Tranducer (psi)
0.0	38.1	69.10
0.5	30	60.80
1.0	26.7	55.91
1.5	23.7	52.15
2.0	21.2	48.64
2.5	18.8	46.13
3.0	17.4	44.17
3.5	15.7	42.01
4.0	14.6	40.36
4.5	13.7	38.80
5.0	12.8	37.74
6.0	11.4	35.70
7.0	10.2	33.84
8.0	9.3	32.40
9.0	8.5	31.05
10.0	7.8	29.93
11.0	7.2	28.95
12.0	6.7	28.05
13.0	6.2	27.29
14.0	5.8	26.6
15.0	5.5	25.97
16.0	5.2	25.41
20.0	4.2	23.62

Test #4

Time (min)	Surface Gauge (psi)	Center Tranducer (psi)
0.0	10	33.07
0.5	9.3	31.94
1.0	8.9	31.28
1.5	8.4	30.56
2.0	8	29.97
2.5	7.4	28.82
3.0	7	28.23
3.5	6.8	27.81
4.0	6.5	27.37
4.5	6.3	26.97
5.0	5.8	26.21
6.0	5.4	25.53
7.0	5.1	24.97
8	4.8	24.39
9	4.6	23.93
10	4.7	23.47
11	4.1	23.07
12	3.9	22.71
13	3.7	22.41
14	3.6	22.10
15	3.4	21.83
16	3.3	21.58
20	2.9	20.95

Test #5

Time (min)	Surface Gauge (psi)	Center Tranducer (psi)
0.0	37.3	67.95
0.5	31.1	61.05
1.0	26.4	55.67
1.5	22.7	50.91
2.0	20.1	47.61
2.5	18.1	45.60
3.0	16.2	43.04
3.5	15.0	40.78
4.0	13.6	38.89
4.5	12.1	36.76
5.0	11.4	35.16
6.0	10.7	34.52
7.0	9.3	32.63
8	8.6	31.22
9	7.9	30.00
10	7.3	28.88
11	6.6	27.85
12	6.2	27.05
13	5.7	26.31
14	5.4	25.61
15	5.0	25.05
16	4.8	24.52
20	3.9	22.97



DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET

JBJ 12-3-06

MACTEC ENGINEERING AND CONSULTING, INC.

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

DATA COLLECTED BY: S Howard DATE COLLECTED: 8-21-06

BORING NO. B950 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 5.0 FT.

TEST INTERVAL DEPTH (FROM DATUM): FROM 57.0 FT. TO 62.0 FT.

TOTAL BORING DEPTH FROM DATUM: 102.0 FT.

(A) DEPTH TO WATER TABLE FROM DATUM: 42.7 FT.

(B) SURFACE GAUGE HEIGHT ABOVE DATUM: .5 FT.

(C) DISTANCE WATER TABLE TO CENTER OF TEST INTERVAL: 16.8 FT.

1/3 MAXIMUM TEST PRESSURE, Po 52.77 (Po = [(A+B) *1] + C*.57 psi)

TEST NUMBER: 1 TEST PRESSURE 17.41 psi PACKER PRESSURE: 100 psi

Initial Transducer Readings: Top .03, Middle 7.41, Bottom 10.11

Transducer Readings after initial pressurization:

Top .24, Middle 11.09, Bottom 9.40

Transducer Readings after final flow measurement:

Top .23, Middle 19.15, Bottom 9.19

TIME (MIN)	FLOW METER READING, (GAL)	Q (GPM)	SURFACE GAUGE, PSI	REMARKS
0.0	2792.6	/	1.5	
0.5	2792.6	0	1.5	
1.0	2793.1	1.0	7.1	
1.5	2793.1	0	7.1	
2.0	2793.1	0	7.1	
2.5	2793.1	0	7.0	
3.0	2793.1	0	7.0	
3.5	2793.1	0	6.9	
4.0	2793.1	0	6.9	
4.5	2793.1	0	6.9	
5.0	2793.1	0	6.8	
6.0				

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

BORING NO.: B950

DATE: 12-21-06

TEST NUMBER: 1

TEST INTERVAL (FROM DATUM): FROM 57.0 **FT. TO** 62.0 **FT.**

DATA COLLECTED BY: SHowell

JA 12-3-06

SHUT-IN TEST

PRESSURE:_____ **psi**

TIME, MIN	SURFACE GAUGE PRESSURE, PSI	MIDDLE TRANSDUCER PRESSURE, PSI
0.0	6.8	20.00
0.5	6.8	19.97
1.0	6.8	19.96
1.5	6.7	19.94
2.0	6.7	19.92
2.5	6.7	19.90
3.0	6.7	19.87
3.5	6.7	19.85
4.0	6.6	19.83
4.5	6.6	19.80
5.0	6.6	19.79
6.0	6.6	19.75
7.0	6.5	19.72
8.0	6.5	19.68
9.0	6.5	19.65
10.0	6.4	19.62
11.0	6.4	19.58
12.0	6.4	19.56
13.0	6.3	19.53
14.0	6.3	19.50
15.0	6.3	19.47
20.0	6.2	19.38
25.0	6.1	19.31
30.0	6.1	19.24
35.0	6.0	19.19

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: B950 - M157 - 62

" - B157 - "

" - T157 - "

DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET

JHT 12-3-06

MACTEC ENGINEERING AND CONSULTING, INC.

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

DATA COLLECTED BY: JHoward DATE COLLECTED: 8-21-06

BORING NO. B95'0 BOREHOLE DIAMETER: 4 IN.

SURFACE CASING HEIGHT ABOVE GROUND: 2.0 FT.

CHECK DATUM USED: TOP OF CASING Y GROUND SURFACE ____

DATUM ELEVATION NA

DISTANCE BOTTOM OF TOP PACKER TO TOP OF BOTTOM PACKER 5'.0 FT.

TEST INTERVAL DEPTH (FROM DATUM): FROM 57.0 FT. TO 62.0 FT.

TOTAL BORING DEPTH FROM DATUM: 162.0 FT.

(A) DEPTH TO WATER TABLE FROM DATUM: 42.7 FT.

(B) SURFACE GAUGE HEIGHT ABOVE DATUM: .5 FT.

(C) DISTANCE WATER TABLE TO CENTER OF TEST INTERVAL: 16.8 FT.

2/3 MAXIMUM TEST PRESSURE, Po 52.77 (Po = [(A+B) *1] + C*.57 psi)

TEST NUMBER: 2 TEST PRESSURE 34.82 psi PACKER PRESSURE: 100 psi

Initial Transducer Readings: Top .03, Middle 7.41, Bottom 10.11

Transducer Readings after initial pressurization:
Top .23, Middle 19.15, Bottom 9.19

Transducer Readings after final flow measurement:
Top .23, Middle 33.34, Bottom 9.19

TIME (MIN)	FLOW METER READING, (GAL)	Q (GPM)	SURFACE GAUGE, PSI	REMARKS
0.0	2793.1	/	6.0	
0.5	2793.2	.2	6.0	
1.0	2793.5	.6	15.6	
1.5	2793.5	Ø	16.9	
2.0	2793.5	Ø	16.9	
2.5	2793.5	Ø	16.9	
3.0	2793.5	Ø	16.9	
3.5	2793.5	Ø	16.9	
4.0	2793.5	Ø	16.9	
4.5	2793.5	Ø	16.9	
5.0	2793.5	Ø	16.9	
6.0				

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

BORING NO.: B950

DATE: 8-21-06

TEST NUMBER: 2

TEST INTERVAL (FROM DATUM): FROM 57.0 **FT. TO** 62.0 **FT.**

DATA COLLECTED BY: J Howard

2

JLH 12-3-06

SHUT-IN TEST

PRESSURE:_____ **psi**

TIME, MIN	SURFACE GAUGE PRESSURE, PSI	MIDDLE TRANSDUCER PRESSURE, PSI
0.0	16.9	34.26
0.5	16.9	34.23
1.0	16.7	34.20
1.5	16.7	34.16
2.0	16.7	34.12
2.5	16.6	34.08
3.0	16.6	34.04
3.5	16.6	34.00
4.0	16.5	33.98
4.5	16.5	33.94
5.0	16.5	33.91
6.0	16.4	33.85
7.0	16.4	33.79
8.0	16.3	33.74
9.0	16.3	3369
10.0	16.2	3364
11.0	16.2	3361
12.0	16.1	33.57
13.0	16.1	33.53
14.0	16.1	33.51
15.0	16.0	3348

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: B950 - M257 - G2

" - B257 - "

" - T257 - "

DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET

JAJ 12-3-06

MACTEC ENGINEERING AND CONSULTING, INC.

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

DATA COLLECTED BY: J Howard DATE COLLECTED: 8-21.06

BORING NO. B950 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 5.0 FT.

TEST INTERVAL DEPTH (FROM DATUM): FROM 57.0 FT. TO 62.0 FT.

TOTAL BORING DEPTH FROM DATUM: 102.0 FT.

(A) DEPTH TO WATER TABLE FROM DATUM: 42.7 FT.

(B) SURFACE GAUGE HEIGHT ABOVE DATUM: .5 FT.

(C) DISTANCE WATER TABLE TO CENTER OF TEST INTERVAL: 16.8 FT.

MAXIMUM TEST PRESSURE, Po 52.77 (Po = [(A+B) *1] + C*.57 psi)

TEST NUMBER: 3 TEST PRESSURE 52.77 psi PACKER PRESSURE: 100 psi

Initial Transducer Readings: Top .03, Middle 7.41, Bottom 10.11

Transducer Readings after initial pressurization:
Top .27, Middle 33.34, Bottom 9.19

Transducer Readings after final flow measurement:
Top .23, Middle 49.34, Bottom 9.19

TIME (MIN)	FLOW METER READING, (GAL)	Q (GPM)	SURFACE GAUGE, PSI	REMARKS
00	2793.5	/	15.8	
0.5	2793.9	.8	29.8	
1.0	2793.9	Ø	29.9	
1.5	2793.9	Ø	29.9	
2.0	2793.9	Ø	29.9	
2.5	2793.9	Ø	31.5	
3.0	2793.9	Ø	31.2	
3.5	2793.9	Ø	32.1	
4.0	2793.9	Ø	32.2	
4.5	2793.9	Ø	32.1	
5.0	2793.9	Ø	32.1	

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

BORING NO.: B950

DATE: 8-21-06

TEST NUMBER: 3

TEST INTERVAL (FROM DATUM): FROM 57.0 **FT. TO** 62.0 **FT.**

DATA COLLECTED BY: S Howell

2 JD 12-3-06

SHUT-IN TEST

PRESSURE:_____ **psi**

TIME, MIN	SURFACE GAUGE PRESSURE, PSI	MIDDLE TRANSDUCER PRESSURE, PSI
0.0	32.1	52.67
0.5	31.9	52.50
1.0	31.8	52.40
1.5	31.7	52.27
2.0	31.6	52.14
2.5	31.5	52.02
3.0	31.4	51.88
3.5	31.2	51.76
4.0	31.1	51.64
4.5	31.0	51.51
5.0	30.9	51.37
6.0	30.6	51.10
7.0	30.5	50.96
8.0	30.4	50.87
9.0	30.2	50.63
10.0	29.9	50.25
11.0	29.5	49.90
12.0	29.3	49.65
13.0	29.2	49.54
14.0	29.1	49.44
15.0	29.1	49.34

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: B950 - M3 57-62

" - B3 57- "

" - T3 57- "

DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET

JAD 12-3-06

MACTEC ENGINEERING AND CONSULTING, INC.

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

DATA COLLECTED BY: J Howard **DATE COLLECTED:** 8-21-06

BORING NO. B-50 **BOREHOLE DIAMETER:** 4 **IN.**

SURFACE CASING HEIGHT ABOVE GROUND: 2.0 **FT.**

CHECK DATUM USED: TOP OF CASING X **GROUND SURFACE** ____

DATUM ELEVATION NR

DISTANCE BOTTOM OF TOP PACKER TO TOP OF BOTTOM PACKER 5.0 **FT.**

TEST INTERVAL DEPTH (FROM DATUM): FROM 57.0 **FT. TO** 62.0 **FT.**

TOTAL BORING DEPTH FROM DATUM: 102.0 **FT.**

(A) DEPTH TO WATER TABLE FROM DATUM: 42.7 **FT.**

(B) SURFACE GAUGE HEIGHT ABOVE DATUM: .5 **FT.**

(C) DISTANCE WATER TABLE TO CENTER OF TEST INTERVAL: 16.8 **FT.**

MAXIMUM TEST PRESSURE, Po 52.77 **(Po = [(A+B) *1] + C*.57 psi)**

1/2

TEST NUMBER: 4 **TEST PRESSURE** ~~52.77~~ 8-21 26.7 **psi PACKER PRESSURE:** 100 **psi**

Initial Transducer Readings: Top____, **Middle** ____, **Bottom** ____

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 Skipped, Hole wont take water

DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET

JHT 12-3-06

MACTEC ENGINEERING AND CONSULTING, INC.

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

DATA COLLECTED BY: JHoward DATE COLLECTED: 8-21-06

BORING NO. B950 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 5.0 FT.

TEST INTERVAL DEPTH (FROM DATUM): FROM 57.0 FT. TO 62.0 FT.

TOTAL BORING DEPTH FROM DATUM: 102.0 FT.

(A) DEPTH TO WATER TABLE FROM DATUM: 42.5 FT.

(B) SURFACE GAUGE HEIGHT ABOVE DATUM: .5 FT.

(C) DISTANCE WATER TABLE TO CENTER OF TEST INTERVAL: 16.8 FT.

