Appendix I
Monitoring Well Sampling Data Forms

ERM Series Monitoring Wells

W.O #S
02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTREEZ
02009.06 EXISTING WELLS

HIA - MIDDLETOWN
WELL SAMPLING DATA FORM

Well Number: ERM-1S Date: 5-17-95 Time: 1008

Boring diameter: _____ Well casing diameter: 2"

Annular space length: _____ Stickup: _____

Total depth (TOC) 13.46 (-) Depth to water (TOC) 7.19 (=) Height of Column 6.27

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	/
Column of water or length of A.S. (whichever is less)	x	/
Volume of annular space	=	/
Gallons per foot of casing	=	.16
Column of water	x	6.27
Volume of casing	=	1.02 gal
TOTAL VOLUME (A.S. + casing)	=	/
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	3.1 gal
TOTAL VOLUME PURGED	=	12 gal

Method of purging: centrifugal

Sample date/time: 5-17-95 / 1030 Sample number: 87727

FIELD PARAMETERS	~~Begin~~				~~End~~		Sample
pH	6.5	6.4	6.2	6.3	6.3	6.3	6.4
Conductivity	390	500	500	490	490	490	500
Temperature	14.5	13.5	13.5	13.5	13.5	13.5	14°
Turbidity	200+	200+	200+	200+	200+	200+	94.6

Sampler's signature/date: M von Maeda / 5-18-95

W.O # S
02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTUREZ
02009.06 EXIST[illegible] WE[illegible]

HIA - MIDDLETOWN

WELL SAMPLING DATA FORM

Well Number: ERM-1I Date: 5-17-95 Time: 0947

Boring diameter: _____ Well casing diameter: 2"

Annular space length: _____ Stickup: _____

Total depth (TOC) 98.65 (-) Depth to water (TOC) 6.77 (=) Height of Column 91.88

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	/
Column of water or length of A.S. (whichever is less)	x	/
Volume of annular space	=	/
Gallons per foot of casing	=	.16
Column of water	x	91.88
Volume of casing	=	15 gal
TOTAL VOLUME (A.S. + casing)	=	/
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	45 gal
TOTAL VOLUME PURGED	=	46 gal

Method of purging: Centrifugal pump

Sample date/time: 5-17-95 / 1020 Sample number: 87728

FIELD PARAMETERS	~~Begin~~					~~End~~	Sample
pH	6.6	7.0	7.0	6.8	6.8	6.8	6.9
Conductivity	500	490	500	500	500	500	500
Temperature	16	16.5	14.5	14.5	14.5	14.5	13°
Turbidity	10.1	5.5	2.2	1.0	0.9	0.9	8.1

Sampler's signature/date: M. von Meidl / 5-18-95

W.O #S
02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTREEZ
02009.06 EXISTING WELLS

HIA - MIDDLETOWN
WELL SAMPLING DATA FORM

Well Number: ERM-2S Date: 5-15-95 Time: 1445

Boring diameter: _____ Well casing diameter: 2"

Annular space length: _____ Stickup: _____

Total depth (TOC) 16.86 (-) Depth to water (TOC) 7.51 (=) Height of Column 9.35

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	/
Column of water or length of A.S. (whichever is less)	x	/
Volume of annular space	=	/
Gallons per foot of casing	=	.16
Column of water	x	9.35
Volume of casing	=	1.53 gal
TOTAL VOLUME (A.S. + casing)	=	/
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	4.8 gal
TOTAL VOLUME PURGED	=	5+ gal

Method of purging: bailer

Sample date/time: 5-15-95 / 1500 Sample number: 87681

FIELD PARAMETERS	~~Begin~~				~~End~~	Sample
pH	6.3	6.5	6.5	6.5	6.6	6.5
Conductivity	700	650	600	600	650	700
Temperature	18	16	13	13	12.5	15°
Turbidity	200+	200+	200+	200+	200+	200+

Sampler's signature/date: M. von Minden / 5-15-95

W.O #S
02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTREEZ
02009.06 EXISTING WELLS

HIA - MIDDLETOWN
WELL SAMPLING DATA FORM

Well Number: ERM-4S Date: 5-15-95 Time: 1100

Boring diameter: _____ Well casing diameter: 2"

Annular space length: _____ Stickup: _____

Total depth (TOC) 19.60 (-) Depth to water (TOC) 13.46 (=) Height of Column 6.14

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	/
Column of water or length of A.S. (whichever is less)	x	/
Volume of annular space	=	/
Gallons per foot of casing	=	.16
Column of water	x	6.14
Volume of casing	=	1.0 gal
TOTAL VOLUME (A.S. + casing)	=	/
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	3. gal
TOTAL VOLUME PURGED	=	3 gal

Method of purging: bailer

Sample date/time: 5-15-95 / 1122 Sample number: 87682

FIELD PARAMETERS	~~Begin~~				~~End~~			Sample
pH	7.3	7.6	7.5	7.5	7.6	7.6	7.6	7.6
Conductivity	500	500	500	500	500	500	500	500
Temperature	17.5	17	15	15	15	15	15	15°
Turbidity	200+	200+	200+	200+	200+	200+	200+	200+

Sampler's signature/date: M. von Muda / 5-16-95

W.O #S
02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTREEZ
02009.06 EXISTING WELLS

HIA - MIDDLETOWN
WELL SAMPLING DATA FORM

Well Number: ERM-5S Date: 5-12-95 Time: 1315

Boring diameter: _____ Well casing diameter: 2"

Annular space length: _____ Stickup: _____

Total depth (TOC) 19.35 (-) Depth to water (TOC) 11.73 (=) Height of Column 7.62

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	/
Column of water or length of A.S. (whichever is less)	x	/
Volume of annular space	=	/
Gallons per foot of casing	=	.16
Column of water	x	7.62
Volume of casing	=	1.25 gal
TOTAL VOLUME (A.S. + casing)	=	/
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	3.75 gal
TOTAL VOLUME PURGED	=	4 gal

Method of purging: bailer

Sample date/time: 5-12-95 / 1330 Sample number: 87646

FIELD PARAMETERS

	~~Begin~~			~~End~~			Sample
pH	6.3	6.3	6.5	6.4	6.4	6.4	6.5
Conductivity	850	700	700	600	600	550	600
Temperature	16	15	15	15	14.5	15	16
Turbidity	200+	200+	200+	200+	200+	200+	200+

Sampler's signature/date: M. Von Maeda / 5-13-95

W.O # S
02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTURE
02009.06 EXISTING WELLS

HIA - MIDDLETOWN
WELL SAMPLING DATA FORM

Well Number: ERM-~~25S~~ 6S Date: 5-12-95 Time: 1105

Boring diameter: _____ Well casing diameter: 2"

Annular space length: _____ Stickup: _____

Total depth (TOC) 23.50 (-) Depth to water (TOC) 16.89 (=) Height of Column 6.61

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	
Column of water or length of A.S. (whichever is less)	x	
Volume of annular space	=	
Gallons per foot of casing	=	.16
Column of water	x	6.61
Volume of casing	=	1.1 gal
TOTAL VOLUME (A.S. + casing)	=	
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	3.3 gal
TOTAL VOLUME PURGED	=	15 gal

Method of purging: centrifugal pump

Sample date/time: 5-12-95 / 1127 Sample number: ERM-6S

FIELD PARAMETERS

	~~Begin~~				~~End~~				Sample
pH	6.6	6.5	6.5	6.4	6.4	6.5	6.5	6.4	6.6
Conductivity	495	460	450	450	450	450	450	450	460
Temperature	15	15	15	15	15	15	15	15	15
Turbidity	200+	200+	200+	200+	200+	200+	200+	49.2 ~~200+~~	200+

Sampler's signature/date: M. Nori Mueda / 5-13-95

W.O #S
02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTURE
02009.06 EXISTING WELLS

HIA - MIDDLETOWN

WELL SAMPLING DATA FORM

Well Number: ERM-7S Date: 5-17-95 Time: 1515

Boring diameter: _____ Well casing diameter: 4"

Annular space length: _____ Stickup: _____

Total depth (TOC) 146.72 (-) Depth to water (TOC) 29.38 (=) Height of Column 117.34

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	/
Column of water or length of A.S. (whichever is less)	x	/
Volume of annular space	=	/
Gallons per foot of casing	=	.65
Column of water	x	117.34
Volume of casing	=	76.5 gal
TOTAL VOLUME (A.S. + casing)	=	/
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	229.5 gal
TOTAL VOLUME PURGED	=	230 gal

Method of purging: 2" Grundfos submersible

Sample date/time: 5-17-95 / 1716 Sample number: 87701

FIELD PARAMETERS	~~Begin~~				~~End~~			Sample
pH	6.4	6.4	6.5	6.5	6.5	6.5	6.5	6.7
Conductivity	600	600	600	650	650	700	700	500
Temperature	16	15	15.5	17	17	17	17.5	16°
Turbidity	2.8	3.5	3.5	2.4	1.2	0.7	0.5	4.1

Sampler's signature/date: M. von Rueda / 5-18-95

02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTUREZ.
02009.06 EXISTING WELL

HIA - MIDDLETOWN

WELL SAMPLING DATA FORM

Well Number: ERM-7I Date: 5/22/95 Time: 1305

Boring diameter: — Well casing diameter: 4"

Annular space length: — Stickup: —

Total depth (TOC) 333.71 (-) Depth to water (TOC) 44.30 (=) Height of Column 289.41

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	—
Column of water or length of A.S. (whichever is less)	x	—
Volume of annular space	=	—
Gallons per foot of casing	=	.652
Column of water	x	289.41
Volume of casing	=	188.7
TOTAL VOLUME (A.S. + casing)	=	188.7
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	566
TOTAL VOLUME PURGED	=	300

Method of purging: 2" GRUNDFOS SUB PUMP

Sample date/time: 5-22-95 / 1802 Sample number: 26241

FIELD PARAMETERS	~~Begin~~		~~End~~		Sample
pH	6.9	6.9	6.9	6.8	7.4
Conductivity	700	700	700	700	550
Temperature	18	19	18	19	17
Turbidity	2.4	2.0	1.9	2.5	13.0

Sampler's signature/date: M. Von Neida / 5-23-95

02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTUREZ.
02009.06 EXISTING WELLS

HIA - MIDDLETOWN

WELL SAMPLING DATA FORM

Well Number: ERM-7D Date: 5/22/95 Time: 1220

Boring diameter: 4" Well casing diameter: 4"

Annular space length: — Stickup: —

Total depth (TOC) 643.35 (-) Depth to water (TOC) 159.00 (=) Height of Column 484.35

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	—
Column of water or length of A.S. (whichever is less)	x	—
Volume of annular space	=	—
Gallons per foot of casing	=	.652
Column of water	x	484.35
Volume of casing	=	315
TOTAL VOLUME (A.S. + casing)	=	315
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	945
TOTAL VOLUME PURGED	=	950

Method of purging: 2" GRUNDFOS SUB PUMP

Sample date/time: 5-22-95 / 1843 Sample number: 26242

FIELD PARAMETERS	~~Begin~~			~~End~~			Sample
pH	9.0	9.2	9.2	8.9	8.8	8.7	8.3
Conductivity	250	210	220	230	230	270	250
Temperature	20	18	19	22	21	20	16
Turbidity	13.5	5.9	4.7	2.9	4.6	11.6	7.5

Sampler's signature/date: M. Von Fida / 5-23-95

W.O #S
02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTURE
02009.06 EXISTING WELLS

NIA - MIDDLETOWN
WELL SAMPLING DATA FORM

Well Number: ERM-8S Date: 5.17-95 Time: 1215

Boring diameter: _____ Well casing diameter: 4"

Annular space length: _____ Stickup: _____

Total depth (TOC) 124.57 (-) Depth to water (TOC) 31.26 (=) Height of Column 93.31

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	/
Column of water or length of A.S. (whichever is less)	x	/
Volume of annular space	=	/
Gallons per foot of casing	=	.65
Column of water	x	93.31
Volume of casing	=	60.7 gal
TOTAL VOLUME (A.S. + casing)	=	/
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	183 gal
TOTAL VOLUME PURGED	=	75 gal (dry)

Method of purging: 2" ~~4"~~ Grundfos Submersible

Sample date/time: 5.17-95 / 1450 Sample number: 87722,23,24 (MS MSD MSD split dupe)

FIELD PARAMETERS	~~Begin~~			~~End~~	Sample
pH	8.3	8.4	7.4	9.0	7.2
Conductivity	350	370	285	380	480
Temperature	13.5	14	15	14	17
Turbidity	3.1	5.2	9.9	5.9	2.1

Sampler's signature/date: M. von Meade / 5-18-95

W.O # S
02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTURE
02009.06 EX[illegible] WELLS

HIA - MIDDLETOWN

WELL SAMPLING DATA FORM

(5-17-95 start)

Well Number: ERM-8I Date: 5-18-95 Time: 0945

Boring diameter: _____ Well casing diameter: 4"

Annular space length: _____ Stickup: _____

Total depth (TOC) 343.80 (-) Depth to water (TOC) 55.53 (=) Height of Column 28827

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	/
Column of water or length of A.S. (whichever is less)	x	/
Volume of annular space	=	/
Gallons per foot of casing	=	.65
Column of water	x	288.27
Volume of casing	=	187.5 gal
TOTAL VOLUME (A.S. + casing)	=	/
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	565.5
TOTAL VOLUME PURGED	=	570 gal

Method of purging: 2" Grundfos submersible

Sample date/time: 5-18-95 / 1435 Sample number: 87725

FIELD PARAMETERS	~~Begin~~					~~End~~	Sample
pH	7.2	7.1	7.0	7.0	7.0	7.0	6.0
Conductivity	700	700	700	700	700	700	600
Temperature	15°	15°	14°	15	15	15	18
Turbidity	6.4	1.5	2.1	2.7	2.3	2.6	7.7

Sampler's signature/date: M von Maude / 5-19-95

W.O #S
02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTURE
02009.06 EXISTING WELLS

HIA - MIDDLETOWN
WELL SAMPLING DATA FORM

Well Number: FRM-8D Date: 5-17-95 Time: ~~1030~~ SAW 1100

Boring diameter: _____ Well casing diameter: 4"

Annular space length: _____ Stickup: _____

Total depth (TOC) 643.95 (-) Depth to water (TOC) 159.50 (=) Height of Column 484.45

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	/
Column of water or length of A.S. (whichever is less)	x	/
Volume of annular space	=	/
Gallons per foot of casing	=	.65
Column of water	x	484.45
Volume of casing	=	315 gal
TOTAL VOLUME (A.S. + casing)	=	/
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	945
TOTAL VOLUME PURGED	=	690 gal

Method of purging: 2" Grundfos submersible

Sample date/time: 5-17-95 / 1739 Sample number: FRM-8D

FIELD PARAMETERS	~~Begin~~				~~End~~			Sample
pH	7.0	7.1	7.0	7.1	7.3	7.3	7.2	7.2
Conductivity	410	390	350	315	285	290	290	280
Temperature	16	15	14	15	15	16	16	11.5
Turbidity	8.6	6.3	4.5	8.0	4.6	4.2	2.5	14.2

Sampler's signature/date: M. von Neda / 5-18-95

W.O #S
02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTUREZ.
02009.06 EXISTING WELLS

HIA - MIDDLETOWN

WELL SAMPLING DATA FORM

Well Number: FRm-95 Date: 5/18/95 Time: 1520

Boring diameter: — Well casing diameter: 4"

Annular space length: — Stickup: —

Total depth (TOC) 144.29 Depth to water (TOC) 39.92 (=) Height of Column 104.37

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	—
Column of water or length of A.S. (whichever is less)	x	—
Volume of annular space	=	—
Gallons per foot of casing	=	.652
Column of water	x	104.37
Volume of casing	=	68
TOTAL VOLUME (A.S. + casing)	=	68
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	204
TOTAL VOLUME PURGED	=	75

Method of purging: 3" GRUNDFOS JET SUB PUMP

Sample date/time: 5-18-95 / 1714 Sample number: 87702

FIELD PARAMETERS	~~Begin~~			~~End~~	Sample
pH	7.8	7.8	7.9		6.0
Conductivity	385	350	360		380
Temperature	18.5	16	16		17
Turbidity	12.63	38.7	31.3		41.0

Sampler's signature/date: M. von Meda / 5-19-95

02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTUREZ.
02009.06 EXISTING WELL

HIA - MIDDLETOWN

WELL SAMPLING DATA FORM

Well Number: ERM-9I Date: 5/23/95 Time: 0933

Boring diameter: — Well casing diameter: 4"

Annular space length: — Stickup: —

Total depth (TOC) 348.22 (-) Depth to water (TOC) 65.80 (=) Height of Column 282.42

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	—
Column of water or length of A.S. (whichever is less)	x	—
Volume of annular space	=	—
Gallons per foot of casing	=	.652
Column of water	x	282.42
Volume of casing	=	184
TOTAL VOLUME (A.S. + casing)	=	184
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	552
TOTAL VOLUME PURGED	=	600

Method of purging: 2" GRUNDFOS SUB PUMP

Sample date/time: 5-23-95 / 1437 Sample number: 26243

FIELD PARAMETERS	~~Begin~~			~~End~~			Sample
pH	7.9	8.0	8.0	7.9	7.8	7.8	7.6
Conductivity	300	290	290	300	300	300	310
Temperature	16	15	15	16	16	17	20
Turbidity	45	6.15	3.3	12.30	3.45	1.75	28.0

Sampler's signature/date: [signature] / 5-24-95

W.O. #
02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTUREZ.
02009.06 EXISTING WELLS

HIA - MIDDLETOWN

WELL SAMPLING DATA FORM

Well Number: FRM-9D Date: 5/23/95 Time: 0950

Boring diameter: — Well casing diameter: 4"

Annular space length: — Stickup: —

Total depth (TOC) 670.91 (-) Depth to water (TOC) 174.96 (=) Height of Column 495.95

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	—
Column of water or length of A.S. (whichever is less)	x	—
Volume of annular space	=	—
Gallons per foot of casing	=	.652
Column of water	x	495.95
Volume of casing	=	323
TOTAL VOLUME (A.S. + casing)	=	323
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	969
TOTAL VOLUME PURGED	=	1000

Method of purging: 2" GRUNDFOS SUB PUMP

Sample date/time: 5-23-95 / 1506 Sample number: 26244

FIELD PARAMETERS	~~Begin~~			~~End~~			Sample
pH	7.8	7.8	7.8	7.7	7.6	7.8	7.3
Conductivity	420	340	330	330	330	330	350
Temperature	24	16	16	17	17	17	20°
Turbidity	3.15	3.4	3.3	2.4	1.7	1.3	16.5

Sampler's signature/date: M. Von Nieda / 5-24-95

W.O #S
02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTUREZ
02009.06 EXISTING WELLS

HIA - MIDDLETOWN
WELL SAMPLING DATA FORM

Well Number: ERM-10I Date: 5-18-95 Time: 1300

Boring diameter: _____ Well casing diameter: 2"

Annular space length: _____ Stickup: _____

Total depth (TOC) 99.85 (-) Depth to water (TOC) 15.37 (=) Height of Column 84.48

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	/
Column of water or length of A.S. (whichever is less)	x	/
Volume of annular space	=	/
Gallons per foot of casing	=	.16
Column of water	x	84.48
Volume of casing	=	13.8 gal
TOTAL VOLUME (A.S. + casing)	=	/
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	42 gal
TOTAL VOLUME PURGED	=	43 gal

Method of purging: centrifugal pump

Sample date/time: 5-18-95 / 1402 Sample number: 87734

FIELD PARAMETERS	~~Begin~~				~~End~~		Sample
pH	6.4	6.6	6.4	6.3	6.3	6.3	6.0
Conductivity	500	500	500	500	500	500	500
Temperature	18.5	19	18	18	17.5	18	16
Turbidity	16	3.2	2.3	1.3	1.1	0.8	2.0

Sampler's signature/date: M. van Meeda / 5-19-95

02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTREEZ
02009.06 EXISTING WELLS

HIA - MIDDLETOWN

WELL SAMPLING DATA FORM

Well Number: ERM-11S Date: 5/25/95 Time: 1530

Boring diameter: — Well casing diameter: 2"

Annular space length: — Stickup: —

Total depth (TOC) 24.69 (-) Depth to water (TOC) 9.91 (=) Height of Column 14.78

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	—
Column of water or length of A.S. (whichever is less)	x	—
Volume of annular space	=	—
Gallons per foot of casing	=	.163
Column of water	x	14.78
Volume of casing	=	2.4
TOTAL VOLUME (A.S. + casing)	=	2.4
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	7.2
TOTAL VOLUME PURGED	=	3

Method of purging: HAND BAIL

Sample date/time: 5-25-95 / 1625 Sample number: 67828

FIELD PARAMETERS	Begin	~~End~~	Sample
pH	7.8	7.7	6.7
Conductivity	370	350	235
Temperature	14	14	16°
Turbidity	85.0	~~200+~~	158

Sampler's signature/date: M. Von Meda / 5-26-95

02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTREEZ
02009.06 EXISTING WELL

HIA - MIDDLETOWN
WELL SAMPLING DATA FORM

Well Number: ERM-11T Date: 5/25/95 Time: 1455

Boring diameter: \ Well casing diameter: 2"

Annular space length: \ Stickup: \

Total depth (TOC) 99.79 (-) Depth to water (TOC) 11.28 (=) Height of Column 88.51

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	\
Column of water or length of A.S. (whichever is less)	x	\
Volume of annular space	=	\
Gallons per foot of casing	=	.163
Column of water	x	88.51
Volume of casing	=	14
TOTAL VOLUME (A.S. + casing)	=	14
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	42
TOTAL VOLUME PURGED	=	45

Method of purging: 2" SUB PUMP (GRUNDFOS)

Sample date/time: 5-25-95/ 1552 Sample number: 87829

FIELD PARAMETERS	~~Begin~~				~~End~~			Sample
pH	7.2	7.2	7.2	7.2	7.2	7.2	7.2	6.8
Conductivity	600	600	600	600	600	600	600	500
Temperature	17	15	15	16	15	15	15	18.5
Turbidity	5.2	3.0	5.0	1.9	1.4	1.5	2.1	10.5

Sampler's signature/date: M. [illegible] / 5-26-95

W.O #S
02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTURE
02009.06 EXISTING WELLS

HIA - MIDDLETOWN
WELL SAMPLING DATA FORM

Well Number: ERM-12S Date: 5-19-95 Time: 1016

Boring diameter: _____ Well casing diameter: 2"

Annular space length: _____ Stickup: _____

Total depth (TOC) 20.61 (-) Depth to water (TOC) 4.92 (=) Height of Column 15.69

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	/
Column of water or length of A.S. (whichever is less)	x	/
Volume of annular space	=	/
Gallons per foot of casing	=	.16
Column of water	x	15.69
Volume of casing	=	2.6
TOTAL VOLUME (A.S. + casing)	=	/
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	8 gal
TOTAL VOLUME PURGED	=	9 gal

Method of purging: centrifugal pump

Sample date/time: 5-19-95 / 1035 Sample number: 87741

FIELD PARAMETERS	~~Begin~~			~~End~~	Sample
pH	6.5	6.0	6.1	6.0	6.2
Conductivity	240	240	240	240	240
Temperature	10	9.5	9.5	9.5	10
Turbidity → meter not working	—	—	—	—	0.3 (mod 5-20)

Sampler's signature/date: M. Von Neede / 5-20-95

W.U. #S
02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTUREZ
02009.06 EXISTING WELL

HIA - MIDDLETOWN

WELL SAMPLING DATA FORM

Well Number: ERM-12I Date: 5/19/95 Time: 1005

Boring diameter: — Well casing diameter: 2"

Annular space length: — Stickup: —

Total depth (TOC) 100.12 (-) Depth to water (TOC) 16.00 (=) Height of Column 84.12

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	—
Column of water or length of A.S. (whichever is less)	x	—
Volume of annular space	=	—
Gallons per foot of casing	=	.163
Column of water	x	84.12
Volume of casing	=	13.7
TOTAL VOLUME (A.S. + casing)	=	13.7
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	41.1
TOTAL VOLUME PURGED	=	18

Method of purging: 2" GRUNDFOS SUB PUMP

Sample date/time: 5-19-95 / 1055 Sample number: 87742

FIELD PARAMETERS	~~Begin~~	~~End~~	Sample
pH	7.3		7.5
Conductivity	360		440
Temperature	13		13°
Turbidity	0.02		200+

Sampler's signature/date: M. von Meda / 5-19-95

W.O. #'S
02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTUREZ,
02009.06 EXISTING WELLS

HIA - MIDDLETOWN
WELL SAMPLING DATA FORM

Well Number: ERM-13S Date: 5/15/95 Time: 1235

Boring diameter: — Well casing diameter: 2"

Annular space length: — Stickup: —

Total depth (TOC) 21.62 (-) Depth to water (TOC) 12.94 (=) Height of Column 8.68

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	—
Column of water or length of A.S. (whichever is less)	x	—
Volume of annular space	=	—
Gallons per foot of casing	=	.163
Column of water	x	8.68
Volume of casing	=	1.4
TOTAL VOLUME (A.S. + casing)	=	1.4
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	4.2
TOTAL VOLUME PURGED	=	6 gal

Method of purging: 1" CENTRIFUGAL PUMP

Sample date/time: 5-15-95 / 1310 Sample number: 87686

FIELD PARAMETERS	~~Begin~~		~~End~~		Sample
pH	6.8	6.9	6.8	6.9	6.7
Conductivity	440	425	425	425	490
Temperature	14.5	14	13.5	13.5	16°
Turbidity	251	200+	200+	200+	200+

Sampler's signature/date: M. von Mueda / 5-16-95

W.O. #'S
02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTUREZ.
02009.06 EXIST WELLS

HIA - MIDDLETOWN

WELL SAMPLING DATA FORM

Well Number: ERM-13I Date: 5/15/95 Time: 1310

Boring diameter: — Well casing diameter: 2"

Annular space length: — Stickup: —

Total depth (TOC) 101.25 (-) Depth to water (TOC) 13.32 (=) Height of Column 87.93

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	—
Column of water or length of A.S. (whichever is less)	x	—
Volume of annular space	=	—
Gallons per foot of casing	=	.163
Column of water	x	87.93
Volume of casing	=	14.3
TOTAL VOLUME (A.S. + casing)	=	14.3
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	42.9
TOTAL VOLUME PURGED	=	45 gal

Method of purging: 2" GRUNDFOS SUB PUMP

Sample date/time: 5-15-95 / 1340 Sample number: 87685

FIELD PARAMETERS	~~Begin~~			~~End~~		Sample
pH	7.9	7.8	7.0	7.0	7.0	6.6
Conductivity	325	340	430	430	430	360
Temperature	16	16	16.5	16.5	16	17°
Turbidity	38.5	24.0	2.07	1.95	1.08	4.5

Sampler's signature/date: M. von Meeder / 5-16-95

W.O #'S
02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTUREZ.
02009.06 EXISTING WELLS

HIA - MIDDLETOWN

WELL SAMPLING DATA FORM

Well Number: ERM-145 Date: 5/15/95 Time: 1108

Boring diameter: — Well casing diameter: 2"

Annular space length: — Stickup: —

Total depth (TOC) 33.00 (-) Depth to water (TOC) 13.25 (=) Height of Column 19.75

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	—
Column of water or length of A.S. (whichever is less)	x	—
Volume of annular space	=	—
Gallons per foot of casing	=	.163
Column of water	x	19.75
Volume of casing	=	3.2
TOTAL VOLUME (A.S. + casing)	=	~~9.6~~ 3.2
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	9.6
TOTAL VOLUME PURGED	=	7

Method of purging: 1" CENTRIFUGAL PUMP

Sample date/time: 5-15-95/1400 Sample number: 87684

FIELD PARAMETERS

	~~Begin~~		~~End~~	SAMPLE
pH	6.6	6.6	6.7	7.6
Conductivity	790	800	850	500
Temperature	20°C	18.5	20	15
Turbidity	200+	200+	200+	500

Sampler's signature/date: M. Von Tuede / 5/16/95

W.O. #'S
02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTUREZ
02009.06 EXIST WELLS

HIA - MIDDLETOWN
WELL SAMPLING DATA FORM

Well Number: ERM-14I Date: 5/15/95 Time: 1108

Boring diameter: — Well casing diameter: 2"

Annular space length: — Stickup: —

Total depth (TOC) 107.7 (-) Depth to water (TOC) 40.31 (=) Height of Column 67.39

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	—
Column of water or length of A.S. (whichever is less)	x	—
Volume of annular space	=	—
Gallons per foot of casing	=	.163
Column of water	x	67.39
Volume of casing	=	10.9
TOTAL VOLUME (A.S. + casing)	=	10.9
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	32.7
TOTAL VOLUME PURGED	=	45

Method of purging: 2" GRUNDFOS SUBMERSIBLE PUMP

Sample date/time: _____ Sample number: _____

FIELD PARAMETERS

	~~Begin~~			~~End~~ SAMPLE
pH	6.8	6.9	6.8	6.8
Conductivity	700	650	650	500
Temperature	16	15.5	15	18
Turbidity	82.1	73.5	42.4	8.5

Sampler's signature/date: [signature] 5/15/95

W.O #S
02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTREE
02009.06 EXISTING WELLS

HIA - MIDDLETOWN
WELL SAMPLING DATA FORM

Well Number: ERM-15I Date: 5-19-95 Time: 0916

Boring diameter: _____ Well casing diameter: 2"

Annular space length: _____ Stickup: _____

Total depth (TOC) 99.70 (-) Depth to water (TOC) 13.12 (=) Height of Column 86.58

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	—
Column of water or length of A.S. (whichever is less)	x	—
Volume of annular space	=	—
Gallons per foot of casing	=	.16
Column of water	x	86.58
Volume of casing	=	14.1 gal
TOTAL VOLUME (A.S. + casing)	=	—
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	43 gal
TOTAL VOLUME PURGED	=	45 gal

Method of purging: centrifugal pump

Sample date/time: 5-19-95 / 0958 Sample number: 87703

FIELD PARAMETERS	~~Begin~~					~~End~~	Sample
pH	7.8	8.0	7.8	7.6	7.6	7.6	7.6
Conductivity	260	270	275	275	275	275	270
Temperature	14	14.5	14.5	14	14	14	13
Turbidity *	—	—	—	—	—	—	3.2 (read on 5-20

* meter not operating

Sampler's signature/date: M. von Meder / 5-22-95

W.O. #s
02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTUREZ.
02009.06 EXISTING WELLS

HIA - MIDDLETOWN

WELL SAMPLING DATA FORM

Well Number: ERM-165 Date: 5/16/95 Time: 1050

Boring diameter: — Well casing diameter: 2"

Annular space length: — Stickup: —

Total depth (TOC) 43.97 (-) Depth to water (TOC) 11.75 (=) Height of Column 32.22

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	—
Column of water or length of A.S. (whichever is less)	x	—
Volume of annular space	=	—
Gallons per foot of casing	=	.163
Column of water	x	32.22
Volume of casing	=	5.25
TOTAL VOLUME (A.S. + casing)	=	5.25
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	15.75
TOTAL VOLUME PURGED	=	18 gal

Method of purging: 1" Centrifugal pump

Sample date/time: 5/16/95 - 1230 Sample number: 087707

FIELD PARAMETERS	~~Begin~~			~~End~~		SAMPLE
pH	5.5	5.25	5.3	5.3	5.3	6.5
Conductivity	20	18	18	19	19	19
Temperature	100	85	85	85	90	200
Turbidity	56.0	10.26	162.0	177.0	114.4	53

Sampler's signature/date: [illegible] 5/16/95

W.O #'S
02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTURE Z.
02009.06 EXIST WELLS

HIA - MIDDLETOWN
WELL SAMPLING DATA FORM

Well Number: ERM-16I Date: 5/16/95 Time: 0948

Boring diameter: ~~2"~~ Well casing diameter: 2"

Annular space length: — Stickup: —

Total depth (TOC) 101.14 (-) Depth to water (TOC) 19.65 (=) Height of Column 81.49

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	~~.163~~
Column of water or length of A.S. (whichever is less)	x	—
Volume of annular space	=	—
Gallons per foot of casing	=	.163
Column of water	x	81.49
Volume of casing	=	14
TOTAL VOLUME (A.S. + casing)	=	14
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	42
TOTAL VOLUME PURGED	=	45

Method of purging: 2" GRUNDFOS SUB PUMP

Sample date/time: 5-16-95/1230 Sample number: B7707

FIELD PARAMETERS	~~Begin~~			~~End~~			Sample
pH	6.15	6.15	6.15	6.15	6.15	6.15	6.5
Conductivity	230	240	240	245	250	245	255
Temperature	16.5	16	16	16	15	15	19
Turbidity	1.21	1.02	0.63	0.70	0.80	0.96	5.2

Sampler's signature/date: M. Von Luecke / 5-17-95

W.O #'S
02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTUREZ.
02009.06 EXISTING WELLS

HIA - MIDDLETOWN

WELL SAMPLING DATA FORM

Well Number: ERM-175 Date: 5/15/95 Time: 1440

Boring diameter: — Well casing diameter: 2"

Annular space length: — Stickup: —

Total depth (TOC) 44.59 (-) Depth to water (TOC) 24.25 (=) Height of Column 20.34

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	—
Column of water or length of A.S. (whichever is less)	x	—
Volume of annular space	=	—
Gallons per foot of casing	=	.163
Column of water	x	20.34
Volume of casing	=	3.3
TOTAL VOLUME (A.S. + casing)	=	3.3
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	9.9
TOTAL VOLUME PURGED	=	12

Method of purging: Bailed By HAND

Sample date/time: 5/15/95 - 1600 Sample number: 087688

FIELD PARAMETERS	~~Begin~~				~~End~~			SAMPLE
pH	4.7	4.85	4.9	4.9	4.85	4.8	4.9	5.1
Conductivity	200	190	190	190	190	190	185	205
Temperature	19	16.5	16	16	16	16	16	20
Turbidity	3.0	200+	200+	200+	200+	200+	200+	150

Sampler's signature/date: [signature] 5/15/95

W.O #'S
02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTUREZ
02009.06 EXIST WELLS

HIA - MIDDLETOWN
WELL SAMPLING DATA FORM

Well Number: ERM-17I Date: 5/15/95 Time: 1550

Boring diameter: — Well casing diameter: 2"

Annular space length: — Stickup: —

Total depth (TOC) 101.17 (-) Depth to water (TOC) 21.53 (=) Height of Column 79.64

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	—
Column of water or length of A.S. (whichever is less)	x	—
Volume of annular space	=	—
Gallons per foot of casing	=	.163
Column of water	x	79.64
Volume of casing	=	12.9
TOTAL VOLUME (A.S. + casing)	=	12.9
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	38.7
TOTAL VOLUME PURGED	=	42

Method of purging: 2" GRUNDfos SUB BUMP

Sample date/time: 5/15/95 - 1630 Sample number: ERM-17I

FIELD PARAMETERS	~~Begin~~			~~End~~		SAMPLE
pH	6.0	6.0	6.0	6.0	6.0	7.0
Conductivity	265	270	285	270	270	310
Temperature	17	18	17	17	17	18
Turbidity	477	6.06	5.8	3.38	2.34	6.3

Sampler's signature/date: TM Von Ledi / 5-16-95

W.O #S
02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTURE
02009.06 EXISTING WELLS

HIA - MIDDLETOWN
WELL SAMPLING DATA FORM

Well Number: ERM-18S Date: 5-31-95 Time: 1512

Boring diameter: _____ Well casing diameter: 2"