MAXIMUM TEST PRESSURE, Po 52.77 (Po = [(A+B) *1] + C*.57 psi)

TEST NUMBER: 5 TEST PRESSURE 52.77 psi PACKER PRESSURE: 100 psi

Initial Transducer Readings: Top ____, Middle ____, Bottom ____

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 skipped, hole won't take water

JCJ 12-3-06

PACKER TESTING CALCULATIONS FOR P(MAX)

Date: 8-18-06

Boring No. B 90

Test Interval: 57.0 to 62.0 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~~ Seise to the water level

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

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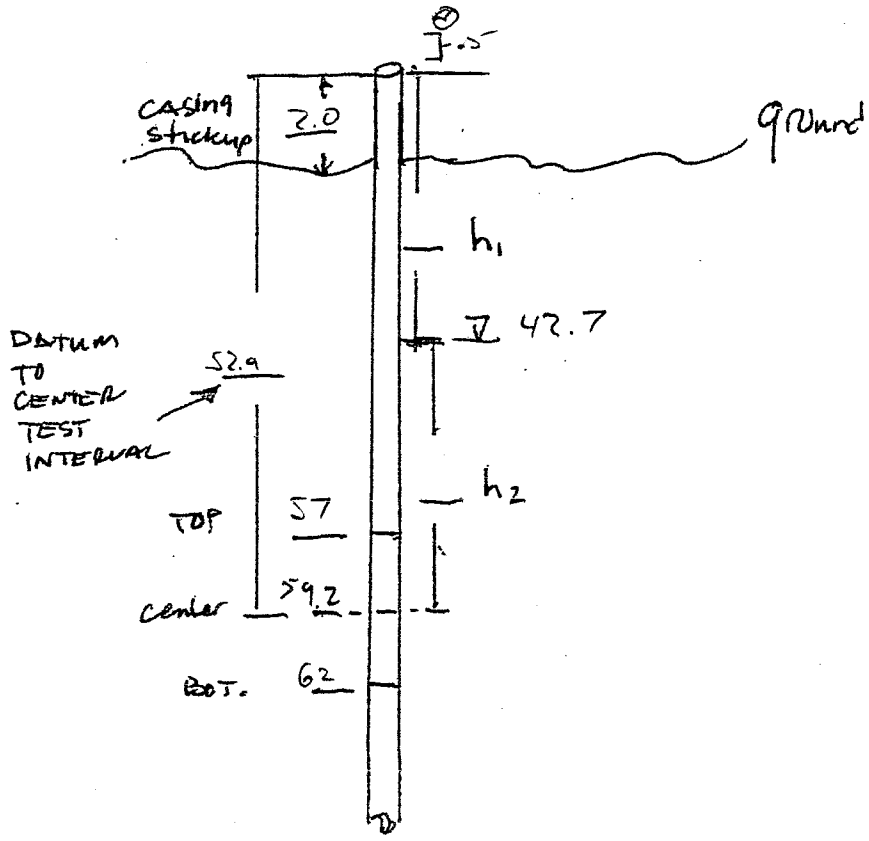
h_1 = 43.2

h_2 = 59.2 - 42.7 = 16.8

P MAX = 43.2 + 9.57 = 52.77

SKETCH



PACKER TESTING CALCULATIONS FOR P(MAX)

JGJ 12-3-06

Date: 8-18-06

Boring No. B-50

Test Interval: 62.0 to 67.0 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~~ surface to the water level
h_2 = Distance from the water level to the center of the test interval

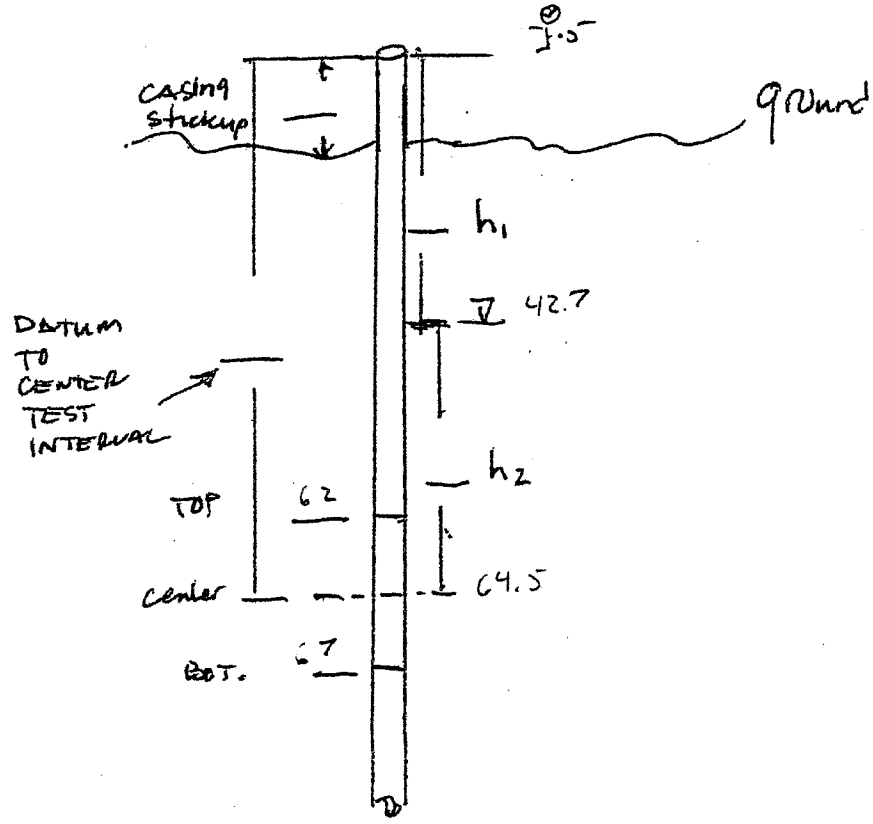
---

h_1 = 43.2

h_2 = 64.5 - ~~43.2~~ Gw 42.7 = 21.8

P MAX = 43.2 + 12.42 = 55.62

SKETCH



DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET

JJ 1-23-06

MACTEC ENGINEERING AND CONSULTING, INC.

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

DATA COLLECTED BY: J Howard DATE COLLECTED: 8-18-06

BORING NO. B-50 BOREHOLE DIAMETER: 4 IN.

SURFACE CASING HEIGHT ABOVE GROUND: 2.0 FT.

CHECK DATUM USED: TOP OF CASING X GROUND SURFACE ____

DATUM ELEVATION NR

DISTANCE BOTTOM OF TOP PACKER TO TOP OF BOTTOM PACKER 5.0 FT.

TEST INTERVAL DEPTH (FROM DATUM): FROM 62.0 FT. TO 67.0 FT.

TOTAL BORING DEPTH FROM DATUM: 102.0 FT.

(A) DEPTH TO WATER TABLE FROM DATUM: 42.7 FT.

(B) SURFACE GAUGE HEIGHT ABOVE DATUM: .5 FT.

(C) DISTANCE WATER TABLE TO CENTER OF TEST INTERVAL: 21.8 FT.

1/3

MAXIMUM TEST PRESSURE, Po 55.62 (Po = [(A+B) *1] + C*.57 psi)

TEST NUMBER: 1 TEST PRESSURE 18.35 psi PACKER PRESSURE: 100 psi

Initial Transducer Readings: Top .24, Middle 9.64, Bottom 12.42

Transducer Readings after initial pressurization:

Top .22, Middle 12.63, Bottom 11.62

Transducer Readings after final flow measurement:

Top .24, Middle 16.46, Bottom 11.38

TIME (MIN)	FLOW METER READING, (GAL)	Q (GPM)	SURFACE GAUGE, PSI	REMARKS
0.0	2787.0	/	1.0	
0.5	2787.0	0	1.0	
1.0	2787.4	.8	1.4	
1.5	2788.1	1.4	10.6	
2.0	2788.1	0	10.5	
2.5	2788.1	0	6.1	
3.0	2788.1	0	5.9	
3.5	2788.1	0	5.8	
4.0	2788.1	0	5.8	
4.5	2788.1	0	5.8	
5.0	2788.1	0	5.7	
6.0				

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

BORING NO.: B950

DATE: 8-18-06

TEST NUMBER: 1

TEST INTERVAL (FROM DATUM): FROM 62.0 **FT. TO** 67.0 **FT.**

DATA COLLECTED BY: S Howard

2

12-3-06

SHUT-IN TEST

PRESSURE:_____ **psi**

TIME, MIN	SURFACE GAUGE PRESSURE, PSI	MIDDLE TRANSDUCER PRESSURE, PSI
0.0	5.7	19.07
0.5	5.7	18.00
1.0	5.7	18.93
1.5	5.6	18.85
2.0	5.6	18.79
2.5	5.6	18.71
3.0	5.5	18.65
3.5	5.4	18.57
4.0	5.4	18.50
4.5	5.4	18.46
5.0	5.4	18.40
6.0	5.3	18.28
7.0	5.2	18.17
8.0	5.2	18.07
9.0	5.1	17.98
10.0	5.1	17.88
11.0	5.0	17.78
12.0	5.0	17.69
13.0	4.9	17.59
14.0	4.9	17.50
15.0	4.8	17.40
16.0	4.8	17.31
20.0	4.6	16.95
25.0	4.3	16.54

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: B950 - M162 - 67

" - B162 - "

" - T162 - "

DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET

12-3-06

MACTEC ENGINEERING AND CONSULTING, INC.

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

DATA COLLECTED BY: J Howard DATE COLLECTED: 8-18-06

BORING NO. B950 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 5.0 FT.

TEST INTERVAL DEPTH (FROM DATUM): FROM 62.0 FT. TO 67.0 FT.

TOTAL BORING DEPTH FROM DATUM: 102.0 FT.

(A) DEPTH TO WATER TABLE FROM DATUM: 42.7 FT.

(B) SURFACE GAUGE HEIGHT ABOVE DATUM: .5 FT.

(C) DISTANCE WATER TABLE TO CENTER OF TEST INTERVAL: 21.8 FT.

2/3 MAXIMUM TEST PRESSURE, Po 55.62 (Po = [(A+B) *1] + C*.57 psi)

TEST NUMBER: 2 TEST PRESSURE 36.17 psi PACKER PRESSURE: 100 psi

Initial Transducer Readings: Top .21, Middle 9.64, Bottom 12.42

Transducer Readings after initial pressurization:
Top .24, Middle 16.46, Bottom 11.38

Transducer Readings after final flow measurement:
Top .21, Middle 25.18, Bottom 11.36

TIME (MIN)	FLOW METER READING, (GAL)	Q (GPM)	SURFACE GAUGE, PSI	REMARKS
0.0	2788.1	/	4.1	
0.5	2788.8	1.4	8.9	
1.0	2789.1	.6	18.9	
1.5	2789.2	.4	17.9	
2.0	2789.2	Ø	17.6	
2.5	2789.2	Ø	17.3	
3.0	2789.2	Ø	17.1	
3.5	2789.2	Ø	16.9	
4.0	2789.2	Ø	16.7	
4.5	2789.2	Ø	17.4	
5.0	2789.2	Ø	17.3	
6.0				

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

BORING NO.: B950 2

DATE: 8-18-06

TEST NUMBER: 2

TEST INTERVAL (FROM DATUM): FROM 62.0 **FT. TO** 67.0 **FT.**

DATA COLLECTED BY: J Howard

12-3-06

SHUT-IN TEST

PRESSURE:_____ **psi**

TIME, MIN	SURFACE GAUGE PRESSURE, PSI	MIDDLE TRANSDUCER PRESSURE, PSI
0.0	17.3	36.29
0.5	17.0	36.04
1.0	16.8	35.68
1.5	16.6	35.47
2.0	16.3	35.19
2.5	16.1	35.00
3.0	16.0	34.68
3.5	15.7	34.31
4.0	15.5	34.16
4.5	15.4	33.90
5.0	15.4	33.48
6.0	14.8	33.15
7.0	14.4	32.65
8.0	14.1	32.22
9.0	13.8	31.80
10.0	13.5	31.34
11.0	13.2	30.94
12.0	12.9	30.52
13.0	12.6	30.11
14.0	12.4	29.75
15.0	12.1	29.35
20.0	10.9	27.68
25.0	9.9	26.18

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: B950 - B262-67
" - TI 62- "
" - M262- "

DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET

JD 12-3-06

MACTEC ENGINEERING AND CONSULTING, INC.

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

DATA COLLECTED BY: J Howard DATE COLLECTED: 8-18-06

BORING NO. B-950 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 5.0 FT.

TEST INTERVAL DEPTH (FROM DATUM): FROM 62.0 FT. TO 67.0 FT.

TOTAL BORING DEPTH FROM DATUM: 102.0 FT.

(A) DEPTH TO WATER TABLE FROM DATUM: 42.7 FT.

(B) SURFACE GAUGE HEIGHT ABOVE DATUM: .5 FT.

(C) DISTANCE WATER TABLE TO CENTER OF TEST INTERVAL: 21.87 FT.

MAXIMUM TEST PRESSURE, Po 55.62 (Po = [(A+B) *1] + C*.57 psi)

TEST NUMBER: 3 TEST PRESSURE 55.62 psi PACKER PRESSURE: 100 psi

Initial Transducer Readings: Top .24, Middle 9.64, Bottom 12.42

Transducer Readings after initial pressurization:
Top .21, Middle 25.18, Bottom 11.36

Transducer Readings after final flow measurement:
Top .18, Middle 25.50, Bottom 11.37

TIME (MIN)	FLOW METER READING, (GAL)	Q (GPM)	SURFACE GAUGE, PSI	REMARKS
0.0	2789.2	/	8.3	
0.5	2790.4	2.4	39.3	
1.0	2790.11	Ø	38.2	
1.5	2790.5	.2	31.1	Bleed at some pressure
2.0	2790.5	Ø	32.9	
2.5	2790.5	Ø	33.2	
3.0	2790.5	Ø	33.3	
3.5	2790.5	Ø	32.6	
4.0	2790.5	Ø	32.5	
4.5	2790.5	Ø	33.1	
5.0	2790.5	Ø	33.2	
6.0				

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

BORING NO.: B 950

DATE: 8-18-06

TEST NUMBER: 3

TEST INTERVAL (FROM DATUM): FROM 62.0 **FT. TO** 67.0 **FT.**

DATA COLLECTED BY: J Howard

2
JJ 12-3-06

SHUT-IN TEST

PRESSURE:_____ **psi**

TIME, MIN	SURFACE GAUGE PRESSURE, PSI	MIDDLE TRANSDUCER PRESSURE, PSI
0.0	37.2	55.42
0.5	31.8	54.44
1.0	30.4	52.83
1.5	29.3	51.55
2.0	28.1	50.28
2.5	27.2	49.08
3.0	26.2	47.96
3.5	25.3	46.98
4.0	24.5	45.99
4.5	~~45.07~~ 23.6	45.07
5.0	22.8	44.15
6.0	21.7	42.60
7.0	20.5	41.13
8.0	19.3	39.74
9.0	18.3	38.43
10.0	17.3	37.32
11.0	16.5	36.25
12.0	15.8	35.29
13.0	15.0	34.23
14.0	14.4	33.40
15.0	13.7	32.52
20.0	11.1	28.93
25.0	9.0	26.02

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: B950 - M362-67
" - T362-"
" - B362-"

DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET

JHJ 12-3-06

MACTEC ENGINEERING AND CONSULTING, INC.

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

DATA COLLECTED BY: JHoward DATE COLLECTED: 8-18-06

BORING NO. B 950 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 5.0 FT.

TEST INTERVAL DEPTH (FROM DATUM): FROM 62.0 FT. TO 67.0 FT.

TOTAL BORING DEPTH FROM DATUM: 102.0 FT.

(A) DEPTH TO WATER TABLE FROM DATUM: 42.7 FT.

(B) SURFACE GAUGE HEIGHT ABOVE DATUM: .5 FT.

(C) DISTANCE WATER TABLE TO CENTER OF TEST INTERVAL: 21.8 FT.

MAXIMUM TEST PRESSURE, Po 55.62 (Po = [(A+B) *1] + C*.57 psi)

1/2

TEST NUMBER: 4 TEST PRESSURE 27.81 psi PACKER PRESSURE: 100 psi

Initial Transducer Readings: Top .24, Middle 9.64, Bottom 12.42

Transducer Readings after initial pressurization:

Top .18, Middle 25.50, Bottom 11.36

Transducer Readings after final flow measurement:

Top .20, Middle 14.86, Bottom 11.36

TIME (MIN)	FLOW METER READING, (GAL)	Q (GPM)	SURFACE GAUGE, PSI	REMARKS
0.0	2790.5	/	2.2	
0.5	2791.2	1.4	10.6	
1.0	2791.2	Ø	10.8	
1.5	2791.2	Ø	10.6	
2.0	2791.2	Ø	10.5	
2.5	2791.2	Ø	10.7	
3.0	2791.2	Ø	10.9	
3.5	2791.2	Ø	11.0	
4.0	2791.2	Ø	11.1	
4.5	2791.2	Ø	11.3	
5.0	2791.2	Ø	11.4	
6.0				

DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET

JAK 12-3 06

MACTEC ENGINEERING AND CONSULTING, INC.

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

DATA COLLECTED BY: J Howard DATE COLLECTED: 8-18.06

BORING NO. B 950 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 5.0 FT.

TEST INTERVAL DEPTH (FROM DATUM): FROM 62.0 FT. TO 67.0 FT.

TOTAL BORING DEPTH FROM DATUM: 102.0 FT.

(A) DEPTH TO WATER TABLE FROM DATUM: 47.7 FT.

(B) SURFACE GAUGE HEIGHT ABOVE DATUM: .5 FT.

(C) DISTANCE WATER TABLE TO CENTER OF TEST INTERVAL: 21.8 FT.

MAXIMUM TEST PRESSURE, Po 55.62 (Po = [(A+B) *1] + C*.57 psi)

TEST NUMBER: 5 TEST PRESSURE ~~18.55~~ 55.62 psi 8-15 PACKER PRESSURE: 100 psi

Initial Transducer Readings: Top .024, Middle 9.64, Bottom 12.42

Transducer Readings after initial pressurization:

Top .20, Middle 14.86, Bottom 11.36

Transducer Readings after final flow measurement:

Top ~~.142~~ .14 8-21, Middle ~~23.84~~ 21.41 8-21, Bottom ~~11.36~~ 11.36 8-21

TIME (MIN)	FLOW METER READING, (GAL)	Q (GPM)	SURFACE GAUGE, PSI	REMARKS
0.0	2791.2	/	2.9	
0.5	2792.6	2.8	32.8	
1.0	2792.6	Ø	37.2	
1.5	2792.6	Ø	35.7	
2.0	2792.6	Ø	34.2	
2.5	2792.6	Ø	32.6	
3.0	2792.6	Ø	33.5	
3.5	2792.6	Ø	34.0	
4.0	2792.6	Ø	33.8	
4.5	2792.6	Ø	33.9	
5.0	2792.6	Ø	33.4	
6.0				

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

BORING NO.: B950

DATE: 8-15-06

TEST NUMBER: 5

TEST INTERVAL (FROM DATUM): FROM 62.0 **FT. TO** 67.0 **FT.**

DATA COLLECTED BY: SHO ward

2
#3 12-3-06

SHUT-IN TEST

PRESSURE:_____ **psi**

TIME, MIN	SURFACE GAUGE PRESSURE, PSI	MIDDLE TRANSDUCER PRESSURE, PSI
0.0	33.4	55.64
0.5	32.0	54.03
1.0	30.9	52.81
1.5	29.5	51.22
2.0	28.5	49.99
2.5	27.7	48.70
3.0	26.6	47.91
3.5	25.7	46.85
4.0	24.6	45.79
4.5	24.0	45.04
5.0	23.4	44.10
6.0	22.1	42.58
7.0	20.9	41.00
8.0	19.9	39.80
9.0	18.8	38.46
10.0	17.9	37.29
11.0	17.2	36.28
12.0	16.4	35.30
13.0	15.8	34.35
14.0	15.1	33.40
15.0	14.4	32.58
20.0	11.9	29.06
25.0	9.8	26.14
30.0	8.4	23.98
35.0	7.1	22.02

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: B950 - M562-67
" - T562-"
" - B562-"

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

BORING NO.: B950

DATE: 8-17-06

TEST NUMBER: 4

TEST INTERVAL (FROM DATUM): FROM 62.0 **FT. TO** 67.0 **FT.**

DATA COLLECTED BY: J Howard

2 of 2 12-3-06

SHUT-IN TEST

PRESSURE:_____ **psi**

TIME, MIN	SURFACE GAUGE PRESSURE, PSI	MIDDLE TRANSDUCER PRESSURE, PSI
0.0	11.4	28.10
0.5	11.2	27.92
1.0	11.0	27.62
1.5	10.8	27.29
2.0	10.5	26.98
2.5	10.3	26.62
3.0	10.1	26.35
3.5	9.9	26.07
4.0	9.7	25.76
4.5	9.4	25.49
5.0	9.3	25.18
6.0	9.0	24.69
7.0	8.6	24.16
8.0	8.3	23.69
9.0	8.1	23.23
10.0	7.7	22.78
11.0	7.4	22.34
12.0	7.1	21.92
13.0	6.9	21.51
14.0	6.6	21.00
15.0	6.4	20.74
20.0	5.4	19.00
~~25.0~~ 8-21		

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: B950 - M462 - 67
" - T462 - "
" - B462 - "

PACKER TESTING CALCULATIONS FOR P(MAX)

JJ 11-3-06

Date: 8-18-06

Boring No. B9-0

Test Interval: 84.0 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 + Height of Casing above Datum
h_2 = Distance from the water level to the center of the test interval

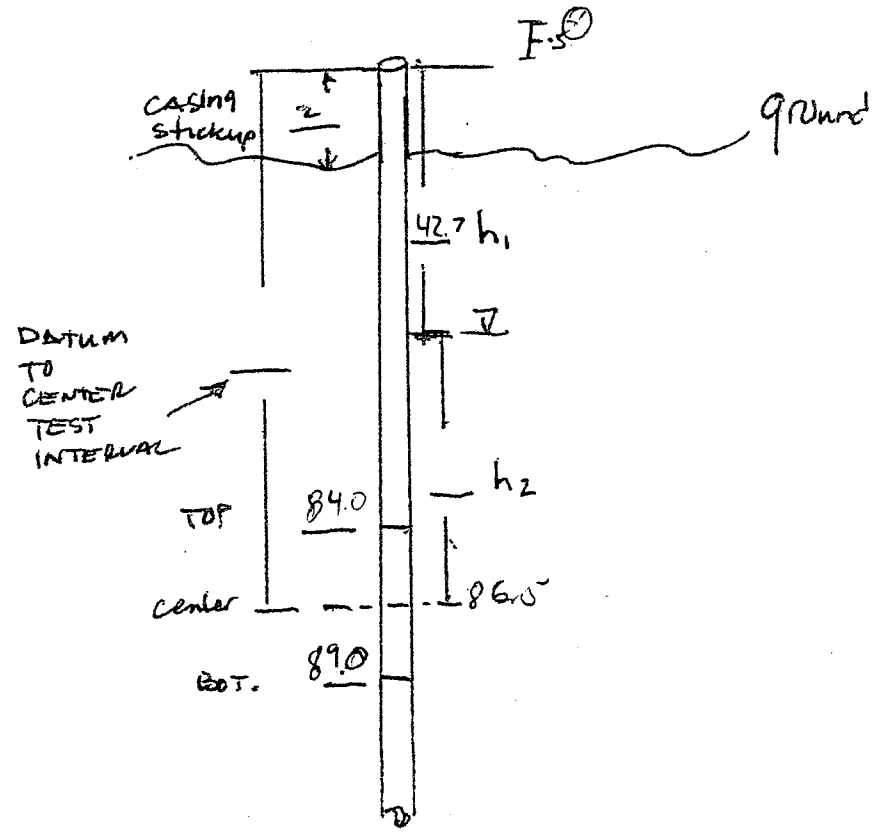
---

h_1 = 42.7 + .5 = (43.2)

h_2 = 86.5 - 42.7 = 43.8

P MAX = 43.2 + 24.9 = 68.16

SKETCH



DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET

JB 12-3-06

MACTEC ENGINEERING AND CONSULTING, INC.

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

DATA COLLECTED BY: S Howard DATE COLLECTED: 8-18-06

BORING NO. B950 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 5.0 FT.

TEST INTERVAL DEPTH (FROM DATUM): FROM 84.0 FT. TO 89.0 FT.

TOTAL BORING DEPTH FROM DATUM: 102.0 FT.

(A) DEPTH TO WATER TABLE FROM DATUM: 42.7 FT.

(B) SURFACE GAUGE HEIGHT ABOVE DATUM: .5 FT.

(C) DISTANCE WATER TABLE TO CENTER OF TEST INTERVAL: 43.8 FT.

1/3 MAXIMUM TEST PRESSURE, Po 68.16 (Po = [(A+B) *1] + C*.57 psi)

TEST NUMBER: 1 TEST PRESSURE 22.49* psi PACKER PRESSURE: 100 psi

Initial Transducer Readings: Top 8.52, Middle ~~26.36~~ 26.36 ~~28.15~~ 8-18, Bottom 29.14

Transducer Readings after initial pressurization:

Top 9.07, Middle 28.15, Bottom 37.29

Transducer Readings after final flow measurement:

Top 7.85, Middle 22.66, Bottom 26.86

TIME (MIN)	FLOW METER READING, (GAL)	Q (GPM)	SURFACE GAUGE, PSI	REMARKS
0.0	2777.6	/	-0.4	
0.5	2777.6	Ø	-1.0	
1.0	2779.1	3.0	+8.2	
1.5	2779.3	.4	9.1	
2.0	2779.3	Ø	8.9	
2.5	2779.3	Ø	8.6	
3.0	2779.3	Ø	8.4	
3.5	2779.3	Ø	8.1	
4.0	2779.3	Ø	7.8	
4.5	2779.3	Ø	7.6	
5.0	2779.3	Ø	7.4	
6.0				

* Per AITee's instructions we will be using 1.1x the natural Pressure instead of the 1/3 MaxPO, which is below Nat. Pressure 30.96

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

BORING NO.: B950

DATE: 8-18-06

TEST NUMBER: 1

TEST INTERVAL (FROM DATUM): FROM 89.0 **FT. TO** 84.0 **FT.**

DATA COLLECTED BY: S Howard

2 12-3-06

SHUT-IN TEST

PRESSURE:_____ **psi**

TIME, MIN	SURFACE GAUGE PRESSURE, PSI	MIDDLE TRANSDUCER PRESSURE, PSI
6.0	7.4	31.39
0.5	7.1	30.87
1.0	7.0	30.53
1.5	6.8	30.15
2.0	6.6	29.75
2.5	6.4	29.34
3.0	6.2	28.96
3.5	6.0	28.62
4.0	6.0	28.38
4.5	5.8	28.05
5.0	5.7	27.77
5.5	5.5	27.50
6.0	5.4	27.26
6.5	5.3	27.00
7.0	5.2	26.77
7.5	5.0	26.56
8.0	4.9	26.36
8.5	4.8	26.14
9.0	4.7	25.94
9.5	4.7	25.75
10.0	4.6	25.56
10.5	4.5	25.36
11.0	4.4	25.20
11.5	4.3	25.03
12.0	4.2	24.85
12.5	4.1	24.67
13.0	4.1	24.54
13.5	4.0	24.36
14.0	3.9	24.21
14.5	3.8	24.05
15.0	3.8	23.91
15.5	3.7	23.77
16.0	3.6	23.64
16.5	3.6	23.50
17.0	3.5	23.37
20.0	3.1	22.66

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: B950 - M184 - 89

11 - B184 - 11

11 - T184 - 11

DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET

12-3-06

MACTEC ENGINEERING AND CONSULTING, INC.