Annular space length: _____ Stickup: _____

Total depth (TOC) 19.72 (-) Depth to water (TOC) 17.23 (=) Height of Column 2.49

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	/
Column of water or length of A.S. (whichever is less)	x	/
Volume of annular space	=	/
Gallons per foot of casing	=	.16
Column of water	x	2.49
Volume of casing	=	0.4 gal.
TOTAL VOLUME (A.S. + casing)	=	/
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	1.2 gal
TOTAL VOLUME PURGED	=	2.5 gal

Method of purging: bailer

Sample date/time: 5-31-95 / 1534 Sample number: 87863

FIELD PARAMETERS

	~~Begin~~				~~End~~		Sample
pH	7.8	6.0	5.8	5.8	5.9	5.7	5.6
Conductivity	265	240	245	230	240	230	235
Temperature	18	14.5	14.5	14.5	15	15	15°
Turbidity	8.5	200+	200+	200+	200+	200+	200

Sampler's signature/date: M. [illegible] / 6-1-95

W.O #S
02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTREEZ
02009.06 EXIST[illegible] WE[illegible]

HIA - MIDDLETOWN
WELL SAMPLING DATA FORM

Well Number: ERM-18T Date: 5/31/95 Time: 1307

Boring diameter: — Well casing diameter: 2"

Annular space length: — Stickup: —

Total depth (TOC) 120.22 (-) Depth to water (TOC) 17.52 (=) Height of Column 102.70

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	—
Column of water or length of A.S. (whichever is less)	x	—
Volume of annular space	=	—
Gallons per foot of casing	=	.163
Column of water	x	102.70
Volume of casing	=	16.43
TOTAL VOLUME (A.S. + casing)	=	16.43
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	49.29
TOTAL VOLUME PURGED	=	50 gal

Method of purging: 1" CENTRIFUGAL PUMP

Sample date/time: 5/31/95 1559 Sample number: ERM-18T

FIELD PARAMETERS

	~~Begin~~					~~End~~	SAMPLE
pH	7.1	6.8	7.5	7.5	7.5	7.5	7.5
Conductivity	450	500	500	500	500	500	500
Temperature	18	16	15	16	16	16	16
Turbidity	8.3	3.7	1.2	5.3	2.0	1.0	1.0

Sampler's signature/date: [illegible] Van Brunn

W.O #S
02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTURE
02009.06 EXISTING WELLS

HIA - MIDDLETOWN
WELL SAMPLING DATA FORM

Well Number: ERM-19S Date: 6-1-95 Time: _____

Boring diameter: _____ Well casing diameter: 2"

Annular space length: _____ Stickup: _____

Total depth (TOC) 18.79 (-) Depth to water (TOC) 13.28 (=) Height of Column 5.51

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	—
Column of water or length of A.S. (whichever is less)	x	—
Volume of annular space	=	—
Gallons per foot of casing	=	.16
Column of water	x	5.51
Volume of casing	=	0.9 gal
TOTAL VOLUME (A.S. + casing)	=	—
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	2.7 gal
TOTAL VOLUME PURGED	=	3 gal

Method of purging: bailer

Sample date/time: 6-1-95/1635 Sample number: ERM-19S

FIELD PARAMETERS	~~Begin~~						~~End~~	Sample
pH	7.4	7.4	7.2	7.2	7.2	7.2	7.2	7.2
Conductivity	290	320	340	340	340	340	340	350
Temperature	18	17	17	17	16	16	16	16
Turbidity	5.5	144.3	200+	200+	200+	200+	200+	200+

Sampler's signature/date: M. von Meede 6-2-95

W.O #S
02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTREE
02009.06 EXISTING WELLS

HIA - MIDDLETOWN

WELL SAMPLING DATA FORM

Well Number: ERM-205 Date: 5-30-95 Time: 1412

Boring diameter: _____ Well casing diameter: 2"

Annular space length: _____ Stickup: _____

Total depth (TOC) 25.37 (-) Depth to water (TOC) 18.06 (=) Height of Column 7.31

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	/
Column of water or length of A.S. (whichever is less)	x	/
Volume of annular space	=	/
Gallons per foot of casing	=	.16
Column of water	x	7.31
Volume of casing	=	1.2 gal
TOTAL VOLUME (A.S. + casing)	=	/
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	3.6 gal
TOTAL VOLUME PURGED	=	4.5 gal

Method of purging: bailer

Sample date/time: 5-30-95 / 1434 Sample number: 87844

FIELD PARAMETERS	~~Begin~~				~~End~~	Sample
pH	9.6	9.7	9.8	9.7	9.7	9.6
Conductivity	900	900	900	900	900	900
Temperature	14.5	13.5	14.	14	14	14°
Turbidity	200+	200+	200+	200+	200+	200+

Sampler's signature/date: M. von Meda / 5-31-95

W.O # S
02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTUREZ
02009.06 EXIST WL

HIA - MIDDLETOWN
WELL SAMPLING DATA FORM

Well Number: ERM-201 Date: 5-30-95 Time: 1420

Boring diameter: \ Well casing diameter: 2"

Annular space length: \ Stickup: \

Total depth (TOC) ~~119.80~~ 119.80 (-) Depth to water (TOC) 18.05 (=) Height of Column 101.75

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	\
Column of water or length of A.S. (whichever is less)	x	\
Volume of annular space	=	\
Gallons per foot of casing	=	.163
Column of water	x	101.75
Volume of casing	=	16.6
TOTAL VOLUME (A.S. + casing)	=	16.3
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	49.8
TOTAL VOLUME PURGED	=	55 gal

Method of purging: 2" GRUNDFOS SUB PUMP

Sample date/time: 5-30-95 / 1458 Sample number: 87845, 46, 47 (MS/MSD, MRD Sp dup)

FIELD PARAMETERS

	~~Begin~~				~~End~~			Sample
pH	7.9	7.8	7.6	7.7	7.5	7.7	7.5	7.3
Conductivity	700	700	700	700	700	700	700	700
Turb ~~Temperature~~	32.1	23.0	2001	100.1	2001	2001	2007	169.1
Temp ~~Turbidity~~	17	14	15	14	14	14	14	15°

Sampler's signature/date: M. von Meda / 5-31-95

02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTREEZ
02009.06 EXISTING WELLS

HIA - MIDDLETOWN

WELL SAMPLING DATA FORM

Well Number: ERM-21S Date: 5-11-95 Time: _____

Boring diameter: 8" Well casing diameter: 2"

Annular space length: _____ Stickup: _____

Total depth (TOC) 34.83 (-) Depth to water (TOC) 19.08 (=) Height of Column 15.75

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	_____
Column of water or length of A.S. (whichever is less)	x	_____
Volume of annular space	=	_____
Gallons per foot of casing	=	.163
Column of water	x	15.75
Volume of casing	=	2.6
TOTAL VOLUME (A.S. + casing)	=	_____
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	8
TOTAL VOLUME PURGED	=	26 gal

Method of purging: centrifugal pump

Sample date/time: 5-11-95 / 0924 Sample number: ERM-21S

FIELD PARAMETERS	~~Begin~~			~~End~~			Sample
pH	6.8	6.8	6.8	6.9	6.9	—	6.8
Conductivity	750	850	800	800	800	—	800
Temperature	14	14	14.5	15	14.5	—	14°
Turbidity	200+	200+	134	42	36	41	112

Sampler's signature/date: M. von Maeda / 5-11-95

02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTREZ
02009.06 EXISTING WE

HIA - MIDDLETOWN

WELL SAMPLING DATA FORM

Well Number: ERM-21 I Date: 5-11-95 Time: _____

Boring diameter: 8" Well casing diameter: 4"

Annular space length: _____ Stickup: _____

Total depth (TOC) 199.76 (-) Depth to water (TOC) 18.62 (=) Height of Column 181.14

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	_____
Column of water or length of A.S. (whichever is less)	x	_____
Volume of annular space	=	_____
Gallons per foot of casing	=	.653
Column of water	x	181.14
Volume of casing	=	118
TOTAL VOLUME (A.S. + casing)	=	_____
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	354
TOTAL VOLUME PURGED	=	360+

Method of purging: centrifugal pump

Sample date/time: 5-11-95/ ERM-21 I Sample number: ERM-21 I

FIELD PARAMETERS

	~~Begin~~			~~End~~			Sample
pH	7.6	7.6	7.5	7.6	7.5	7.6	7.6
Conductivity	350	325	325	325	325	330	335
Temperature	14	14	14	14	14	14.5	14.5
Turbidity	10.2	4.8	0.4	0.4	0.2	0.1	2.8

Sampler's signature/date: S.M. von Muehlen / 5-11-95

02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTUREZ
02009.06 EXISTING WELLS

HIA - MIDDLETOWN

WELL SAMPLING DATA FORM

Well Number: ERM-21D Date: 5-11-95 Time: _____

Boring diameter: 8" Well casing diameter: 4"

Annular space length: _____ Stickup: _____

Total depth (TOC) 599.17 (-) Depth to water (TOC) 25.60 (=) Height of Column 573.57

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	_____
Column of water or length of A.S. (whichever is less)	x	_____
Volume of annular space	=	_____
Gallons per foot of casing	=	.653
Column of water	x	573.57
Volume of casing	=	374 ~~18~~ mu
TOTAL VOLUME (A.S. + casing)	=	~~1122~~
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	1122
TOTAL VOLUME PURGED	=	1137

Method of purging: 2" submersible

Sample date/time: 5-11-95/ 1110 Sample number: ERM-21D

FIELD PARAMETERS

	~~Begin~~				~~End~~			Sample
pH	7.9	7.7	7.5	7.6	7.6	7.6	7.6	7.6
Conductivity	600	500	435	440	435	430	430	500
Temperature	14	14	14	14	14	14	14.	15
Turbidity	9.0	11	3.8	1.6	1.0	0.5	0.5	9.9

Sampler's signature/date: M. von Reeda 5-11-95

W.O. #S
02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTUREZ.
02009.06 EXISTING WELLS

HIA - MIDDLETOWN
WELL SAMPLING DATA FORM

Well Number: ERM-22S Date: 5-9-95 Time: _____

Boring diameter: 8 Well casing diameter: 2"

Annular space length: _____ Stickup: _____

Total depth (TOC) 43.07 (-) Depth to water (TOC) 23.75 (=) Height of Column 19.32

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	_____
Column of water or length of A.S. (whichever is less)	x	_____
Volume of annular space	=	_____
Gallons per foot of casing	=	.163
Column of water	x	19.32
Volume of casing	=	3.15
TOTAL VOLUME (A.S. + casing)	=	_____
Number of volumes to be evacuated	=	3 gal
Total volume to be evacuated	=	9.45 gal
TOTAL VOLUME PURGED	=	64 gal

Method of purging: centrifugal pump

Sample date/time: 5-9-95 / 1304 Sample number: ERM-22S

FIELD PARAMETERS	~~Begin~~			~~End~~		Sample
pH	6.8	6.9	6.9	6.8	6.9	6.9
(umhos) Conductivity	950	950	950	950	950	950
(°C) Temperature	14	14	14	14	14	14
(Ntu) Turbidity	189	80	21	7.4	5.6 4.7...	18.8
	... 2.6	2.0	2.2			

Sampler's signature/date: [illegible] / 5-9-95

02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTREEZ
02009.06 EXISTING WELL

HIA - MIDDLETOWN
WELL SAMPLING DATA FORM

Well Number: ERM-22 I Date: 5-9-95 Time: _____

Boring diameter: 8" Well casing diameter: 4"

Annular space length: _____ Stickup: _____

Total depth (TOC) 199.47 (-) Depth to water (TOC) 24.98 (=) Height of Column 174.49

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	_____
Column of water or length of A.S. (whichever is less)	x	_____
Volume of annular space	=	_____
Gallons per foot of casing	=	.653
Column of water	x	174.49
Volume of casing	=	114 gal
TOTAL VOLUME (A.S. + casing)	=	_____
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	342 gal
TOTAL VOLUME PURGED	=	342 gal

Method of purging: 2" - submersible

Sample date/time: 5-9-95 / 1413 Sample number: ERM-22 I

FIELD PARAMETERS	~~Begin~~				~~End~~				Sample
pH	7.1	7.5	7.5	7.4	7.5	7.5	7.5	7.5	7.5
Conductivity	900	800	800	750	750	750	750	750	800
Temperature	15	14	13.5	13	13	13	13	13	15°
Turbidity	4.0	3.9	5.0	1.8	1.0	0.7	0.8	1.0	1.95

Sampler's signature/date: M. von Meda / 5-9-95

02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTUREZ
02009.06 EXISTING WELLS

HIA - MIDDLETOWN

WELL SAMPLING DATA FORM

Well Number: ERM-22D Date: 5-9-95 Time: _____

Boring diameter: 8" Well casing diameter: 4"

Annular space length: _____ Stickup: _____

Total depth (TOC) 599.13 (-) Depth to water (TOC) 23.32 (=) Height of Column 575.81

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	_____
Column of water or length of A.S. (whichever is less)	x	_____
Volume of annular space	=	_____
Gallons per foot of casing	=	.653
Column of water	x	575.81
Volume of casing	=	376 gal
TOTAL VOLUME (A.S. + casing)	=	_____
Number of volumes to be evacuated	=	~~1128~~ 3
Total volume to be evacuated	=	1128
TOTAL VOLUME PURGED	=	1128

Method of purging: 2" submersible

Sample date/time: 5-9-95 / 1614 Sample number: ERM-22D

FIELD PARAMETERS	~~Begin~~			~~End~~			Sample
pH	7.5	7.2	7.3	7.4	7.4	7.4	7.1
Conductivity	1000	1150	1200	1200	1250	1250	1050
Temperature	14	13	13.5	13.5	14	13	15°
Turbidity	7.8	1.3	1.1	1.0	0.3	0.2	5.0

Sampler's signature/date: M. Montreda / 5-9-95

02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTREEZ
02009.06 EXISTING WELLS

HIA - MIDDLETOWN

WELL SAMPLING DATA FORM

Well Number: ERM-23 S Date: 5-10-95 Time: _____

Boring diameter: 8" Well casing diameter: 2"

Annular space length: _____ Stickup: _____

Total depth (TOC) 24.44 (-) Depth to water (TOC) 15.46 (=) Height of Column 8.98

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	_____
Column of water or length of A.S. (whichever is less)	x	_____
Volume of annular space	=	_____
Gallons per foot of casing	=	.163
Column of water	x	8.98
Volume of casing	=	1.5
TOTAL VOLUME (A.S. + casing)	=	_____
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	4.5
TOTAL VOLUME PURGED	=	27 gal

Method of purging: centrifugal

Sample date/time: 5-10-95 / 1618 Sample number: ERM-23S

FIELD PARAMETERS

	~~Begin~~			~~End~~	Sample
pH	6.7	6.6	6.6	6.6	6.3
Temp. ~~Conductivity~~	15	15	15	15	550
Conductivity ~~Temperature~~	500	500	500	500	14.5
Turbidity	200+	200+	200+	200+	200+

Sampler's signature/date: M. von Nieda / 5-10-95

02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTREEZ
02009.06 EXISTING WELL

HIA - MIDDLETOWN

WELL SAMPLING DATA FORM

Well Number: ERM-23I Date: 5-10-95 Time: _____

Boring diameter: 8" Well casing diameter: 4"

Annular space length: _____ Stickup: _____

Total depth (TOC) 196.58 (-) Depth to water (TOC) 16.19 (=) Height of Column 180.39

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	_____
Column of water or length of A.S. (whichever is less)	x	_____
Volume of annular space	=	_____
Gallons per foot of casing	=	.653
Column of water	x	180.39
Volume of casing	=	118
TOTAL VOLUME (A.S. + casing)	=	_____
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	354
TOTAL VOLUME PURGED	=	360 gal

Method of purging: centrifugal

Sample date/time: 5-10-95 / 1325 Sample number: ERM-23I

FIELD PARAMETERS	~~Begin~~				~~End~~			Sample
pH	7.5	7.4	7.3	7.2	7.0	6.9	7.0	7.1
Conductivity	430	430	425	420	415	415	410	410
Temperature	15°	16°	15°	15°	15°	15°	15°	15
Turbidity	6.6	6.3	1.5	0.6	0.4	0.3	0.3	1.5

Sampler's signature/date: M. von Muedla / 5-10-95

02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTREEZ
02009.06 EXISTING WELLS

HIA - MIDDLETOWN

WELL SAMPLING DATA FORM

Well Number: ERM-23D Date: 5-10-95 Time: _____

Boring diameter: 8" Well casing diameter: 4"

Annular space length: _____ Stickup: _____

Total depth (TOC) 593.59 (-) Depth to water (TOC) 22.42 (=) Height of Column 571.17

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	_____
Column of water or length of A.S. (whichever is less)	x	_____
Volume of annular space	=	_____
Gallons per foot of casing	=	.653
Column of water	x	571.17
Volume of casing	=	373
TOTAL VOLUME (A.S. + casing)	=	_____
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	1118
TOTAL VOLUME PURGED	=	1120

Method of purging: 2" submersible

Sample date/time: 5-10-95 / 1733 Sample number: ERM-23D

FIELD PARAMETERS	~~Begin~~				~~End~~			Sample
pH	7.3	7.3	7.2	7.2	7.0	7.2	7.2	7.3
Conductivity	550	500	500	495	480	480	480	500
Temperature	17	16	15	15	15	15	15	16
Turbidity	17.1	5.4	2.8	1.4	3.0	1.0	1.0	12.3

Sampler's signature/date: M. von Nieda / 5-10-95

02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTUREZ
02009.06 EXISTING WELLS

HIA - MIDDLETOWN

WELL SAMPLING DATA FORM

Well Number: ERM-24S Date: _____ Time: _____

Boring diameter: 8" Well casing diameter: 2"

Annular space length: _____ Stickup: _____

Total depth (TOC) 24.39 (-) Depth to water (TOC) 14.07 (=) Height of Column 10.32

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	_____
Column of water or length of A.S. (whichever is less)	x	_____
Volume of annular space	=	_____
Gallons per foot of casing	=	.163
Column of water	x	10.32
Volume of casing	=	1.7 gal
TOTAL VOLUME (A.S. + casing)	=	_____
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	5.1
TOTAL VOLUME PURGED	=	10 gal

Method of purging: centrifugal

Sample date/time: 5-10-95 / 0940 Sample number: ERM-24S

FIELD PARAMETERS

	~~Begin~~			~~End~~			
pH	6.8	6.6	6.6	6.7	6.7	6.7	6.9
Conductivity	500	490	500	490	490	490	490
Temperature	15°	15°	14.5°	15°	19.5	15.5	15°
Turbidity	28	200+	200+	79	45	34	200+
	22	21.7					

Sampler's signature/date: Matthew von Maedy / 5-10-95

02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTREEZ
02009.06 EXISTING WELL

HIA - MIDDLETOWN
WELL SAMPLING DATA FORM

Well Number: ERM-24 I Date: 5-10-95 Time: _____

Boring diameter: 8" Well casing diameter: 4"

Annular space length: _____ Stickup: _____

Total depth (TOC) 199.07 (-) Depth to water (TOC) 18.23 (=) Height of Column 180.84

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	_____
Column of water or length of A.S. (whichever is less)	x	_____
Volume of annular space	=	_____
Gallons per foot of casing	=	.653
Column of water	x	180.84
Volume of casing	=	118.1 gal.
TOTAL VOLUME (A.S. + casing)	=	_____
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	356
TOTAL VOLUME PURGED	=	356

Method of purging: 2" submersible

Sample date/time: 5-10-95 / 1120 Sample number: ERM-24I

FIELD PARAMETERS

	~~Begin~~			~~End~~			Sample
pH	7.6	7.7	7.2	7.5	7.5	7.4	7.2
Conductivity	600	590	600	600	600	600	600
Temperature	15	15.5	15	15	15	15	16.5
Turbidity	3.3	2.6	2.6	1.5	0.9	0.8	3.5

Sampler's signature/date: M. [illegible] / 5-10-95

02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTUREZ
02009.06 EXISTING WELLS

HIA - MIDDLETOWN

WELL SAMPLING DATA FORM

Well Number: ERM-24D Date: 5-10-95 Time: _____

Boring diameter: 8" Well casing diameter: 4"

Annular space length: _____ Stickup: _____

Total depth (TOC) 598.85 (-) Depth to water (TOC) 38.49 (=) Height of Column 560.36

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	_____
Column of water or length of A.S. (whichever is less)	x	_____
Volume of annular space	=	_____
Gallons per foot of casing	=	.653
Column of water	x	560.36
Volume of casing	=	366g.
TOTAL VOLUME (A.S. + casing)	=	_____
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	1098
TOTAL VOLUME PURGED	=	_____

Method of purging: 2" submersible

Sample date/time: 5-10-95 / 1354 Sample number: ERM-24D

FIELD PARAMETERS

	~~Begin~~				~~End~~			
pH	6.9	7.4	7.2	7.0	7.0	7.0	7.0	7.0
Conductivity	600	600	600	600	650	600	600	600
Temperature	16.5	16.5	16	15	15	15	15	16.5
Turbidity	16.5	2.2	4.1	1.7	0.6	0.6	0.9	7.0

Sampler's signature/date: Marvin Needs / 5-10-95

W.O # S
02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTUREZ
02009.06 EXISTING WELLS

HIA - MIDDLETOWN
WELL SAMPLING DATA FORM

Well Number: ERM26S Date: 5-12-95 Time: 0850

Boring diameter: _____ Well casing diameter: 2"

Annular space length: _____ Stickup: _____

Total depth (TOC) 45.45 (-) Depth to water (TOC) 32.57 (=) Height of Column 12.88

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	/
Column of water or length of A.S. (whichever is less)	x	/
Volume of annular space	=	/
Gallons per foot of casing	=	.16
Column of water	x	12.88
Volume of casing	=	2.1
TOTAL VOLUME (A.S. + casing)	=	/
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	6.3 gal
TOTAL VOLUME PURGED	=	7 gal

Method of purging: bailer

Sample date/time: 5-12-95 / 0935 Sample number: 87643

FIELD PARAMETERS	~~Begin~~					~~End~~	Sample
pH	7.1	7.1	7.1	7.2	7.2	7.1	7.3
Conductivity	700	700	700	700	700	700	700
Temperature	15	15	14	14	14	14	15
Turbidity	200+	200+	200+	200+	200+	200+	200+

Sampler's signature/date: M. von Rhoda / 5-13-95

W.U. #s
02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTUREZ
02009.06 EXIST WE

HIA - MIDDLETOWN

WELL SAMPLING DATA FORM

Well Number: ERM-25I Date: 5/16/95 Time: 1330

Boring diameter: — Well casing diameter: 4"

Annular space length: _____ Stickup: _____

Total depth (TOC) 189.91 (-) Depth to water (TOC) 35.68 (=) Height of Column 154.23

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	—
Column of water or length of A.S. (whichever is less)	x	—
Volume of annular space	=	—
Gallons per foot of casing	=	.653
Column of water	x	154.23
Volume of casing	=	100
TOTAL VOLUME (A.S. + casing)	=	~~300~~ 100
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	300
TOTAL VOLUME PURGED	=	300

Method of purging: 2" GRUNDFOS SUBMERSIBLE PUMP

Sample date/time: 5-16-95/1515 Sample number: 87720

FIELD PARAMETERS

	~~Begin~~			~~End~~			Sample
pH	7.3	7.35	7.25	7.25	7.15	7.15	7.5
Conductivity	300	310	305	300	295	290	360
Temperature	19	16	16	16	16	16	19°
Turbidity	5.23	3.51	12.63	22.4	11.25	7.01	5.5

Sampler's signature/date: [signature] / 5-17-95

02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTREEZ
02009.06 EXISTING WELLS

HIA - MIDDLETOWN

WELL SAMPLING DATA FORM

Well Number: ERM-25D Date: 5-12-95 Time: 810

Boring diameter: 8" Well casing diameter: 4"

Annular space length: _____ Stickup: _____

Total depth (TOC) 599.19 (-) Depth to water (TOC) 38.18 (=) Height of Column 561.01

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	_____
Column of water or length of A.S. (whichever is less)	x	_____
Volume of annular space	=	_____
Gallons per foot of casing	=	.653
Column of water	x	561.01
Volume of casing	=	366.5
TOTAL VOLUME (A.S. + casing)	=	_____
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	1099.5
TOTAL VOLUME PURGED	=	1104+

Method of purging: 2" submersible

Sample date/time: 5-12-95/1405 Sample number: ERM-25D

FIELD PARAMETERS	~~Begin~~			~~End~~			Sample
pH	8.0	7.9	8.0	7.6	7.5	7.3	7.6
Conductivity	430	310	270	240	245	260	255
Temperature	15	14	15	14	14.5	15	16°
Turbidity	15.0	23.2	19.5	2.0	1.2	10.5	5.7

Sampler's signature/date: M. Von Maeder / 5-15-95

W.O #S
02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTURE
02009.06 EXISTING WELLS

HIA - MIDDLETOWN

WELL SAMPLING DATA FORM

Well Number: ERM-26S Date: 5-11-95 Time: 1325

Boring diameter: _____ Well casing diameter: 2"

Annular space length: _____ Stickup: _____

Total depth (TOC) ~~34.57~~ 45.97 (-) Depth to water (TOC) 34.57 (=) Height of Column 11.40

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	/
Column of water or length of A.S. (whichever is less)	x	/
Volume of annular space	=	/
Gallons per foot of casing	=	.16
Column of water	x	11.40
Volume of casing	=	1.9 gal
TOTAL VOLUME (A.S. + casing)	=	/
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	5.7 gal
TOTAL VOLUME PURGED	=	6+ gal

Method of purging: bailer

Sample date/time: 5-11-95 / 1358 Sample number: 87659

FIELD PARAMETERS	~~Begin~~				~~End~~	Sample
pH	6.7	6.6	6.6	6.6	6.6	6.5
Conductivity	600	600	600	600	600	650
Temperature	17	17	17	17	17	19
Turbidity	200+	200+	200+	200+	200+	28.4

Sampler's signature/date: M. von Meda 5-13-95

W.O. # S
02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTURE
02009.06 EX[illegible]

HIA - MIDDLETOWN
WELL SAMPLING DATA FORM

Well Number: ERM-26I Date: 5-11-95 Time: 1525

Boring diameter: _____ Well casing diameter: 4"

Annular space length: _____ Stickup: _____

Total depth (TOC) 200.06 (-) Depth to water (TOC) 39.32 (=) Height of Column 160.74

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	/
Column of water or length of A.S. (whichever is less)	x	/
Volume of annular space	=	/
Gallons per foot of casing	=	.65
Column of water	x	160.74
Volume of casing	=	104.5 gal
TOTAL VOLUME (A.S. + casing)	=	/
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	314 gal
TOTAL VOLUME PURGED	=	319 gal

Method of purging: 2" Grundfos submersible

Sample date/time: 5-11-95 / 1672 Sample number: 87642

FIELD PARAMETERS

	Begin					End
pH	7.3	7.3	7.4	7.4	7.3	7.3
Conductivity	360	360	350	345	350	345
Temperature	16	17	15.5	15	15	15
Turbidity	1.6	5.9	0.3	1.8	1.2	0.7

Sampler's signature/date: M. Von Neda / 5-13-95

02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTUREZ
02009.06 EXISTING WELLS

HIA - MIDDLETOWN

WELL SAMPLING DATA FORM

Well Number: ERM-26D Date: 5-11-95 Time: _____

Boring diameter: 8" Well casing diameter: 4"

Annular space length: _____ Stickup: _____

Total depth (TOC) 599.92 (-) Depth to water (TOC) 41.28 (=) Height of Column 558.64

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	_____
Column of water or length of A.S. (whichever is less)	x	_____
Volume of annular space	=	_____
Gallons per foot of casing	=	.653
Column of water	x	558.64
Volume of casing	=	365
TOTAL VOLUME (A.S. + casing)	=	_____
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	1095
TOTAL VOLUME PURGED	=	1428

Method of purging: 2" submersible

Sample date/time: 5-11-95 / 1540 Sample number: ERM-26D

FIELD PARAMETERS

	~~Begin~~				~~End~~			Sample
pH	7.3	7.1	7.1	7.0	7.4	7.3	7.4	7.4
Conductivity	340	290	270	270	270	270	270	340
Temperature	16	17	16	16	16	15	15	16°
Turbidity	15.8	9.1	13.9	1.7	0.4	0.3	0.8	7.3

Sampler's signature/date: M. von Freda / 5-11-95

W.O. #S
02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTUREZ
02009.06 EXISTING WELLS

HIA - MIDDLETOWN

WELL SAMPLING DATA FORM

Well Number: ERM-27S Date: 5/16/95 Time: 1640

Boring diameter: — Well casing diameter: 2"

Annular space length: — Stickup: —

Total depth (TOC) 22.76 (-) Depth to water (TOC) 15.18 (=) Height of Column 7.58

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	—
Column of water or length of A.S. (whichever is less)	x	—
Volume of annular space	=	—
Gallons per foot of casing	=	.163
Column of water	x	7.58
Volume of casing	=	1.3
TOTAL VOLUME (A.S. + casing)	=	1.3
Number of volumes to be evacuated	=	~~3.93~~
Total volume to be evacuated	=	3.9
TOTAL VOLUME PURGED	=	4.5

Method of purging: HAND BAIL

Sample date/time: 5-16-95/1720 Sample number: ERM-27S

FIELD PARAMETERS	~~Begin~~				~~End~~		Sample
pH	6.2	6.2	6.25	6.3	6.3	6.3	6.3
Conductivity	475	470	470	465	465	460	460
Temperature	17.5	15.5	15	14.5	15	15	15
Turbidity	183.5	200+	200+	200+	200+	200+	200+

Sampler's signature/date: M. Von Nieda / 5/16/95

W.O #S
02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTREEZ
02009.06 EXISTING WELLS

HIA - MIDDLETOWN
WELL SAMPLING DATA FORM

Well Number: ERM-28 S Date: 5.17-95 Time: 1609

Boring diameter: _____ Well casing diameter: 2"

Annular space length: _____ Stickup: _____

Total depth (TOC) 21.45 (-) Depth to water (TOC) 8.74 (=) Height of Column 12.71

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	/
Column of water or length of A.S. (whichever is less)	x	/
Volume of annular space	=	/
Gallons per foot of casing	=	.16
Column of water	x	12.71
Volume of casing	=	2.1
TOTAL VOLUME (A.S. + casing)	=	/
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	6.3
TOTAL VOLUME PURGED	=	7 gal

Method of purging: bailer

Sample date/time 5-17-95 / 1634 Sample number: 87700

FIELD PARAMETERS

	~~Begin~~					~~End~~
pH	6.3	6.2	6.1	6.1	6.1	6.1
Conductivity	700	700	700	700	700	700
Temperature	15.5	14.5	14	14.5	14	13.5
Turbidity	200+	200+	200+	200+	200+	200+

Sampler's signature/date: M. Von Linden / 5-18-95

W.O. #'S
02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTUREZ
02009.06 EXISTING WELLS

HIA - MIDDLETOWN
WELL SAMPLING DATA FORM

Well Number: ERM-29S Date: 5/15/95 Time: 1705

Boring diameter: \ Well casing diameter: 2"

Annular space length: \ Stickup: \

Total depth (TOC) 45.16 (-) Depth to water (TOC) 31.99 (=) Height of Column 13.17

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	\
Column of water or length of A.S. (whichever is less)	x	\
Volume of annular space	=	\
Gallons per foot of casing	=	.163
Column of water	x	13.17
Volume of casing	=	2.1
TOTAL VOLUME (A.S. + casing)	=	2.1
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	6.3
TOTAL VOLUME PURGED	=	6.5

Method of purging: Bailed By Hand

Sample date/time: 5/15/95 — 1725 Sample number: 087705

FIELD PARAMETERS

	~~Begin~~				~~End~~		SAMPLE
pH	4.5	4.8	5.0	5.2	5.2	5.3	6.3
Conductivity	250	290	300	310	360	360	385
Temperature	16	15	15	15	15	15	17
Turbidity	14.0	200+	200+	200+	200+	200+	200+

Sampler's signature/date: M. Von Meda / 5-16-95

W.O. #'S
02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTURE Z
02009.06 EXIST WELLS

HIA - MIDDLETOWN
WELL SAMPLING DATA FORM

Well Number: ERM-29T Date: 5/15/95 Time: 1610

Boring diameter: — Well casing diameter: 2"

Annular space length: — Stickup: —

Total depth (TOC) 99.78 (-) Depth to water (TOC) 22.07 (=) Height of Column 77.71

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	—
Column of water or length of A.S. (whichever is less)	x	—
Volume of annular space	=	—
Gallons per foot of casing	=	.163
Column of water	x	77.71
Volume of casing	=	12.6
TOTAL VOLUME (A.S. + casing)	=	12.6
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	37.8
TOTAL VOLUME PURGED	=	40

Method of purging: 2" GRUNDFOS SUB. PUMP

Sample date/time: 5/15/95 - 1710 Sample number: ERM-29T

FIELD PARAMETERS	~~Begin~~			~~End~~			SAMPLE
pH	4.8	5.4	5.6	5.7	5.65	5.6	6.5
Conductivity	395	400	390	385	390	390	430
Temperature	18	16	15	15	15	15	17.5
Turbidity	5.01	1.69	1.59	1.23	0.91	0.89	10.3

Sampler's signature/date: M. Nondiedier / 5-16-95

W.O #S
02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTURE
02009.06 EXISTING WELLS

HIA - MIDDLETOWN
WELL SAMPLING DATA FORM

Well Number: ERM-30S Date: 5-24-95 Time: 1242

Boring diameter: _____ Well casing diameter: 2"

Annular space length: _____ Stickup: _____

Total depth (TOC) 19.53 (-) Depth to water (TOC) 9.13 (=) Height of Column 10.40

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	/
Column of water or length of A.S. (whichever is less)	x	/
Volume of annular space	=	/
Gallons per foot of casing	=	.16
Column of water	x	10.40
Volume of casing	=	1.7 gal
TOTAL VOLUME (A.S. + casing)	=	/
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	5.5 gal
TOTAL VOLUME PURGED	=	5.5

Method of purging: bailer

Sample date/time: 5-24-95 / 1305 Sample number: 26309

FIELD PARAMETERS

	~~Begin~~				~~End~~	
pH	6.4	6.3	6.4	6.3	6.3	6.3
Conductivity	160	155	160	160	160	160
Temperature	15.5	14.5	13.5	14.5	13.5	14.5
Turbidity	200+	200+	200+	200+	200+	200+

Sampler's signature/date: M. von Meade / 5-25-95

W.O #S
02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTURE
02009.06 EXI[illegible] WELLS

HIA - MIDDLETOWN
WELL SAMPLING DATA FORM

Well Number: ERM-30I Date: 5-24-95 Time: 1238

Boring diameter: _____ Well casing diameter: 2"

Annular space length: _____ Stickup: _____

Total depth (TOC) 100.10 (-) Depth to water (TOC) 8.30 (=) Height of Column 91.80

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	/
Column of water or length of A.S. (whichever is less)	x	/
Volume of annular space	=	/
Gallons per foot of casing	=	.16
Column of water	x	91.80
Volume of casing	=	15 gal
TOTAL VOLUME (A.S. + casing)	=	/
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	45 gal
TOTAL VOLUME PURGED	=	50 gal

Method of purging: centrifugal pump

Sample date/time: 5-24-95 Sample number: 26263

FIELD PARAMETERS	~~Begin~~				~~End~~		Sample
pH	6.7	6.9	6.7	6.7	6.7	6.7	6.9
Conductivity	370	370	370	370	370	370	390
Temperature	17	16.5	16	16	16	16	18
Turbidity	-	-	-	4.4	3.5	3.7	4.8

Sampler's signature/date: M. Von Meeda / 5-25-95

W.O. #	
02005.08	BLDGS
02006.07	N.B.L.
02008.04	RUNWAY
02008.05	CAPTUREZ
02009.06	EXISTING WELLS

HIA - MIDDLETOWN

WELL SAMPLING DATA FORM

Well Number: ERM-31I Date: 5/19/95 Time: 1220

Boring diameter: — Well casing diameter: 2"

Annular space length: — Stickup: —

Total depth (TOC) 200.32 (-) Depth to water (TOC) 15.32 (=) Height of Column 185.0

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	—
Column of water or length of A.S. (whichever is less)	x	—
Volume of annular space	=	—
Gallons per foot of casing	=	.163
Column of water	x	185.0
Volume of casing	=	30
TOTAL VOLUME (A.S. + casing)	=	30
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	90
TOTAL VOLUME PURGED	=	50

Method of purging: 2" GRUNDFOS SUBMERSIBLE PUMP

Sample date/time: 5-19-95 / 1328 Sample number: 87743

FIELD PARAMETERS	~~Begin~~			~~End~~	Sample
pH	7.15	7.15	7.1	7.1	7.0
Conductivity	650	650	800	1050	900
Temperature	12.5	12.5	13	13	12.5
Turbidity	0.04	0.04	0.04	0.04	0.06

Sampler's signature/date: M. Van Meda / 5-19-95

W.O #S
02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTREEZ
02009.06 EXISTING WELLS

HIA - MIDDLETOWN
WELL SAMPLING DATA FORM

Well Number: ERM-32I Date: 5-24-95 Time: 1051

Boring diameter: _____ Well casing diameter: 2"

Annular space length: _____ Stickup: _____

Total depth (TOC) 100.10 (-) Depth to water (TOC) 12.49 (=) Height of Column 87.61

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	/
Column of water or length of A.S. (whichever is less)	x	/
Volume of annular space	=	/
Gallons per foot of casing	=	.16
Column of water	x	87.61
Volume of casing	=	14.5 gal
TOTAL VOLUME (A.S. + casing)	=	/
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	44 gal
TOTAL VOLUME PURGED	=	45 gal

Method of purging: centrifugal pump

Sample date/time: 5-24-95 / 1124 Sample number: 26264

FIELD PARAMETERS	~~Begin~~				~~End~~		Sample
pH	7.2	7.2	7.0	6.9	6.9	7.0	6.9
Conductivity	480	500	500	500	500	500	500
Temperature	20.5	21.	21.5	21	20.5	21	20.5
Turbidity	–	–	–	3.2	2.3	2.5	13.9

Sampler's signature/date: M. von Nieda / 5-25-95

WELL SAMPLING DATA FORM

Well Number: ERM-32D Date: 9/5/95 Time: 1427 TD = 295.90

Boring Number: _____ Well casing diameter: 4" DTW = 16.12

Annular space length: _____ Stickup: _____ Column: 279.78

COLUMN OF WATER IN WELL

Gallons per foot of annular space (A.S.)	= _____
Column of water or length of A.S. (whichever is less)	X _____
Volume of annular space	= _____
Gallons per foot of casing	= .65
Column of water	X 279.78
Volume of casing	= 181.9 gal
TOTAL VOLUME (A.S. + Casing)	= _____
Number of volumes to be evacuated	= 3
Total volume to be evacuated	= 546 gal
TOTAL VOLUME PURGED	= 640 gal

Method of purging: 2" grundfos submersible

Sample date/time: 9/5/95 1610 Sample Number: ERM-32D TR# 89529

FIELD PARAMETERS	Begin					End (sample)
pH	6.5	6.5	6.8	6.8	6.7	6.8
Conductivity	600	600	600	600	600	~~18~~ 600
Temperature	18	18	18	18	18	18°
D.O	2.8	2.7	2.7	2.6	2.6	2.4
turb	29.8	133	4.5	5.6	4.9	17.0

Sampler's signature/date: M. [illegible] 9/5/95

Reviewer's signature/date: _____

ERM

02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTUREZ.
02009.06 EXISTING WELLS

HIA - MIDDLETOWN

WELL SAMPLING DATA FORM

Well Number: ERM-33I Date: 5/24/95 Time: 0900

Boring diameter: Well casing diameter: 2"

Annular space length: Stickup:

Total depth (TOC) 131.89 (-) Depth to water (TOC) 10.09 (=) Height of Column 121.80

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	
Column of water or length of A.S. (whichever is less)	x	
Volume of annular space	=	
Gallons per foot of casing	=	.163
Column of water	x	121.80
Volume of casing	=	20
TOTAL VOLUME (A.S. + casing)	=	20
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	60
TOTAL VOLUME PURGED	=	68

Method of purging: 2" GRUND FOS SUB PUMP

Sample date/time: 5-24-95 / 1032 Sample number: 26240

FIELD PARAMETERS	~~Begin~~				~~End~~			Sample
pH	7.6	7.4	7.4	7.5	7.5	7.5	7.5	7.7
Conductivity	360	400	400	410	390	390	390	370
Temperature	17	19	17	19	17	17	17	20°
Turbidity	18.6	12.5	11.0	2.1	1.3	0.7	0.9	29.5

Sampler's signature/date: M. von Luedke / 5-25-95

W.O #S
02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTURE
02009.06 EXISTING WELLS

HIA - MIDDLETOWN
WELL SAMPLING DATA FORM

Well Number: ERM-345 Date: 5-23-95 Time: 1150

Boring diameter: _____ Well casing diameter: 2"

Annular space length: _____ Stickup: _____

Total depth (TOC) 17.50 (-) Depth to water (TOC) 9.49 (=) Height of Column 8.01

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	/
Column of water or length of A.S. (whichever is less)	x	/
Volume of annular space	=	/
Gallons per foot of casing	=	.16
Column of water	x	8.01
Volume of casing	=	1.3 gal
TOTAL VOLUME (A.S. + casing)	=	/
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	4 gal
TOTAL VOLUME PURGED	=	5 gal

Method of purging: bailer

Sample date/time: 5-23-95 / 1209 Sample number: 26254

FIELD PARAMETERS	~~Begin~~			~~End~~			Sample
pH	6.5	6.6	6.5	6.7	6.6	6.5	6.4
Conductivity	390	415	420	415	410	415	430
Temperature	17	15	15	14	14.5	14	15°
Turbidity	200+	200+	200+	200+	200+	200+	200+

Sampler's signature/date: M. von Meda / 5-24-95

W.O #S
02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTURE:
02009.06 EXI[illegible]
W[illegible]S

HIA - MIDDLETOWN
WELL SAMPLING DATA FORM

Well Number: ERM-34 I Date: 5-23-95 Time: 1144

Boring diameter: _____ Well casing diameter: 2"

Annular space length: _____ Stickup: _____

Total depth (TOC) 99.90 (-) Depth to water (TOC) 9.22 (=) Height of Column 90.68

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	/
Column of water or length of A.S. (whichever is less)	x	/
Volume of annular space	=	/
Gallons per foot of casing	=	.16
Column of water	x	90.68
Volume of casing	=	15 gal
TOTAL VOLUME (A.S. + casing)	=	/
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	45 gal
TOTAL VOLUME PURGED	=	65 gal

Method of purging: centrifugal pump

Sample date/time: 5-23-95 / 1227 Sample number: 28255, 59, 60 (MS/MSD MRO Spec dup Sample)

FIELD PARAMETERS

	~~Begin~~				~~End~~		
pH	7.1	7.1	7.1	7.0	7.0	6.9	7.0
Conductivity	480	480	480	465	460	460	480
Temperature	19	17.5	17	16	16	16.5	17
Turbidity	—	—	—	4.8	3.5	1.4	2.7

Sampler's signature/date: M. von Dreele / 5-24-95

W.O #S
02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTURE
02009.06 EXISTING WELLS

HIA - MIDDLETOWN
WELL SAMPLING DATA FORM

Well Number: ERM-355 Date: 5-24-95 Time: 0900

Boring diameter: _____ Well casing diameter: 2"

Annular space length: _____ Stickup: _____

Total depth (TOC) 19.37 (-) Depth to water (TOC) 12.19 (=) Height of Column 7.18

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	/
Column of water or length of A.S. (whichever is less)	x	/
Volume of annular space	=	/
Gallons per foot of casing	=	.16
Column of water	x	7.18
Volume of casing	=	1.2
TOTAL VOLUME (A.S. + casing)	=	/
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	4 gal
TOTAL VOLUME PURGED	=	5 gal

Method of purging: bailer

Sample date/time: 5-24-95 / 0930 Sample number: 26256

FIELD PARAMETERS

	~~Begin~~				~~End~~	Sample
pH	6.2	6.1	6.1	6.2	6.2	6.1
Conductivity	420	410	415	410	410	415
Temperature	13	13.5	14	13.5	13.5	14°
Turbidity	200+	200+	200+	200+	200+	200+

Sampler's signature/date: Mason Needs / 5-25-95

W.C #S
02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTURE
02009.06 EXIS[illegible] WELLS

HIA - MIDDLETOWN
WELL SAMPLING DATA FORM

Well Number: ERM-35I Date: 5-24-95 Time: 0853

Boring diameter: _____ Well casing diameter: 2"

Annular space length: _____ Stickup: _____

Total depth (TOC) 99.78 (-) Depth to water (TOC) 11.87 (=) Height of Column 87.91

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	/
Column of water or length of A.S. (whichever is less)	x	/
Volume of annular space	=	/
Gallons per foot of casing	=	.16
Column of water	x	87.91
Volume of casing	=	14.5 gal
TOTAL VOLUME (A.S. + casing)	=	/
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	44 gal
TOTAL VOLUME PURGED	=	46 gal

Method of purging: centrifugal pump

Sample date/time: 5-24-95 / 922 Sample number: 26257

Sample

FIELD PARAMETERS

	~~Begin~~				~~End~~			
pH	8.1	7.4	7.3	7.3	7.2	7.2	7.3	7.3
Conductivity	130	390	395	395	400	395	395	415
Temperature	17	16	16	16	16	16	16	14
Turbidity	—	—	—	—	13.1	5	1.6	200+

Sampler's signature/date: M. von Meed / 5-25-95

Gannett Fleming Series Monitoring Wells

W.O #S
02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTREEZ
02009.06 EXISTING WELLS

HIA - MIDDLETOWN
WELL SAMPLING DATA FORM

Well Number: GF-204 Date: 5/24/95 Time: 1519

Boring diameter: _____ Well casing diameter: 6"

Annular space length: _____ Stickup: _____

Total depth (TOC) 30.35 (-) Depth to water (TOC) 27.09 (=) Height of Column 3.26

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	
Column of water or length of A.S. (whichever is less)	x	
Volume of annular space	=	
Gallons per foot of casing	=	1.47
Column of water	x	3.26
Volume of casing	=	4.8
TOTAL VOLUME (A.S. + casing)	=	
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	14.4
TOTAL VOLUME PURGED	=	6 gal (dry)

Method of purging: hand bailed.

Sample date/time: _____ Sample number: 26306

FIELD PARAMETERS	~~Begin~~		~~End~~	Sample
pH	6.9	6.8		6.4
Conductivity	1100	1000		850
Temperature	16	14		17°
Turbidity	200+	128.		150.

Sampler's signature/date: M. von Meda / 5-26-95

W.O. #s
02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTUREZ.
02009.06 EXISTING WEL

HIA - MIDDLETOWN

WELL SAMPLING DATA FORM

Well Number: GF-205 Date: 5/24/95 Time: 1420

Boring diameter: — Well casing diameter: 2"

Annular space length: — Stickup: —

Total depth (TOC) 33.74 (-) Depth to water (TOC) 27.73 (=) Height of Column 6.01

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	—
Column of water or length of A.S. (whichever is less)	x	—
Volume of annular space	=	—
Gallons per foot of casing	=	.163
Column of water	x	6.01
Volume of casing	=	1
TOTAL VOLUME (A.S. + casing)	=	1
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	3
TOTAL VOLUME PURGED	=	3

Method of purging: HAND BAILED

Sample date/time 5/24/95 1600 Sample number: GF-205

FIELD PARAMETERS	~~Begin~~				~~End~~		
pH	7.2	7.2	7.2	7.2	7.2	7.2	7.0
Conductivity	900	900	900	900	900	900	900
Temperature	20	16	16	16	15	15	17
Turbidity	333	123.1	101.3	105.8	77.5	77.9	32.5

Sampler's signature/date: [illegible] 5/24/95

W.O #S
02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTURE
02009.06 EXISTING WELLS

HIA - MIDDLETOWN
WELL SAMPLING DATA FORM

Well Number: GF-207 Date: 5-31-95 Time: 1204

Boring diameter: _____ Well casing diameter: 2"

Annular space length: _____ Stickup: _____

Total depth (TOC) 18.77 (-) Depth to water (TOC) 13.32 (=) Height of Column 5.45

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	/
Column of water or length of A.S. (whichever is less)	x	/
Volume of annular space	=	/
Gallons per foot of casing	=	.16
Column of water	x	5.45
Volume of casing	=	0.9
TOTAL VOLUME (A.S. + casing)	=	/
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	2.7 gal
TOTAL VOLUME PURGED	=	3 gal

Method of purging: bailer

Sample date/time: 5-31-95 / 1223 Sample number: 87858

FIELD PARAMETERS	~~Begin~~			~~End~~		Sample
pH	6.8	6.7	6.5	6.5	6.5	6.7
Conductivity	16	16	16	15.5	15.	18
Temperature	1250	1250	1250	1200	1200	1200
Turbidity	117.2	74.5	67.1	70.1	85.6	33.8

Sampler's signature/date: M. von Nieda / 6-1-95

W.C #S
02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTREE
02009.06 EXIS[illegible] WELLS

HIA - MIDDLETOWN
WELL SAMPLING DATA FORM

Well Number: GF-208 Date: 5-30-95 Time: 1130

Boring diameter: _____ Well casing diameter: 2"

Annular space length: _____ Stickup: _____

Total depth (TOC) 29.10 (-) Depth to water (TOC) 23.13 (=) Height of Column 5.97

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	/
Column of water or length of A.S. (whichever is less)	x	/
Volume of annular space	=	/
Gallons per foot of casing	=	.16
Column of water	x	5.97
Volume of casing	=	.1 gal
TOTAL VOLUME (A.S. + casing)	=	/
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	3 gal
TOTAL VOLUME PURGED	=	3 gal

Method of purging: bailer

Sample date/time: 5-30-95 / 1158 Sample number: 87842

FIELD PARAMETERS	~~Begin~~				~~End~~		
pH	9.9	10.0	10.1	10.1	10.1	10.1	10.1
Conductivity	1150	1150	1150	1150	1150	1150	1200
Temperature	15	15	15	15	14.5	14.5	14
Turbidity	136.9	62.1	53.6	62.4	51.0	32.7	24.9

Sampler's signature/date: M. von Neda / 5-31-95

W.C #S
02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTREE
02009.06 EXISTING WELLS

HIA - MIDDLETOWN

WELL SAMPLING DATA FORM

Well Number: GF-209 Date: 5-18-95 Time: 0950

Boring diameter: _____ Well casing diameter: 2"

Annular space length: _____ Stickup: _____

Total depth (TOC) 12.81 (-) Depth to water (TOC) 11.25 (=) Height of Column 1.56

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	/
Column of water or length of A.S. (whichever is less)	x	/
Volume of annular space	=	/
Gallons per foot of casing	=	.16
Column of water	x	1.56
Volume of casing	=	0.25 gal
TOTAL VOLUME (A.S. + casing)	=	/
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	0.75 gal
TOTAL VOLUME PURGED	=	0.25 gal (dry)

Method of purging: bailer

Sample date/time: 5-18-95 / 1055 Sample number: 87730

FIELD PARAMETERS	~~Begin~~	~~End~~	Sample
pH	6.3		—
Conductivity	490		—
Temperature	17°		—
Turbidity	200+		—

Sampler's signature/date: M. Von Maeda 5/19/95

W.O #S
02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTUREZ
02009.06 EXIS[illegible] WELLS

HIA - MIDDLETOWN

WELL SAMPLING DATA FORM

Well Number: GF-210 Date: 5-25-95 Time: 1206

Boring diameter: _____ Well casing diameter: 2"

Annular space length: _____ Stickup: _____

Total depth (TOC) 38.58 (-) Depth to water (TOC) 31.31 (=) Height of Column 7.27

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	/
Column of water or length of A.S. (whichever is less)	x	/
Volume of annular space	=	/
Gallons per foot of casing	=	.16
Column of water	x	7.26
Volume of casing	=	1.2 gal
TOTAL VOLUME (A.S. + casing)	=	/
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	4 gal
TOTAL VOLUME PURGED	=	4 gal

Method of purging: bailer

Sample date/time: 5-25-95 / 1222 Sample number: 87811

FIELD PARAMETERS	~~Begin~~				~~End~~	Sample
pH	5.6	5.5	5.4	5.5	5.4	5.4
Conductivity	17.5	16.5	16	16	16	17.5
Temperature	500	500	500	500	500	500
Turbidity	200+	200+	200+	200+	200+	200+

Sampler's signature/date: M. van Reich / 5-26-95

W.O #S
02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTURE
02009.06 EXISTING WELLS

HIA - MIDDLETOWN

WELL SAMPLING DATA FORM

Well Number: GF-212 Date: 5-22-95 Time: 1142

Boring diameter: _____ Well casing diameter: 4"

Annular space length: _____ Stickup: _____

Total depth (TOC) 37.47 (-) Depth to water (TOC) 12.53 (=) Height of Column 24.94

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	/
Column of water or length of A.S. (whichever is less)	x	/
Volume of annular space	=	/
Gallons per foot of casing	=	.65
Column of water	x	24.94
Volume of casing	=	16.3
TOTAL VOLUME (A.S. + casing)	=	/
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	49 gal
TOTAL VOLUME PURGED	=	49 gal

Method of purging: centrifugal pump

Sample date/time: 5-22-95 / 1224 Sample number: 26247

FIELD PARAMETERS	~~Begin~~			~~End~~				Sample
pH	7.1	6.9	6.8	6.7	6.8	6.8	6.9	6.8
Conductivity	370	485	430	445	450	450	450	440
Temperature	16.5	17	17	16.5	17	16.5	16.5	17
Turbidity	200+	62.5	54	19.5	16.5	9.0	9.3	50.

Sampler's signature/date: M. von Meda / 5-23-95

W.O #S
02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTREE
02009.06 EXIS[illegible]
WI[illegible]S

HIA - MIDDLETOWN
WELL SAMPLING DATA FORM

Well Number: GF-215 Date: 6-1-95 Time: 1458

Boring diameter: _____ Well casing diameter: 2"

Annular space length: _____ Stickup: _____

Total depth (TOC) 17.78 (-) Depth to water (TOC) 15.67 (=) Height of Column 2.11

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	/
Column of water or length of A.S. (whichever is less)	x	/
Volume of annular space	=	/
Gallons per foot of casing	=	.16
Column of water	x	2.11
Volume of casing	=	0.34 gal
TOTAL VOLUME (A.S. + casing)	=	/
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	1.1 gal
TOTAL VOLUME PURGED 20 min @ 0.06 g/min	=	1.2 gal

Method of purging: bailer

Sample date/time: 6-1-95 / 1535 Sample number: 87869

FIELD PARAMETERS	~~Begin~~				~~End~~		Sample
pH	7.0	7.0	6.9	7.0	6.9	6.9	6.9
Conductivity	320	325	300	295	300	300	310
Temperature	20	20	18	17	17	16.5	18°
Turbidity	77	200+	200+	200+	200+	200+	200+

Sampler's signature/date: M. Von Meeds / 6-2-95

W.U. #S
02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTUREZ
02009.06 EXISTING WELLS

HIA - MIDDLETOWN

WELL SAMPLING DATA FORM

Well Number: GF-217 Date: 5/26/95 Time: 1140

Boring diameter: — Well casing diameter: 2"

Annular space length: — Stickup: —

Total depth (TOC) 21.39 (-) Depth to water (TOC) 12.20 (=) Height of Column 9.19

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	—
Column of water or length of A.S. (whichever is less)	x	—
Volume of annular space	=	—
Gallons per foot of casing	=	.163
Column of water	x	9.19
Volume of casing	=	1.5
TOTAL VOLUME (A.S. + casing)	=	~~3~~1.5
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	4.5
TOTAL VOLUME PURGED	=	5 gal

Method of purging: HAND BAILED

Sample date/time: 5-26-95 / 1255 Sample number: 87841

FIELD PARAMETERS	~~Begin~~			~~End~~			Sample
pH	6.4	6.5	6.5	6.5	6.5	6.5	6.4
Conductivity	450	450	445	445	440	440	460
Temperature	16.5	16	16	16.5	16	16	17°
Turbidity	200+	200+	200+	200+	200+	200+	200+

Sampler's signature/date: M. Von Meda / 5-26-95

W.U #S
02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTURE
02009.06 EXT[illegible] WELLS

HIA - MIDDLETOWN
WELL SAMPLING DATA FORM

Well Number: GF-218 Date: 5-22-95 Time: 1330

Boring diameter: _____ Well casing diameter: 2"

Annular space length: _____ Stickup: _____

Total depth (TOC) 22.41 (-) Depth to water (TOC) 12.90 (=) Height of Column 9.51

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	/
Column of water or length of A.S. (whichever is less)	x	/
Volume of annular space	=	/
Gallons per foot of casing	=	.16
Column of water	x	9.51
Volume of casing	=	1.6 gal
TOTAL VOLUME (A.S. + casing)	=	/
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	4.8 gal
TOTAL VOLUME PURGED	=	5+ gal

Method of purging: Bailer

Sample date/time: 5-22-95 / 1437 Sample number: 26249

FIELD PARAMETERS	~~Begin~~			~~End~~	Sample
pH	6.2	6.3	6.3	6.3	6.3
Conductivity	470	460	450	450	460
Temperature	15°	15°	14.5	14°	15°
Turbidity	200+	200+	200+	200+	200+

Sampler's signature/date: Marvin Nicole / 5-22-95

W.U #
02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTREEZ
02009.06 EXISTING WELLS

HIA - MIDDLETOWN

WELL SAMPLING DATA FORM

Well Number: GF-219 Date: 5/18/95 Time: 1720

Boring diameter: — Well casing diameter: 2"

Annular space length: — Stickup: —

Total depth (TOC) 24.44 (-) Depth to water (TOC) 15.57 (=) Height of Column 8.47

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	—
Column of water or length of A.S. (whichever is less)	x	—
Volume of annular space	=	—
Gallons per foot of casing	=	.163
Column of water	x	8.47
Volume of casing	=	1.4
TOTAL VOLUME (A.S. + casing)	=	1.4
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	4.2
TOTAL VOLUME PURGED	=	5

Method of purging: HAND BAIL

Sample date/time: 5/18/95 1805 Sample number: GF-219

FIELD PARAMETERS

	Begin					End	
pH	5.8	5.8	5.8	5.9	5.9	5.9	5.9
Conductivity	850	850	850	850	850	850	800
Temperature	18	18	14	15	15	15	15
Turbidity	200+	200+	200+	200+	200+	200+	200+

Sampler's signature/date: David Van Kenen

W.O #S
02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTURE
02009.06 EXIS[illegible] WELLS

HIA - MIDDLETOWN
WELL SAMPLING DATA FORM

Well Number: GF-220 Date: 5-18-95 Time: 1536

Boring diameter: _____ Well casing diameter: 2"

Annular space length: _____ Stickup: _____

Total depth (TOC) 26.84 (-) Depth to water (TOC) 16.99 (=) Height of Column 9.85

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	/
Column of water or length of A.S. (whichever is less)	x	/
Volume of annular space	=	/
Gallons per foot of casing	=	.16
Column of water	x	9.85
Volume of casing	=	1.6 gal
TOTAL VOLUME (A.S. + casing)	=	/
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	4.8 gal
TOTAL VOLUME PURGED	=	5+ gal

Method of purging: bailer

Sample date/time: 5-18-95 / 1601 Sample number: GF-220

FIELD PARAMETERS	~~Begin~~			~~End~~			Sample
pH	3.7	2.9	2.7	3.8	3.7	3.9	5.4
Conductivity	550	550	550	550	500	500	500
Temperature	17	17	16	16	15.5	15	15
Turbidity	200+	200+	200+	200+	200+	200+	200+

Sampler's signature/date: M. von Meda / 5-19-95

W.O #S
02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTREE
02009.06 EXISTIN WELLS

HIA - MIDDLETOWN

WELL SAMPLING DATA FORM

Well Number: GF-221 Date: 5-18-95 Time: 1753

Boring diameter: _____ Well casing diameter: 2"

Annular space length: _____ Stickup: _____

Total depth (TOC) 32.50 (-) Depth to water (TOC) 19.65 (=) Height of Column 12.85

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	—
Column of water or length of A.S. (whichever is less)	x	—
Volume of annular space	=	—
Gallons per foot of casing	=	.16
Column of water	x	12.85
Volume of casing	=	2.1 gal
TOTAL VOLUME (A.S. + casing)	=	—
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	6.3 gal
TOTAL VOLUME PURGED	=	6.5 gal

Method of purging: bailer

Sample date/time: 5-18-95 / 1811 Sample number: 87737

FIELD PARAMETERS

	~~Begin~~					~~End~~	
pH	6.5	6.0	5.9	6.0	6.0	6.2	6.3
Conductivity	345	335	325	330	330	325	325
Temperature	17.5	19	16	16.5	16	16	15
Turbidity	200+	200+	200+	200+	200+	200+	200+

Sampler's signature/date: M. Von Meda / 5-19-95

W.O. # S
02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTUREE
02009.06 EXIS[illegible]
W[illegible]S

HIA - MIDDLETOWN
WELL SAMPLING DATA FORM

Well Number: GF-222 Date: 5-23-95 Time: 0933

Boring diameter: _____ Well casing diameter: 4"

Annular space length: _____ Stickup: _____

Total depth (TOC) 19.25 (-) Depth to water (TOC) 10.47 (=) Height of Column 8.78

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	/
Column of water or length of A.S. (whichever is less)	x	/
Volume of annular space	=	/
Gallons per foot of casing	=	.65
Column of water	x	8.78
Volume of casing	=	6 gal
TOTAL VOLUME (A.S. + casing)	=	/
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	18 gal
TOTAL VOLUME PURGED	=	6 gal (dry)

Method of purging: centrifugal pump

Sample date/time: 5-23-95 / 1003 Sample number: 26246

FIELD PARAMETERS	~~Begin~~		~~End~~	Sample
pH	6.1	5.7		6.0
Conductivity	410	395		490
Temperature	20°	16.5		18°
Turbidity	200+	200+		200

Sampler's signature/date: M von Maeda / 5-24-95

W.O. #S
02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTURE
02009.06 EXISTING WELLS

HIA - MIDDLETOWN

WELL SAMPLING DATA FORM

Well Number: GF-223 Date: 6-2-95 Time: 0900

Boring diameter: _____ Well casing diameter: 2"

Annular space length: _____ Stickup: _____

Total depth (TOC) 18.89 (-) Depth to water (TOC) 14.79 (=) Height of Column 4.10

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	/
Column of water or length of A.S. (whichever is less)	x	/
Volume of annular space	=	/
Gallons per foot of casing	=	.16
Column of water	x	4.10
Volume of casing	=	0.66 gal
TOTAL VOLUME (A.S. + casing)	=	/
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	2 gal
TOTAL VOLUME PURGED (1 Min bail 0.25)	=	2.5 gal

Method of purging: bailer

Sample date/time: 6-2-95 / 0918 Sample number: 87862

FIELD PARAMETERS	~~Begin~~				~~End~~	Sample
pH	6.4	6.6	6.7	6.7	6.6	6.6
Conductivity	500	495	485	485	490	495
Temperature	18.5	17	16.5	16.5	16.5	16
Turbidity	200+	200+	200+	200+	200+	200+

Sampler's signature/date: M. von Needa / 6-5-95

W.U #S
02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTURE
02009.06 EXIS[illegible]
WELLS

HIA - MIDDLETOWN
WELL SAMPLING DATA FORM

Well Number: GF-226 Date: 5-24-95 Time: 1435

Boring diameter: _____ Well casing diameter: 2"

Annular space length: _____ Stickup: _____

Total depth (TOC) 50.13 (-) Depth to water (TOC) 33.48 (=) Height of Column 16.65

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	/
Column of water or length of A.S. (whichever is less)	x	/
Volume of annular space	=	/
Gallons per foot of casing	=	.16
Column of water	x	16.65
Volume of casing	=	2.8
TOTAL VOLUME (A.S. + casing)	=	/
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	8.5
TOTAL VOLUME PURGED	=	_____

Method of purging: bailer

Sample date/time: 5-24-95 / 1515 Sample number: 87712

FIELD PARAMETERS	~~Begin~~				~~End~~		Sample
pH	5.9	5.9	5.9	5.9	5.9	5.9	6.0
Conductivity	425	420	420	410	405	390	395
Temperature	21	20	20	20	20	18.5	19
Turbidity	200+	200+	200+	200+	200+	200+	139.6

Sampler's signature/date: M Von Muda / 5-25-95

W.C #S
02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTURE
02009.06 EXISTING WELLS

HIA - MIDDLETOWN
WELL SAMPLING DATA FORM

Well Number: GF-227 Date: 5-31-95 Time: 1626

Boring diameter: _____ Well casing diameter: 2"

Annular space length: _____ Stickup: _____

Total depth (TOC) 19.34 (-) Depth to water (TOC) 9.95 (=) Height of Column 9.39

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	—
Column of water or length of A.S. (whichever is less)	x	—
Volume of annular space	=	—
Gallons per foot of casing	=	.16
Column of water	x	9.39
Volume of casing	=	1.5 gal
TOTAL VOLUME (A.S. + casing)	=	—
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	4.5 gal
TOTAL VOLUME PURGED	=	5 gal

Method of purging: bailer

Sample date/time: 5-31-95 / 1648 Sample number: 87839

FIELD PARAMETERS

	~~Begin~~			~~End~~		
pH	6.9	6.9	6.8	6.7	6.8	6.8
Conductivity	700	700	700	700	750	750
Temperature	16	16	15	15	15.5	15
Turbidity	14.0	16.4	17.5	200+	200+	200+

Sampler's signature/date: [illegible] / 6-1-95

W.O # S
02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTURE
02009.06 EXIS[illegible]

HIA - MIDDLETOWN

WELL SAMPLING DATA FORM

Well Number: GF-250 Date: 5-25-95 Time: 1417

Boring diameter: _____ Well casing diameter: 2"

Annular space length: _____ Stickup: _____

Total depth (TOC) 19.90 (-) Depth to water (TOC) 7.37 (=) Height of Column 12.53

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	/
Column of water or length of A.S. (whichever is less)	x	/
Volume of annular space	=	/
Gallons per foot of casing	=	.16
Column of water	x	12.53
Volume of casing	=	2.1 gal
TOTAL VOLUME (A.S. + casing)	=	/
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	6.5 gal
TOTAL VOLUME PURGED	=	6.5 gal

Method of purging: bailer

Sample date/time: 5-25-95 / 1443 Sample number: 87813

FIELD PARAMETERS

	Begin				End			Sample
pH	6.1	6.3	6.3	6.3	6.6	6.6	6.6	6.4
Conductivity	295	365	350	290	310	310	310	310
Temperature	16.5	15.5	13	14	14.5	15	14.5	14.5
Turbidity			200+	200+	200+	200+	200+	105.0

Sampler's signature/date: M. von Moody / 5-26-95

02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTREEZ
02009.06 EXISTING WELLS

HIA - MIDDLETOWN

WELL SAMPLING DATA FORM

Well Number: GF-301 Date: 5/25/95 Time: 1620

Boring diameter: — Well casing diameter: 6"

Annular space length: — Stickup: —

Total depth (TOC) 89.48 (-) Depth to water (TOC) 21.08 (=) Height of Column 68.4

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	—
Column of water or length of A.S. (whichever is less)	x	—
Volume of annular space	=	—
Gallons per foot of casing	=	1.46
Column of water	x	68.4
Volume of casing	=	100
TOTAL VOLUME (A.S. + casing)	=	100
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	300
TOTAL VOLUME PURGED	=	415

Method of purging: 2" GRUNDFOS SUB PUMP

Sample date/time: 5-25-95 / 1737 Sample number: 87814

FIELD PARAMETERS	~~Begin~~				~~End~~				Sample
pH	6.7	6.5	6.6	6.7	6.7	6.7	6.7	6.8	7.1
Conductivity	1000	900	700	900	600	600	700	800	170
Temperature	16	15	15	15	15	15	15	15	18°
Turbidity	288	1800	176.9	1345	1020	770	970	54.6	666

Sampler's signature/date: M. Von Riedel / 5-26-95

W.O # S
02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTURE
02009.06 EXI[illegible]

HIA - MIDDLETOWN
WELL SAMPLING DATA FORM

Well Number: GF-302 Date: 5-16-95 Time: 0950

Boring diameter: _____ Well casing diameter: 4"

Annular space length: _____ Stickup: _____

Total depth (TOC) 89.51 (-) Depth to water (TOC) 16.21 (=) Height of Column 73.3

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	/
Column of water or length of A.S. (whichever is less)	x	/
Volume of annular space	=	/
Gallons per foot of casing	=	.65
Column of water	x	73.3
Volume of casing	=	.48 gal
TOTAL VOLUME (A.S. + casing)	=	/
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	144 gal
TOTAL VOLUME PURGED	=	152 gal

Method of purging: 2" Grundfos submersible

Sample date/time: 5-16-95 / 1118 Sample number: 87709, 712, 713 (MS/MSD MRD spike dupl)

FIELD PARAMETERS	~~Begin~~					~~End~~		Sample
pH	7.3	7.0	7.0	7.0	7.0	7.0	7.0	7.0
Conductivity	480	300	300	300	210	200	200	200
Temperature	18	17.5	20	20	20	19	19	20
Turbidity	200+	70	17	3.7	3.3	3.3	3.4	53.