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

DATA COLLECTED BY: S Howard DATE COLLECTED: 8-18-06

BORING NO. B950 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 5.0 FT.

TEST INTERVAL DEPTH (FROM DATUM): FROM 84.0 FT. TO 89.0 FT.

TOTAL BORING DEPTH FROM DATUM: 102.0 FT.

(A) DEPTH TO WATER TABLE FROM DATUM: 42.7 FT.

(B) SURFACE GAUGE HEIGHT ABOVE DATUM: .5 FT.

(C) DISTANCE WATER TABLE TO CENTER OF TEST INTERVAL: 43.8 FT.

2/3 MAXIMUM TEST PRESSURE, Po 68.16 (Po = [(A+B) *1] + C*.57 psi)

TEST NUMBER: 2 TEST PRESSURE 44.98 psi PACKER PRESSURE: 100 psi

Initial Transducer Readings: Top 8.52, Middle 26.49, Bottom 29.14

Transducer Readings after initial pressurization:

Top 7.85, Middle 22.66, Bottom 27.29

Transducer Readings after final flow measurement:

Top 6.50, Middle 22.54, Bottom 28.12

TIME (MIN)	FLOW METER READING, (GAL)	Q (GPM)	SURFACE GAUGE, PSI	REMARKS
0.0	2779.3	/	2.1	
0.5	2781.0	1.4	4.5	
1.0	2781.0	Ø	23.3	
1.5	2781.0	Ø	21.1	
2.0	2781.0	Ø	19.4	
2.5	2781.0	Ø	17.8	
3.0	2781.0	Ø	16.3	
3.5	2781.0	Ø	15.5	
4.0	2781.0	Ø	14.7	
4.5	2781.0	Ø	19.7	
5.0	2781.0	Ø	18.8	
6.0	2781.0	Ø	18.7	

DOUBLE PACKER TEST DATA SHEET, MACTEC PROJECT NO. 6468-06-1472
BORING NO.: B950
DATE: 8-18-06
TEST NUMBER: 2
TEST INTERVAL (FROM DATUM): FROM 84.0 **FT. TO** 89.0 **FT.**
DATA COLLECTED BY: J Howard

JJ 12-3-06

SHUT-IN TEST

PRESSURE:_____ **psi**

TIME, MIN	SURFACE GAUGE PRESSURE, PSI	MIDDLE TRANSDUCER PRESSURE, PSI
0.0	18.7	45.29
0.5	17.8	44.03
1.0	16.6	42.47
1.5	16.6	41.08
2.0	14.7	39.92
2.5	13.4	38.69
3.0	13.1	37.58
3.5	12.5	36.65
4.0	11.9	35.77
4.5	11.4	34.89
5.0	10.9	34.24
6.0	10.0	32.84
7.0	9.3	31.67
8.0	8.7	30.65
9.0	8.1	29.71
10.0	7.6	28.90
11.0	7.2	28.15
12.0	6.9	27.47
13.0	6.5	26.87
14.0	6.2	26.30
15.0	5.9	25.78
16.0	5.6	25.31
20.0	4.8	23.76

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: B950 - M284-89
" - T284 - "
" - B284 - "

DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET

12-3-06

MACTEC ENGINEERING AND CONSULTING, INC.

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

DATA COLLECTED BY: S Howard DATE COLLECTED: 8-18-06

BORING NO. B950 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 5.0 FT.

TEST INTERVAL DEPTH (FROM DATUM): FROM 84.0 FT. TO 89.0 FT.

TOTAL BORING DEPTH FROM DATUM: 102.0 FT.

(A) DEPTH TO WATER TABLE FROM DATUM: 42.7 FT.

(B) SURFACE GAUGE HEIGHT ABOVE DATUM: .5 FT.

(C) DISTANCE WATER TABLE TO CENTER OF TEST INTERVAL: 43.8 FT.

MAXIMUM TEST PRESSURE, Po 68.16 (Po = [(A+B) *1] + C*.57 psi)

TEST NUMBER: 3 TEST PRESSURE 68.16 psi PACKER PRESSURE: 100 psi

Initial Transducer Readings: Top 8.52, Middle 28.36, Bottom 29.14

Transducer Readings after initial pressurization:

Top 6.50, Middle 22.54, Bottom 28.12

Transducer Readings after final flow measurement:

Top 5.45, Middle 29.91, Bottom 35.70

TIME (MIN)	FLOW METER READING, (GAL)	Q (GPM)	SURFACE GAUGE, PSI	REMARKS
0.0	2781.3	—	3.8	
0.5	2783.0	3.4	33.4	
1.0	2783.1	.2	38.2	
1.5	2783.2	.2	35.5	
2.0	2783.3	.2	34.0	
2.5	2783.3	Ø	36.3	
3.0	2783.3	Ø	37.1	
3.5	2783.3	Ø	38.1	
4.0	2783.3	Ø	35.9	
4.5	2783.3	Ø	37.8	
5.0	2783.4	.2	37.1	
6.0	2783.5	.2	34.4	
7.0	2783.5	Ø	38.1	

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

BORING NO.: B950

DATE: 8-18-06

TEST NUMBER: 3

TEST INTERVAL (FROM DATUM): FROM 84.0 **FT. TO** 89.0 **FT.**

DATA COLLECTED BY: JHoward

JJ 12-3-06

SHUT-IN TEST

PRESSURE:_____ **psi**

TIME, MIN	SURFACE GAUGE PRESSURE, PSI	MIDDLE TRANSDUCER PRESSURE, PSI
0.0	38.1	69.10
0.5	30.0	60.80
1.0	26.7	55.91
1.5	23.7	52.15
2.0	21.2	48.64
2.5	18.8	46.13
3.0	17.4	44.17
3.5	15.7	42.01
4.0	14.6	40.36
4.5	13.7	38.80
5.0	12.9	37.74
6.0	11.4	35.70
7.0	10.2	33.84
8.0	9.3	32.40
9.0	8.5	31.05
10.0	7.8	29.93
11.0	7.2	28.95
12.0	6.7	28.05
13.0	6.2	27.29
14.0	5.8	26.60
15.0	5.5	25.97
16.0	5.2	25.41
20.0	4.2	23.62

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: B950 - M384-89
" - D384-"
" - T384-"

DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET

JAJ 12-3-06

MACTEC ENGINEERING AND CONSULTING, INC.

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

DATA COLLECTED BY: J Howard DATE COLLECTED: 8-18-06

BORING NO. B950 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 5.0 FT.

TEST INTERVAL DEPTH (FROM DATUM): FROM 84.0 FT. TO 89.0 FT.

TOTAL BORING DEPTH FROM DATUM: 102.0 FT.

(A) DEPTH TO WATER TABLE FROM DATUM: 42.7 FT.

(B) SURFACE GAUGE HEIGHT ABOVE DATUM: .5 FT.

(C) DISTANCE WATER TABLE TO CENTER OF TEST INTERVAL: 43.8 FT.

MAXIMUM TEST PRESSURE, Po 68.16 (Po = [(A+B) *1] + C*.57 psi)

1/2 TEST NUMBER: 4 TEST PRESSURE 34.08 psi PACKER PRESSURE: 120* psi

Initial Transducer Readings: Top 8.52, Middle 26.36, Bottom 29.14

Transducer Readings after initial pressurization:
Top 3.45, Middle 29.91, Bottom 35.70

Transducer Readings after final flow measurement:
Top 4.64, Middle 19.63, Bottom 35.70

TIME (MIN)	FLOW METER READING, (GAL)	Q (GPM)	SURFACE GAUGE, PSI	REMARKS
0.0	2783.5	/	2.8	
0.5	2783.9	.8	6.5	
1.0	2784.7	1.2	16.7	
1.5	2784.7	Ø	15.7	
2.0	2784.7	Ø	14.5	
2.5	2784.7	Ø	13.4	
3.0	2784.7	Ø	12.5	
3.5	2784.7	Ø	11.7	
4.0	2784.7	Ø	11.1	
4.5	2784.7	Ø	10.5	
5.0	2784.7	Ø	10.0	

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

BORING NO.: B950
DATE: 8-18-06
TEST NUMBER: 4
TEST INTERVAL (FROM DATUM): FROM 84.0 **FT. TO** 89.0 **FT.**
DATA COLLECTED BY: J Howard

12-3-06

SHUT-IN TEST

PRESSURE: _____ **psi**

TIME, MIN	SURFACE GAUGE PRESSURE, PSI	MIDDLE TRANSDUCER PRESSURE, PSI
0.0	10.0	33.07
0.5	9.3	31.94
1.0	8.9	31.28
1.5	8.4	30.56
2.0	8.0	29.97
2.5	7.4	28.82
3.0	7.0	28.23
3.5	6.8	27.81
4.0	6.5	27.37
4.5	6.3	26.97
5.0	5.8	26.21
6.0	5.4	25.53
7.0	5.1	24.94
8.0	4.8	24.39
9.0	4.6	23.93
10.0	4.3	23.47
11.0	4.1	23.07
12.0	3.9	22.71
13.0	3.7	22.41
14.0	3.6	22.10
15.0	3.4	21.83
~~20.0~~ 16.0	3.3	21.58
20.0	2.9	20.95

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: B950-M484-89
" B484 "
" T484 "

DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET

JH 1-3-06

MACTEC ENGINEERING AND CONSULTING, INC.

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

DATA COLLECTED BY: S Howard **DATE COLLECTED:** 8-18-06

BORING NO. B-50 **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 5.0 **FT.**

TEST INTERVAL DEPTH (FROM DATUM): FROM 84.0 **FT. TO** 89.0 **FT.**

TOTAL BORING DEPTH FROM DATUM: 102.0 **FT.**

(A) DEPTH TO WATER TABLE FROM DATUM: 42.7 **FT.**

(B) SURFACE GAUGE HEIGHT ABOVE DATUM: .5 **FT.**

(C) DISTANCE WATER TABLE TO CENTER OF TEST INTERVAL: 43.8 **FT.**

MAXIMUM TEST PRESSURE, Po 68.16 **(Po = [(A+B) *1] + C*.57 psi)**

TEST NUMBER: 5 **TEST PRESSURE** 68.16 **psi PACKER PRESSURE:** ~~100~~ 125* **psi**

Initial Transducer Readings: Top 8.56 **, Middle** 26.36 **, Bottom** 29.14

Transducer Readings after initial pressurization:
Top 4.64 **, Middle** 19.63 **, Bottom** 35.70

Transducer Readings after final flow measurement:
Top 4.09 **, Middle** 22.78 **, Bottom** 36.50

TIME (MIN)	FLOW METER READING, (GAL)	Q (GPM)	SURFACE GAUGE, PSI	REMARKS
0.0	2784.7	✓	2.3	
0.5	2785.6	1.8	14.0	
1.0	2786.6	2.0	34.3	
1.5	2786.6	Ø	35.6	
2.0	2786.7	.2	38.1	
2.5	2786.8	.2	40.0	
3.0	2786.8	Ø	36.6	
3.5	2786.8	Ø	36.9	
4.0	2786.9	.2	38.0	
4.5	2786.9	Ø	38.1	
5.0	2786.9	Ø	37.7	
6.0	2787.0	.2	37.3	

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

BORING NO.: B950

DATE: 8-18-06

TEST NUMBER: 5

TEST INTERVAL (FROM DATUM): FROM 84.0 **FT. TO** 89.0 **FT.**

DATA COLLECTED BY: SHW

12-3-06

SHUT-IN TEST

PRESSURE:_____ **psi**

TIME, MIN	SURFACE GAUGE PRESSURE, PSI	MIDDLE TRANSDUCER PRESSURE, PSI
0.0	37.3	67.95
0.5	31.1	61.05
1.0	26.4	55.67
1.5	22.7	50.91
2.0	20.1	47.61
2.5	18.1	45.6
3.0	16.2	43.04
3.5	15.0	40.78
4.0	13.9	38.89
4.5	12.1	36.76
5.0	11.4	35.16
6.0	10.7	34.52
7.0	9.5	32.63
8.0	8.6	31.22
9.0	7.9	30.00
10.0	7.3	28.88
11.0	6.6	27.85
12.0	6.2	27.05
13.0	5.7	26.31
14.0	5.4	25.61
15.0	5.0	25.05
16.0	4.8	24.52
20.0	3.9	22.97

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: B950 - MS84-89
" - TS84-"
" - BS84-"

(5)

8-18-06

James Hoover

Miller: Mark Hughes, Tom Gartland

B949 & 950

Arrive 7

Safety meeting 730

Breakdown & clean test on B949 8-830

Move & Setup on B950 830-930

Get water 930-10

More setup 10-1115

lunch 1115-1145

Packer tests 1145-345 (84-89')

BD 345-4

Paperwork 4-430

(6) 8-21-06

James Howard

Miller, Mark Hughes, Tim Garland

B 950

2 arrive

830 meeting

4-Packers set-up

10-130 Packers @ ~~130~~ 8-21 62-67'

130-430 Packers @ 57-62

430-5 Paperwork

D 11

(2) 47.2

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-951

Given Parameters

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

Test Section Length, ℓ, ft:	5			
Radius of Borehole r_0, in:	2.00			
GW Depth, ft:	23.00	(from top of casing)	21.50	(from top of casing)

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:	**71 - 76**	(from ground surface)						
1	0.00	37.63	5.63	31.54	34.26	0.0	86.8	0.00
2	0.00	39.63	5.63	31.54	34.26	0.0	91.5	0.00
3	0.00	45.06	5.63	31.54	34.26	0.0	104.0	0.00
4	TNP	22.53	-	-	-	-	52.0	
5	TNP	45.06	-	-	-	-	104.0	
							K_e, ft/year:	**0.00**
Interval 2, ft:	**78 - 83**	(from ground surface)						
1	0.00	39.67	5.94	34.74	37.33	0.0	91.5	0.00
2	0.00	32.37	5.94	34.74	37.33	0.0	74.7	0.00
3	0.00	49.05	5.94	34.74	37.33	0.0	113.2	0.00
4	TNP	24.52	-	-	-	-	56.6	#VALUE!
5	TNP	49.05	-	-	-	-	113.2	#VALUE!
							K_e, ft/year:	**0.00**

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.