Sampler's signature/date: M. von Meda / 5-17-95

W.O. #S
02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTUREZ
02009.06 EXISTING WELLS

HIA - MIDDLETOWN

WELL SAMPLING DATA FORM

Well Number: GF-303 Date: 5/26/95 Time: 0850

Boring diameter: \ Well casing diameter: 6"

Annular space length: \ Stickup: \

Total depth (TOC) 89.31 (-) Depth to water (TOC) 29.91 (=) Height of Column 65.4

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	\
Column of water or length of A.S. (whichever is less)	x	\
Volume of annular space	=	\
Gallons per foot of casing	=	1.46
Column of water	x	65.4
Volume of casing	=	95.5
TOTAL VOLUME (A.S. + casing)	=	95.5
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	286.5
TOTAL VOLUME PURGED	=	375

Method of purging: 2" GRUNDFOS SUB PUMP

Sample date/time: 5-26-95 / 1104 Sample number: 87836,37,38 (ms/~~MSD~~, MSD spkd, dupl)

FIELD PARAMETERS	~~Begin~~				~~End~~				Sample
pH	6.9	6.8	6.9	6.8	6.7	6.7	6.7	6.7	6.8
Conductivity	700	800	850	800	800	800	800	800	250
Temperature	13	13	13	13	13	13	13	13	15°
Turbidity	61.5	33.2	17.8	13.2	11.5	8.2	7.6	6.9	200+

Sampler's signature/date: M. von Meden / 5-26-95

W.U. #	
02005.08	BLDGS
02006.07	N.B.L.
02008.04	RUNWAY
02008.05	CAPTUREZ.
02009.06	EXISTING WELL

HIA - MIDDLETOWN

WELL SAMPLING DATA FORM

Well Number: GF-305 Date: 5/24/95 Time: 1235

Boring diameter: — Well casing diameter: 6"

Annular space length: — Stickup: —

Total depth (TOC) 102.09 (-) Depth to water (TOC) 24.38 (=) Height of Column 77.71

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	—
Column of water or length of A.S. (whichever is less)	x	—
Volume of annular space	=	—
Gallons per foot of casing	=	1.46
Column of water	x	77.71
Volume of casing	=	114
TOTAL VOLUME (A.S. + casing)	=	114
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	342
TOTAL VOLUME PURGED	=	350

Method of purging: 2" GRUNDFOS SUB PUMP

Sample date/time: 5/24/95 1540 Sample number: GF-305

FIELD PARAMETERS

	~~Begin~~				~~End~~			
pH	11.2	9.8	9.4	8.3	7.4	7.5	7.5	7.4
Conductivity	800	400	370	500	600	640	600	700
Temperature	17	15	15	15	15	15	15	18
Turbidity	260	94.5	74.7	26.9	10.1	4.4	11.2	48.0

Sampler's signature/date: [signature] 5/24/95

W.O #S
02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTUREZ
02009.06 EXISTING WELLS

HIA - MIDDLETOWN

WELL SAMPLING DATA FORM

Well Number: GF-307 Date: 5/31/95 Time: 1129

Boring diameter: — Well casing diameter: 6

Annular space length: — Stickup: —

Total depth (TOC) 90.39 (-) Depth to water (TOC) 15.65 (=) Height of Column 74.74

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	—
Column of water or length of A.S. (whichever is less)	x	—
Volume of annular space	=	—
Gallons per foot of casing	=	1.46
Column of water	x	74.74
Volume of casing	=	112.80
TOTAL VOLUME (A.S. + casing)	=	112.80
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	338.42
TOTAL VOLUME PURGED	=	~~X~~400

Method of purging: 1" Centrifugal pump

Sample date/time: 5-31-95 / 1236 Sample number: 87859, 60, 61 (MS/MSD, MRD spike dup)

FIELD PARAMETERS	~~Begin~~				~~End~~	Sample
pH	7.2	6.5	6.8	6.3	6.2	6.2
Conductivity	120	900	1000	900	900	700
Temperature	18	17	17	15	15	19°
Turbidity	200+	~~40.5~~ 116.5	~~16.8~~ 40.5	16.8	13.2	200+

Sampler's signature/date: M. von Meda / 6-1-95

W.O # S
02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTUREZ
02009.06 EXIST[illegible]
WS[illegible]

HIA - MIDDLETOWN

WELL SAMPLING DATA FORM

Well Number: GF-308 Date: 5/30/95 Time: 1140

Boring diameter: — Well casing diameter: 6

Annular space length: — Stickup: —

Total depth (TOC) 112.54 (-) Depth to water (TOC) 23.12 (=) Height of Column 89.42

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	—
Column of water or length of A.S. (whichever is less)	x	—
Volume of annular space	=	—
Gallons per foot of casing	=	1.46
Column of water	x	89.42
Volume of casing	=	131
TOTAL VOLUME (A.S. + casing)	=	131
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	393
TOTAL VOLUME PURGED	=	360

Method of purging: 1" CENTRIFUGAL PUMP

Sample date/time: 5-30-95/1232 Sample number: 87843

FIELD PARAMETERS	~~Begin~~				~~End~~			Sample
pH	9.9	9.6	9.7	9.7	9.7	9.7	9.7	10.8
Conductivity	900	1300	1300	1300	1300	1300	1300	190
Temperature	15	15	14	14	14	14	14	15
Turbidity	26.1	12.1	9.8	6.1	4.2	3.6	3.4	64.0

Sampler's signature/date: M. von Riedel / 5-31-95

W.O # S
02005.08 SLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTURE:
02009.06 EXISTING WELLS

HIA - MIDDLETOWN
WELL SAMPLING DATA FORM

Well Number: GF-309 Date: 5-18-95 Time: 0950

Boring diameter: _____ Well casing diameter: 6"

Annular space length: _____ Stickup: _____

Total depth (TOC) 83.25 (-) Depth to water (TOC) 10.22 (=) Height of Column 73.03

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	/
Column of water or length of A.S. (whichever is less)	x	/
Volume of annular space	=	/
Gallons per foot of casing	=	1.47
Column of water	x	73.03
Volume of casing	=	108 gal
TOTAL VOLUME (A.S. + casing)	=	/
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	324 gal
TOTAL VOLUME PURGED	=	370 gal

Method of purging: centrifugal pump

Sample date/time: 5-18-95 / 1105 Sample number: 87731, 32, 33 (MS/MSD MRD split sampl)

FIELD PARAMETERS	~~Begin~~				~~End~~			Sample
pH	6.1	5.9	5.9	6.0	6.1	6.1	5.8	6.6
Conductivity	500	500	500	500	500	500	500	500
Temperature	14.5	14	14.5	14.5	14.5	14.5	15	15
Turbidity	200+	45.1	45.5	16.1	9.8	13.7	15.5	14.5

Sampler's signature/date: M. von Muehl / 5-19-95

02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTUREZ
02009.06 EXISTING WE

HIA - MIDDLETOWN

WELL SAMPLING DATA FORM

Well Number: GF-310 Date: 5/25/95 Time: 1110

Boring diameter: — Well casing diameter: 6"

Annular space length: — Stickup: —

Total depth (TOC) 102.57 (-) Depth to water (TOC) 30.69 (=) Height of Column 71.88

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	—
Column of water or length of A.S. (whichever is less)	x	—
Volume of annular space	=	—
Gallons per foot of casing	=	1.46
Column of water	x	71.88
Volume of casing	=	105
TOTAL VOLUME (A.S. + casing)	=	105
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	315
TOTAL VOLUME PURGED	=	330

Method of purging: 2" GRUNDFOS SUB PUMP

Sample date/time: 5-25-95/ 1252 Sample number: 87827

FIELD PARAMETERS	~~Begin~~						~~End~~	Sample
pH	8.2	7.3	7.2	7.1	7.2	7.2	7.2	6.9
Conductivity	230	450	600	600	600	600	600	230
Temperature	16	15	15	15	15	15	16	17.5
Turbidity	31.8	99.0	123.5	61.0	27.8	14.1	8.6	33.7

Sampler's signature/date: M. von Meda / 5-25-95

W.U. #S
02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTUREZ
02009.06 EXISTING WELLS

HIA - MIDDLETOWN

WELL SAMPLING DATA FORM

Well Number: GF-311 Date: 5/16/95 Time: 1500

Boring diameter: — Well casing diameter: 6"

Annular space length: — Stickup: —

Total depth (TOC) 97.91 (-) Depth to water (TOC) 29.86 (=) Height of Column 78.05

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	—
Column of water or length of A.S. (whichever is less)	x	—
Volume of annular space	=	—
Gallons per foot of casing	=	
Column of water	x	78.05
Volume of casing	=	100
TOTAL VOLUME (A.S. + casing)	=	100
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	300
TOTAL VOLUME PURGED	=	

Method of purging: 2" GRUNDFOS SUBMERSIBLE PUMP

Sample date/time: 5/16/95 - 1615 Sample number: 0877[illegible]/18/19

FIELD PARAMETERS	~~Begin~~				~~End~~			SAMPLE
pH	6.0	6.0	6.0	6.05	6.1	6.05	6.10	7.5
Conductivity	295	295	300	310	300	305	300	75
Temperature	17	18	19	19	20	17.5	17.5	20
Turbidity	105.4	58.1	23.8	9.31	7.93	5.34	4.53	95.6

Sampler's signature/date: David A. Van Kooten 5/16/95

02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTUREZ.
02009.06 EXISTING WELL

HIA - MIDDLETOWN

WELL SAMPLING DATA FORM

Well Number: GF-312 Date: 5/23/95 Time: 1640

Boring diameter: — Well casing diameter: 6"

Annular space length: — Stickup: —

Total depth (TOC) 99.91 (-) Depth to water (TOC) 13.00 (=) Height of Column 86.91

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	—
Column of water or length of A.S. (whichever is less)	x	—
Volume of annular space	=	—
Gallons per foot of casing	=	.652
Column of water	x	86.91
Volume of casing	=	128
TOTAL VOLUME (A.S. + casing)	=	128
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	384
TOTAL VOLUME PURGED	=	208

Method of purging: 2" GRUNDFOS SUB PUMP

Sample date/time: 5/23/95 1745 Sample number: GF-312

FIELD PARAMETERS	~~Begin~~				Sample ~~End~~
pH	7.3	7.3	7.8	7.8	7.2
Conductivity	580	~~500~~	290	250	600
Temperature	18	15	15	15	16
Turbidity	18.1	79.0	55.1	87.7	96.5

Sampler's signature/date: [signature] 5/23/95

02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTREEZ
02009.06 EXISTING WELLS

HIA - MIDDLETOWN

WELL SAMPLING DATA FORM

Well Number: GF-314 Date: 5/25/95 Time: 0925

Boring diameter: Well casing diameter: 10"

Annular space length: Stickup:

Total depth (TOC) 97.58 (-) Depth to water (TOC) 26.58 (=) Height of Column 71.0

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of ~~annular space (A.S.)~~	=	
~~Column of water or length of A.S. (whichever is less)~~	x	
~~Volume of annular space~~	=	
Gallons per foot of casing	=	1.46
Column of water	x	71
Volume of casing	=	103
TOTAL VOLUME (A.S. + casing)	=	103
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	309
TOTAL VOLUME PURGED	=	310

Method of purging: 2" GRUNDFOS SUBPUMP

Sample date/time: 5-25-95 / 1040 Sample number: 87826, 830, 831 (MS/MSD, MRO split, dup)

FIELD PARAMETERS

	~~Begin~~				~~End~~	Sample
pH	7.2	7.9	7.8	7.7	7.5	7.3
Conductivity	900	280	360	420	800	700
Temperature	14	14	14	14	14	18
Turbidity	1760	1420	200+	200+	200+	196

Sampler's signature/date: M. Van Riedu / 5-26-95

W.O #S
02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTURE
02009.06 EXT[illegible] WELLS

HIA - MIDDLETOWN
WELL SAMPLING DATA FORM

Well Number: GF-315 Date: 6-1-95 Time: _____

Boring diameter: _____ Well casing diameter: 6"

Annular space length: _____ Stickup: _____

Total depth (TOC) 93.72 (-) Depth to water (TOC) 15.98 (=) Height of Column 77.74

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	/
Column of water or length of A.S. (whichever is less)	x	/
Volume of annular space	=	/
Gallons per foot of casing	=	1.47
Column of water	x	77.74 ~~114.3 gal~~
Volume of casing	=	114.3 gal
TOTAL VOLUME (A.S. + casing)	=	/
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	343 gal
TOTAL VOLUME PURGED	=	345 gal

Method of purging: 2" Grundfos submersible

Sample date/time: 6-1-95 / 1604 Sample number: 87868, 70, 71 (MS/MSD MRD Split Dupl.)

FIELD PARAMETERS	~~Begin~~					~~End~~		Sample
pH	8.5	7.2	7.4	7.3	7.3	7.3	7.3	7.2
Conductivity	120	360	350	300	350	350	350	340
Temperature	19	17	17	16	16	17	17	18
Turbidity	88.2	102.	16.5	40.4	39	2.3	2.9	37.0

Sampler's signature/date: [illegible] / 6-2-95

02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTREEZ
02009.06 EXISTING WELLS

HIA - MIDDLETOWN
WELL SAMPLING DATA FORM

Well Number: GF-317 Date: 5/26/95 Time: 1215

Boring diameter: — Well casing diameter: 6"

Annular space length: — Stickup: —

Total depth (TOC) 88.51 (-) Depth to water (TOC) 11.76 (=) Height of Column 76.75

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	—
Column of water or length of A.S. (whichever is less)	x	—
Volume of annular space	=	—
Gallons per foot of casing	=	1.46
Column of water	x	76.75
Volume of casing	=	113
TOTAL VOLUME (A.S. + casing)	=	113
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	339
TOTAL VOLUME PURGED	=	350

Method of purging: 2" GRUNDFOS SUB PUMP

Sample date/time: 5-26-95 / 1308 Sample number: 87840

FIELD PARAMETERS	~~Begin~~					~~End~~		Sample
pH	8.3	7.5	7.3	7.2	7.2	7.2	7.2	8.0
Conductivity	190	280	400	410	410	420	420	190
Temperature	16	16	16	16	16	16	16	18°
Turbidity	91.9	96.9	17.9	11.1	7.1	6.8	5.2	62.0

Sampler's signature/date: [illegible] / 5-26-95

W.O. # S
02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTURE
02009.06 EXIS[illegible] WE[illegible]S

HIA - MIDDLETOWN
WELL SAMPLING DATA FORM

Well Number: GF-318 Date: 5-22-95 Time: 1350

Boring diameter: _____ Well casing diameter: 6"

Annular space length: _____ Stickup: _____

Total depth (TOC) 90.60 (-) Depth to water (TOC) 15.85 (=) Height of Column 74.75

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	/
Column of water or length of A.S. (whichever is less)	x	/
Volume of annular space	=	/
Gallons per foot of casing	=	1.47
Column of water	x	74.75
Volume of casing	=	110 gal
TOTAL VOLUME (A.S. + casing)	=	/
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	330 gal.
TOTAL VOLUME PURGED	=	330 gal

Method of purging: centrifugal pump

Sample date/time: 5-22-95 / 1505 Sample number: 26251, 250, 248 (MS/MSD MRD spkd dupl)

FIELD PARAMETERS	~~Begin~~				~~End~~			Sample
pH	8.3	6.4	6.4	6.5	6.6	6.8	6.8	7.7
Conductivity	145	420	435	430	445	450	450	180
Temperature	19	19	17	17.5	17.5	17	17	17°
Turbidity	200+	57.5	51.	40	18.	7.3	7.0	66

Sampler's signature/date: M. von Meda / 5-23-95

R.F. Weston Series Monitoring Wells

W.O. #S
02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTUREZ.
02009.06 EXISTING WELLS

HIA - MIDDLETOWN

WELL SAMPLING DATA FORM

Well Number: RFW-1 Date: 5/19/95 Time: 1026

Boring diameter: — Well casing diameter: 6"

Annular space length: — Stickup: —

Total depth (TOC) 103.23 (-) Depth to water (TOC) 5.54 (=) Height of Column 97.69

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	—
Column of water or length of A.S. (whichever is less)	x	—
Volume of annular space	=	—
Gallons per foot of casing	=	1.46
Column of water	x	97.69
Volume of casing	=	142.6
TOTAL VOLUME (A.S. + casing)	=	142.6
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	427.8
TOTAL VOLUME PURGED	=	500

Method of purging: 1" CENTRIFUGAL PUMP

Sample date/time: 5-19-95 / 1215 Sample number: 26238, 39, 37 (MS/MSD, MRD replicate duplicate).

FIELD PARAMETERS	~~Begin~~				~~End~~					Sample
pH	6.8	6.7	6.8	6.75	6.75	6.75	6.5	6.5	6.5	6.8
Conductivity	270	280	280	285	285	310	600	700	700	500
Temperature	12	12	12	12	13	13	13	13	13	13
Turbidity	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	35.9

Sampler's signature/date: M. Von Meda / 5-19-95

W.O # S
02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTUREE
02009.06 EXIS[illegible] WELLS

HIA - MIDDLETOWN
WELL SAMPLING DATA FORM

Well Number: RFW-2 Date: 5-26-95 Time: 0940

Boring diameter: _____ Well casing diameter: 4"

Annular space length: _____ Stickup: _____

Total depth (TOC) 29.20 (-) Depth to water (TOC) 12.59 (=) Height of Column 16.61

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	/
Column of water or length of A.S. (whichever is less)	x	/
Volume of annular space	=	/
Gallons per foot of casing	=	.65
Column of water	x	16.61
Volume of casing	=	11 gal
TOTAL VOLUME (A.S. + casing)	=	/
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	33 gal
TOTAL VOLUME PURGED	=	13 gal (dry)

Method of purging: bailer

Sample date/time: 5-26-95 / 1024 Sample number: 87815

FIELD PARAMETERS	~~Begin~~			~~End~~	Sample
pH	7.6	6.2	6.3		6.6
Conductivity	360	365	360		350
Temperature	16	15	14.5		15°
Turbidity	200+	200+	200+		200+

Sampler's signature/date: M von Meda / 5-30-95

W.O # S
02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTURE
02009.06 EXISTING WELLS

HIA - MIDDLETOWN

WELL SAMPLING DATA FORM

Well Number: RFW-3 Date: 5-23-95 Time: 1050

Boring diameter: _____ Well casing diameter: 4"

Annular space length: _____ Stickup: _____

Total depth (TOC) 23.84 (-) Depth to water (TOC) 16.79 (=) Height of Column 7.05

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	/
Column of water or length of A.S. (whichever is less)	x	/
Volume of annular space	=	/
Gallons per foot of casing	=	.65
Column of water	x	7.05
Volume of casing	=	4.6
TOTAL VOLUME (A.S. + casing)	=	/
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	14 gal
TOTAL VOLUME PURGED	=	15 gal

Method of purging: centrifugal pump

Sample date/time: 5-23-95 / 1109 Sample number: 26261

FIELD PARAMETERS

	~~Begin~~				~~End~~			Sample
pH	6.5	6.8	6.6	6.5	6.6	6.6	6.6	6.7
Conductivity	500	500	500	500	500	500	500	500
Temperature	22	20	19	20	20	20	20	190
Turbidity	200+	200+	200+	200+	73	21.5	22	165

Sampler's signature/date: M. von Nida / 5/24/95

W.O #S
02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTURE
02009.06 EXI[illegible]

HIA - MIDDLETOWN
WELL SAMPLING DATA FORM

Well Number: RFW-4 Date: 5-22-95 Time: 1655

Boring diameter: _____ Well casing diameter: 4"

Annular space length: _____ Stickup: _____

Total depth (TOC) 26.95 (-) Depth to water (TOC) 14.81 (=) Height of Column 12.14

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	/
Column of water or length of A.S. (whichever is less)	x	/
Volume of annular space	=	/
Gallons per foot of casing	=	.65
Column of water	x	12.14
Volume of casing	=	7.9 gal
TOTAL VOLUME (A.S. + casing)	=	/
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	24 gal
TOTAL VOLUME PURGED	=	24 gal

Method of purging: centrifugal pump

Sample date/time: 5-22-95 / 1719 Sample number: 26245

FIELD PARAMETERS	~~Begin~~				~~End~~		Sample
pH	6.6	6.8	6.8	6.8	6.8	6.9	6.8
Conductivity	950	850	750	750	800	750	700
Temperature	23	19.5	17	16	17.5	17	15°
Turbidity	200+	200+	200+	200+	200+	200+	200+

Sampler's signature/date: M. von Maede / 5-23-95

W.O #S
02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTURE
02009.06 EXISTING WELLS

HIA - MIDDLETOWN
WELL SAMPLING DATA FORM

Well Number: RFW-06 Date: 6-1-95 Time: 1100

Boring diameter: _____ Well casing diameter: 6"

Annular space length: _____ Stickup: _____

Total depth (TOC) 115.53 (-) Depth to water (TOC) 15.93 (=) Height of Column 99.60

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	/
Column of water or length of A.S. (whichever is less)	x	/
Volume of annular space	=	/
Gallons per foot of casing	=	1.47
Column of water	x	99.60
Volume of casing	=	146.4 gal
TOTAL VOLUME (A.S. + casing)	=	/
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	439.2 gal
TOTAL VOLUME PURGED	=	320 (dry)

Method of purging: 2" Grundfos Submersible

Sample date/time: 6-1-95 / 1312 Sample number: 87854

FIELD PARAMETERS

	Begin						End	
pH	7.1	7.4	7.5	7.5	7.4	7.6	7.4	7.6
Conductivity	375	370	360	360	400	340	340	350
Temperature	16	15	14	15	23	16	15	17°
Turbidity	44	33.5	18.6	53.1	111.5	134.7	156.7	27.2

Sampler's signature/date: M. von Nodi / 6-2-95

W.U #S
02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTREEZ
02009.06 EXIST[illegible]
WI[illegible]

HIA - MIDDLETOWN
WELL SAMPLING DATA FORM

Well Number: RFW-7 Date: 5/31/95 Time: 1031

Boring diameter: — Well casing diameter: 4"

Annular space length: — Stickup: —

Total depth (TOC) 23.98 (-) Depth to water (TOC) 15.64 (=) Height of Column 8.34

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	—
Column of water or length of A.S. (whichever is less)	x	—
Volume of annular space	=	—
Gallons per foot of casing	=	.653
Column of water	x	8.34
Volume of casing	=	5.5
TOTAL VOLUME (A.S. + casing)	=	5.5
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	14.5
TOTAL VOLUME PURGED	=	8.25

Method of purging: Centrifugal 1" TANAKA

Sample date/time: 5-31-95 / 1154 Sample number: 87848

FIELD PARAMETERS	~~Begin~~	~~End~~	Sample*
pH	7.5	7.9	—
Conductivity	1200	900	—
Temperature	25	18	—
Turbidity		8.96	—

* not enough water

Sampler's signature/date: M. Nonmed. / 6-1-95

R.E. Wright Series Monitoring Wells

W.O # S
02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTURE:
02009.06 EXISTING WELLS

HIA - MIDDLETOWN
WELL SAMPLING DATA FORM

Well Number: WRT-01 Date: 5-30 95 Time: 1600

Boring diameter: _____ Well casing diameter: 6"

Annular space length: _____ Stickup: _____

Total depth (TOC) 52.62 (-) Depth to water (TOC) 17.16 (=) Height of Column 35.46

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	_____
Column of water or length of A.S. (whichever is less)	x	_____
Volume of annular space	=	_____
Gallons per foot of casing	=	1.47
Column of water	x	35.46
Volume of casing	=	52.1 gal
TOTAL VOLUME (A.S. + casing)	=	/
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	156.3 gal
TOTAL VOLUME PURGED	=	180 gal

Method of purging: 2" Grundfos submersible

Sample date/time: 5-30-95 / 1625 Sample number: 87850, 55 MRD Split

FIELD PARAMETERS	~~Begin~~				~~End~~			Sample
pH	5.9	6.0	6.1	6.3	6.3	6.4	6.3	7.1
Conductivity	330	270	370	360	360	360	360	175
Temperature	19	16	15	15	15	15	15	16
Turbidity	200+	193.5	101.5	68.5	43.5	20.1	16.3	200+

Sampler's signature/date: M. Woodhouse / 5-31-95

W.O #S
02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTUREZ
02009.06 EXIST WE

HIA - MIDDLETOWN
WELL SAMPLING DATA FORM

Well Number: WRT-2 Date: 5/30/95 Time: 1620

Boring diameter: \ Well casing diameter: 6"

Annular space length: \ Stickup: \

Total depth (TOC) 49.6 (-) Depth to water (TOC) 17.65 (=) Height of Column 31.95

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	\
Column of water or length of A.S. (whichever is less)	x	\
Volume of annular space	=	\
Gallons per foot of casing	=	1.46
Column of water	x	31.95
Volume of casing	=	46.9
TOTAL VOLUME (A.S. + casing)	=	46.9
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	140.7
TOTAL VOLUME PURGED	=	

Method of purging: 1" CENTRIFUGAL PUMP

Sample date/time: 5-30-95 / 1652 Sample number: 87851

FIELD PARAMETERS	~~Begin~~				~~End~~			Sample
pH	6.5	6.6	6.7	6.6	6.6	6.6	6.6	6.9
Conductivity	600	500	600	500	500	500	500	500
Temperature	16	16	16	16	16	16	16	16.5
Turbidity	200+	173.5	87.2	50.0	39.5	26.3	23.4	191.0

Sampler's signature/date: M. Von Maeda / 5-31-95

W.U #S
02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTREE
02009.06 EXISTING WELLS

HIA - MIDDLETOWN
WELL SAMPLING DATA FORM

Well Number: WRT-03 Date: 5-31-95 Time: 1012

Boring diameter: _____ Well casing diameter: 6"

Annular space length: _____ Stickup: _____

Total depth (TOC) 50.65 (-) Depth to water (TOC) 18.50 (=) Height of Column 32.15

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	/
Column of water or length of A.S. (whichever is less)	x	/
Volume of annular space	=	/
Gallons per foot of casing	=	1.47
Column of water	x	32.15
Volume of casing	=	47.5 gal
TOTAL VOLUME (A.S. + casing)	=	/
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	143 gal
TOTAL VOLUME PURGED	=	150 gal

Method of purging: centrifugal pump

Sample date/time: 5-31-95 / 1111 Sample number: 87849

FIELD PARAMETERS	~~Begin~~				~~End~~		Sample
pH	6.8	6.8	6.7	6.4	6.5	6.7	6.7
Conductivity	500	455	460	600	600	590	500
Temperature	17.5	15.5	15.5	18°	19°	17°	18.5
Turbidity	200+	200+	28.	24.7	17.8	21.5	26.9

Sampler's signature/date: M. Von Jrode / 6-1-95

W.L #S
02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTREEZ
02009.06 EXIST WL

HIA - MIDDLETOWN
WELL SAMPLING DATA FORM

Well Number: WRT-4 Date: 5-31-95 Time: 922

Boring diameter: \ Well casing diameter: 6"

Annular space length: \ Stickup: \

Total depth (TOC) 53.11 (-) Depth to water (TOC) 17.44 (=) Height of Column 35.67

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	\
Column of water or length of A.S. (whichever is less)	x	\
Volume of annular space	=	\
Gallons per foot of casing	=	1.46
Column of water	x	35.67
Volume of casing	=	52
TOTAL VOLUME (A.S. + casing)	=	52
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	156
TOTAL VOLUME PURGED	=	160

Method of purging: 2" GRUNDFOS SUBMERSIBLE PUMP

Sample date/time: 5-31-95 / 1040 Sample number: 87852

FIELD PARAMETERS	~~Begin~~			~~End~~			Sample
pH	6.2	6.6	6.6	6.6	6.6	6.6	6.7
Conductivity	300	400	400	400	400	400	420
Temperature	21	16	16	15	15	15	17.5
Turbidity	200+	143.5	57.5	31.0	23.4	29.5	152.

Sampler's signature/date: [illegible] / 6-1-95

W.O # S
02005.08 BLDG-5
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTUREZ
02009.06 EXISTING WELLS

HIA - MIDDLETOWN
WELL SAMPLING DATA FORM

Well Number: WRT-5 Date: 6/1/95 Time: 940

Boring diameter: Well casing diameter: 6"

Annular space length: Stickup:

Total depth (TOC) 50.84 (-) Depth to water (TOC) 18.25 (=) Height of Column 32.59

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	
Column of water or length of A.S. (whichever is less)	x	
Volume of annular space	=	
Gallons per foot of casing	=	1.46
Column of water	x	32.59
Volume of casing	=	48
TOTAL VOLUME (A.S. + casing)	=	48
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	144
TOTAL VOLUME PURGED	=	185

Method of purging: 2" GRUNDFOS SUB PUMP

Sample date/time: 6-1-95 / 1118 Sample number: 26430

FIELD PARAMETERS	~~Begin~~								~~End~~	Sample
pH	6.0	6.0	6.2	6.3	6.4	6.5	6.6	6.6	6.7	6.5
Conductivity	1000	900	900	900	800	700	700	700	700	600
Temperature	15	15	15	15	15	15	15	15	15	17°
Turbidity	83.5	104.5	90.2	63.8	63.4	51.2	40.7	22.7	17.3	37.0

Sampler's signature/date: M. Von Meda / 6-2-95

W.O # S
02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTURE
02009.06 EXT

HIA - MIDDLETOWN
WELL SAMPLING DATA FORM

Well Number: WRT-06 Date: 6-1-95 Time: 1141

Boring diameter: _____ Well casing diameter: 6"

Annular space length: _____ Stickup: _____

Total depth (TOC) 50.25 (-) Depth to water (TOC) 17.45 (=) Height of Column 32.80

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	/
Column of water or length of A.S. (whichever is less)	x	/
Volume of annular space	=	/
Gallons per foot of casing	=	1.47
Column of water	x	32.80
Volume of casing	=	48.2 gal
TOTAL VOLUME (A.S. + casing)	=	/
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	145 gal
TOTAL VOLUME PURGED	=	148 gal

Method of purging: centrifugal pump

Sample date/time: 6-1-95 / 1225 Sample number: 87865

FIELD PARAMETERS	~~Begin~~					~~End~~	Sample
pH	6.8	6.5	6.6	6.5	6.5	6.6	6.2
Conductivity	325	290	320	340	350	350	400
Temperature	17	15	15	15	14.5	14.5	15°
Turbidity	200+	200+	200+	200+	200+	200+	200+

Sampler's signature/date: M. von Neida / 6-2-95

W.O #S
02005.08 BLDGS
02006.07 N.B.L.
02008.04 RUNWAY
02008.05 CAPTURE
02009.06 EXISTING WELLS

HIA - MIDDLETOWN

WELL SAMPLING DATA FORM

Well Number: WRT-07 Date: 6-1-95 Time: _____

Boring diameter: _____ Well casing diameter: 6"

Annular space length: _____ Stickup: _____

Total depth (TOC) 49.48 (-) Depth to water (TOC) 24.84 (=) Height of Column 24.64

COLUMN OF WATER IN WELL (CASING VOL. ONLY)

Gallons per foot of annular space (A.S.)	=	/
Column of water or length of A.S. (whichever is less)	x	/
Volume of annular space	=	/
Gallons per foot of casing	=	1.47
Column of water	x	24.64
Volume of casing	=	36.2 gal
TOTAL VOLUME (A.S. + casing)	=	/
Number of volumes to be evacuated	=	3
Total volume to be evacuated	=	1086 gal
TOTAL VOLUME PURGED	=	109 gal

Method of purging: 2" Grundfos submersible

Sample date/time: 6-1-95 / 1700 Sample number: 26431

FIELD PARAMETERS	~~Begin~~					~~End~~		Sample
pH	6.7	6.9	6.9	6.9	6.8	6.8	6.8	6.6
Conductivity	600	350	400	340	360	340	340	360
Temperature	27	17	15	15	14	14	14	14°
Turbidity	56.5	186	129.5	87.	172.4	42.0	36.3	48.5

Sampler's signature/date: M. Von Needa / 6-2-95

HIA Production Wells

WELL SAMPLING DATA FORM

Well Number: 41A-1 Date: 5-23-95 Time: ~~1055~~ 1050

Boring diameter: 10" Well casing diameter: 10" (WS)

Annular space length: — Stickup: —

Total depth (TOC) 630' (-) Depth to water (TOC) _____ (=) Height of Column _____

COLUMN OF WATER IN WELL

Gallons per foot of annular space (A.S.)	=	X
Column of water or length of A.S. (whichever is less)	x	
Volume of annular space	=	
Gallons per foot of casing	=	
Column of water	x	
Volume of casing	=	
TOTAL VOLUME (A.S. + casing)	=	
Number of volumes to be evacuated	=	
Total volume to be evacuated	=	
TOTAL VOLUME PURGED	180gpm x 5 min =	900 Gallons (Pump was running)

Method of purging: Pump in well

Sample date/time: 1055 on 5-23-95 Sample number: 41A-1

FIELD PARAMETERS	Begin	End
pH		7.1
Conductivity		550 umHos
Temperature		15°C
	Turbidity	7.10 NTU

Sampler's signature/date: [signature] 5-23-95

WELL SAMPLING DATA FORM

Well Number: HIA-2 Date: 5-24-95 Time: 1300

Boring diameter: 10" Well casing diameter: —

Annular space length: — Stickup: —

Total depth (TOC) 450' (-) Depth to water (TOC) _____ (=) Height of Column _____

COLUMN OF WATER IN WELL

Gallons per foot of annular space (A.S.)	=	X
Column of water or length of A.S. (whichever is less)	x	
Volume of annular space	=	
Gallons per foot of casing	=	
Column of water	x	
Volume of casing	=	
TOTAL VOLUME (A.S. + casing)	=	
Number of volumes to be evacuated	=	
Total volume to be evacuated	=	
TOTAL VOLUME PURGED	200GPM + 5 min =	1,000 Gallons

Method of purging: Pump in well

Sample date/time: 5-24-95 @ 1305 Sample number: HIA-2

FIELD PARAMETERS	Begin	End
pH		7.3
Conductivity		480 umhos
Temperature		15.5 °C
	Turbidity	4.38 NTU

Sampler's signature/date: [signature] 5-24-95

WELL SAMPLING DATA FORM

Well Number: HIA-3 Date: 5-24-95 Time: 1330

Boring diameter: 10" Well casing diameter: —

Annular space length: — Stickup: —

Total depth (TOC) 450 (-) Depth to water (TOC) _____ (=) Height of Column _____

COLUMN OF WATER IN WELL

Gallons per foot of annular space (A.S.)	=	X
Column of water or length of A.S. (whichever is less)	x	
Volume of annular space	=	
Gallons per foot of casing	=	
Column of water	x	
Volume of casing	=	
TOTAL VOLUME (A.S. + casing)	=	
Number of volumes to be evacuated	=	
Total volume to be evacuated	=	
TOTAL VOLUME PURGED 140 GPM x 5 min.	=	700 Gallons

Method of purging: Pump in Well ~~In Pump~~

Sample date/time: 5-24-95 @ 1335 Sample number: HIA-3

FIELD PARAMETERS	Begin	End
pH		7.2
Conductivity		710 umhos
Temperature		15°C
	Turbidity	4.80 NTU

Sampler's signature/date: William N. Fay 5-24-95

WELL SAMPLING DATA FORM

Well Number: HIA-4 Date: 5-24-95 Time: 1348

Boring diameter: 10" Well casing diameter: —

Annular space length: — Stickup: —

Total depth (TOC) 450' (-) Depth to water (TOC) _____ (=) Height of Column _____

COLUMN OF WATER IN WELL

Gallons per foot of annular space (A.S.)	=	X
Column of water or length of A.S. (whichever is less)	x	
Volume of annular space	=	
Gallons per foot of casing	=	
Column of water	x	
Volume of casing	=	
TOTAL VOLUME (A.S. + casing)	=	
Number of volumes to be evacuated	=	
Total volume to be evacuated	=	
TOTAL VOLUME PURGED	140 Gallons PM / 5 min. =	700 Gallons

Method of purging: Pump in Well

Sample date/time: 5-24-95 @ 1353 Sample number: HIA-4

FIELD PARAMETERS	Begin	End
pH		7.0
Conductivity		780 umhos
Temperature		15°C
	Turbidity	5.21 NTU

Sampler's signature/date: Wan M. Rep 5-24-95

WELL SAMPLING DATA FORM

Well Number: HIA-5 Date: 5-24-95 Time: 1320

Boring diameter: 10" Well casing diameter: —

Annular space length: — Stickup: —

Total depth (TOC) 450 (-) Depth to water (TOC) _____ (=) Height of Column _____

COLUMN OF WATER IN WELL

Gallons per foot of annular space (A.S.)	=	Ø
Column of water or length of A.S. (whichever is less)	x	
Volume of annular space	=	
Gallons per foot of casing	=	
Column of water	x	
Volume of casing	=	
TOTAL VOLUME (A.S. + casing)	=	
Number of volumes to be evacuated	=	
Total volume to be evacuated	=	
TOTAL VOLUME PURGED 170 GPM x 5 MIN.	=	850 Gallons

Method of purging: Pump in Well

Sample date/time: 5-24-95 @ 1325 Sample number: HIA-5

FIELD PARAMETERS	Begin	End
pH		7.2
Conductivity		440 umHos
Temperature		15°C
Turbidity		4.10 NTU

Sampler's signature/date: William M. Fox 5-24-95

WELL SAMPLING DATA FORM

Well Number: HIA-6 Date: 5-23-95 Time: 1115

Boring diameter: 10" Well casing diameter: —

Annular space length: — Stickup: —

Total depth (TOC) 500' (-) Depth to water (TOC) _____ (=) Height of Column _____

COLUMN OF WATER IN WELL

Gallons per foot of annular space (A.S.)	=	X
Column of water or length of A.S. (whichever is less)	x	
Volume of annular space	=	
Gallons per foot of casing	=	
Column of water	x	
Volume of casing	=	
TOTAL VOLUME (A.S. + casing)	=	
Number of volumes to be evacuated	=	
Total volume to be evacuated	=	4
TOTAL VOLUME PURGED 550 GPM x 5 min. (Pump was running)	=	2,750 Gallons

Method of purging: Pump in Well

Sample date/time: 5-23-95 @ 1120 Sample number: HIA-6

FIELD PARAMETERS	Begin	End
pH		6.8
Conductivity		300 umHos
Temperature		15.5°C
	Turbidity	3.42 NTU

Sampler's signature/date: Warren N. Fay 5-23-95

WELL SAMPLING DATA FORM

Well Number: H1A-9 Date: 5-24-95 Time: 1410

Boring diameter: 10" Well casing diameter: —

Annular space length: — Stickup: —

Total depth (TOC) 450' (-) Depth to water (TOC) _____ (=) Height of Column _____

COLUMN OF WATER IN WELL

Gallons per foot of annular space (A.S.)	=	X
Column of water or length of A.S. (whichever is less)	x	
Volume of annular space	=	
Gallons per foot of casing	=	
Column of water	x	
Volume of casing	=	
TOTAL VOLUME (A.S. + casing)	=	
Number of volumes to be evacuated	=	
Total volume to be evacuated	=	
TOTAL VOLUME PURGED 200GPM x 5 MIN.	=	1,000 Gallons

Method of purging: Pump in Well

Sample date/time: 5-24-95 @ 1415 Sample number: H1A-9

FIELD PARAMETERS	Begin	End
pH		7.0
Conductivity		510 umHos
Temperature		16 °C
	Turbidity	5.16 NTU

Sampler's signature/date: Warren N. Fry 5-24-95

WELL SAMPLING DATA FORM

Well Number: HIA-10 Date: 6-2-95 Time: 0730

Boring diameter: 10" Well casing diameter: —

Annular space length: — Stickup: —

Total depth (TOC) 450' (-) Depth to water (TOC) _____ (=) Height of Column _____

COLUMN OF WATER IN WELL

Gallons per foot of annular space (A.S.)	=	X
Column of water or length of A.S. (whichever is less)	x	
Volume of annular space	=	
Gallons per foot of casing	=	
Column of water	x	
Volume of casing	=	
TOTAL VOLUME (A.S. + casing)	=	
Number of volumes to be evacuated	=	
Total volume to be evacuated	=	
TOTAL VOLUME PURGED 9GPM x 210 MIN.	=	1,780

Method of purging: Submersible Pump placed in well

Sample date/time: 6-2-95 @ 1125 Sample number: HIA-10

FIELD PARAMETERS	Begin	End
pH		6.8
Conductivity		600 um Hos
Temperature		15.7°C
	Turbidity	6.8 NTU

Sampler's signature/date: [signature] 6-2-95

For Matt VanWerke

WELL SAMPLING DATA FORM

Well Number: HIA-11 Date: 5-24-95 Time: 1242

Boring diameter: 10" Well casing diameter: —

Annular space length: — Stickup: —

Total depth (TOC) 603' (-) Depth to water (TOC) _____ (=) Height of Column _____

COLUMN OF WATER IN WELL

Gallons per foot of annular space (A.S.)	=	Ø
Column of water or length of A.S. (whichever is less)	x	
Volume of annular space	=	
Gallons per foot of casing	=	
Column of water	x	
Volume of casing	=	
TOTAL VOLUME (A.S. + casing)	=	
Number of volumes to be evacuated	=	
Total volume to be evacuated	=	
TOTAL VOLUME PURGED	650 GPM x 5 MIN. =	3,250 Gallons

Method of purging: Pump in Well

Sample date/time: 5-24-95 @ 1247 Sample number: HIA-11

FIELD PARAMETERS	Begin	End
pH		7.2
Conductivity		710 umhos
Temperature		15°C
	Turbidity	3.21 NTU

Sampler's signature/date: Wm N. Fup 5-24-95

WELL SAMPLING DATA FORM

Well Number: HIA-12 Date: 5-24-95 Time: 1400

Boring diameter: 10" Well casing diameter: —

Annular space length: — Stickup: —

Total depth (TOC) 603' (-) Depth to water (TOC) _____ (=) Height of Column _____

COLUMN OF WATER IN WELL

Gallons per foot of annular space (A.S.)	=	
Column of water or length of A.S. (whichever is less)	x	
Volume of annular space	=	
Gallons per foot of casing	=	
Column of water	x	
Volume of casing	=	
TOTAL VOLUME (A.S. + casing)	=	
Number of volumes to be evacuated	=	
Total volume to be evacuated	=	
TOTAL VOLUME PURGED 650 GPM x 5 min.	=	3250 Gallons

Method of purging: ~~Well no~~ (we) Pump in Well

Sample date/time: 5-24-95 @ 1405 Sample number: HIA-12

FIELD PARAMETERS	Begin	End
pH		7.4
Conductivity		780 umhos
Temperature		15°C
	Turbidity	2.45 NTU

Sampler's signature/date: [signature] 5-24-95

WELL SAMPLING DATA FORM

Well Number: HIA-13 Date: 5-24-95 Time: 1250

Boring diameter: 10" Well casing diameter: —

Annular space length: — Stickup: —

Total depth (TOC) 800' (-) Depth to water (TOC) _____ (=) Height of Column _____

COLUMN OF WATER IN WELL

Gallons per foot of annular space (A.S.)	=	X
Column of water or length of A.S. (whichever is less)	x	
Volume of annular space	=	
Gallons per foot of casing	=	
Column of water	x	
Volume of casing	=	
TOTAL VOLUME (A.S. + casing)	=	
Number of volumes to be evacuated	=	
Total volume to be evacuated	=	
TOTAL VOLUME PURGED 400 GPM x 5 min.	=	2000 Gallons

Method of purging: Pump in Well

Sample date/time: 5-24-95 @ 1255 Sample number: HIA-13

FIELD PARAMETERS	Begin	End
pH		7.1
Conductivity		890 umhos
Temperature		15.5°C
	Turbidity	3.01 NTU

Sampler's signature/date: Warren N. Fop 5-24-95

WELL SAMPLING DATA FORM

Well Number: HIA - 14 Date: 5-22-95 Time: 0950

Boring diameter: 10" Well casing diameter: —

Annular space length: — Stickup: —

Total depth (TOC) 800' (-) Depth to water (TOC) _____ (=) Height of Column _____

COLUMN OF WATER IN WELL

Gallons per foot of annular space (A.S.)	=	X
Column of water or length of A.S. (whichever is less)	x	
Volume of annular space	=	
Gallons per foot of casing	=	
Column of water	x	
Volume of casing	=	
TOTAL VOLUME (A.S. + casing)	=	
Number of volumes to be evacuated	=	
Total volume to be evacuated	=	
TOTAL VOLUME PURGED 380 GPM x 5 min.	=	1,900 Gallons

Method of purging: Pump in Well

Sample date/time: 5-22-95 @ 1000 Sample number: HIA - 14

FIELD PARAMETERS	Begin	End
pH		7.1
Conductivity		425 umhos
Temperature		15°C
	Turbidity	4.22 NTU

Sampler's signature/date: Wm. N. Fox 5-22-95

WELL SAMPLING DATA FORM

Well Number: HIA-17 Date: 6/6/95 Time: 0930

Boring diameter: 10" Well casing diameter: —

Annular space length: — Stickup: —

Total depth (TOC) 700' (-) Depth to water (TOC) _____ (=) Height of Column _____

COLUMN OF WATER IN WELL

Gallons per foot of annular space (A.S.)	=	∅
Column of water or length of A.S. (whichever is less)	x	
Volume of annular space	=	
Gallons per foot of casing	=	
Column of water	x	
Volume of casing	=	
TOTAL VOLUME (A.S. + casing)	=	
Number of volumes to be evacuated	=	
Total volume to be evacuated	=	
TOTAL VOLUME PURGED 9GPM x 2.6 Hours	=	1400 Gallons

Method of purging: Submersible Pump put in well

Sample date/time: 6-6-95 @ 1205 Sample number: HIA-17

FIELD PARAMETERS	Begin	End
pH	7.0	6.8
Conductivity (umHos)	500	400
Temperature (°C)	17	16
Turbidity (NTU)	>200	52.7

Sampler's signature/date: Warren N. Fay 6-6-95 (for Matt VonNeida)

WELL SAMPLING DATA FORM

Well Number: HIA-18 Date: 6-6-95 Time: 1415

Boring diameter: 10" Well casing diameter: —

Annular space length: — Stickup: —

Total depth (TOC) 350' (-) Depth to water (TOC) _____ (=) Height of Column _____

COLUMN OF WATER IN WELL

Gallons per foot of annular space (A.S.)	=	V
Column of water or length of A.S. (whichever is less)	x	
Volume of annular space	=	
Gallons per foot of casing	=	
Column of water	x	
Volume of casing	=	
TOTAL VOLUME (A.S. + casing)	=	
Number of volumes to be evacuated	=	
Total volume to be evacuated 9.5 GPM x 110 m	=	
TOTAL VOLUME PURGED ~~9.5 min x~~	=	1040 g.

Method of purging: Submersible Pump put in well.

Sample date/time: 6-6-95 @ 1620 Sample number: HIA-18

FIELD PARAMETERS	Begin	End
pH	7.3	7.1
Conductivity (umHos)	280	230
Temperature (°C)	12.7	12.6
Turbidity (NTU)	171.7	15.6

Sampler's signature/date: [signature] 6-6-95 (for Matt Von Weide)

WELL SAMPLING DATA FORM

Well Number: MID-04 Date: 6-5-95 Time: 1330

Boring diameter: 10" Well casing diameter: —

Annular space length: — Stickup: —

Total depth (TOC) 450'? (-) Depth to water (TOC) _____ (=) Height of Column _____

COLUMN OF WATER IN WELL

Gallons per foot of annular space (A.S.)	=	X
Column of water or length of A.S. (whichever is less)	x	
Volume of annular space	=	
Gallons per foot of casing	=	
Column of water	x	
Volume of casing	=	
TOTAL VOLUME (A.S. + casing)	=	
Number of volumes to be evacuated	=	
Total volume to be evacuated	=	
TOTAL VOLUME PURGED 500 GPM x 5 min.	=	2500 Gallons

Method of purging: Pump in Well

Sample date/time: 6-5-95 @ 1340 Sample number: MID-04

FIELD PARAMETERS	Begin	End
pH		7.3
Conductivity		390 mmHos
Temperature		20.0° °C
	Turbidity	1.35 NTU

Sampler's signature/date: Warren R. Fox 6-5-95

Residential Wells

WELL SAMPLING DATA FORM

Well Number: RES-01 Date: 6-5-95 Time: 1455

Boring diameter: — Well casing diameter: —

Annular space length: — Stickup: N/A

Total depth (TOC) Unk. (-) Depth to water (TOC) Unk. (=) Height of Column —

COLUMN OF WATER IN WELL

Gallons per foot of annular space (A.S.)	=	X
Column of water or length of A.S. (whichever is less)	x	
Volume of annular space	=	
Gallons per foot of casing	=	
Column of water	x	
Volume of casing	=	
TOTAL VOLUME (A.S. + casing)	=	
Number of volumes to be evacuated	=	
Total volume to be evacuated	=	
TOTAL VOLUME PURGED 10gal/min - 10 minutes	=	100 gallons

Method of purging: Pump in well

Sample date/time: 6-5-95 @ 1505 Sample number: RES-01

FIELD PARAMETERS	Begin	End
pH	X	6.9
Conductivity	X	490 umhos
Temperature	X	23 °C
	Turbidity	2.95 NTU

Sampler's signature/date: Wam M. Fox 6-5-95

WELL SAMPLING DATA FORM

Well Number: RES-02 Date: 6-5-95 Time: 1510

Boring diameter: — Well casing diameter: —

Annular space length: — Stickup: N/A

Total depth (TOC) Unk. (-) Depth to water (TOC) Unk (=) Height of Column X

COLUMN OF WATER IN WELL

Gallons per foot of annular space (A.S.)	=	X
Column of water or length of A.S. (whichever is less)	x	
Volume of annular space	=	
Gallons per foot of casing	=	
Column of water	x	
Volume of casing	=	
TOTAL VOLUME (A.S. + casing)	=	
Number of volumes to be evacuated	=	
Total volume to be evacuated	=	
TOTAL VOLUME PURGED 10 gal/min	=	100 Gallons

Method of purging: Pump in well.

Sample date/time: 6-5-95 @ 1520 Sample number: RES-02

Duplicate Collected here!

FIELD PARAMETERS	Begin	End
pH	X	7.3
Conductivity	X	430 umHos
Temperature	X	26°C
	Turbidity	6.01 NTU

Sampler's signature/date: Warren Fox 6-5-95

WELL SAMPLING DATA FORM

Well Number: RES-03 Date: 5-23-95 Time: ~~1055~~ 1535

Boring diameter: Unk. Well casing diameter: Unk

Annular space length: Unk Stickup: Unk.

Total depth (TOC) — (-) Depth to water (TOC) — (=) Height of Column —

COLUMN OF WATER IN WELL

Gallons per foot of annular space (A.S.)	=	X
Column of water or length of A.S. (whichever is less)	x	
Volume of annular space	=	
Gallons per foot of casing	=	
Column of water	x	
Volume of casing	=	
TOTAL VOLUME (A.S. + casing)	=	
Number of volumes to be evacuated	=	
Total volume to be evacuated	=	
TOTAL VOLUME PURGED 10 gal/min	=	100 gallons

Method of purging: Pump on Well

Sample date/time: 5-23-95 @ ~~1105~~ 1545 Sample number: RES-03

FIELD PARAMETERS	Begin	End
pH	X	7.2
Conductivity	X	340 umhos
Temperature	X	17°C
	Turbidity	3.62 NTU

Sampler's signature/date: [illegible] 5-23-95

WELL SAMPLING DATA FORM

Well Number: RES-04 Date: 6-5-95 Time: 1055

Boring diameter: Unk → Well casing diameter: —

Annular space length: — Stickup: —

Total depth (TOC) — (-) Depth to water (TOC) — (=) Height of Column —

COLUMN OF WATER IN WELL

Gallons per foot of annular space (A.S.)	=	φ
Column of water or length of A.S. (whichever is less)	x	
Volume of annular space	=	
Gallons per foot of casing	=	
Column of water	x	
Volume of casing	=	
TOTAL VOLUME (A.S. + casing)	=	
Number of volumes to be evacuated	=	
Total volume to be evacuated	=	
TOTAL VOLUME PURGED 10gal/min.	=	100 gallons

Method of purging: Pump in well

Sample date/time: 6-5-95 @ 1105 Sample number: RES-04

FIELD PARAMETERS	Begin	End
pH	φ	7.5
Conductivity	φ	280 umhos
Temperature	φ	19°C
	Turbidity	4.25 NTU

Sampler's signature/date: [illegible] 6-5-95

WELL SAMPLING DATA FORM

Well Number: RES-05 Date: 6-5-95 Time: 1635

Boring diameter: Unk → Well casing diameter: —

Annular space length: — Stickup: —

Total depth (TOC) — (-) Depth to water (TOC) — (=) Height of Column —

COLUMN OF WATER IN WELL

Gallons per foot of annular space (A.S.)	=	X
Column of water or length of A.S. (whichever is less)	x	
Volume of annular space	=	
Gallons per foot of casing	=	
Column of water	x	
Volume of casing	=	
TOTAL VOLUME (A.S. + casing)	=	
Number of volumes to be evacuated	=	
Total volume to be evacuated	=	
TOTAL VOLUME PURGED 10 gal/min	=	100 gallons

Method of purging: Pump in Well

Sample date/time: 6-5-95 @ 1645 Sample number: RES-05

FIELD PARAMETERS	Begin	End
pH	X	7.4
Conductivity	X	420 umHos
Temperature	X	24°C
	Turbidity	4.7 NTU

Sampler's signature/date: [illegible] 6-5-95

WELL SAMPLING DATA FORM

Well Number: RES-06 Date: 5-22-95 Time: 1415

Boring diameter: Unk → Well casing diameter: —

Annular space length: — Stickup: —

Total depth (TOC) — (-) Depth to water (TOC) — (=) Height of Column —

COLUMN OF WATER IN WELL

Gallons per foot of annular space (A.S.)	=	X
Column of water or length of A.S. (whichever is less)	x	
Volume of annular space	=	
Gallons per foot of casing	=	
Column of water	x	
Volume of casing	=	
TOTAL VOLUME (A.S. + casing)	=	
Number of volumes to be evacuated	=	
Total volume to be evacuated	=	
TOTAL VOLUME PURGED 10gal/min →	=	100 gallons

Method of purging: Pump in well

Sample date/time: 5-22-95 @ 1425 Sample number: RES-06

FIELD PARAMETERS	Begin	End
pH	X	7.4
Conductivity	X	800 mmhos
Temperature	X	16.5°C
	Turbidity	25.11 NTU

Sampler's signature/date: Warren N. Zup 5-22-95

WELL SAMPLING DATA FORM

Well Number: RES-07 Date: 6-5-95 Time: 1705

Boring diameter: Unk → Well casing diameter: —

Annular space length: — Stickup: —

Total depth (TOC) — (-) Depth to water (TOC) — (=) Height of Column —

COLUMN OF WATER IN WELL

Gallons per foot of annular space (A.S.)	=	X
Column of water or length of A.S. (whichever is less)	x	
Volume of annular space	=	
Gallons per foot of casing	=	
Column of water	x	
Volume of casing	=	
TOTAL VOLUME (A.S. + casing)	=	
Number of volumes to be evacuated	=	
Total volume to be evacuated	=	
TOTAL VOLUME PURGED 10 gal/min.	=	100 gallons

Method of purging: Pump in Well

Sample date/time: 6-5-95 @ 1715 Sample number: RES-07

FIELD PARAMETERS	Begin	End
pH	X	7.4
Conductivity	X	330 umhos
Temperature	X	18 °C
Turbidity		1.75 NTU

Sampler's signature/date: Warren N. Fay 6-5-95

WELL SAMPLING DATA FORM

Well Number: RES-08 Date: 6-5-95 Time: 1120

Boring diameter: Unknown → Well casing diameter: —

Annular space length: — Stickup: —

Total depth (TOC) — (-) Depth to water (TOC) — (=) Height of Column —

COLUMN OF WATER IN WELL

Gallons per foot of annular space (A.S.)	=	X
Column of water or length of A.S. (whichever is less)	x	
Volume of annular space	=	
Gallons per foot of casing	=	
Column of water	x	
Volume of casing	=	
TOTAL VOLUME (A.S. + casing)	=	
Number of volumes to be evacuated	=	
Total volume to be evacuated	=	
TOTAL VOLUME PURGED 10gal/minutes	≈	90 gallons

Method of purging: Pump in Well

Sample date/time: 6-5-95 @ 1129 Sample number: RES-08

FIELD PARAMETERS	Begin	End
pH	X	7.1
Conductivity	X	120 umhos
Temperature	X	19°C
	Turbidity	1.35 NTU.

Sampler's signature/date: [illegible] 6-5-95

Appendix J
Slug Test Data

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ATTACHMENT

J.1 Slug Test Calculations

J.1 INTRODUCTION

In order to evaluate the hydraulic conductivity (K) of the overburden and the bedrock in the different areas of the Site, slug tests were conducted on the 2-inch shallow and intermediate monitoring wells installed by ERM. The areas where the slug tests were performed included the Main Building/Lagoon Area, the Runway Area, and the North Base Landfill. The deep bedrock wells, the capture zone wells, and the sentinel wells were not slug tested.

The following monitoring wells were tested:

ERM-1S	ERM-14I	ERM-28S
ERM-1I	ERM-15I	ERM-29S
ERM-2S	ERM-16S	ERM-29I
ERM-3S	ERM-16I	ERM-30S
ERM-5S	ERM-17S	ERM-30I
ERM-10I	ERM-17I	ERM-31I
ERM-11S	ERM-18S	ERM-32I
ERM-11I	ERM-18I	ERM-33I
ERM-12S	ERM-19S	ERM-34S
ERM-12I	ERM-20S	ERM-34I
ERM-13S	ERM-20I	ERM-35S
ERM-13I	ERM-27S	ERM-35I
ERM-14S		

J.2 GENERAL APPROACH

The slug tests were performed by effecting an "instantaneous" rise or drop in the water level in the well using a solid displacement slug. The volume of the slug was selected to effect an initial rise or drop in water level between 1 and 3 feet. The water levels in the wells were monitored using electronic water level recorders.

Both falling and rising head tests were conducted at each of the monitoring wells. Falling head tests were performed by introducing the displacement slug into the well thereby effecting a rise in water level. Rising head tests were performed by removing the displacement slug thereby causing a drop in water level.

For each well, the radius of the well casing (Rc), radius of the boring (Rw), screen diameter, screen length, and depth of screen interval relative to the initial water level were determined from field measurements and/or as-built construction details. All depths are reported in feet below grade.

J.3 PROCEDURES

J.3.1 Falling Head Test

The slug was lowered inside the well casing to just above the static water level, then the electronic water level recorder started, and after the recorder has run for approximately 2 seconds, the slug was quickly lowered into the well.

Hand water level measurements were taken several times prior to the start of the test to ensure a reliable static water level measurement, and during the test to validate the data logger readings. The pressure transducer was installed into the well at least 15 minutes prior to the start of the test. This allows the transducer's temperature to equilibrate with the water in the well and allows the transducer cable to stretch. After 15 minutes, the data logger was connected and the water level reference was set. The data logger was programmed to collect water level measurements on a logarithmic time scale.

The test was considered to be completed when the well had recovered to within 0.2 feet of the static water level (approximately 90% recovery i.e. the remaining displacement is less than 0.1 times the predicted initial replacement). For slowly recovering wells the recovery data was plotted as a semi-logarithmic type graph: displacement (logarithmic y-axis) versus time (arithmetic x-axis) and a straight line fit to the data. The approximate time for recovery was determined from the graph. If it appeared that recovery to 50% of the initial displacement would require more than 8 hours, the hydraulic conductivity at the location was obviously very low, a qualitative observation sufficient for the intended evaluation, Thus, the test of very slowly recovering wells was stopped after 30 minutes.

J.3.2 RISING HEAD TEST

Following the completion of the falling head test, a rising head test or slug out test was conducted in a similar manner. This test is only valid if the well had fully recovered after the falling head test. At the beginning of the test, the data logger was reset to record on a logarithmic time scale.

Even though the water levels were monitored with an electronic water level, hand measurements were also collected to validate the instrument readings and monitor the progress of the test. A static water level was measured just prior to the start of the test.

J.4 DATA ANALYSIS

The wells at the Site partially penetrate the aquifer, and conditions in any given water bearing zone may be confined, semi-confined, or unconfined. The Bouwer & Rice Method is applicable to fully or partially penetrating wells in unconfined homogeneous porous media. This method assumes that the aquifer exhibits no storage. The Cooper-Papadopulos method is applicable to fully penetrating wells in confined homogeneous porous media. The Cooper-Papadopulos method incorporates the effect of aquifer storage.

Most of the slug tests conducted on the monitoring wells at the Middletown Airfield Site were analyzed using the Bouwer and Rice method. The Bouwer and Rice method solves for the hydraulic conductivity, K, the following equation:

$$K = [rc2 \ln(R_e/r_w)] \,/\, 2L_e\,[(1/t)\,(\ln y_o/y_t)] \qquad \text{(Equation 1)}$$

where y_o = y at time zero and
y_t = y at time t

Since y_t and t are the only variables in Equation (1), a plot of log(y) versus t must show a straight line (Bouwer, 1989). K is calculated based on the slope of the straight line. The results for well ERM-1S, a nearly ideal data set, and the straight line curve fit is provided in Attachment J.1.

J.4.1 *Deviations of the Real Data from the Bower & Rice Straight Line Fit*

As a slug test progresses, the drawdown of the ground water table around the well becomes increasingly significant and the points in the semi-logarithmic plot begin to deviate from the straight line for large t and small y (Bouwer, 1989).

In the case of gravel pack drainage, a double line anomaly will be observed in the semi-logarithmic plot of y vs. t (Attachment J.1). In a rising head slug test, the first straight line portion of the plot is a result of rapid drainage of the gravel pack or developed zone around the well into the well casing/screen. When the water level in the permeable zone has equilibrated with the water level in the well itself, the actual "slug test" of the aquifer material begins. The data exhibit a second, less steep, straight line. This second straight line is indicative of the flow from the aquifer filling both the well casing and gravel pack around the casing.

Only wells with static water levels within the screened interval were considered for gravel pack drainage analyses. As indicated on each calculation sheet, those were wells: ERM-1S, ERM-3S, ERM-18S, ERM-19S, and ERM-35S. The second straight line portions of the plots for these wells were used to calculate K. As an example, ERM-1S, as shown in Attachment J.1, was analyzed using the second portion of the semi-logarithmic plot with a resulting K value of about 13 ft/day. Analysis based on the first portion of the plot would result in a much higher K value, reflective of flow through the gravel pack.

The data for several of the wells (ERM-12I and ERM-13I) plot as slightly curved lines on semi-logarithmic paper rather than straight lines as predicted by Bouwer & Rice, which suggests that the effects of aquifer storage were important. These data were analyzed using the Cooper-Papadopulos method by plotting y versus log t, the resultant curve matched to one of a series of type curves, depending on the degree of aquifer storativity. Plotting the match curves from the Cooper-Papadopulos method on the log y vs. t plot used for Bouwer & Rice results in curved lines similar to those observed for the above mentioned wells, indicating the effect of aquifer storage not accounted for by the Bouwer & Rice method.

J.4.2 SUMMARY AND CONCLUSIONS

In summary, it is important to note the basis on which the slug test analyses methods were developed and the validity of the model description of the well.

- The Bouwer & Rice Method, used for the slug test evaluations discussed herein, is applicable to fully or partially penetrating wells in unconfined homogeneous porous media. The wells tested were not in porous media but rather in bedrock. Therefore, they do not meet the basic assumptions of the method, however, the results appear consistent among wells screened in similar zones of the aquifer, and therefore the relative results are likely reasonable.
- The Cooper-Papadopulos method is applicable to fully penetrating wells in confined homogeneous porous media. However, use of the Cooper-Papadopulos method appears to be more appropriate for those wells exhibiting the effect of aquifer storage as discussed above. The wells at the Site partially penetrate the aquifer, and conditions in any given water bearing zone may be confined, semi-confined, or unconfined.

Most of the slug tests were analyzed using the Bouwer and Rice method. This method assumes the aquifer is unconfined and there is no aquifer storage. Two wells, ERM-12I and ERM-13I, showed evidence of aquifer storage. Therefore, the slug tests performed for these two wells was analyzed using the Cooper-Papadopulos method.

A summary of the slug test results for each of the different areas is presented below. Table J-1 presents the K values determined for the shallow and intermediate depth wells tested. The test data and slug test calculations for each well are provided in Attachment J.1.

Main Building/Lagoon Area

Intermediate – 0.04 ft/day (ERM-33I) to 60.78 ft/day (ERM-1I)

Shallow – 0.12 ft/day (ERM-28S) to 139.70 ft/day (ERM-34S)

Runway Area

Intermediate – 2.52 ft/day (ERM-20I)
This is the only intermediate well in this area that had valid slug test data. The data from well ERM-18I could not be analyzed due to possible interference from a nearby pumping well.

Shallow – 12.01 ft/day (ERM-19S) to 272.49 ft/day (ERM-20S)

North Base Landfill

Intermediate – 0.05 ft/day (ERM-12I) to 8.76 ft/day (ERM-16I)

Shallow – 0.02 ft/day (ERM-14S) to 3.23 ft/day (ERM-12S)

It should be recognized in the application of the test results that slug test data provide order of magnitude hydraulic conductivity values. Application of these results are most useful for comparison of relative conductivity in different zones of the aquifer, and are useful for estimating relative water transmission through the various aquifer zones, and for conceptual remedial evaluations. However, designs requiring better than order of magnitude ground water flow rates should not be based on slug test results.

Table J-1
Hydraulic Conductivity Values - ERM Wells
Middletown Airfield Site
Middletown, Pennsylvania

Well	Calculated K Value (ft/day) Slug In	Calculated K Value (ft/day) Slug Out	Remarks
ERM-1S	9.87	13.18	
ERM-1I	60.78	49.42	Plots presented in arithmetic form to show data fit.
ERM-2S	-	18.88	The Slug In data could not be analyzed due to data logger malfunction.
ERM-3S	-	8.09	Slug Out Data is more representative of the formation based on development yield
ERM-5S	113.16	98.67	Plots presented in arithmetic form to show data fit.
ERM-10I	0.64	0.64	
ERM-11S	-	0.04	The Slug In data could not be analyzed
ERM-11I	0.46	0.46	
ERM-12S	3.23	3.23	
ERM-12I	0.07	0.05	
ERM-13S	1.03	1.06	
ERM-13I	4.42	4.62	
ERM-14S	0.03	0.02	
ERM-14I	1.69	1.69	
ERM-15I	1.12	1.12	
ERM-16S	0.36	0.36	
ERM-16I	8.76	8.76	
ERM-17S	0.95	0.95	
ERM-17I	1.08	1.04	

Table J-1 (Continued)
Hydraulic Conductivity Values - ERM Wells
Middletown Airfield Site
Middletown, Pennsyvlvania

Well	Calculated K Value (ft/day) Slug In	Calculated K Value (ft/day) Slug Out	Remarks
ERM-18S	27.22	27.34	
ERM-18I	-	-	Data was uninterpretable
ERM-19S	-	12.01	Difference caused by the screen bridging different materials.
ERM-20S	-	272.49	The Slug In data could not be analyzed due to data logger malfunction.
ERM-20I	2.52	2.10	
ERM-27S	25.60	64.00	
ERM-28S	0.13	0.12	
ERM-29S	-	2.38	The Slug In data could not be analyzed due to data logger malfunction.
ERM-29I	2.02	1.73	
ERM-30S	2.42	1.93	
ERM-30I	3.81	3.75	
ERM-3II	0.03	0.02	
ERM-32I	1.81	2.00	
ERM-33I	0.06	0.04	
ERM-34S	139.70	131.72	
ERM-34I	35.36	30.45	Plots presented in arithmetic form to show data fit.
ERM-35S	17.70	-	The Slug Out data was not interpretable
ERM-35I	1.70	1.67	

J.5 REFERENCES

Bouwer Herman, and Rice, R. C. A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers With Completely or Partially Penetrating Wells, Water Resources Research, Vol. 12, No. 3, p. 423-428.

Bouwer Herman. The Bouwer and Rice Slug Test - An Update, Ground Water Journal, Vol. 27, No. 3, May-June 1989, p.15-20.