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: 8/23/2006
Boring No: B-951
Test Interval: 72.5 ft to 77.5 ft (from Datum)
Stick up length: 1.5 ft
Test Interval: 71.0 ft to 76 ft (from surface)
Test Type: Double Packer Technique

Prepared by: ZO Date: 12-7-06
Checked by: JW2 Date: 1-17-07

Depth of Water Table= 2.60 ft (from top of casing)
h1= 3.80 (from top of casing)
h2 = 72.40 ft (from top of casing)
ρ_w = 62.4 lb/ft^3

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

P_0 Max= 45.07 psi Value on field data sheet= 45.06

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

TEST #1

Actual Excess Pressure= 6.09 psi
Initial Middle Transducer Reading= 31.54 psi
Test Pressure= 37.63 psi

Time (min)	Flow Meter Reading (Gal)	Q (GPM)	Surface Gauge (psi)
0	2795.1		0.2
0.5	2795.1	0.0	0.2
1	2795.2	0.2	5.5
1.5	2795.2	0.0	6.2
2	2795.2	0.0	6
2.5	2795.2	0.0	6.5
3	2795.2	0.0	6.8
3.5	2795.2	0.0	6.6
4	2795.2	0.0	6.7
4.5	2795.2	0.0	6.5
5	2795.2	0.0	6.6

Average Q: 0.0 gpm
Excess Pore pressure: 6.09 psi

TEST #2

Actual Excess Pressure= 8.09 psi
Initial Middle Transducer Reading= 31.54 psi
Test Pressure= 39.63 psi

Time (min)	Flow Meter Reading (Gal)	Q (GPM)	Surface Gauge (psi)
0	2795.2		2.1
0.5	2795.4	0.4	8.2
1	2795.4	0.0	9.4
1.5	2795.4	0.0	8.7
2	2795.4	0.0	8.5
2.5	2795.4	0.0	8
3	2795.4	0.0	10.5
3.5	2795.4	0.0	9.8
4	2795.4	0.0	9.3
4.5	2795.4	0.0	8.9
5	2795.4	0.0	8.4

Average Q: 0.0 gpm
Excess Pore pressure: 8.09 psi

TEST #3

Actual Excess Pressure= 13.52 psi
Initial Middle Transducer Reading= 31.54 psi
Test Pressure= 45.06 psi

Time (min)	Flow Meter Reading (Gal)	Q (GPM)	Surface Gauge (psi)
0	2795.4		1.8
0.5	2795.7	0.6	9
1	2795.7	0.0	13.4
1.5	2795.7	0.0	14.8
2	2795.7	0.0	13.8
2.5	2795.7	0.0	13.4
3	2795.7	0.0	13.4
3.5	2795.7	0.0	13.6
4	2795.7	0.0	13.2
4.5	2795.7	0.0	13.7
5	2795.7	0.0	13.2

Average Q: 0.0 gpm
Excess Pore pressure: 13.52 psi

JA 1-17-07

TEST #4

Actual Excess Pressure= 22.53 psi
Initial Middle Transducer 31.54 psi
Test Pressure= psi

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

Average Q: gpm
Excess Pore pressure: psi

TEST #5

Actual Excess Pressure= 45.07 psi
Initial Middle Transducer 31.54 psi
Test Pressure= psi

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

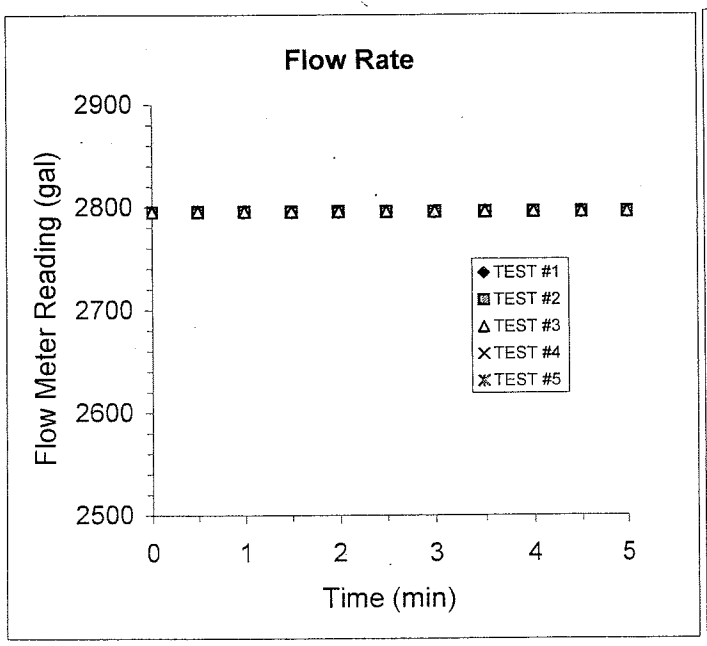
Average Q: gpm
Excess Pore pressure: psi

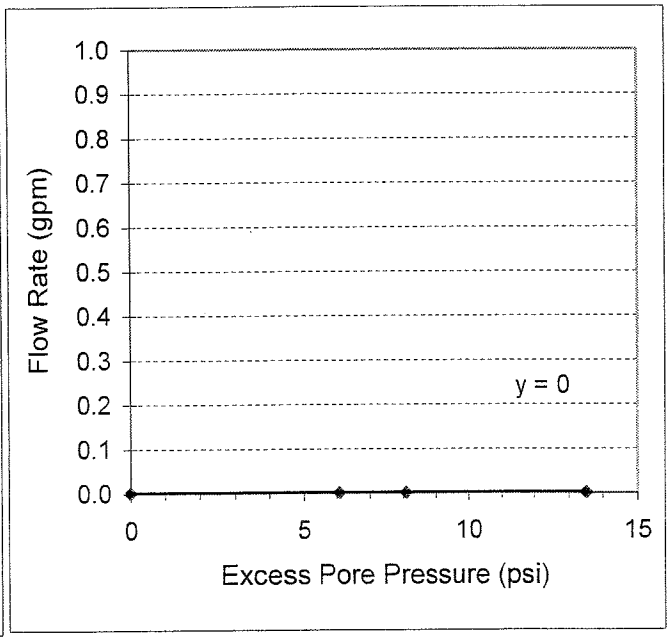
Boring No: B-951
Test Interva 71 ft to 76 ft
(from surface)

Density of water, ρ_w=62.4 lb/ft^3
= 0.0361 lb/in
Length= 5 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	6.09	0.00	14.05	0.00
2	8.09	0.00	18.67	0.00
3	13.52	0.00	31.2	0.00
4	0.00	0.00	0.0	
5	0.00	0.00	0.0	

* Q obtained from graph Flow Rate-1





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

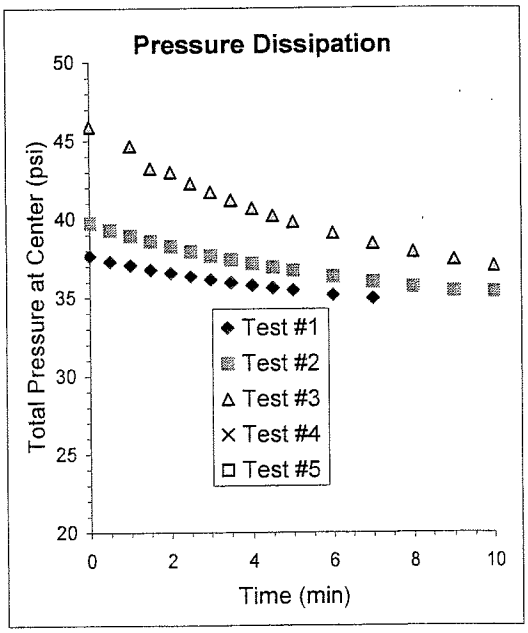
Pressure Decay Test

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: 8/23/2006
Boring No: B-951
Test Interval: 71 ft to 76 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	6.6	37.63	0.0	8.4	39.74	0.0	15.2	45.87
0.5	6.1	37.29	0.5	8	39.3	0.5		
1.0	5.9	37.04	1.0	7.6	38.92	1.0	12.8	44.64
1.5	5.6	36.76	1.5	7.3	38.57	1.5	12.1	43.22
2.0	5.4	36.53	2.0	7	38.24	2.0	11.4	42.97
2.5	5.3	36.32	2.5	6.7	37.92	2.5	10.8	42.26
3.0	5.1	36.13	3.0	6.5	37.63	3.0	10.2	41.71
3.5	4.9	35.92	3.5	6.2	37.4	3.5	9.7	41.18
4.0	4.7	35.75	4.0	6	37.15	4.0	9.2	40.66
4.5	4.6	35.59	4.5	5.8	36.91	4.5	8.8	40.19
5.0	4.4	35.44	5.0	5.6	36.7	5.0	8.5	39.80
6.0	4.2	35.14	6.0	5.3	36.31	6.0	7.8	39.08
7.0	4	34.89	7.0	5	35.96	7.0	7.2	38.42
8.0	3.8	34.69	8.0	4.7	35.64	8.0	6.7	37.88
9.0	3.6	34.47	9.0	4.4	35.36	9.0	6.2	37.40
10.0	3.4	34.28	10.0	4.3	35.33	10.0	5.4	36.98
11.0	3.3	34.11	11.0	4	34.88	11.0	5.5	36.58
12.0	3.2	33.96	12.0	3.8	34.67	12.0	5.2	36.2
13.0	3	33.81	13.0	3.7	34.49	13.0	4.9	35.93
14.0	2.9	33.68	14.0	3.5	34.3	14.0	4.7	35.64
15.0	2.8	33.57	15.0	3.4	34.16	15.0	4.5	35.39
20.0	2.4	33.11	20.0	2.8	33.5	20.0	3.6	34.4

Test #4			Test #5		
Time (min)	Surface Gauge (psi)	Center Tranducer (psi)	Time (min)	Surface Gauge (psi)	Center Tranducer (psi)
No data Test not conducted?			No data 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: 8/23/2006
Boring No: B-951
Test Interval: 79.5 ft to 84.5 ft
Stick up length: 1.5 ft
Test Interval: 78.0 ft to 83 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= 2.60 ft (from top of casing)
h1= 3.80 (from top of casing)
h2 = 79.40 ft (from top of casing)
ρ_w = 62.4 lb/ft^3

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

P_0 Max= 49.06 psi Value on field data sheet=

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

TEST #1

Actual Excess Pressure= 16.35 psi
Initial Middle Transducer Reading= 34.74 psi
Test Pressure= 39.67 psi

Time (min)	Flow Meter Reading (Gal)	Q (GPM)	Surface Gauge (psi)
0	2793.9		0.2
0.5	2793.9	0.0	0.5
1	2794.3	0.8	3.8
1.5	2794.3	0.0	3.7
2	2794.3	0.0	3.7
2.5	2794.3	0.0	3.7
3	2794.3	0.0	3.7
3.5	2794.3	0.0	3.7
4	2794.3	0.0	3.7
4.5	2794.3	0.0	3.7
5	2794.3	0.0	3.7

Average Q: 0.0 gpm
Excess Pore pressure: 4.93 psi

TEST #2

Actual Excess Pressure= 32.71 psi
Initial Middle Transducer Reading= 34.74 psi
Test Pressure= 41.89 psi

Time (min)	Flow Meter Reading (Gal)	Q (GPM)	Surface Gauge (psi)
0	2794.3		0
0.5	2794.3	0.0	0.2
1	2794.5	0.4	4.7
1.5	2794.5	0.0	5.5
2	2794.5	0.0	5.6
2.5	2794.5	0.0	5.5
3	2794.5	0.0	5.5
3.5	2794.5	0.0	5.5
4	2794.5	0.0	5.5
4.5	2794.5	0.0	5.6
5	2794.5	0.0	5.5

Average Q: 0.0 gpm
Excess Pore pressure: 7.15 psi

TEST #3

Actual Excess Pressure= 14.31 psi
Initial Middle Transducer Reading= 34.7 psi
Test Pressure= 49.05 psi