Attachment J.1
Slug Test Calculations

Bouwer and Rice Slug Test Calculations *

Well ERM-1S — Case 3: Gravel Pack Drainage
Slug Out — *K gravel pack >> K formation*
Water Level Below Top of the Gravel Pack

Definition Of Variables:

D : Saturated Aquifer Thickness
H : Depth To the Bottom of the Gravel Pack minus the Static Depth to Water
L = H for Well with Gravel Pack Drainage
A & B : Well Geometry Factors - from Bouwer & Rice, Figure 3
rc : Inner Radius of the Well casing
rw : Radius of the Gravel Pack
Yo : Water Level Displacement at time = 0
t : Arbitrary Time from Recovery vs Time Plot
Yt : Water Level Displacement at time = t

Determined Values for Variables:

D =	100	feet		
H =	6.13	feet	Notes:	
L =	6.13	feet	L = H	
A =	2		L/rw =	16
B =	0.3			
rw =	0.375	feet		
rc =	0.083	feet		
Yo =	0.35	feet		
t =	0.85	minutes		
Yt =	0.1	feet		

Calculations

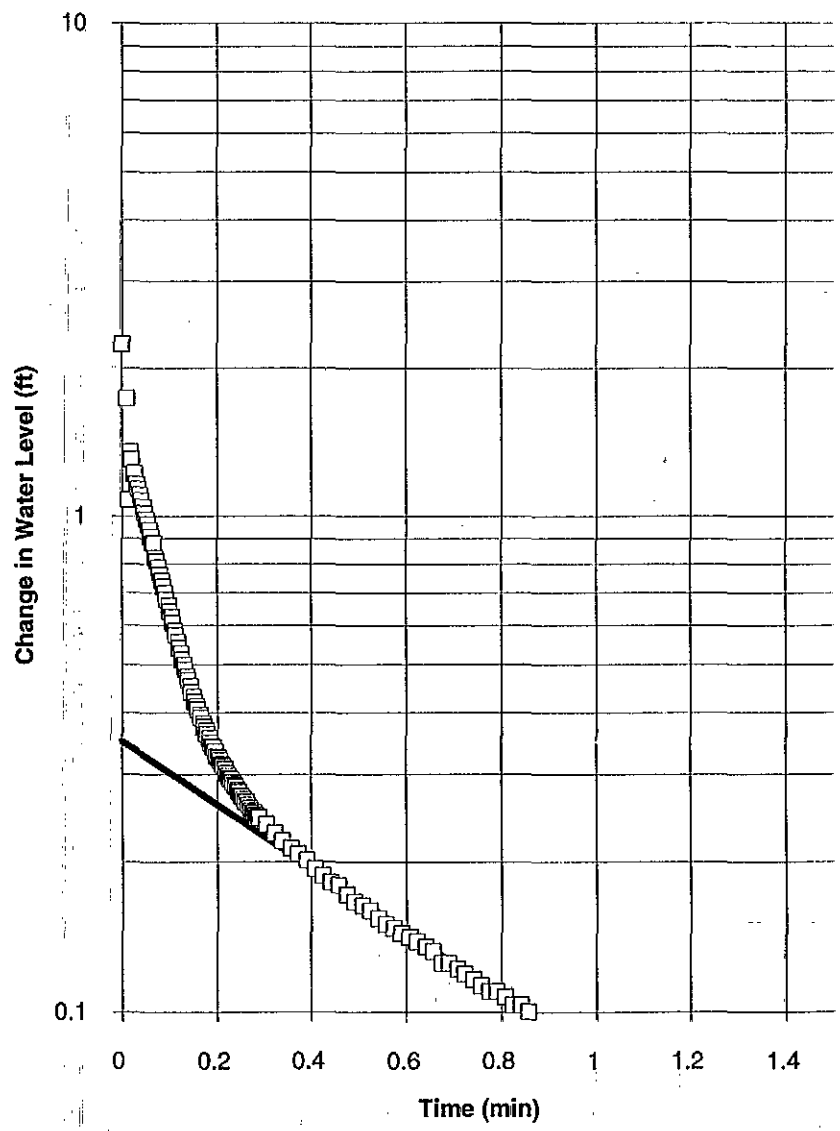
(1/t)*ln(Yo/Yt) = 1.4738

ln(Re/rw) = 1/[(1.1/ln(H/rw)+(A+Bln((D-H)/rw)))/(L/rw)]
= 1.6197

K = [(rc*rc)+0.3*(rw*rw-rc*rc)]*ln(Re/rw)*(1/t)*ln(Yo/Yt))/(2L)
= 13.18 feet/day = 4.65E-03 cm/sec

* Reference: Bouwer,H and Rice,R.C, 1976: A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers With Completely or Partially Penetrating Wells: Water Res. Res. V.12. No. 3

THE ERM GROUP



Bouwer and Rice Slug Test Calculations *

Well ERM-1S — Case 3: Gravel Pack Drainage
Slug In — K gravel pack >> K formation
Water Level Below Top of the Gravel Pack

Definition Of Variables:

D : Saturated Aquifer Thickness
H : Depth To the Bottom of the Gravel Pack minus the Static Depth to Water
L = H for Well with Gravel Pack Drainage
A & B : Well Geometry Factors - from Bouwer & Rice, Figure 3
rc : Inner Radius of the Well casing
rw : Radius of the Gravel Pack
Yo : Water Level Displacement at time = 0
t : Arbitrary Time from Recovery vs Time Plot
Yt : Water Level Displacement at time = t

Determined Values for Variables:

D =	100	feet	
H =	6.13	feet	Notes:
L =	6.13	feet	L = H
A =	2		L/rw = 16
B =	0.3		
rw =	0.375	feet	
rc =	0.083	feet	
Yo =	0.27	feet	
t =	0.9	minutes	
Yt =	0.1	feet	

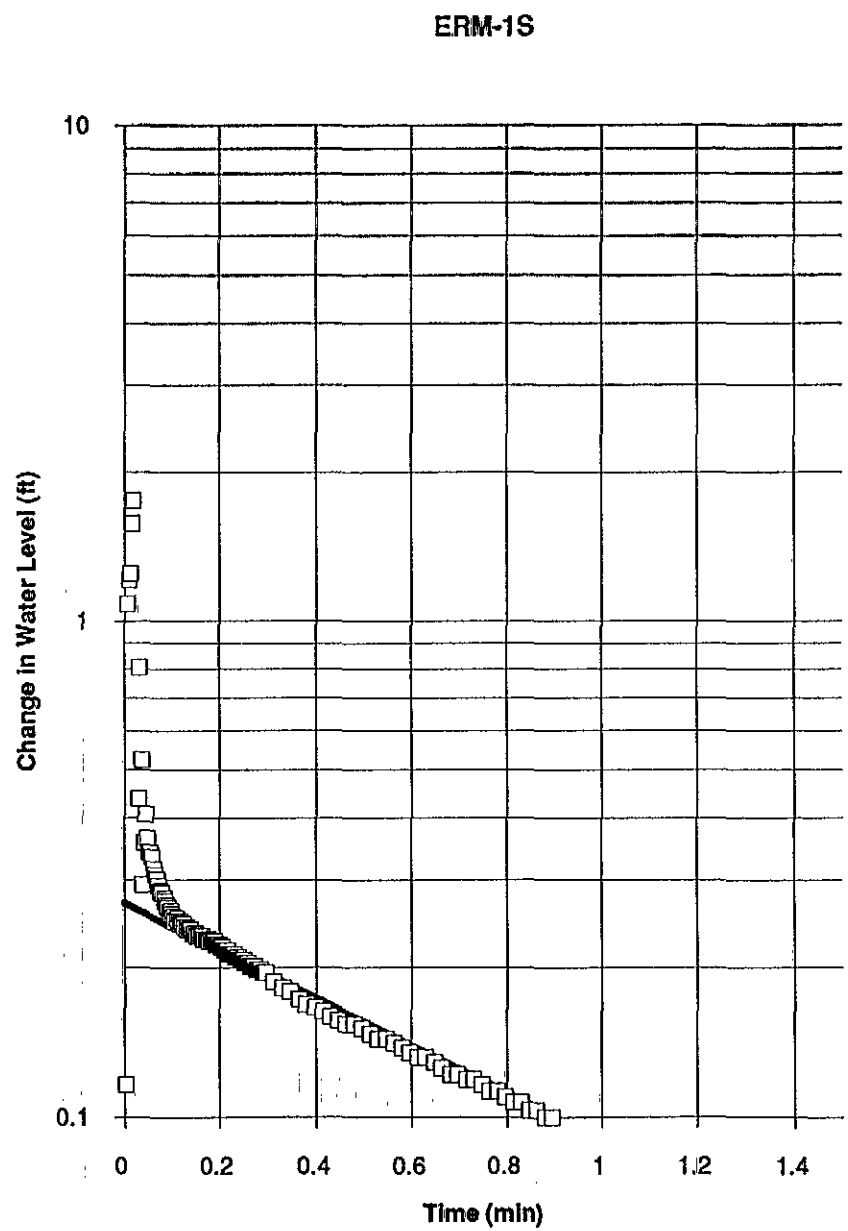
Calculations

(1/t)*ln(Yo/Yt) = 1.1036

ln(Re/rw) = 1/[(1.1/ln(H/rw)+(A+Bln((D-H)/rw)))/(L/rw)]
= 1.6197

K = [(rc*rc)+0.3*(rw*rw-rc*rc)]*ln(Re/rw)*(1/t)*ln(Yo/Yt))/(2L)
= 9.87 feet/day = 3.48E-03 cm/sec

* Reference: Bouwer,H and Rice,R.C, 1976: A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers With Completely or Partially Penetrating Wells: Water Res. Res. V.12. No. 3



Bouwer and Rice Slug Test Calculations *

Well ERM-1S
Slug Out

Case 3: Gravel Pack Drainage
K gravel pack >> K formation
Water Level Below Top of the Gravel Pack

Definition Of Variables:

D : Saturated Aquifer Thickness
H : Depth To the Bottom of the Gravel Pack minus the Static Depth to Water
L = H for Well with Gravel Pack Drainage
A & B : Well Geometry Factors - from Bouwer & Rice, Figure 3
rc : Inner Radius of the Well casing
rw : Radius of the Gravel Pack
Yo : Water Level Displacement at time = 0
t : Arbitrary Time from Recovery vs Time Plot
Yt : Water Level Displacement at time = t

Determined Values for Variables:

D =	100	feet		
H =	6.13	feet	Notes:	
L =	6.13	feet	L = H	
A =	2		L/rw =	16
B =	0.3			
rw =	*0.375*	*feet*		
rc =	0.083	feet		
Yo =	0.35	feet		
t =	0.85	minutes		
Yt =	0.1	feet		

Calculations

(1/t)*ln(Yo/Yt) = 1.4738

ln(Re/rw) = 1/[(1.1/ln(H/rw)+(A+Bln((D-H)/rw)))/(L/rw)]
= 1.6197

K = [(rc*rc)+0.3*(rw*rw-rc*rc)]*ln(Re/rw)*(1/t)*ln(Yo/Yt))/(2L)
= 13.18 feet/day = 4.65E-03 cm/sec

* Reference: Bouwer,H and Rice,R.C, 1976: A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers With Completely or Partially Penetrating Wells: Water Res. Res. V.12. No. 3

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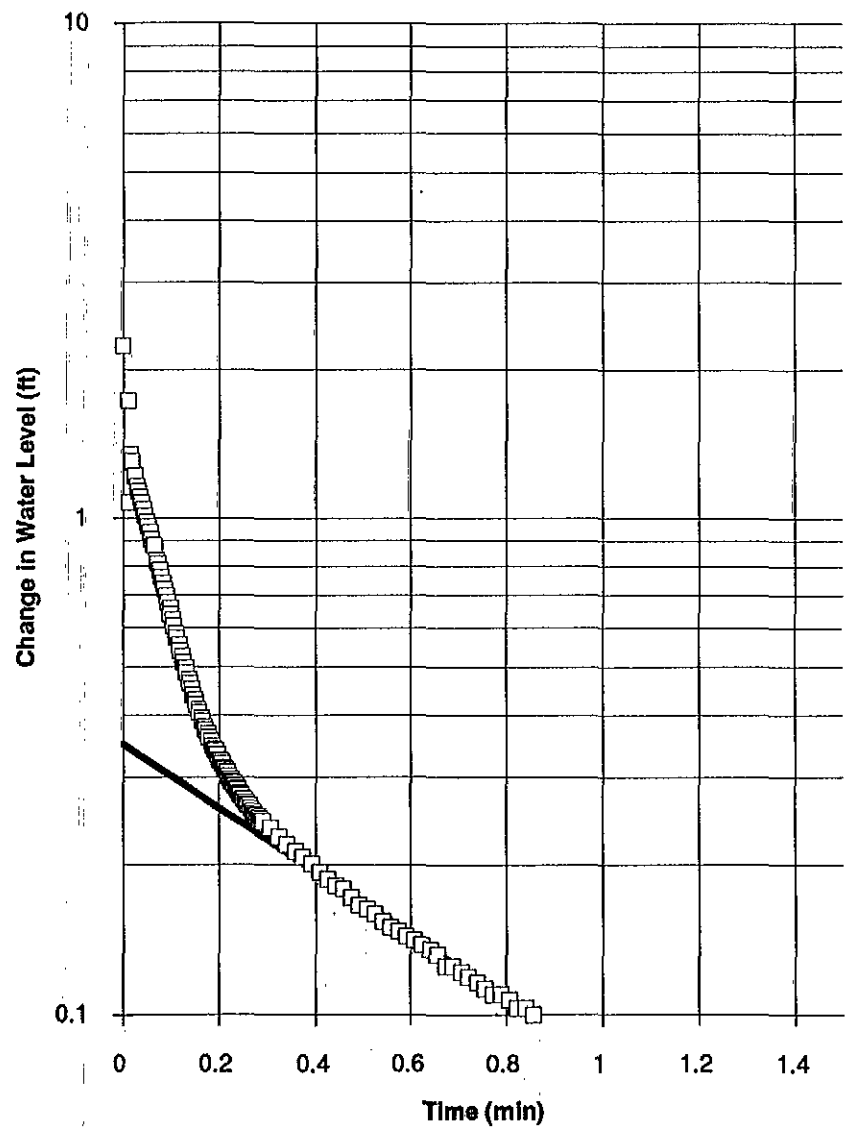

Bouwer and Rice Slug Test Calculations *

Well ERM-1I — Case 5: Well Penetrates to the Aquifer Bottom
Slug In — K gravel pack ≈ K formation
No Gravel Pack Drainage

Definition Of Variables:

D : Saturated Aquifer Thickness
H : Depth of Water in the Well
H = Static Water Elev. - Elev. of Well Bottom
L : Length of Screen Below Water Table
Note: L = H if Water level is Below the Top of the Screen
C : Well Geometry Factor - from Bouwer & Rice, Figure 3
rc : Inner Radius of the Well casing
rw : Radius of the Gravel Pack
Yo : Water Level Displacement at time = 0
t : Arbitrary Time from Recovery vs Time Plot
Yt : Water Level Displacement at time = t

Determined Values for Variables:

D =	91	feet	
H =	91	feet	Notes:
L =	24.6	feet	H = D for this analysis
C =	8.5		rw not used in this analusis
rw =	0.333	feet	L/rc = 296
rc =	0.083	feet	
Yo =	2.25	feet	
t =	0.22	minutes	
Yt =	1E-05	feet	

Calculations

(1/t)*ln(Yo/Yt) = 56.018

ln(Re/rc) = 1/(1.1/ln(H/rc)+C/(L/rc))
= 5.3814

K = (rc*rc*ln(Re/rc)*(1/t)*ln(Yo/Yt))/(2L)
= 60.78 feet/day = 2.1 E-02 cm/sec

* Reference: Bouwer,H and Rice,R.C, 1976: A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers With Completely or Partially Penetrating Wells: Water Res. Res. V.12. No. 3

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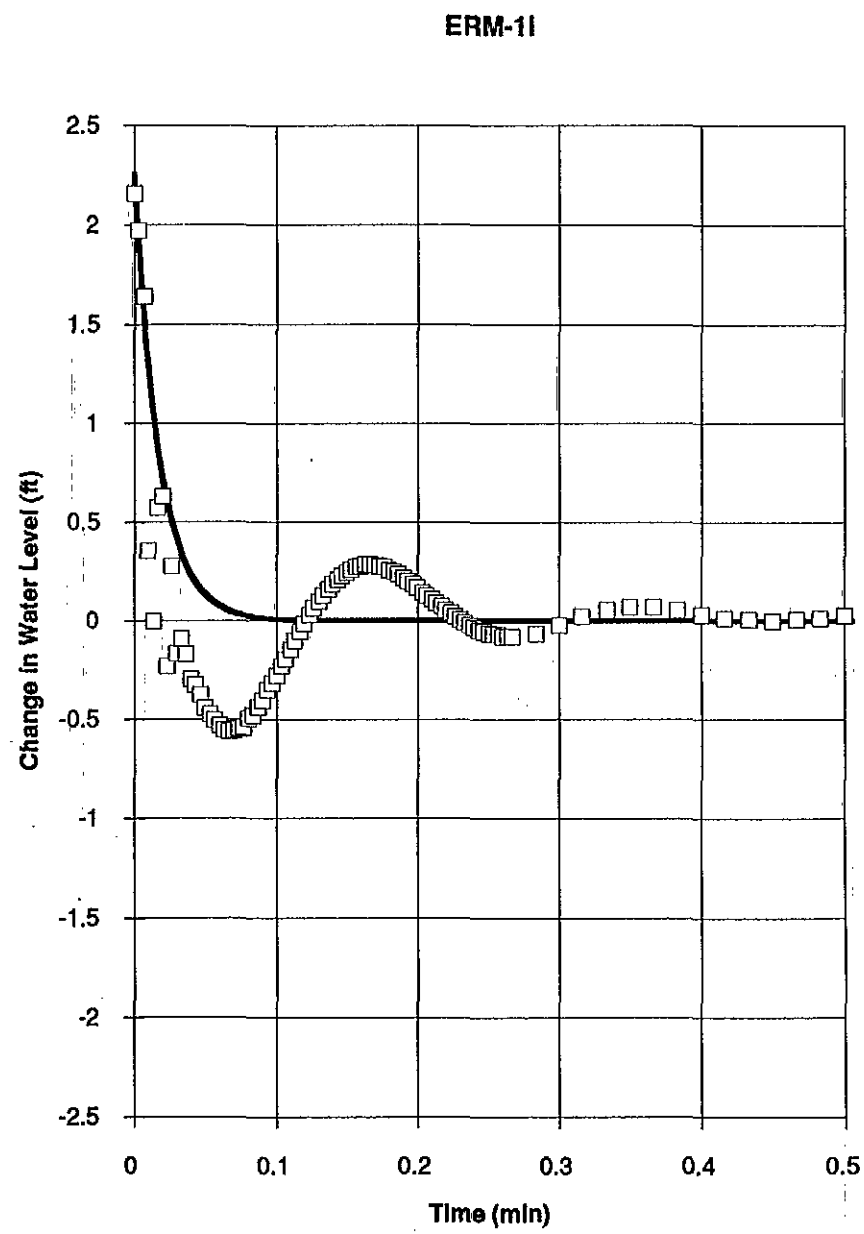


Bouwer and Rice Slug Test Calculations *

Well ERM-1I — Case 5: Well Penetrates to the Aquifer Bottom
Slug Out — K gravel pack ≈ K formation
No Gravel Pack Drainage

Definition Of Variables:

D : Saturated Aquifer Thickness
H : Depth of Water in the Well
H = Static Water Elev. - Elev. of Well Bottom
L : Length of Screen Below Water Table
Note: L = H if Water level is Below the Top of the Screen
C : Well Geometry Factor - from Bouwer & Rice, Figure 3
rc : Inner Radius of the Well casing
rw : Radius of the Gravel Pack
Yo : Water Level Displacement at time = 0
t : Arbitrary Time from Recovery vs Time Plot
Yt : Water Level Displacement at time = t

Determined Values for Variables:

D =	91	feet	
H =	91	feet	Notes:
L =	24.6	feet	H = D for this analysis
C =	8.5		rw not used in this analusis
rw =	0.333	feet	L/rc = 296
rc =	0.083	feet	
Yo =	2.25	feet	
t =	0.22	minutes	
Yt =	0.0001	feet	
	0		

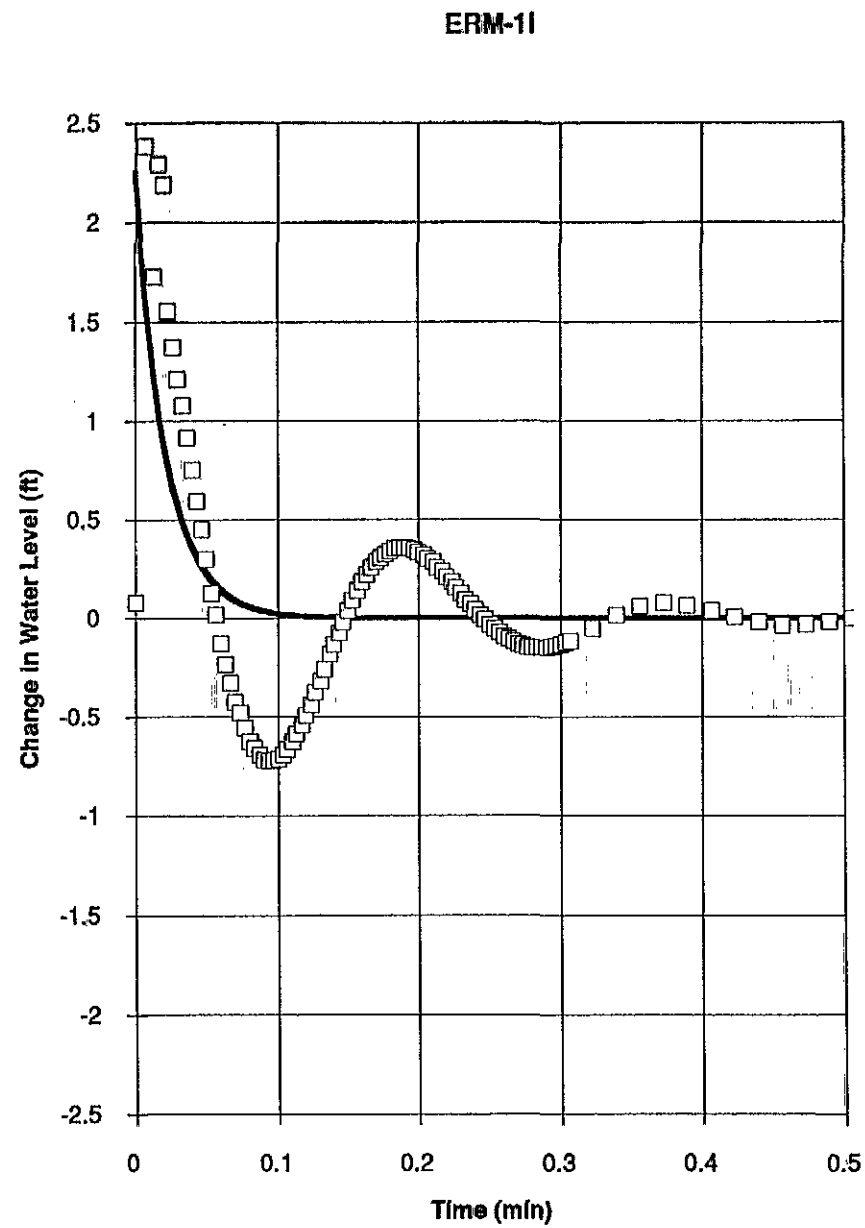
Calculations

(1/t)*ln(Yo/Yt) = 45.551

ln(Re/rc) = 1/(1.1/ln(H/rc)+C/(L/rc))
= 5.3814

K = (rc*rc*ln(Re/rc)*(1/t)*ln(Yo/Yt))/(2L)
= 49.42 feet/day = 1.7 E-02 cm/sec

* Reference: Bouwer,H and Rice,R.C, 1976: A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers With Completely or Partially Penetrating Wells: Water Res. Res. V.12. No. 3



Bouwer and Rice Slug Test Calculations *

Well ERM-2S — Case 2:
Slug Out — K gravel pack = K formation
No Gravel Pack Drainage

Definition Of Variables:

D : Saturated Aquifer Thickness
H : Depth of Water in the Well
H = Static Water Elev. - Elev. of Well Bottom
L : Length of screen Below Water Table
Note: L = H if Water level is Below the Top of the Screen
A & B : Well Geometry Factors - from Bouwer & Rice, Figure 3
rc : Inner Radius of the Well casing
rw : Radius of the Gravel Pack
Yo : Water Level Displacement at time = 0
t : Arbitrary Time from Recovery vs Time Plot
Yt : Water Level Displacement at time = t

Determined Values for Variables:

D =	100	feet	
H =	10.3	feet	Notes:
L =	10.3	feet	rw not used in Case 2 calculations
A =	4.5		L/rc = 124
B =	0.76		
rw =	0.5	feet	
rc =	0.083	feet	
Yo =	2.25	feet	
t =	0.4	minutes	
Yt =	0.02	feet	

Calculations

(1/t)*ln(Yo/Yt) = 11.807

ln(Re/rc) = 1/(1.1/ln(H/rc)+(A+B*ln((D-H)/rc))/(L/rc))
= 3.3203

K = (rc*rc*ln(Re/rc)*(1/t)*ln(Yo/Yt))/(2L)
= 18.88 feet/day = 6.66E-03 cm/sec

* Reference: Bouwer,H and Rice,R.C, 1976: A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers With Completely or Partially Penetrating Wells: Water Res. Res. V.12. No. 3

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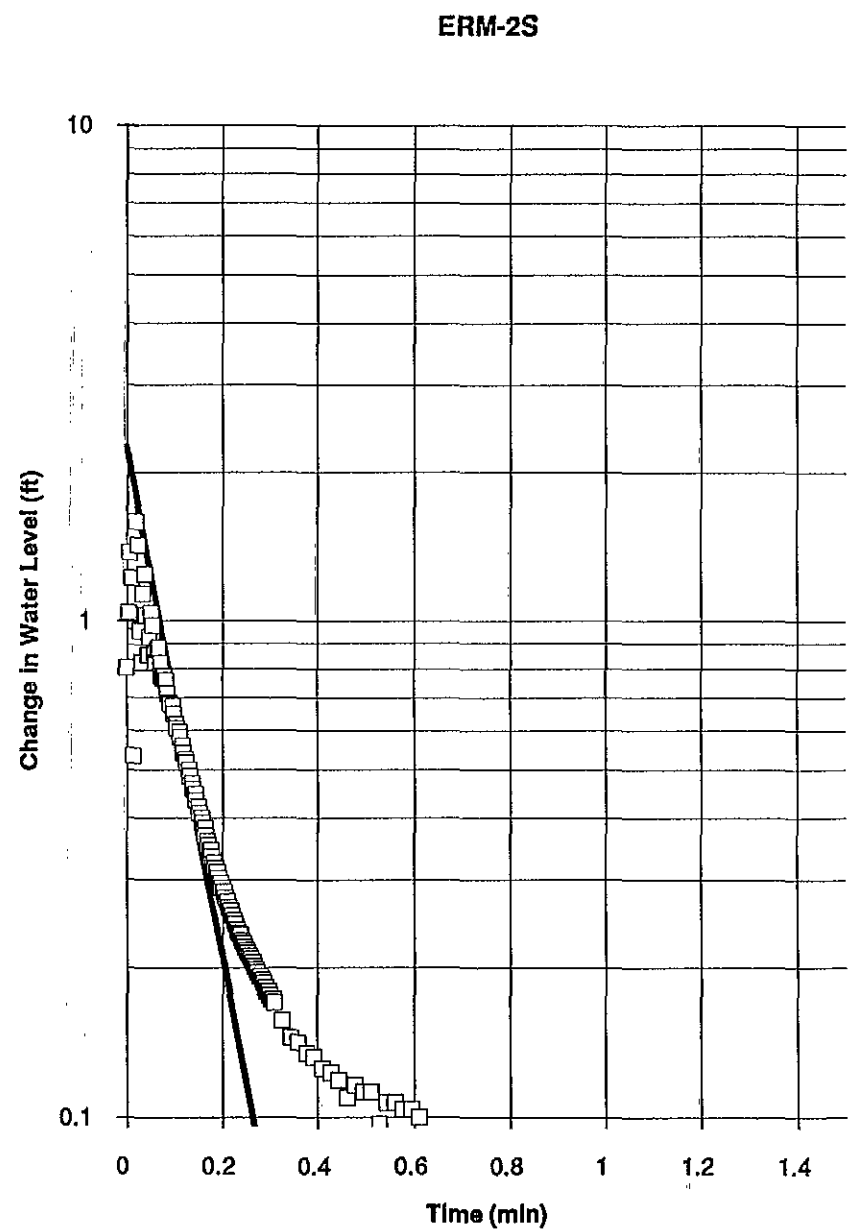

Bouwer and Rice Slug Test Calculations *

Well ERM-3S — Case 3: Gravel Pack Drainage
Slug Out — K gravel pack >> K formation
Water Level Below Top of the Gravel Pack

Definition Of Variables:

D : Saturated Aquifer Thickness
H : Depth To the Bottom of the Gravel Pack minus the Static Depth to Water
L = H for Well with Gravel Pack Drainage
A & B : Well Geometry Factors - from Bouwer & Rice, Figure 3
rc : Inner Radius of the Well casing
rw : Radius of the Gravel Pack
Yo : Water Level Displacement at time = 0
t : Arbitrary Time from Recovery vs Time Plot
Yt : Water Level Displacement at time = t

Determined Values for Variables:

D =	100	feet	
H =	4.75	feet	Notes:
L =	4.75	feet	L = H
A =	1.8		L/rw = 10
B =	0.25		
rw =	0.5	feet	
rc =	0.083	feet	
Yo =	1.3	feet	
t =	4.7	minutes	
Yt =	0.1	feet	

Calculations

(1/t)*ln(Yo/Yt) = 0.5457

ln(Re/rw) = 1/[(1.1/ln(H/rw)+(A+Bln((D-H)/rw)))/(L/rw)]
= 1.2251

K = [(rc*rc)+0.3*(rw*rw-rc*rc)]*ln(Re/rw)*(1/t)*ln(Yo/Yt))/(2L)
= 8.09 feet/day = 2.85E-03 cm/sec

* Reference: Bouwer,H and Rice,R.C, 1976: A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers With Completely or Partially Penetrating Wells: Water Res. Res. V.12. No. 3

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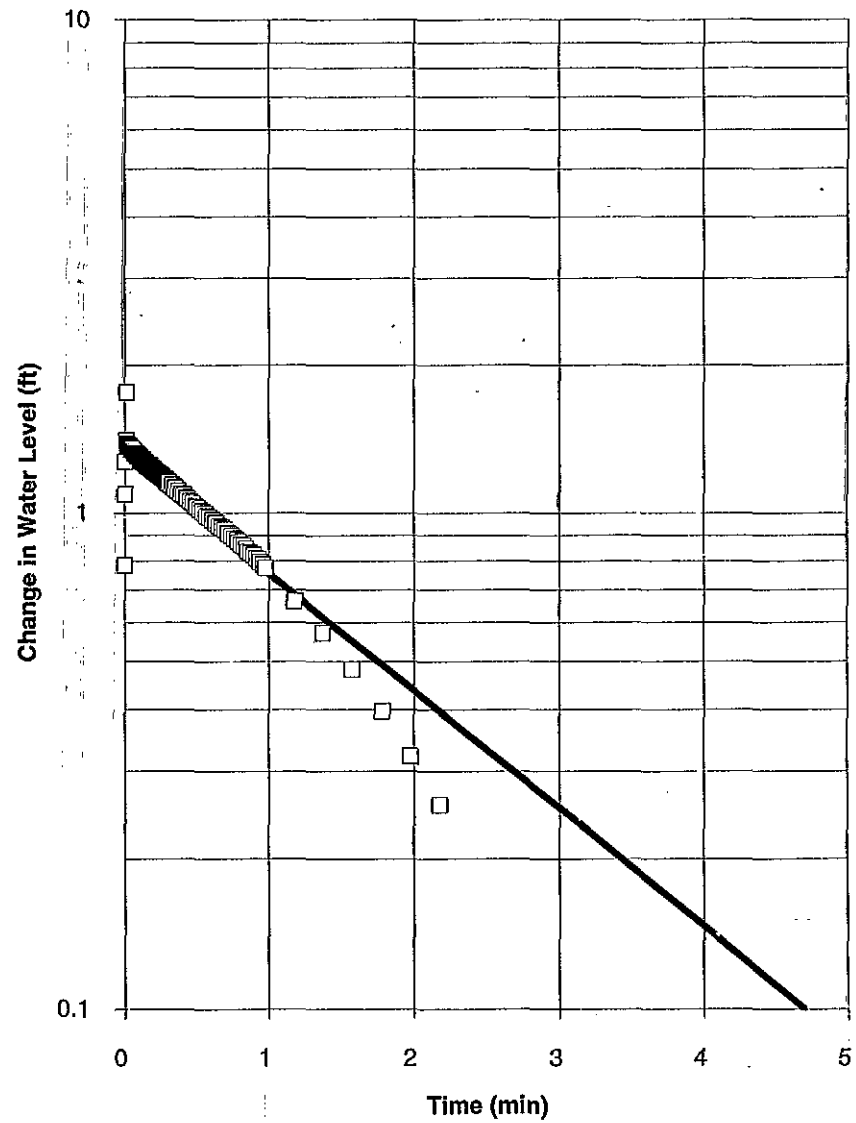


Bouwer and Rice Slug Test Calculations *

Well ERM-5S — Case 2:
Slug In — K gravel pack ≈ K formation
No Gravel Pack Drainage

Definition Of Variables:

D : Saturated Aquifer Thickness
H : Depth of Water in the Well
H = Static Water Elev. - Elev. of Well Bottom
L : Length of screen Below Water Table
Note: L = H if Water level is Below the Top of the Screen
A & B : Well Geometry Factors - from Bouwer & Rice, Figure 3
rc : Inner Radius of the Well casing
rw : Radius of the Gravel Pack
Yo : Water Level Displacement at time = 0
t : Arbitrary Time from Recovery vs Time Plot
Yt : Water Level Displacement at time = t

Determined Values for Variables:

D =	100	feet	
H =	7.9	feet	Notes:
L =	7.9	feet	rw not used in Case 2 calculations
A =	4.3		L/rc = 95
B =	0.75		
rw =	0.5	feet	
rc =	0.083	feet	
Yo =	2.25	feet	
t =	0.09	minutes	
Yt =	0.01	feet	

Calculations

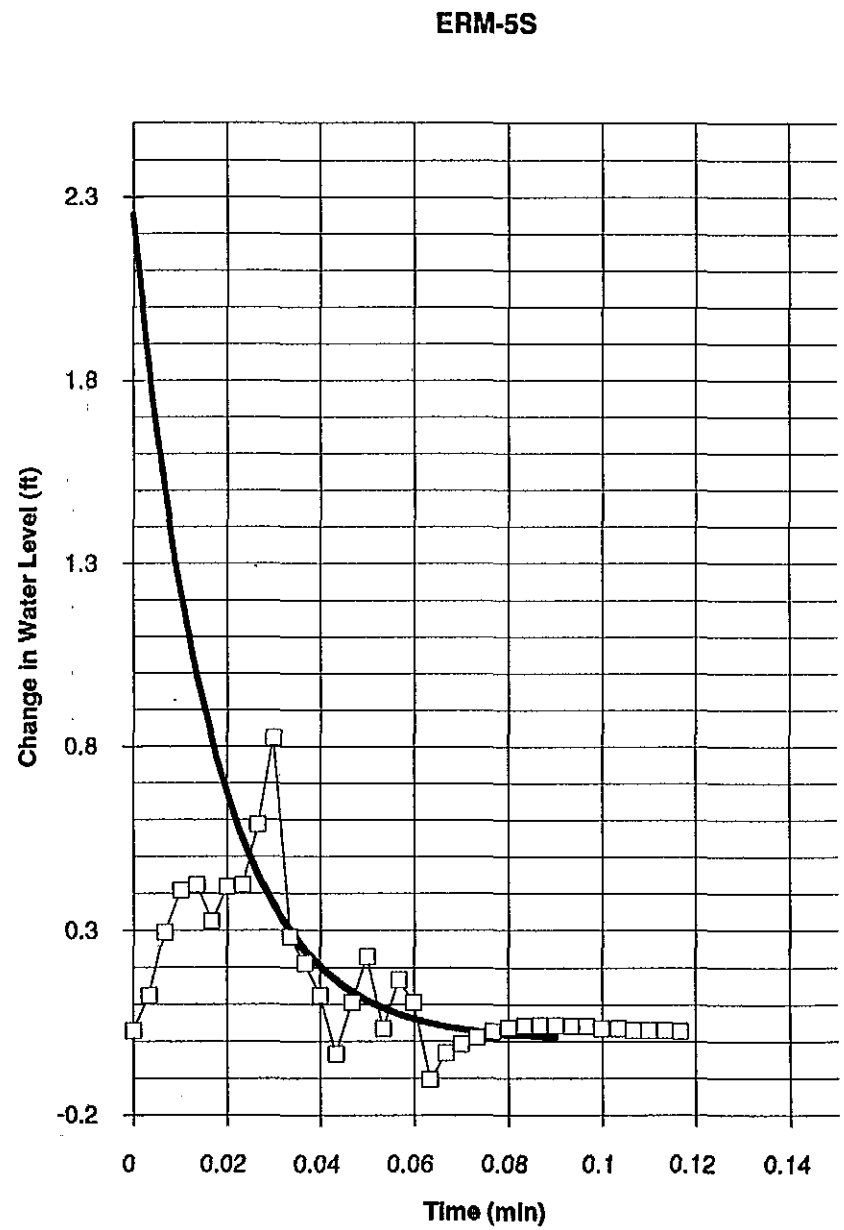
(1/t)*ln(Yo/Yt) = 60.179

ln(Re/rc) = 1/(1.1/ln(H/rc)+(A+B*ln((D-H)/rc))/(L/rc))
= 2.9948

K = (rc*rc*ln(Re/rc)*(1/t)*ln(Yo/Yt))/(2L)
= 113.16 feet/day = 3.99E-02 cm/sec

* Reference: Bouwer,H and Rice,R.C, 1976: A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers With Completely or Partially Penetrating Wells: Water Res. Res. V.12. No. 3

THE ERM GROUP



Bouwer and Rice Slug Test Calculations *

Well ERM-5S — Case 2:
Slug Out — K gravel pack ≈ K formation
No Gravel Pack Drainage

Definition Of Variables:

D : Saturated Aquifer Thickness
H : Depth of Water in the Well
H = Static Water Elev. - Elev. of Well Bottom
L : Length of screen Below Water Table
Note: L = H if Water level is Below the Top of the Screen
A & B : Well Geometry Factors - from Bouwer & Rice, Figure 3
rc : Inner Radius of the Well casing
rw : Radius of the Gravel Pack
Yo : Water Level Displacement at time = 0
t : Arbitrary Time from Recovery vs Time Plot
Yt : Water Level Displacement at time = t

Determined Values for Variables:

D =	100	feet	
H =	7.9	feet	Notes:
L =	7.9	feet	rw not used in Case 2 calculations
A =	4.3		L/rc = 95
B =	0.75		
rw =	0.5	feet	
rc =	0.083	feet	
Yo =	2.25	feet	
t =	0.09	minutes	
Yt =	0.02	feet	