Time (min)	Flow Meter Reading (Gal)	Q (GPM)	Surface Gauge (psi)
0	2794.5		-0.1
0.5	2794.8	0.6	9.1
1	2795.1	0.6	13.2
1.5	2795.1	0.0	13.1
2	2795.1	0.0	13.1
2.5	2795.1	0.0	13.1
3	2795.1	0.0	13.1
3.5	2795.1	0.0	13.1
4	2795.1	0.0	13.2
4.5	2795.1	0.0	13.1
5	2795.1	0.0	13.1

Average Q: 0.0 gpm
Excess Pore pressure: 14.31 psi

1-17-07

TEST #4

Actual Excess Pressure= NA psi
Initial Middle Transducer 34.74 psi
Test Pressure= NA psi

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

TEST #5

Actual Excess Pressure= NA psi
Initial Middle Transducer 34.74 psi
Test Pressure= NA psi

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

Boring No: B-951
Test Interva 78 ft to 83 ft
(from surface)

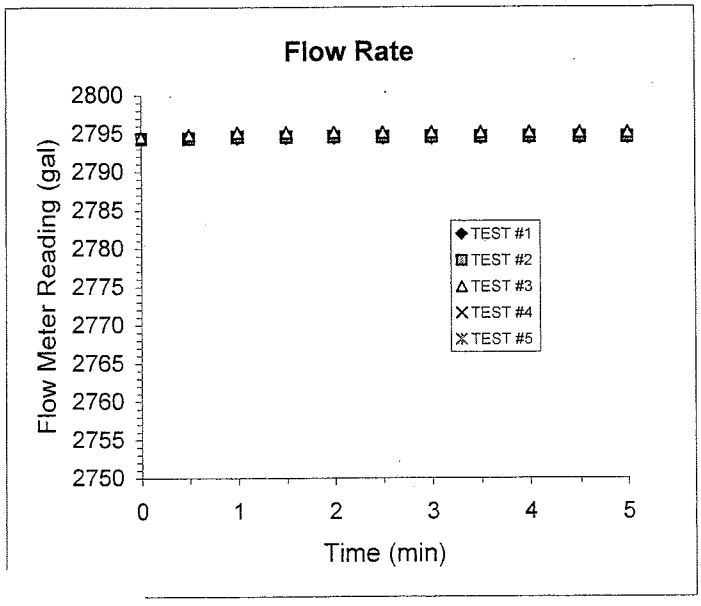
Density of water, ρ_w=62.4 lb/ft^3
= 0.0361 lb/in^3
Length= 5 ft
Borehole radius= 2.00 in
R ranges from 5-10 ft:
choose R= 5 ft

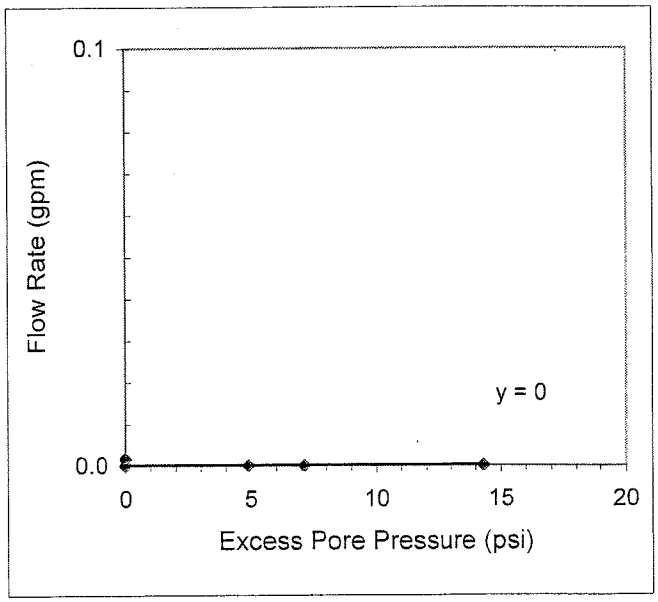
	Excess Pressure (psi)	Q (gpm)	Test Pres. (ft)	k_e (fpy)
1	4.93	0.000	37.74	0.00
2	7.15	0.000	75.47	0.00
3	14.31	0.000	33.02	0.00
4	0.00	0.000	######	#VALUE!
5	0.00	0.002	######	#VALUE!

* Q obtained from graph Flow Rate-1

Average Q: gpm **Excess Pore pressure:** psi

Average Q: gpm **Excess Pore pressure:** 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**

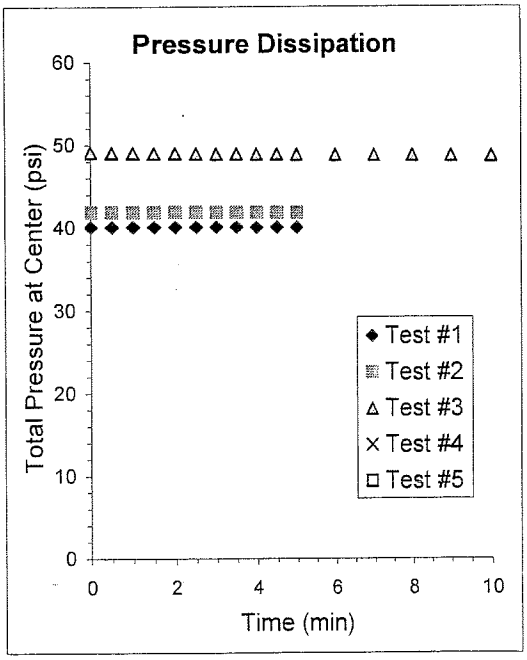
Pressure Decay Test

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: 8/23/2006
Boring No: B-951
Test Interval: 78 ft to 83 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	3.7	40.04	0.0	5.5	41.89	0.0	13.1	49.06
0.5	3.7	40.04	0.5	5.5	41.87	0.5	13.1	49.02
1.0	3.7	40.05	1.0	5.5	41.87	1.0	13.1	49.00
1.5	3.7	40.04	1.5	5.5	41.86	1.5	13.1	48.96
2.0	3.7	40.04	2.0	5.5	41.86	2.0	13.1	48.96
2.5	3.7	40.04	2.5	5.5	41.86	2.5	13.0	48.92
3.0	3.7	40.04	3.0	5.5	41.85	3.0	13.0	48.89
3.5	3.7	40.04	3.5	5.5	41.84	3.5	13.0	48.87
4.0	3.7	40.03	4.0	5.5	41.83	4.0	13.0	48.85
4.5	3.7	40.03	4.5	5.5	41.81	4.5	13.0	48.84
5.0	3.7	40.03	5.0	5.5	41.81	5.0	13	48.82
						6.0	12.9	48.77
						7.0	12.9	48.73
						8.0	12.9	48.69
						9.0	12.9	48.67
						10.0	12.8	48.63

Test #4			Test #5		
Time (min)	Surface Gauge (psi)	Center Tranducer (psi)	Time (min)	Surface Gauge (psi)	Center Tranducer (psi)



I

PACKER TESTING CALCULATIONS FOR P(MAX)

12-3-06

Date: 8-22-06

Boring No. B951

Test Interval: 72.5 to 77.5 feet from Datum

L = 5'

Casing Stickup 1.5 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

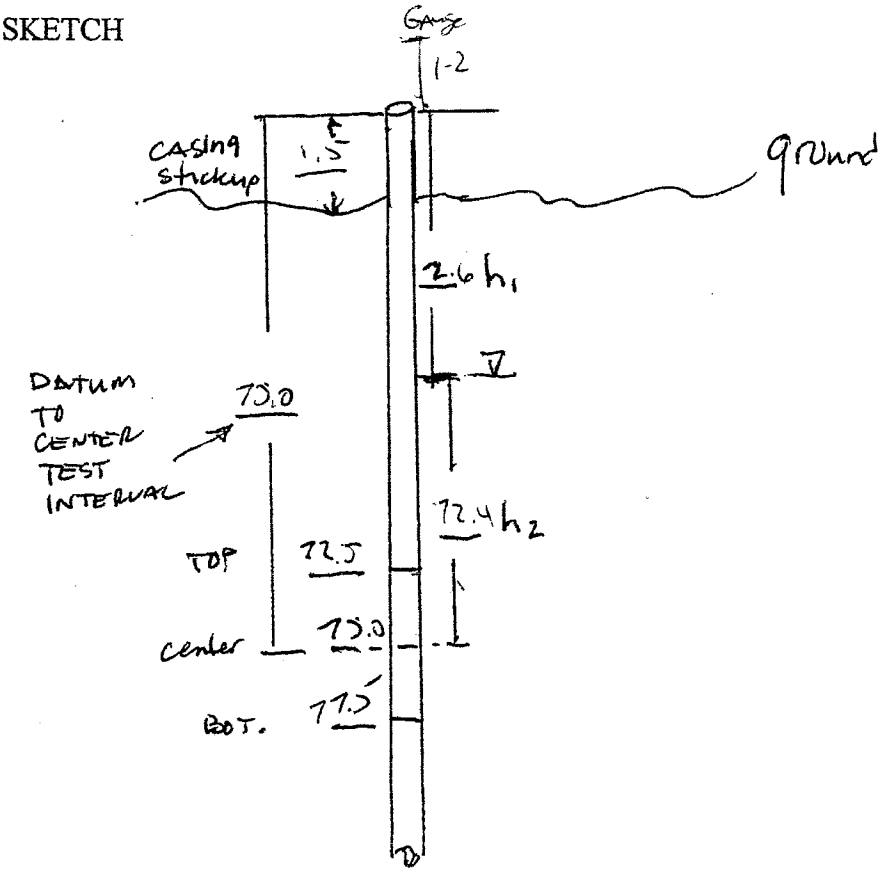
---

h_1 = 3.8

h_2 = 76 - 73.0 = 72.4

P MAX = 3.8 + 41.26 = 45.06

SKETCH



DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET

1/07 12-3-06

MACTEC ENGINEERING AND CONSULTING, INC.

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

DATA COLLECTED BY: J Howard DATE COLLECTED: 8-23-06

BORING NO. B951 BOREHOLE DIAMETER: 4 IN.

SURFACE CASING HEIGHT ABOVE GROUND: 1.5' FT.

CHECK DATUM USED: TOP OF CASING X GROUND SURFACE ____

DATUM ELEVATION NA

DISTANCE BOTTOM OF TOP PACKER TO TOP OF BOTTOM PACKER 5.0 FT.

TEST INTERVAL DEPTH (FROM DATUM): FROM 72.5' FT. TO 77.5' FT.

TOTAL BORING DEPTH FROM DATUM: 102.5' FT.

(A) DEPTH TO WATER TABLE FROM DATUM: 2.6 FT.

(B) SURFACE GAUGE HEIGHT ABOVE DATUM: 1.2 FT.

(C) DISTANCE WATER TABLE TO CENTER OF TEST INTERVAL: 72.4 FT.

1/3 MAXIMUM TEST PRESSURE, Po 45.06 (Po = [(A+B) *1] + C*.57 psi)

TEST NUMBER: 1 TEST PRESSURE 14.87* psi PACKER PRESSURE: 100 psi

Initial Transducer Readings: Top 5.62, Middle 31.54, Bottom 34.26

Transducer Readings after initial pressurization:

Top 6.09, Middle 34.21, Bottom 34.99

Transducer Readings after final flow measurement:

Top 3.63, Middle 33.04, Bottom 34.50

TIME (MIN)	FLOW METER READING, (GAL)	Q (GPM)	SURFACE GAUGE, PSI	REMARKS
0.0	2795.1	~	~~1.4~~ .2	
0.5'	2795.1	Ø	.2	
1.0	2795.2	.2	5.5	
1.5'	2795.2	Ø	6.2	
2.0	2795.2	Ø	6.0	
2.5	2795.2	Ø	6.5	
3.0	2795.2	Ø	6.8	
3.5'	2795.2	Ø	6.6	
4.0	2795.2	Ø	6.7	
4.5'	2795.2	Ø	6.5'	
5.0	2795.2	Ø	6.6	

VB 8-23 Test pressure increased due to the natural pressure being higher than the test pressure, per AlTire's instructions

* 37.63

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

BORING NO.: B951

DATE: 8-27-06

TEST NUMBER: 1

TEST INTERVAL (FROM DATUM): FROM 72.5 FT. TO 77.5 FT.

DATA COLLECTED BY: S Howard

2

12-3-06

SHUT-IN TEST

PRESSURE:_____ psi

TIME, MIN	SURFACE GAUGE PRESSURE, PSI	MIDDLE TRANSDUCER PRESSURE, PSI
0.0	6.6	37.65
0.5	6.1	37.29
1.0	5.9	37.041
1.5	5.6	36.76
2.0	5.41	36.53
2.5	5.3	36.32
3.0	5.1	36.13
3.5	4.9	35.92
4.0	4.7	35.75
4.5	4.6	35.59
5.0	4.4	35.44
6.0	4.2	35.14
7.0	4.0	34.89
8.0	3.8	34.69
9.0	3.6	34.47
10.0	3.4	34.28
11.0	3.3	34.11
12.0	3.2	33.96
13.0	3.0	33.81
14.0	2.9	33.68
15.0	2.8	33.57
20.0	2.4	33.11

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: B951 - M172 - 77

11 - B172 - 11

11 - T172 - 11

DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET

JAV 12-3-06

MACTEC ENGINEERING AND CONSULTING, INC.

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

DATA COLLECTED BY: J Howard DATE COLLECTED: 8-23-06

BORING NO. B951 BOREHOLE DIAMETER: 4 IN.

SURFACE CASING HEIGHT ABOVE GROUND: 1.5' FT.

CHECK DATUM USED: TOP OF CASING X GROUND SURFACE ____

DATUM ELEVATION NA

DISTANCE BOTTOM OF TOP PACKER TO TOP OF BOTTOM PACKER 5'.0 FT.