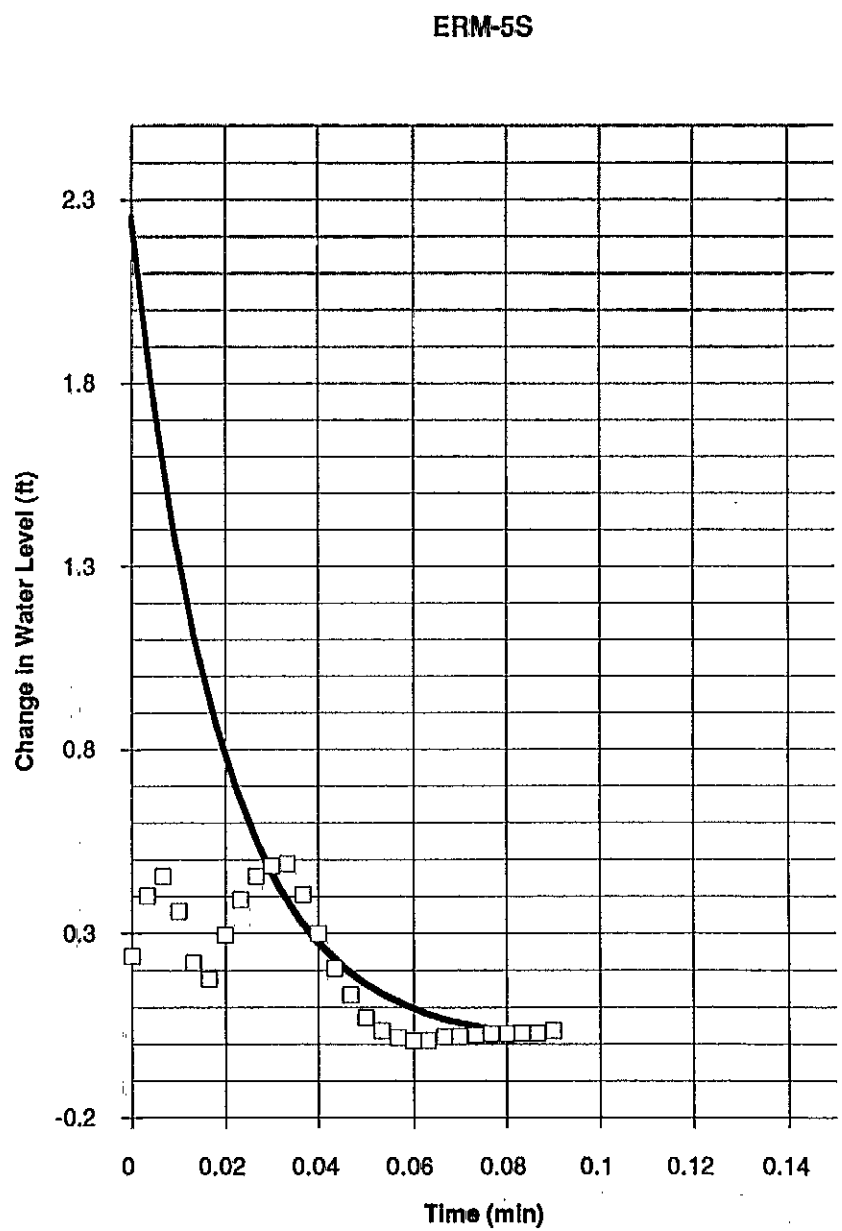
Calculations

(1/t)*ln(Yo/Yt) = 52.477

ln(Re/rc) = 1/(1.1/ln(H/rc)+(A+B*ln((D-H)/rc))/(L/rc))
= 2.9948

K = (rc*rc*ln(Re/rc)*(1/t)*ln(Yo/Yt))/(2L)
= 98.67 feet/day = 3.48E-02 cm/sec

* Reference: Bouwer,H and Rice,R.C, 1976: A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers With Completely or Partially Penetrating Wells: Water Res. Res. V.12. No. 3



Bouwer and Rice Slug Test Calculations *

Well ERM-10I — *Case 4: Well Penetrates to the Aquifer Bottom*
Slug Out — K gravel pack >> K formation
No Gravel Pack Drainage

Definition Of Variables:

D : Saturated Aquifer Thickness
H : Depth of Water in the Well
H = Static Water Elev. - Elev. of Well Bottom
L : Length of Gravel Pack Below Water Table
Note: L = H if Water level is Below the Top of the Screen
C : Well Geometry Factor - from Bouwer & Rice, Figure 3
rc : Inner Radius of the Well casing
rw : Radius of the Gravel Pack
Yo : Water Level Displacement at time = 0
t : Arbitrary Time from Recovery vs Time Plot
Yt : Water Level Displacement at time = t

Determined Values for Variables:

D =	86	feet	
H =	86	feet	Notes:
L =	24	feet	H = D for this analysis
C =	3.4		L/rw = 72
rw =	0.333	feet	
rc =	0.083	feet	
Yo =	2.25	feet	
t =	4.1	minutes	
Yt =	0.1	feet	

Calculations

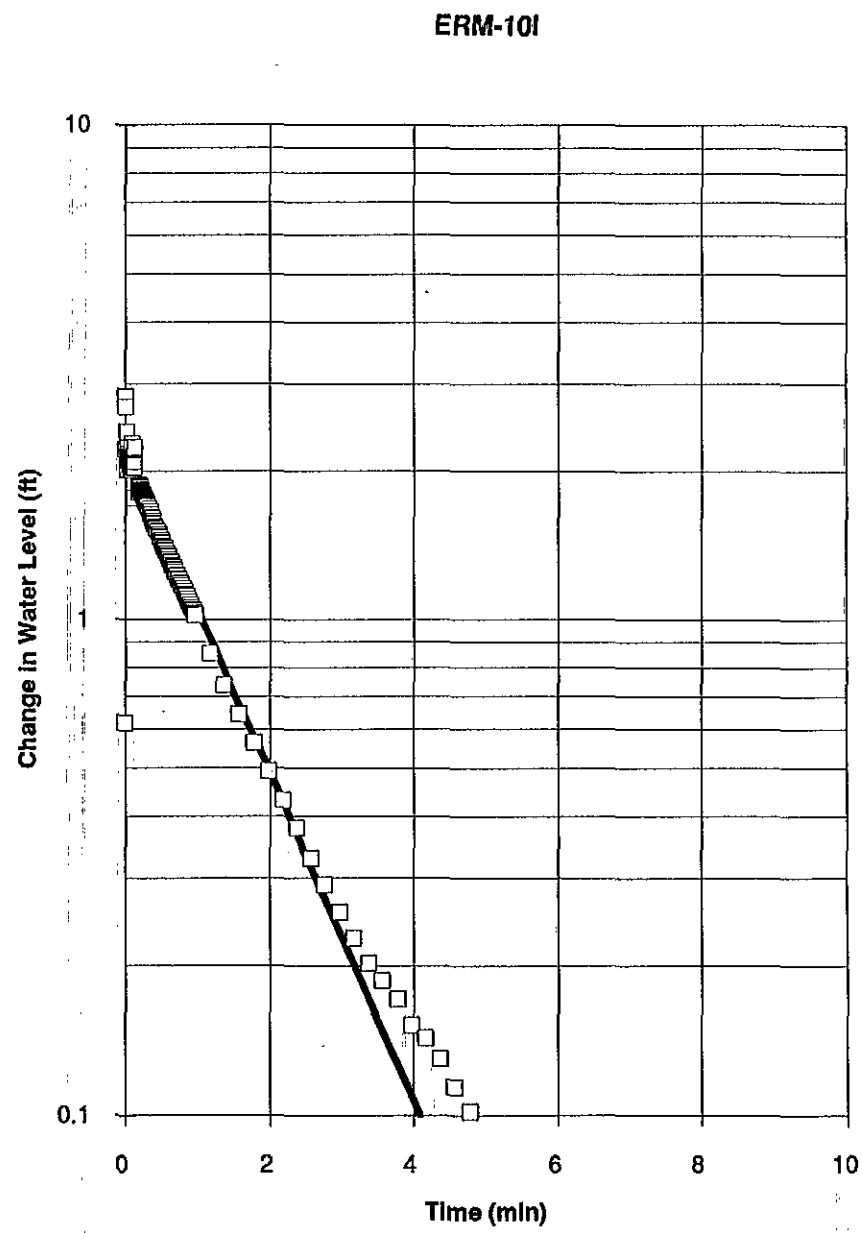
(1/t)*ln(Yo/Yt) = 0.7594

ln(Re/rw) = 1/(1.1/ln(H/rw)+C/(L/rw))
= 4.0778

K = (rc*rc*ln(Re/rw)*(1/t)*ln(Yo/Yt))/(2L)
= 0.64 feet/day = 2.3 E-04 cm/sec

* Reference: Bouwer,H and Rice,R.C, 1976: A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers With Completely or Partially Penetrating Wells: Water Res. Res. V.12. No. 3

THE ERM GROUP



Bouwer and Rice Slug Test Calculations *

Well ERM-10I — Case 4: Well Penetrates to the Aquifer Bottom
Slug In — K gravel pack >> K formation
No Gravel Pack Drainage

Definition Of Variables:

D : Saturated Aquifer Thickness
H : Depth of Water in the Well
H = Static Water Elev. - Elev. of Well Bottom
L : Length of Gravel Pack Below Water Table
Note: L = H if Water level is Below the Top of the Screen
C : Well Geometry Factor - from Bouwer & Rice, Figure 3
rc : Inner Radius of the Well casing
rw : Radius of the Gravel Pack
Yo : Water Level Displacement at time = 0
t : Arbitrary Time from Recovery vs Time Plot
Yt : Water Level Displacement at time = t

Determined Values for Variables:

D =	86	feet	
H =	86	feet	Notes:
L =	24	feet	H = D for this analysis
C =	3.4		L/rw = 72
rw =	0.333	feet	
rc =	0.083	feet	
Yo =	2.25	feet	
t =	4.1	minutes	
Yt =	0.1	feet	

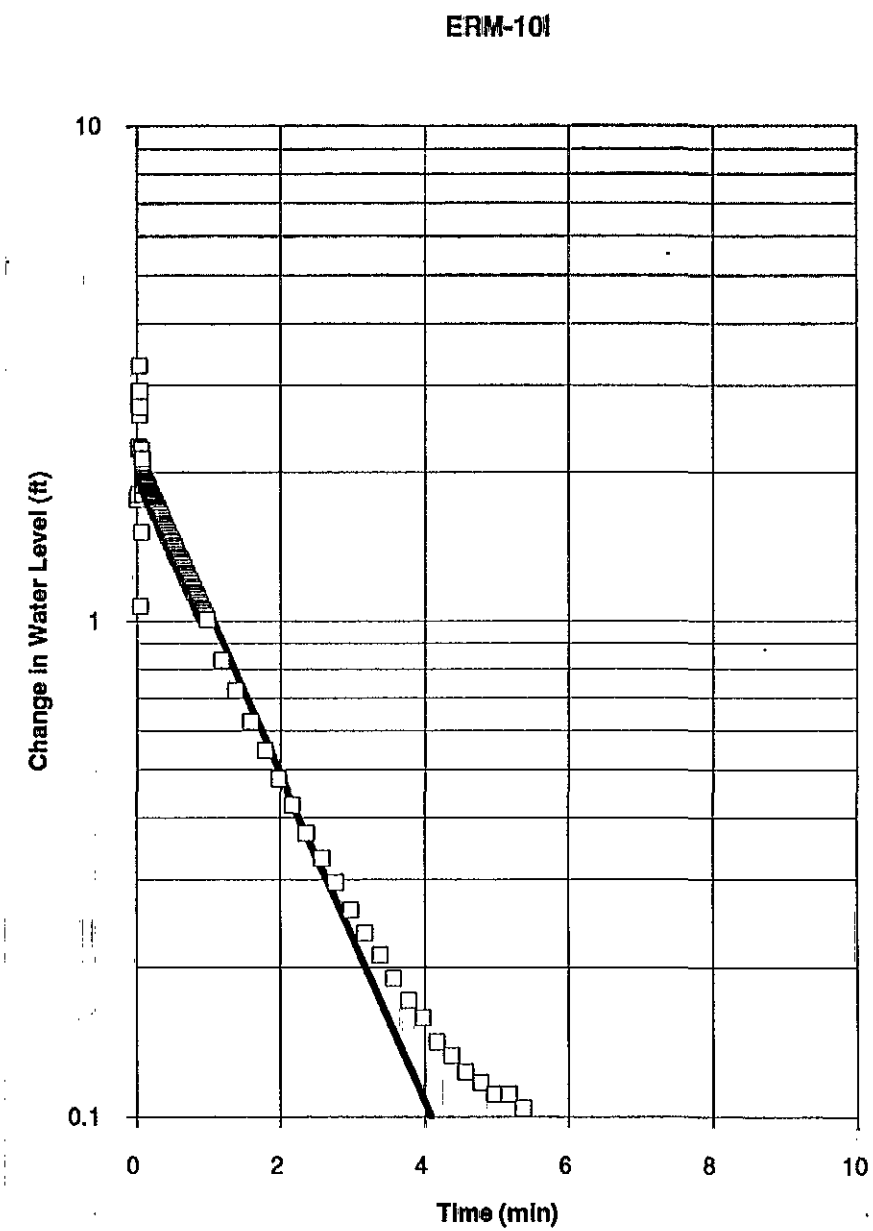
Calculations

(1/t)*ln(Yo/Yt) = 0.7594

ln(Re/rw) = 1/(1.1/ln(H/rw)+C/(L/rw))
= 4.0778

K = (rc*rc*ln(Re/rw)*(1/t)*ln(Yo/Yt))/(2L)
= 0.64 feet/day = 2.3 E-04 cm/sec

* Reference: Bouwer,H and Rice,R.C, 1976: A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers With Completely or Partially Penetrating Wells: Water Res. Res. V.12. No. 3



Bouwer and Rice Slug Test Calculations *

Well ERM-11S — Case 1: Standard Bouwer and Rice
Slug Out — K gravel pack >> K formation
No Gravel Pack Drainage

Definition Of Variables:

D : Saturated Aquifer Thickness
H : Depth of Water in the Well
H = Static Water Elev. - Elev. of Well Bottom
L : Length of Gravel Pack Below Water Table
Note: L = H if Water level is Below the Top of the Screen
A & B : Well Geometry Factors - from Bouwer & Rice, Figure 3
rc : Inner Radius of the Well casing
rw : Radius of the Gravel Pack
Yo : Water Level Displacement at time = 0
t : Arbitrary Time from Recovery vs Time Plot
Yt : Water Level Displacement at time = t

Determined Values for Variables:

D =	100	feet	
H =	15.1	feet	Notes:
L =	10	feet	If H=L then there should be gravel pack
A =	2.2		drainage or K pack= K formation
B =	0.3		L/rw = 20
rw =	0.5	feet	
rc =	0.083	feet	
Yo =	1.6	feet	
t =	60	minutes	
Yt =	0.1	feet	

Calculations

(1/t)*ln(Yo/Yt) = 0.0462

ln(Re/rw) = 1/(1.1/ln(H/rw)+(A+B*ln((D-H)/rw))/(L/rw))
= 1.9615

K = (rc*rc*ln(Re/rw)*(1/t)*ln(Yo/Yt))/(2L)
= 0.04 feet/day = 1.59E-05 cm/sec

* Reference: Bouwer,H and Rice,R.C, 1976: A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers With Completely or Partially Penetrating Wells: Water Res. Res. V.12. No. 3

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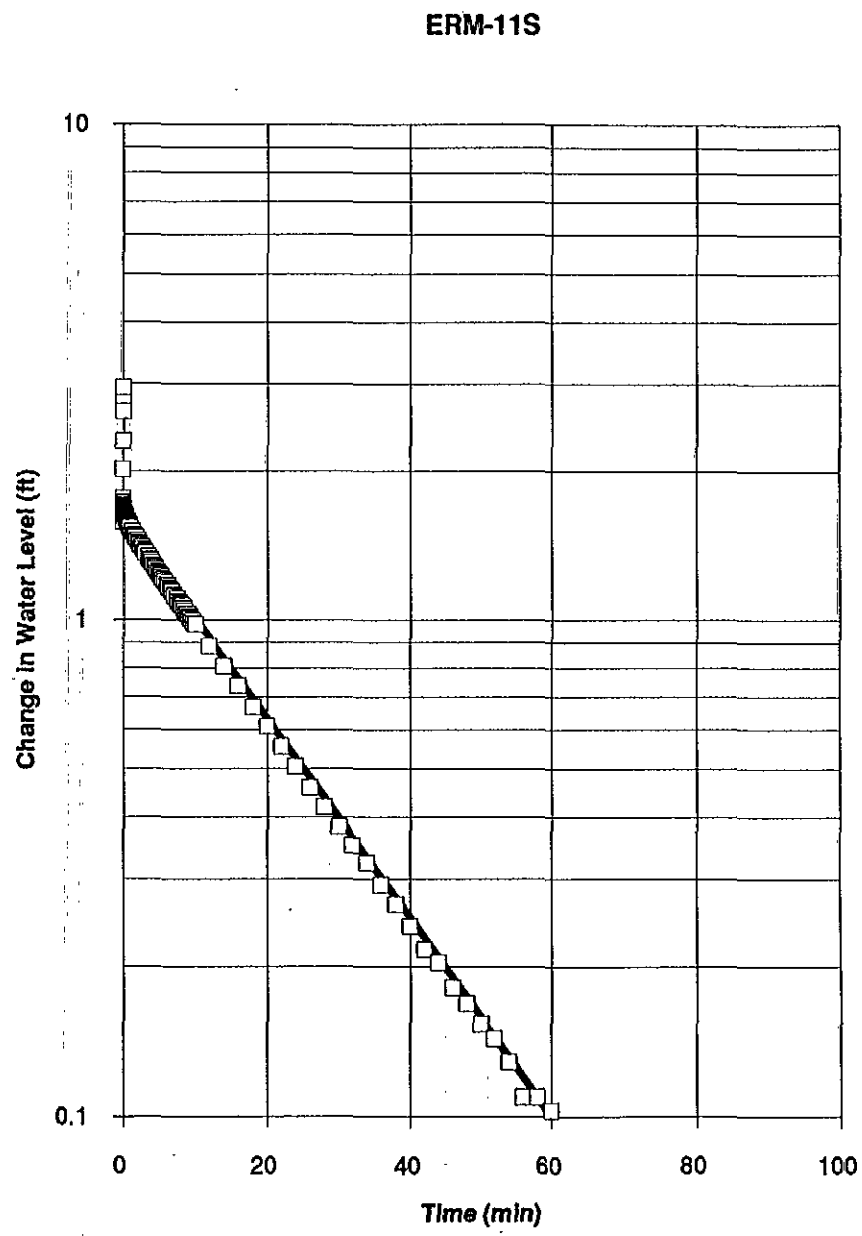

Bouwer and Rice Slug Test Calculations *

Well ERM-11I — Case 4: Well Penetrates to the Aquifer Bottom
Slug In — K gravel pack >> K formation
No Gravel Pack Drainage

Definition Of Variables:

D : Saturated Aquifer Thickness
H : Depth of Water in the Well
H = Static Water Elev. - Elev. of Well Bottom
L : Length of Gravel Pack Below Water Table
Note: L = H if Water level is Below the Top of the Screen
C : Well Geometry Factor - from Bouwer & Rice, Figure 3
rc : Inner Radius of the Well casing
rw : Radius of the Gravel Pack
Yo : Water Level Displacement at time = 0
t : Arbitrary Time from Recovery vs Time Plot
Yt : Water Level Displacement at time = t

Determined Values for Variables:

D =	91	feet	
H =	91	feet	Notes:
L =	25	feet	H = D for this analysis
C =	3.4		L/rw = 75
rw =	0.333	feet	
rc =	0.083	feet	
Yo =	2.25	feet	
t =	5.6	minutes	
Yt =	0.1	feet	

Calculations

(1/t)*ln(Yo/Yt) = 0.556

ln(Re/rw) = 1/(1.1/ln(H/rw)+C/(L/rw))
= 4.1434

K = (rc*rc*ln(Re/rw)*(1/t)*ln(Yo/Yt))/(2L)
= 0.46 feet/day = 1.6 E-04 cm/sec

* Reference: Bouwer,H and Rice,R.C, 1976: A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers With Completely or Partially Penetrating Wells: Water Res. Res. V.12. No. 3

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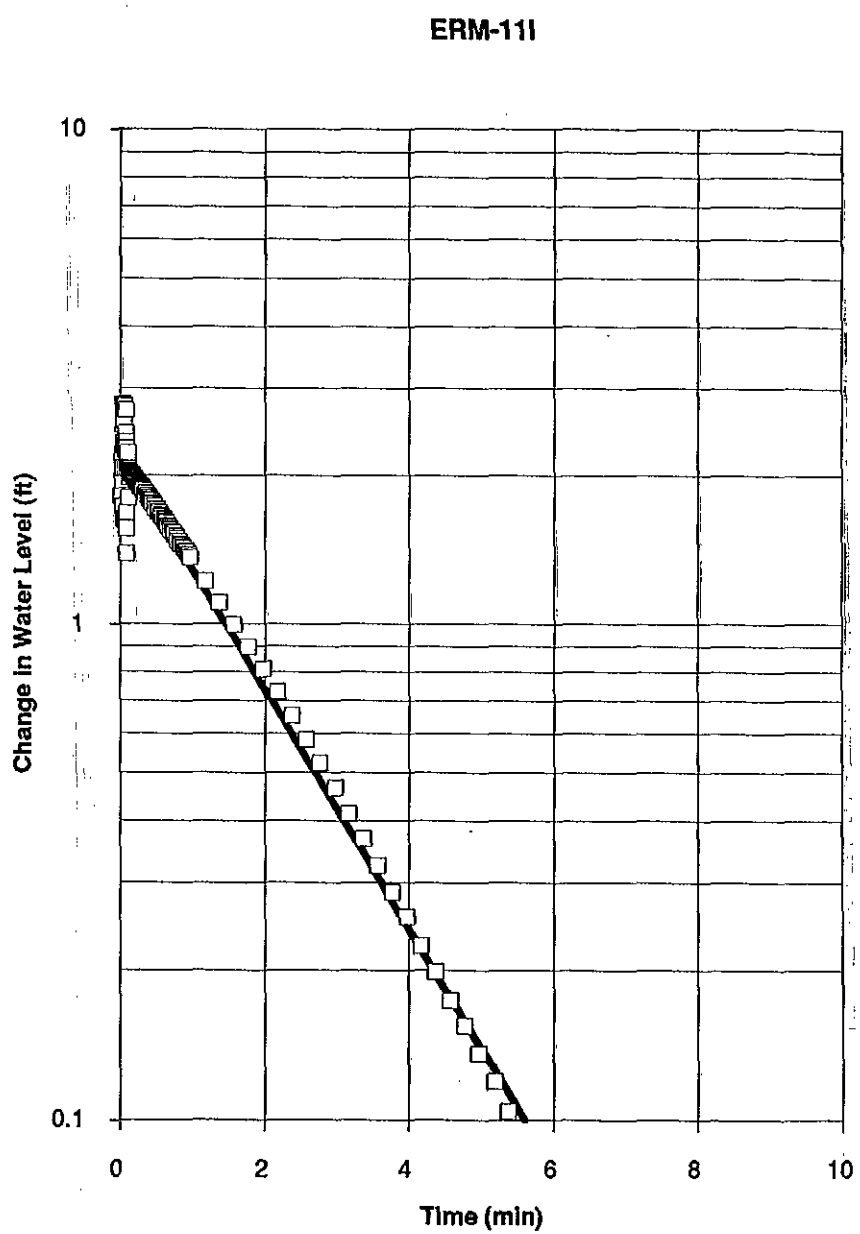


Bouwer and Rice Slug Test Calculations *

Well ERM-11I — Case 4: Well Penetrates to the Aquifer Bottom
Slug Out — *K gravel pack >> K formation*
No Gravel Pack Drainage

Definition Of Variables:

D : Saturated Aquifer Thickness
H : Depth of Water in the Well
H = Static Water Elev. - Elev. of Well Bottom
L : Length of Gravel Pack Below Water Table
Note: L = H if Water level is Below the Top of the Screen
C : Well Geometry Factor - from Bouwer & Rice, Figure 3
rc : Inner Radius of the Well casing
rw : Radius of the Gravel Pack
Yo : Water Level Displacement at time = 0
t : Arbitrary Time from Recovery vs Time Plot
Yt : Water Level Displacement at time = t

Determined Values for Variables:

D =	91	feet	
H =	91	feet	Notes:
L =	25	feet	H = D for this analysis
C =	3.4		L/rw = 75
rw =	0.333	feet	
rc =	0.083	feet	
Yo =	2.25	feet	
t =	5.6	minutes	
Yt =	0.1	feet	

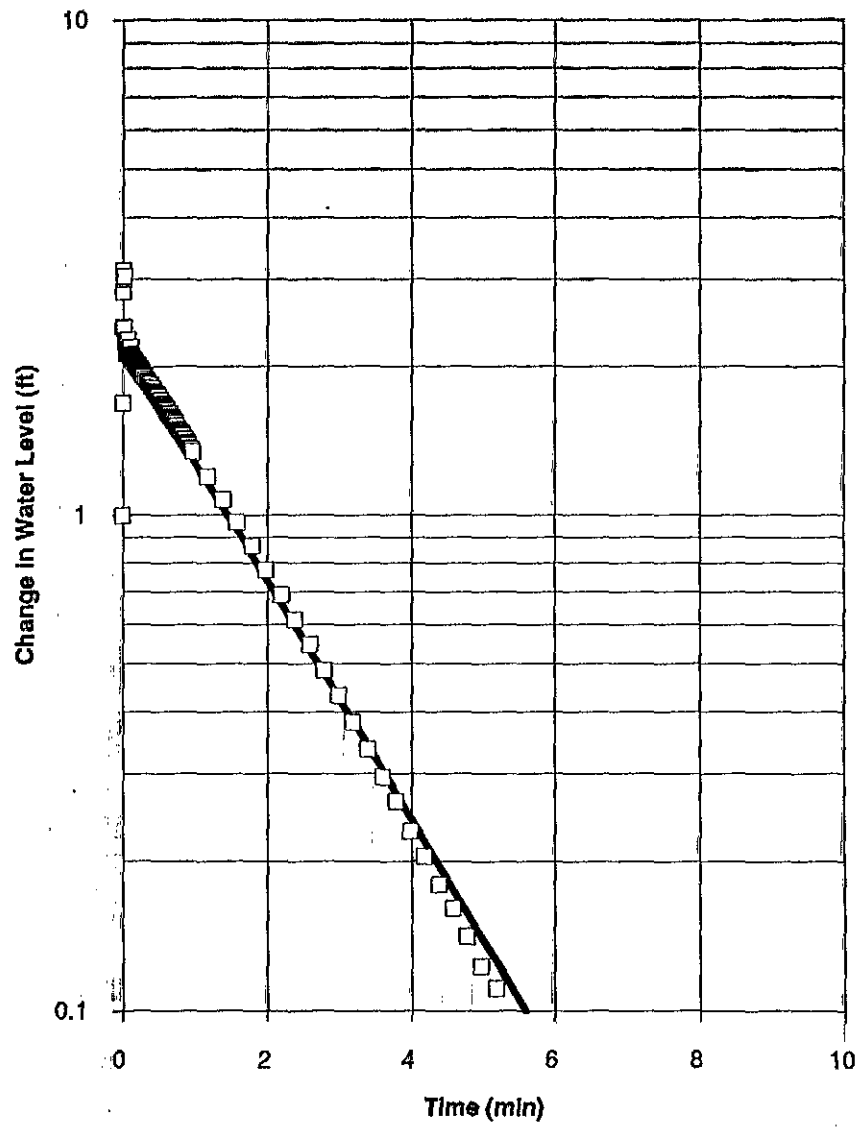
Calculations

(1/t)*ln(Yo/Yt) = 0.556

ln(Re/rw) = 1/(1.1/ln(H/rw)+C/(L/rw))
= 4.1434

K = (rc*rc*ln(Re/rw)*(1/t)*ln(Yo/Yt))/(2L)
= 0.46 feet/day = 1.6 E-04 cm/sec

* Reference: Bouwer,H and Rice,R.C, 1976: A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers With Completely or Partially Penetrating Wells: Water Res. Res. V.12. No. 3



Bouwer and Rice Slug Test Calculations *

Well ERM-12S — Case 1: Standard Bouwer and Rice
Slug In — K gravel pack >> K formation
No Gravel Pack Drainage

Definition Of Variables:

D : Saturated Aquifer Thickness
H : Depth of Water in the Well
H = Static Water Elev. - Elev. of Well Bottom
L : Length of Gravel Pack Below Water Table
Note: L = H if Water level is Below the Top of the Screen
A & B : Well Geometry Factors - from Bouwer & Rice, Figure 3
rc : Inner Radius of the Well casing
rw : Radius of the Gravel Pack
Yo : Water Level Displacement at time = 0
t : Arbitrary Time from Recovery vs Time Plot
Yt : Water Level Displacement at time = t

Determined Values for Variables:

D =	100	feet
H =	16.5	feet
L =	11	feet
A =	2.9	
B =	0.45	
rw =	0.26	feet
rc =	0.083	feet
Yo =	2.25	feet
t =	1.1	minutes
Yt =	0.1	feet

Notes:
If H=L then there should be gravel pack drainage or K pack= K formation
L/rw = 42

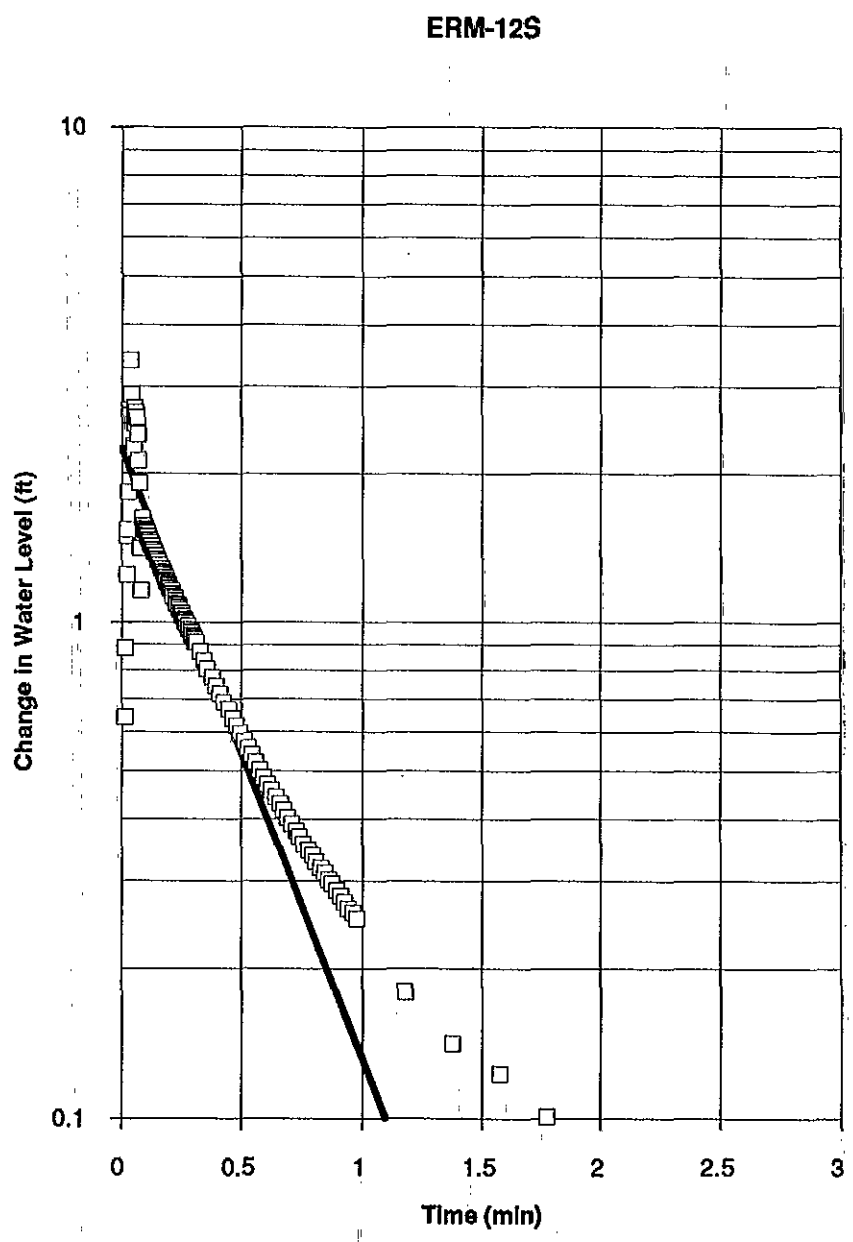
Calculations

(1/t)*ln(Yo/Yt) = 2.8305

ln(Re/rw) = 1/(1.1/ln(H/rw)+(A+B*ln((D-H)/rw))/(L/rw))
= 2.5318

K = (rc*rc*ln(Re/rw)*(1/t)*ln(Yo/Yt))/(2L)
= 3.23 feet/day = 1.14E-03 cm/sec

* Reference: Bouwer,H and Rice,R.C, 1976: A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers With Completely or Partially Penetrating Wells: Water Res. Res. V.12. No. 3



Bouwer and Rice Slug Test Calculations *

Well ERM-12S — Case 1: Standard Bouwer and Rice
Slug Out — K gravel pack >> K formation
No Gravel Pack Drainage

Definition Of Variables:

D : Saturated Aquifer Thickness
H : Depth of Water in the Well
H = Static Water Elev. - Elev. of Well Bottom
L : Length of Gravel Pack Below Water Table
Note: L = H if Water level is Below the Top of the Screen
A & B : Well Geometry Factors - from Bouwer & Rice, Figure 3
rc : Inner Radius of the Well casing
rw : Radius of the Gravel Pack
Yo : Water Level Displacement at time = 0
t : Arbitrary Time from Recovery vs Time Plot
Yt : Water Level Displacement at time = t

Determined Values for Variables:

D =	100	feet	
H =	16.5	feet	Notes:
L =	11	feet	If H=L then there should be gravel pack
A =	2.9		drainage or K pack= K formation
B =	0.45		L/rw = 42
rw =	0.26	feet	
rc =	0.083	feet	
Yo =	2.25	feet	
t =	1.1	minutes	
Yt =	0.1	feet	