TEST INTERVAL DEPTH (FROM DATUM): FROM 72.5' FT. TO 77.5' FT.

TOTAL BORING DEPTH FROM DATUM: 102.5' FT.

(A) DEPTH TO WATER TABLE FROM DATUM: 2.6 FT.

(B) SURFACE GAUGE HEIGHT ABOVE DATUM: 1.2 FT.

(C) DISTANCE WATER TABLE TO CENTER OF TEST INTERVAL: 72.4 FT.

2/3 MAXIMUM TEST PRESSURE, Po 45.06 (Po = [(A+B) *1] + C*.57 psi)

TEST NUMBER: ~~3~~ 2 TEST PRESSURE 29.74* psi PACKER PRESSURE: 100 psi

Initial Transducer Readings: Top 5.62, Middle 31.54, Bottom 34.26

Transducer Readings after initial pressurization:

Top 5.63, Middle 33.04, Bottom 34.50

Transducer Readings after final flow measurement:

Top 5.62, Middle 32.80, Bottom 34.49

TIME (MIN)	FLOW METER READING, (GAL)	Q (GPM)	SURFACE GAUGE, PSI	REMARKS
0.0	2795.2	✓	2.1	
0.5	2795.4	.4	8.2	
1.0	2795.4	Ø	9.4	
1.5	2795.4	Ø	8.7	
2.0	2795.4	Ø	8.5	
2.5	2795.4	Ø	8.0	
3.0	2795.4	Ø	10.5	
3.5	2795.4	Ø	9.8	
4.0	2795.4	Ø	9.3	
4.5	2795.4	Ø	8.9	
5.0	2795.4	Ø	8.4	

See test #1 * 39.63

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

BORING NO.: B951

DATE: 8-23-06

TEST NUMBER: 2

TEST INTERVAL (FROM DATUM): FROM 72.5 FT. TO 77.5 FT.

DATA COLLECTED BY: SHoward

jbs 12-3-06

SHUT-IN TEST

PRESSURE:_____ psi

TIME, MIN	SURFACE GAUGE PRESSURE, PSI	MIDDLE TRANSDUCER PRESSURE, PSI
0.0	8.4	39.74
0.5	8.0	39.30
1.0	7.6	38.92
1.5	7.3	38.57
2.0	7.0	38.24
2.5	6.7	37.92
3.0	6.5	37.63
3.5	6.2	37.40
4.0	6.0	37.15
4.5	5.8	36.91
5.0	5.6	36.70
6.0	5.3	3631
7.0	5.0	35.96
8.0	4.7	35.64
9.0	4.4	35.36
10.0	4.3	35.13
11.0	4.0	34.85
12.0	3.8	34.67
13.0	3.7	34.49
14.0	3.5	34.30
15.0	3.4	34.16
20.0	2.8	33.50

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: B951 - M272 - 77
" - B272 - "
" - T272 - "

DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET

12-3-06

MACTEC ENGINEERING AND CONSULTING, INC.

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

DATA COLLECTED BY: J Howard DATE COLLECTED: 8-23-06

BORING NO. B951 BOREHOLE DIAMETER: 4 IN.

SURFACE CASING HEIGHT ABOVE GROUND: 1.5 FT.

CHECK DATUM USED: TOP OF CASING X GROUND SURFACE ____

DATUM ELEVATION NA

DISTANCE BOTTOM OF TOP PACKER TO TOP OF BOTTOM PACKER 5.0 FT.

TEST INTERVAL DEPTH (FROM DATUM): FROM 72.5 FT. TO 77.5 FT.

TOTAL BORING DEPTH FROM DATUM: 102.5 FT.

(A) DEPTH TO WATER TABLE FROM DATUM: 2.6 FT.

(B) SURFACE GAUGE HEIGHT ABOVE DATUM: 1.2 FT.

(C) DISTANCE WATER TABLE TO CENTER OF TEST INTERVAL: 72.4 FT.

MAXIMUM TEST PRESSURE, Po 45.06 (Po = [(A+B) *1] + C*.57 psi)

TEST NUMBER: 3 TEST PRESSURE 45.06 psi PACKER PRESSURE: 100 psi

Initial Transducer Readings: Top 5.62, Middle 31.54, Bottom 34.26

Transducer Readings after initial pressurization:
Top 5.62, Middle 32.80, Bottom 34.49

Transducer Readings after final flow measurement:
Top 5.62, Middle 34.30, Bottom 34.51

TIME (MIN)	FLOW METER READING, (GAL)	Q (GPM)	SURFACE GAUGE, PSI	REMARKS
0.0	2795.4	✓	1.8	
0.5	2795.7	.6	9.0	
1.0	2795.7	Ø	13.4	
1.5	2795.7	Ø	14.8	
2.0	2795.7	Ø	13.8	
2.5	2795.7	Ø	13.4	
3.0	2795.7	Ø	13.4	
3.5	2795.7	Ø	13.6	
4.0	2795.7	Ø	13.2	
4.5	2795.7	Ø	13.7	
5.0	2795.7	Ø	15.2	

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

BORING NO.: B 95-1

DATE: 8-23-06

TEST NUMBER: 3

TEST INTERVAL (FROM DATUM): FROM 72.5 FT. TO 77.5 FT.

DATA COLLECTED BY: J Howard

JAT 12-3-06

SHUT-IN TEST

PRESSURE:_____ psi

TIME, MIN	SURFACE GAUGE PRESSURE, PSI	MIDDLE TRANSDUCER PRESSURE, PSI
0.0	13.2	95.87
0.5	/	/
1.0	12.8	44.64
1.5	12.1	43.72
2.0	11.6	42.97
2.5	10.8	42.26
3.0	10.2	41.72
3.5	9.7	41.18
4.0	9.2	40.66
4.5	8.8	40.19
5.0	8.5	39.80
6.0	7.8	39.08
7.0	7.2	38.42
8.0	6.7	37.88
9.0	6.2	37.40
10.0	5.9	36.98
11.0	5.5	36.58
12.0	5.2	36.20
13.0	4.9	35.93
14.0	4.7	35.64
15.0	4.5	35.39
20.0	3.6	34.40

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

Test: B95 1 - MB72 - 77

11 - BB72 - 11

11 - TB72 - 11

DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET

JCL 12-3-06

MACTEC ENGINEERING AND CONSULTING, INC.

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

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

BORING NO. BG51 BOREHOLE DIAMETER: 4 IN.

SURFACE CASING HEIGHT ABOVE GROUND: 1.5' FT.

CHECK DATUM USED: TOP OF CASING X GROUND SURFACE ____

DATUM ELEVATION NA

DISTANCE BOTTOM OF TOP PACKER TO TOP OF BOTTOM PACKER 5.0 FT.

TEST INTERVAL DEPTH (FROM DATUM): FROM 72.5' FT. TO 77.5' FT.

TOTAL BORING DEPTH FROM DATUM: 102.5' FT.

(A) DEPTH TO WATER TABLE FROM DATUM: 2.6 FT.

(B) SURFACE GAUGE HEIGHT ABOVE DATUM: 1.2 FT.

(C) DISTANCE WATER TABLE TO CENTER OF TEST INTERVAL: 72.4 FT.

1/2 MAXIMUM TEST PRESSURE, Po 45.06 (Po = [(A+B) *1] + C*.57 psi)

TEST NUMBER: 4 TEST PRESSURE 22.53 psi PACKER PRESSURE: 100 psi

Initial Transducer Readings: Top____, Middle ____, Bottom ____

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, so test not preformed

DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET

JHD 12-3-06

MACTEC ENGINEERING AND CONSULTING, INC.

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

DATA COLLECTED BY: J Howard DATE COLLECTED: 8-23-06

BORING NO. B-51 BOREHOLE DIAMETER: 4 IN.

SURFACE CASING HEIGHT ABOVE GROUND: 1.5 FT.

CHECK DATUM USED: TOP OF CASING X GROUND SURFACE ____

DATUM ELEVATION NA

DISTANCE BOTTOM OF TOP PACKER TO TOP OF BOTTOM PACKER 5.0 FT.

TEST INTERVAL DEPTH (FROM DATUM): FROM 72.5 FT. TO 77.5 FT.

TOTAL BORING DEPTH FROM DATUM: 102.5 FT.

(A) DEPTH TO WATER TABLE FROM DATUM: 2.6 FT.

(B) SURFACE GAUGE HEIGHT ABOVE DATUM: 1.2 FT.

(C) DISTANCE WATER TABLE TO CENTER OF TEST INTERVAL: 72.61 FT.

MAXIMUM TEST PRESSURE, Po 45.06 (Po = [(A+B) *1] + C*.57 psi)

TEST NUMBER: 5 TEST PRESSURE 45.06 psi PACKER PRESSURE: 100 psi

Initial Transducer Readings: Top____, Middle ____, Bottom ____

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				
3.0'				
4.0				
4.5				
5.0				

Hole not taking water, so test not performed

78 83
-1.5 +1.5
79.5 84.5

PACKER TESTING CALCULATIONS FOR P(MAX)

Date: 8-22

Boring No. B95I

Test Interval: 79.5 to 84.5 feet from Datum

Casing Stickup 1.5 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~~ Gauge to the water level

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

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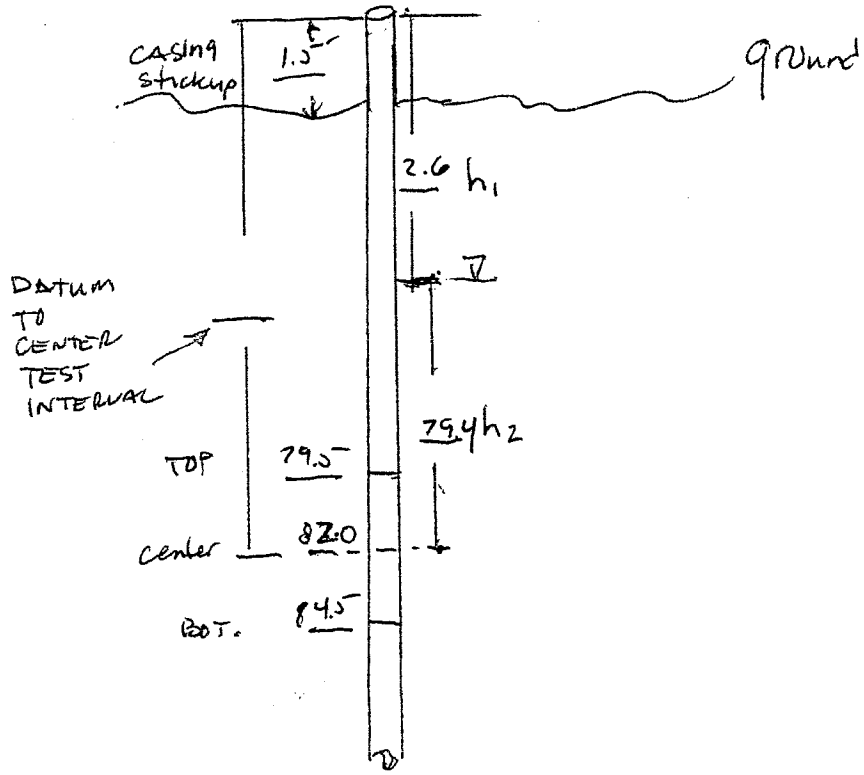
h_1 = 3.8

h_2 = 82.0 - 2.6 = 79.4

P MAX = 3.8 + 45.25 = 49.05

SKETCH



DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET

JT 1-23-07

MACTEC ENGINEERING AND CONSULTING, INC.

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

DATA COLLECTED BY: S Howard DATE COLLECTED: 8-22-06

BORING NO. B95T BOREHOLE DIAMETER: 4 IN.

SURFACE CASING HEIGHT ABOVE GROUND: 1.5 FT.

CHECK DATUM USED: TOP OF CASING X GROUND SURFACE ____

DATUM ELEVATION NA

DISTANCE BOTTOM OF TOP PACKER TO TOP OF BOTTOM PACKER 5.0 FT.

TEST INTERVAL DEPTH (FROM DATUM): FROM 79.5 FT. TO 84.5 FT.

TOTAL BORING DEPTH FROM DATUM: 1025 FT.

(A) DEPTH TO WATER TABLE FROM DATUM: 2.6 FT.

(B) SURFACE GAUGE HEIGHT ABOVE DATUM: 1.2 FT.

(C) DISTANCE WATER TABLE TO CENTER OF TEST INTERVAL: 79.4 FT.

1/3 MAXIMUM TEST PRESSURE, Po 49.05 (Po = [(A+B) *1] + C*.57 psi)

TEST NUMBER: 1 TEST PRESSURE 16.18* psi PACKER PRESSURE: 100 psi

Initial Transducer Readings: Top 5.94, Middle 34.74, Bottom 37.33

Transducer Readings after initial pressurization:
Top 6.13, Middle 36.07, Bottom 37.74

Transducer Readings after final flow measurement:
Top 5.80, Middle 40.05, Bottom 37.48

TIME (MIN)	FLOW METER READING, (GAL)	Q (GPM)	SURFACE GAUGE, PSI	REMARKS
0.0	2793.9	—	.2	
0.5	2793.9	Ø	.5	
1.0	2794.3	.8	3.8	
1.5	2794.3	Ø	3.7	
2.0	2794.3	Ø	3.7	
2.5	2794.3	Ø	3.7	
3.0	2794.3	Ø	3.7	
3.5	2794.3	Ø	3.7	
4.0	2794.3	Ø	3.7	
4.5	2794.3	Ø	3.7	
5.0	2794.3	Ø	3.7	

1. Pressure raised per Al Tice's instructions; Test pressure below natural Pressure 39.67*

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

BORING NO.: B951

DATE: 8-22-06

TEST NUMBER: 1

TEST INTERVAL (FROM DATUM): FROM 79.5 FT. TO 84.5 FT.

DATA COLLECTED BY: J Howard

12-3-06

SHUT-IN TEST

PRESSURE:_____ psi

TIME, MIN	SURFACE GAUGE PRESSURE, PSI	MIDDLE TRANSDUCER PRESSURE, PSI
0.0	3.7	40.04
0.5	3.7	40.04
1.0	3.7	40.05
1.5	3.7	40.04
2.0	3.7	40.04
2.5	3.7	40.04
3.0	3.7	40.04
3.5	3.7	40.04
4.0	3.7	40.03
4.5	3.7	40.03
5.0	3.8	40.03

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: B951 - M179 - 84

" - B179 - "

" - T179 - "

DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET

JLG 11-3-06

MACTEC ENGINEERING AND CONSULTING, INC.

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

DATA COLLECTED BY: J Howard DATE COLLECTED: 8-22-06

BORING NO. B951 BOREHOLE DIAMETER: 4 IN.

SURFACE CASING HEIGHT ABOVE GROUND: 1.5' FT.

CHECK DATUM USED: TOP OF CASING X GROUND SURFACE ____

DATUM ELEVATION NA

DISTANCE BOTTOM OF TOP PACKER TO TOP OF BOTTOM PACKER 5.0 FT.

TEST INTERVAL DEPTH (FROM DATUM): FROM 79.5' FT. TO 84.5' FT.

TOTAL BORING DEPTH FROM DATUM: 102.5' FT.

(A) DEPTH TO WATER TABLE FROM DATUM: 2.6 FT.

(B) SURFACE GAUGE HEIGHT ABOVE DATUM: 1.2 FT.

(C) DISTANCE WATER TABLE TO CENTER OF TEST INTERVAL: 79.4 FT.

2/3 MAXIMUM TEST PRESSURE, Po 49.05' (Po = [(A+B) *1] + C*.57 psi)

TEST NUMBER: 2 TEST PRESSURE 32.37* psi PACKER PRESSURE: 100 psi

Initial Transducer Readings: Top 5.44, Middle 34.74, Bottom 37.33

Transducer Readings after initial pressurization:
Top 5.80, Middle 35.83, Bottom 37.46

Transducer Readings after final flow measurement:
Top 5.80, Middle 41.81, Bottom 37.46

TIME (MIN)	FLOW METER READING, (GAL)	Q (GPM)	SURFACE GAUGE, PSI	REMARKS
0.0	2794.3	/	00.0	
0.5'	2794.3	Ø	0.2	
1.0	2794.5	.4	4.7	
1.5	2794.5	Ø	5.5'	
2.0	2794.5'	Ø	5.6	
2.5	2794.5	Ø	5.5'	
3.0	2794.5'	Ø	5.5'	
3.5'	2794.5'	Ø	5.5'	
4.0	2794.5	Ø	5.5'	
4.5'	2794.5	Ø	5.6	
5.0	2794.5	Ø	5.5'	

* 41.89 See test 1

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

BORING NO.: B95-1

DATE: 8-22

TEST NUMBER: 2

TEST INTERVAL (FROM DATUM): FROM 79 FT. TO 84.5 FT.

DATA COLLECTED BY: Howard

BJ 12-3-06

SHUT-IN TEST

PRESSURE:_____ psi

TIME, MIN	SURFACE GAUGE PRESSURE, PSI	MIDDLE TRANSDUCER PRESSURE, PSI
0.0	5.5	41.89
0.5	5.5	41.87
1.0	5.5	41.87
1.5	5.5	41.86
2.0	5.5	41.86
2.5	5.5	41.86
3.0	5.5	41.85
3.5	5.5	41.84
4.0	5.5	41.83
4.5	5.5	41.81
5.0	5.5	41.81

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: B95-1 - MZ 79 - 84

" - BZ 79 - "

" - TZ 79 - "

DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET

12-3-06

MACTEC ENGINEERING AND CONSULTING, INC.

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

DATA COLLECTED BY: J Howard DATE COLLECTED: 8-22-06

BORING NO. B951 BOREHOLE DIAMETER: 4 IN.

SURFACE CASING HEIGHT ABOVE GROUND: 1.5' FT.

CHECK DATUM USED: TOP OF CASING X GROUND SURFACE ____

DATUM ELEVATION NA

DISTANCE BOTTOM OF TOP PACKER TO TOP OF BOTTOM PACKER 5.0 FT.

TEST INTERVAL DEPTH (FROM DATUM): FROM 79.5' FT. TO 84.5' FT.

TOTAL BORING DEPTH FROM DATUM: 102.5' FT.

(A) DEPTH TO WATER TABLE FROM DATUM: 2.6 FT.

(B) SURFACE GAUGE HEIGHT ABOVE DATUM: 1.2 FT.

(C) DISTANCE WATER TABLE TO CENTER OF TEST INTERVAL: 79.4 FT.

MAXIMUM TEST PRESSURE, Po 49.05' (Po = [(A+B) *1] + C*.57 psi)

TEST NUMBER: 3 TEST PRESSURE 49.05' psi PACKER PRESSURE: 100 psi

Initial Transducer Readings: Top 5.94, Middle 34.74, Bottom 37.33

Transducer Readings after initial pressurization:

Top 9.80, Middle 35.61, Bottom 37.45'

Transducer Readings after final flow measurement:

Top 5.79, Middle 48.58, Bottom 37.47

TIME (MIN)	FLOW METER READING, (GAL)	Q (GPM)	SURFACE GAUGE, PSI	REMARKS
0.0	2794.5	/	-0.1	
0.5'	2794.8	0.6	9.1	
1.0	2795.1	0.6	13.2	
1.5'	2795.1	Ø	13.1	
2.0	2795.1	Ø	13.1	
2.5'	2795.1	Ø	13.1	
3.0	2795.1	Ø	13.1	
3.5'	2795.1	Ø	13.1	
4.0	2795.1	Ø	13.2	
4.5'	2795.1	Ø	13.1	
5.0	2795.1	Ø	13.1	

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

BORING NO.: B95I

DATE: 8-22-06

TEST NUMBER: 3

TEST INTERVAL (FROM DATUM): FROM 84.5' FT. TO 79.5' FT.

DATA COLLECTED BY: S Howard

2
JBA 12-3-06

SHUT-IN TEST

PRESSURE:_____ psi

TIME, MIN	SURFACE GAUGE PRESSURE, PSI	MIDDLE TRANSDUCER PRESSURE, PSI
0.0	13.1	49.06
0.5	13.1	49.02
1.0	13.1	48.00
1.5	13.1	48.96
2.0	13.1	48.96
2.5	13.0	48.92
3.0	13.0	48.89
3.5	13.0	48.87
4.0	13.0	48.85
4.5	13.0	48.84
5.0	13.0	48.82
6.0	12.9	48.77
7.0	12.9	48.73
8.0	12.9	48.69
9.0	12.9	48.67
10.0	12.8	48.63

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: B95I - MW79 - 84

" - BW79 - "

" - TW79 - "

DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET

12-306

MACTEC ENGINEERING AND CONSULTING, INC.

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

DATA COLLECTED BY: S Howard DATE COLLECTED: 8-22-06

BORING NO. B951 BOREHOLE DIAMETER: 4 IN.

SURFACE CASING HEIGHT ABOVE GROUND: 1.5 FT.

CHECK DATUM USED: TOP OF CASING X GROUND SURFACE ____

DATUM ELEVATION NA

DISTANCE BOTTOM OF TOP PACKER TO TOP OF BOTTOM PACKER 5.0 FT.

TEST INTERVAL DEPTH (FROM DATUM): FROM 79.5 FT. TO 84.5 FT.

TOTAL BORING DEPTH FROM DATUM: 102.5 FT.

(A) DEPTH TO WATER TABLE FROM DATUM: 2.6 FT.

(B) SURFACE GAUGE HEIGHT ABOVE DATUM: 1.2 FT.

(C) DISTANCE WATER TABLE TO CENTER OF TEST INTERVAL: 79.4 FT.

1/2 MAXIMUM TEST PRESSURE, Po 49.05 (Po = [(A+B) *1] + C*.57 psi)

TEST NUMBER: 4 TEST PRESSURE 24.52 psi PACKER PRESSURE: 100 psi

Initial Transducer Readings: Top____, Middle ____, Bottom ____

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				

No Test, Hole not taking water

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

BORING NO.: B951

DATE: 8-22-06

TEST NUMBER: 4

TEST INTERVAL (FROM DATUM): FROM 79.5 FT. TO 84.5 FT.

DATA COLLECTED BY: Stoward

2

12-3-06

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

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: B951- M479-84

11 - T479-11

11 - B479-11

DOUBLE PACKER BOREHOLE PERMEABILITY TEST DATA SHEET

12-3-06

MACTEC ENGINEERING AND CONSULTING, INC.

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

DATA COLLECTED BY: J Howard DATE COLLECTED: 8-22-06

BORING NO. B 951 BOREHOLE DIAMETER: 4 IN.

SURFACE CASING HEIGHT ABOVE GROUND: 1.5 FT.

CHECK DATUM USED: TOP OF CASING X GROUND SURFACE ____

DATUM ELEVATION N/A

DISTANCE BOTTOM OF TOP PACKER TO TOP OF BOTTOM PACKER 5.0 FT.

TEST INTERVAL DEPTH (FROM DATUM): FROM 79.5 FT. TO 84.5 FT.

TOTAL BORING DEPTH FROM DATUM: 102.5 FT.

(A) DEPTH TO WATER TABLE FROM DATUM: 2.6 FT.

(B) SURFACE GAUGE HEIGHT ABOVE DATUM: 1.2 FT.

(C) DISTANCE WATER TABLE TO CENTER OF TEST INTERVAL: 79.4 FT.

MAXIMUM TEST PRESSURE, Po 49.05 (Po = [(A+B) *1] + C*.57 psi)

TEST NUMBER: 5 TEST PRESSURE 49.05 psi PACKER PRESSURE: 100 psi

Initial Transducer Readings: Top____, Middle ____, Bottom ____

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				

No test Hole not taking water

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

BORING NO.: B951

DATE: 8-22-06

TEST NUMBER: 3

TEST INTERVAL (FROM DATUM): FROM ~~84.5~~ 79.5 **FT. TO** ~~79.5~~ 84.5 **FT.**

DATA COLLECTED BY: S Howard

12-3-06

SHUT-IN TEST

PRESSURE:_____ **psi**

TIME, MIN	SURFACE GAUGE PRESSURE, PSI	MIDDLE TRANSDUCER PRESSURE, PSI
0.0	13.1	49.06
0.5	13.1	49.02
1.0	13.1	48.00
1.5	13.1	48.96
2.0	13.1	48.96
2.5	13.0	48.92
3.0	13.0	48.89
3.5	13.0	48.87
4.0	13.0	48.85
4.5	13.0	48.84
5.0	13.0	48.82
6.0	12.9	48.77
7.0	12.9	48.73
8.0	12.9	48.69
9.0	12.9	48.67
10.0	12.8	48.63

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: B951 - MW79 - 84

" - BW79 - "

" - TW79 - "

8-22-06

Samos Hovard

Miller & Mark Hughes, Tim Garland

B950 & 951

~~Date 8-22~~

~~An~~

Arrival 7am

Meeting 730-8

Breakfast B950 8-9

Stand by. Fix Planks to cross ditch at B951

~~Date 8-23~~ 9-1030 11

lunch 11-1130

1130 - 1230 Look for guys making cut std. bridge

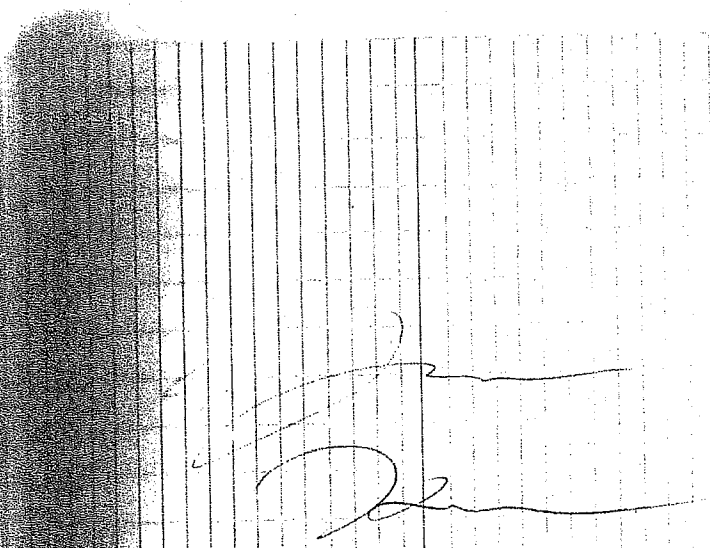
1230 - 1 Safty meeting

1 - 2 Setup packers

2 - 345 Packer test B951 ~~Date 8-23~~ 730 - 845

345-4 Breakdown & Move packer ye

4 - 430 Paperwork



(1)

B9-C6

Edward Howard

Mark Hughes, Tim Garland

P431

Arrive 7am

Safety Meeting 730am

8-830 Set up packer tests

830 - 1030 Test Interval 72.5-77.5

1030 - 1130 Breakdown

1130 - 1230 lunch

1230 - 145 Breakdown

145 - 430 Drill B9-14 w/George Alcin

60.6 to 80.8 (Rock core)

430-5 Breakdown/Clean up

5 - 530 Paperwork