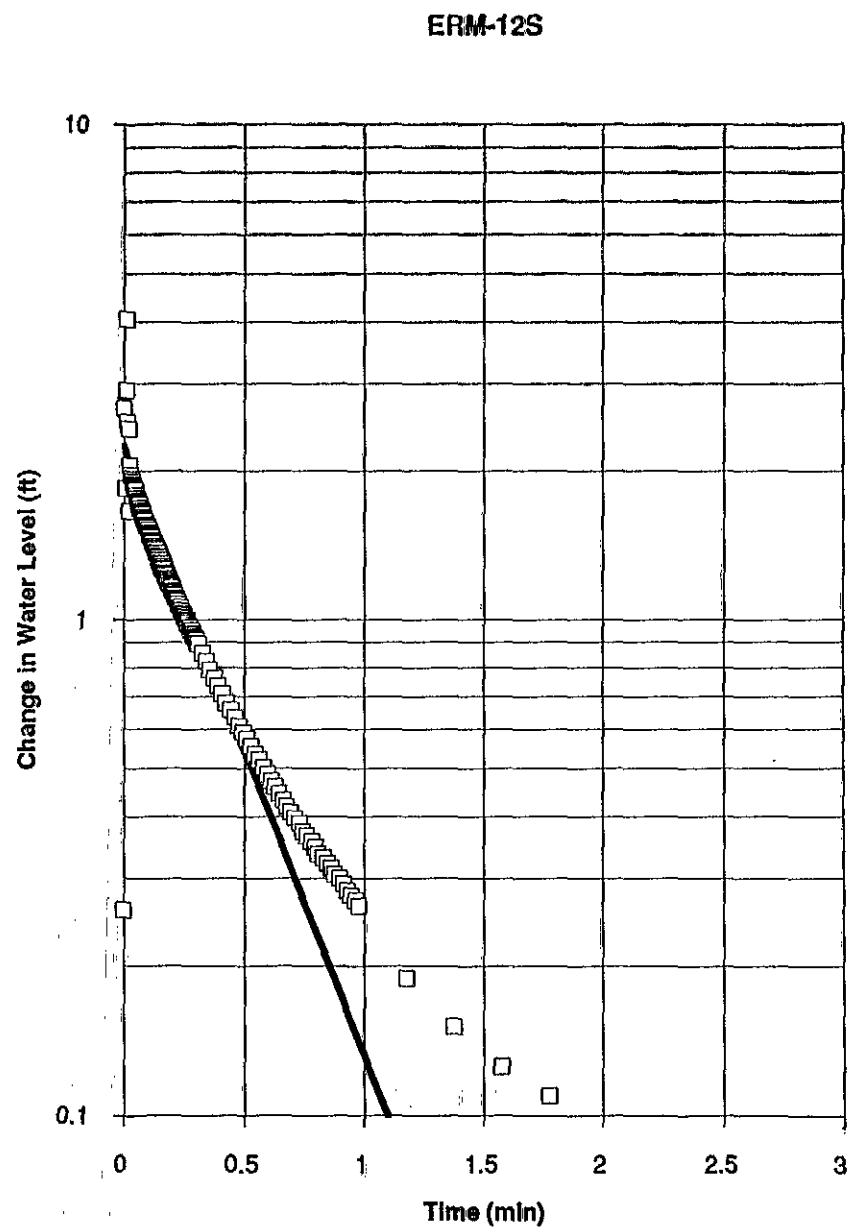
Calculations

(1/t)*ln(Yo/Yt) = 2.8305

ln(Re/rw) = 1/(1.1/ln(H/rw)+(A+B*ln((D-H)/rw))/(L/rw))
= 2.5318

K = (rc*rc*ln(Re/rw)*(1/t)*ln(Yo/Yt))/(2L)
= 3.23 feet/day = 1.14E-03 cm/sec

* Reference: Bouwer,H and Rice,R.C, 1976: A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers With Completely or Partially Penetrating Wells: Water Res. Res. V.12. No. 3



Cooper-Papadopulos Slug Test Calculations *

Well ID ERM-12I
Slug In

Definition Of Variables:

rc : Inner radius of the well casing (draining casing)
rw : Radius of the boring/gravel pack
Ho : Water level displacement at time = 0
T : Aquifer transmissivity
K : Aquifer hydraulic conductivity
b : aquifer saturated thickness
S : Aquifer storage coefficient

Well / aquifer parameters:

rw = 0.33 feet
rc = 0.083 feet
b = 26 feet

Curve fitting parameters (adjust to match data)

Ho = 2 feet
T = 1.7 sq ft / day

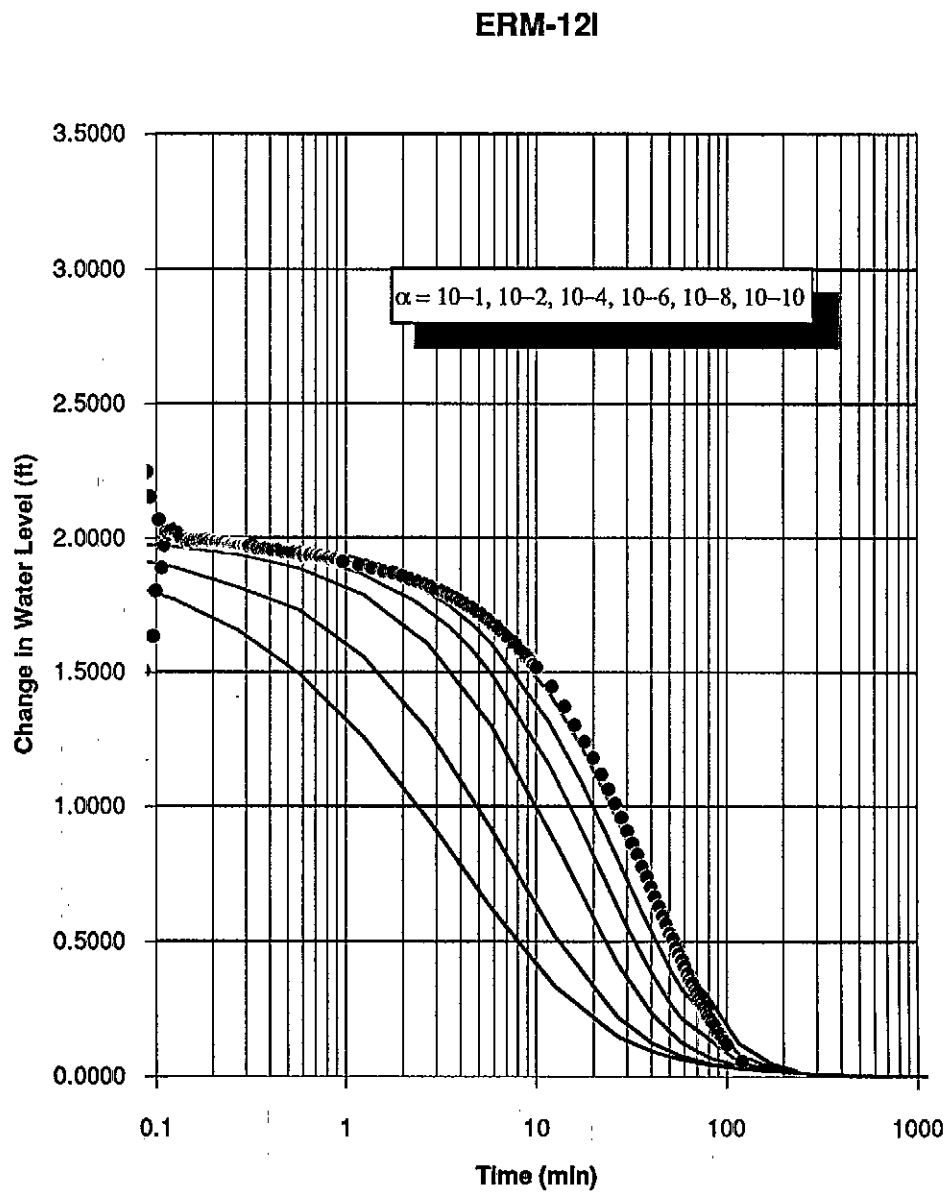
Best fit curve

α = 1 E-8

Calculations

K = T/b
= 0.07 ft/day
S = 6 E-10 dimensionless

* Reference: Cooper, H.H., Bredehoeft,J.D., and S.S.Papadopulos
Response of a finite diameter well to and instantaneous
charge of water, Water Resources Research, 1967
3(1) pp 263-269



Cooper-Papadopulos Slug Test Calculations *

Well ID ERM-12I
Slug Out

Definition Of Variables:

rc : Inner radius of the well casing (draining casing)
rw : Radius of the boring/gravel pack
Ho : Water level displacement at time = 0
T : Aquifer transmissivity
K : Aquifer hydraulic conductivity
b : aquifer saturated thickness
S : Aquifer storage coefficient

Well / aquifer parameters:

rw = 0.33 feet
rc = 0.083 feet
b = 26 feet

Curve fitting parameters (adjust to match data)

Ho = 2 feet
T = 1.4 sq ft / day

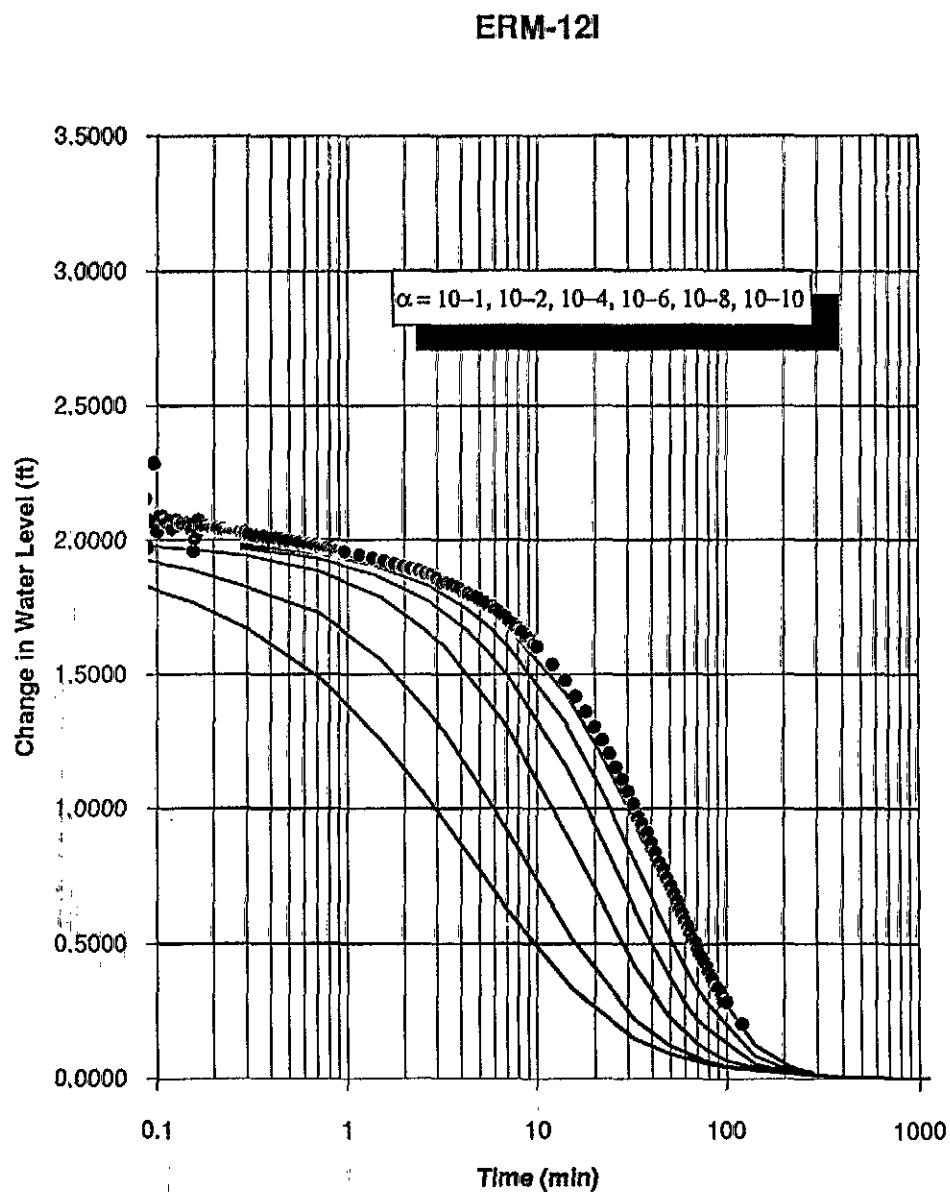
Best fit curve

α = 1 E-8

Calculations

K = T/b
= 0.05 ft/day
S = 6 E-10 dimensionless

* Reference: Cooper, H.H., Bredehoeft,J.D., and S.S.Papadopulos
Response of a finite diameter well to and instantaneous
charge of water, Water Resources Research, 1967
3(1) pp 263-269



Bouwer and Rice Slug Test Calculations *

Well ERM-13S — Case 1: Standard Bouwer and Rice
Slug In — K gravel pack >> K formation
No Gravel Pack Drainage

Definition Of Variables:

D : Saturated Aquifer Thickness
H : Depth of Water in the Well
H = Static Water Elev. - Elev. of Well Bottom
L : Length of Gravel Pack Below Water Table
Note: L = H if Water level is Below the Top of the Screen
A & B : Well Geometry Factors - from Bouwer & Rice, Figure 3
rc : Inner Radius of the Well casing
rw : Radius of the Gravel Pack
Yo : Water Level Displacement at time = 0
t : Arbitrary Time from Recovery vs Time Plot
Yt : Water Level Displacement at time = t

Determined Values for Variables:

D =	100	feet	
H =	16.5	feet	Notes:
L =	13.5	feet	If H=L then there should be gravel pack
A =	3.2		drainage or K pack= K formation
B =	0.5		L/rw = 52
rw =	0.26	feet	
rc =	0.083	feet	
Yo =	2.25	feet	
t =	2.9	minutes	
Yt =	0.1	feet	

Calculations

(1/t)*ln(Yo/Yt) = 1.0736

ln(Re/rw) = 1/(1.1/ln(H/rw)+(A+B*ln((D-H)/rw))/(L/rw))
= 2.6161

K = (rc*rc*ln(Re/rw)*(1/t)*ln(Yo/Yt))/(2L)
= 1.03 feet/day = 3.64E-04 cm/sec

* Reference: Bouwer,H and Rice,R.C, 1976: A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers With Completely or Partially Penetrating Wells: Water Res. Res. V.12. No. 3

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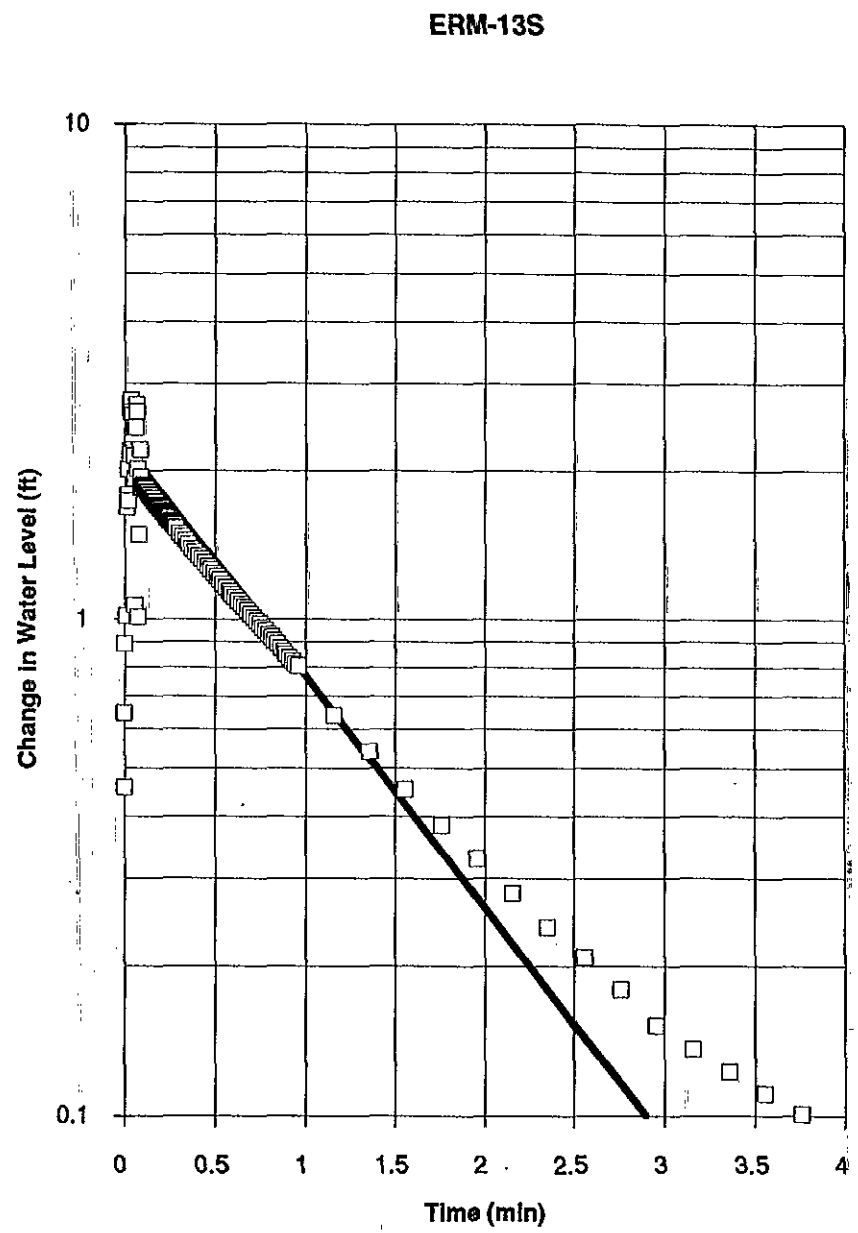


Bouwer and Rice Slug Test Calculations *

Well ERM-13S — Case 1: Standard Bouwer and Rice
Slug Out — K gravel pack >> K formation
No Gravel Pack Drainage

Definition Of Variables:

D : Saturated Aquifer Thickness
H : Depth of Water in the Well
H = Static Water Elev. - Elev. of Well Bottom
L : Length of Gravel Pack Below Water Table
Note: L = H if Water level is Below the Top of the Screen
A & B : Well Geometry Factors - from Bouwer & Rice, Figure 3
rc : Inner Radius of the Well casing
rw : Radius of the Gravel Pack
Yo : Water Level Displacement at time = 0
t : Arbitrary Time from Recovery vs Time Plot
Yt : Water Level Displacement at time = t

Determined Values for Variables:

D =	100	feet	
H =	19	feet	*Notes:*
L =	13.5	feet	If H=L then there should be gravel pack
A =	3.2		drainage or K pack= K formation
B =	0.5		L/rw = 52
rw =	0.26	feet	
rc =	0.083	feet	
Yo =	2.25	feet	
t =	2.9	minutes	
Yt =	0.1	feet	

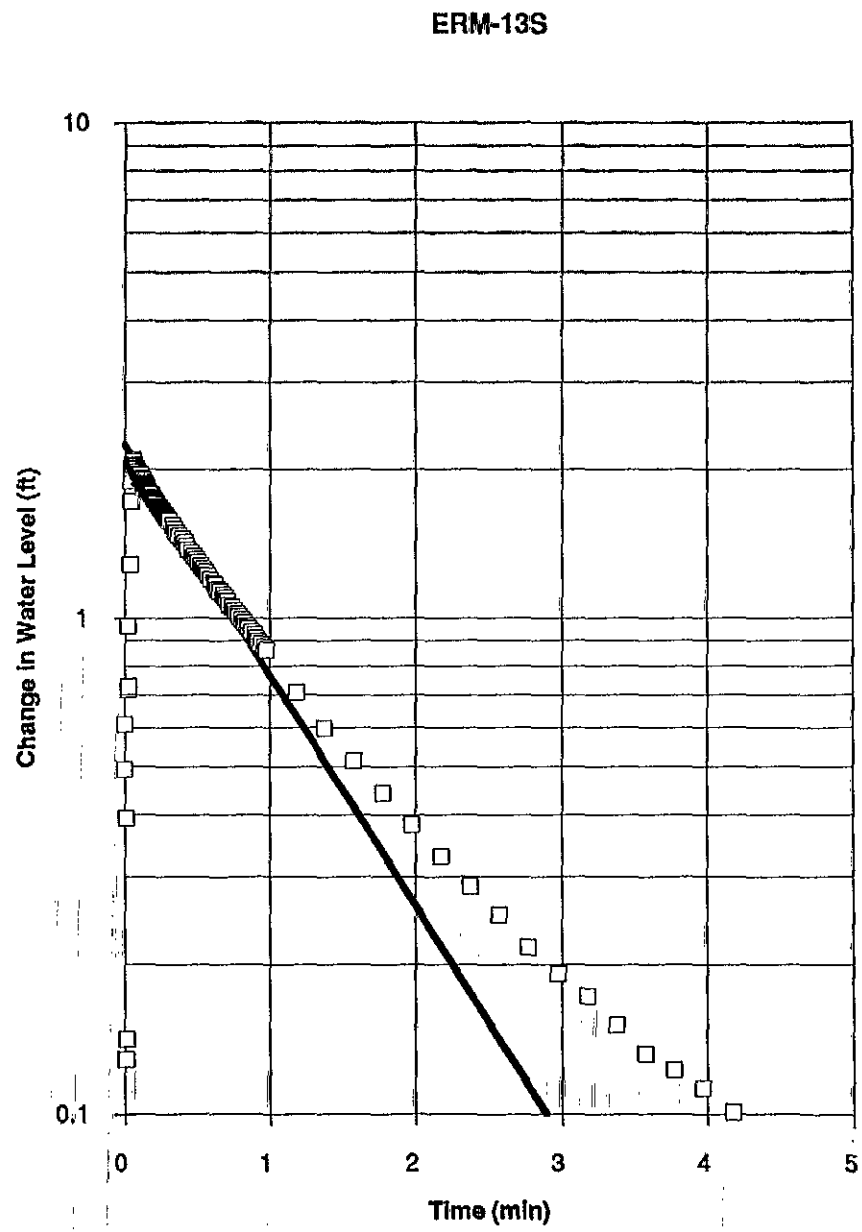
Calculations

(1/t)*ln(Yo/Yt) = 1.0736

ln(Re/rw) = 1/(1.1/ln(H/rw)+(A+B*ln((D-H)/rw))/(L/rw))
= 2.6793

K = (rc*rc*ln(Re/rw)*(1/t)*ln(Yo/Yt))/(2L)
= 1.06 feet/day = 3.73E-04 cm/sec

* Reference: Bouwer,H and Rice,R.C, 1976: A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers With Completely or Partially Penetrating Wells: Water Res. Res. V.12. No. 3



Cooper-Papadopulos Slug Test Calculations *

Well ID ERM-13I
Slug Out

Definition Of Variables:

rc : Inner radius of the well casing (draining casing)
rw : Radius of the boring/gravel pack
Ho : Water level displacement at time = 0
T : Aquifer transmissivity
K : Aquifer hydraulic conductivity
b : aquifer saturated thickness
S : Aquifer storage coefficient

Well / aquifer parameters:

rw = 0.33 feet
rc = 0.083 feet
b = 26 feet

Curve fitting parameters (adjust to match data)

Ho = 2.25 feet
T = 115 sq ft / day

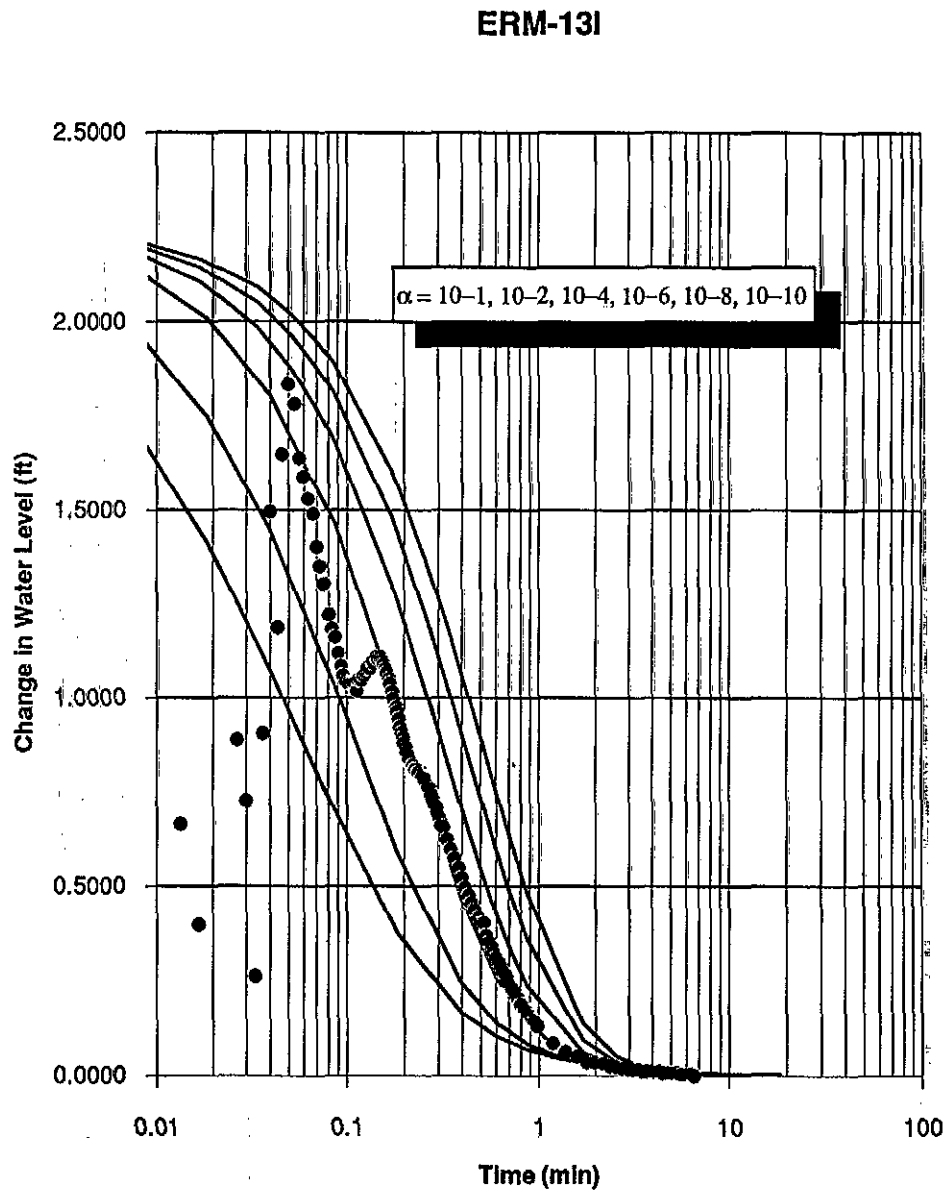
Best fit curve

α = 1 E-8

Calculations

K = T/b
= 4.42 ft/day
S = 6 E-10 dimensionless

* Reference: Cooper, H.H., Bredehoeft,J.D., and S.S.Papadopulos Response of a finite diameter well to and instantaneous charge of water, Water Resources Research, 1967 3(1) pp 263-269



Cooper-Papadopulos Slug Test Calculations *

Well ID ERM-13I
Slug In

Definition Of Variables:

rc : Inner radius of the well casing (draining casing)
rw : Radius of the boring/gravel pack
Ho : Water level displacement at time = 0
T : Aquifer transmissivity
K : Aquifer hydraulic conductivity
b : aquifer saturated thickness
S : Aquifer storage coefficient

Well / aquifer parameters:

rw = 0.33 feet
rc = 0.083 feet
b = 26 feet

Curve fitting parameters (adjust to match data)

Ho = 2.25 feet
T = 120 sq ft / day

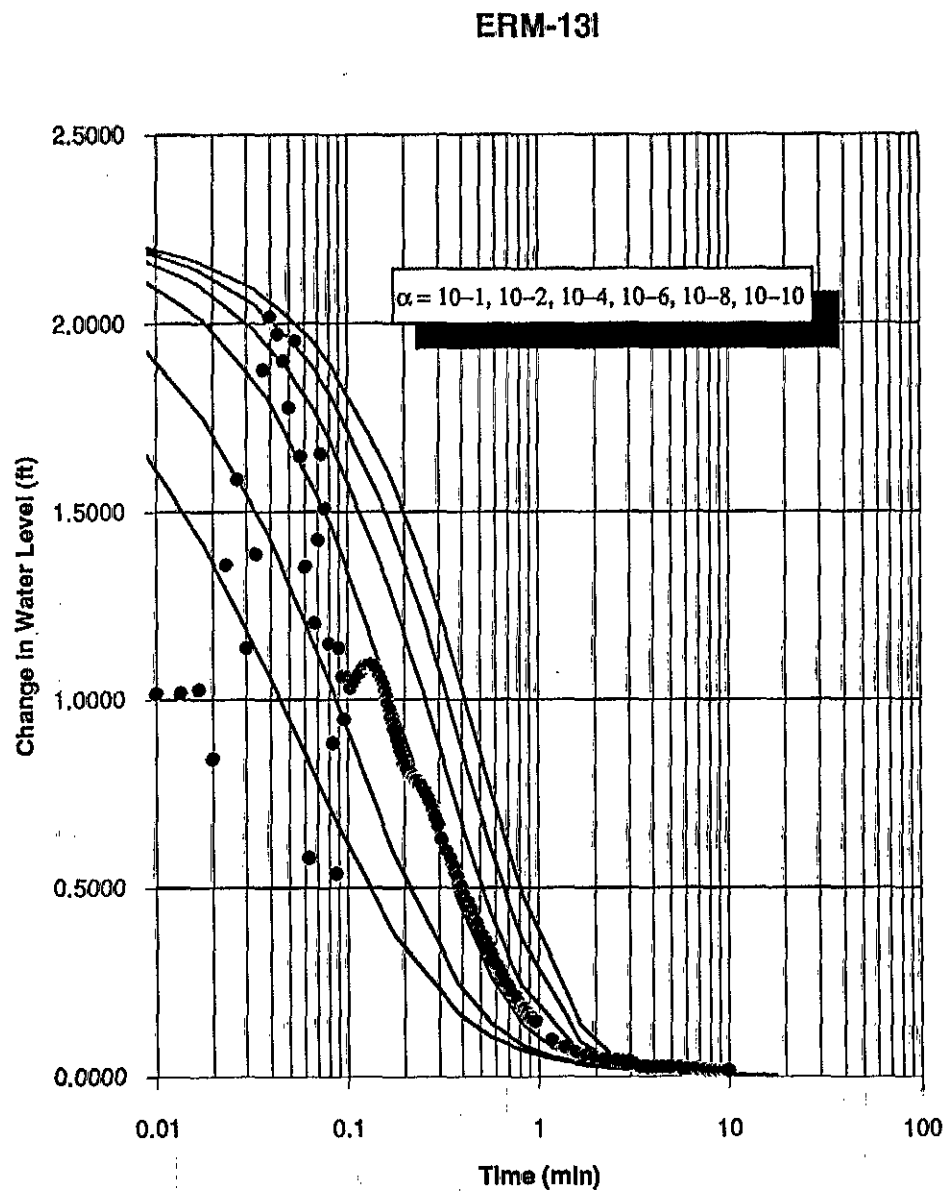
Best fit curve

α = 1 E-8

Calculations

K = T/b
= 4.62 ft/day
S = 6 E-10 dimensionless

* Reference: Cooper, H.H., Bredehoeft,J.D., and S.S.Papadopulos
Response of a finite diameter well to and instantaneous charge of water, Water Resources Research, 1967
3(1) pp 263-269



Bouwer and Rice Slug Test Calculations *

Well ERM-14S — Case 1: Standard Bouwer and Rice
Slug In — K gravel pack >> K formation
No Gravel Pack Drainage

Definition Of Variables:

D : Saturated Aquifer Thickness
H : Depth of Water in the Well
H = Static Water Elev. - Elev. of Well Bottom
L : Length of Gravel Pack Below Water Table
Note: L = H if Water level is Below the Top of the Screen
A & B : Well Geometry Factors - from Bouwer & Rice, Figure 3
rc : Inner Radius of the Well casing
rw : Radius of the Gravel Pack
Yo : Water Level Displacement at time = 0
t : Arbitrary Time from Recovery vs Time Plot
Yt : Water Level Displacement at time = t

Determined Values for Variables:

D =	100	feet
H =	22	feet
L =	14.5	feet
A =	3.3	
B =	0.55	
rw =	0.26	feet
rc =	0.083	feet
Yo =	1.9	feet
t =	90	minutes
Yt =	0.1	feet

Notes:
If H=L then there should be gravel pack drainage or K pack= K formation
L/rw = 56

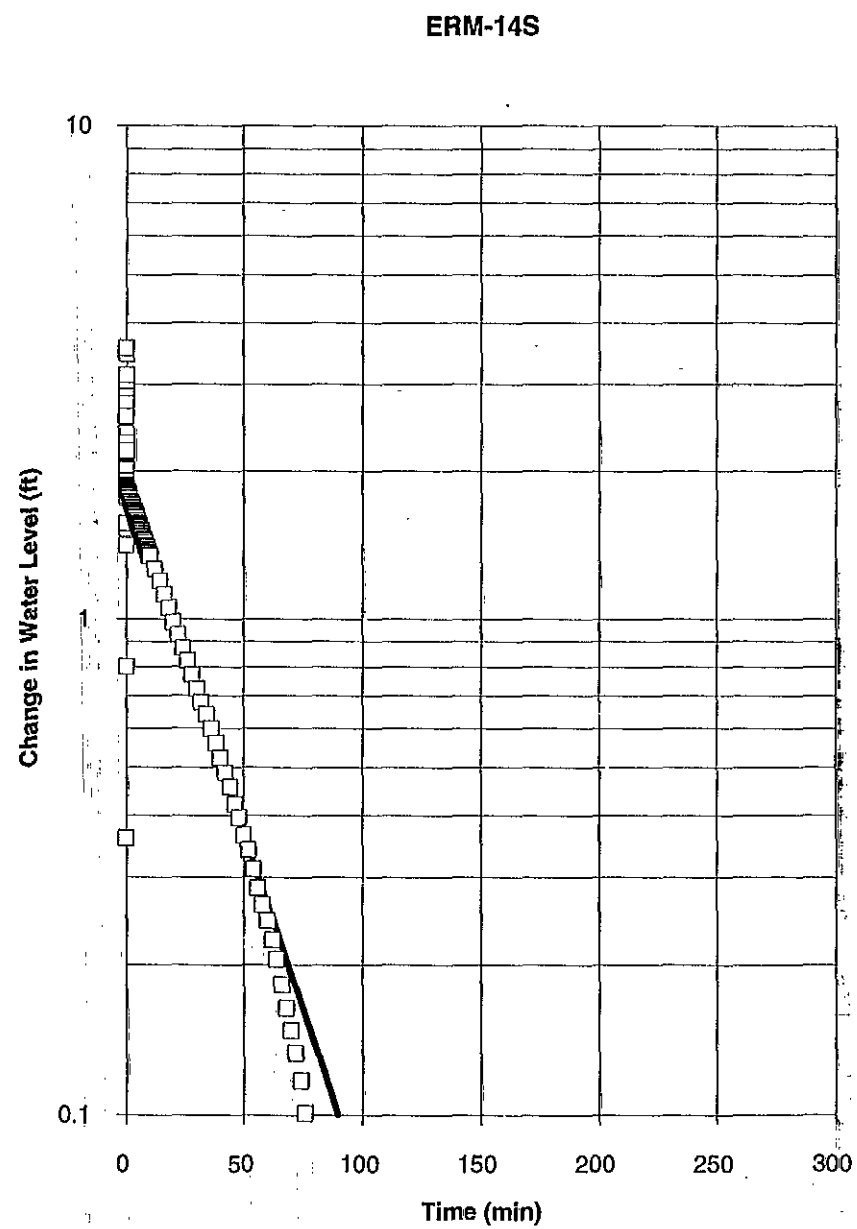
Calculations

(1/t)*ln(Yo/Yt) = 0.0327

ln(Re/rw) = 1/(1.1/ln(H/rw)+(A+B*ln((D-H)/rw))/(L/rw))
= 2.7527

K = (rc*rc*ln(Re/rw)*(1/t)*ln(Yo/Yt))/(2L)
= 0.03 feet/day = 1.09E-05 cm/sec

* Reference: Bouwer,H and Rice,R.C, 1976: A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers With Completely or Partially Penetrating Wells: Water Res. Res. V.12. No. 3



Bouwer and Rice Slug Test Calculations *

Well ERM-14S — Case 1: Standard Bouwer and Rice
Slug Out — K gravel pack >> K formation
No Gravel Pack Drainage

Definition Of Variables:

D : Saturated Aquifer Thickness
H : Depth of Water in the Well
H = Static Water Elev. - Elev. of Well Bottom
L : *Length of Gravel Pack Below Water Table*
Note: L = H if Water level is Below the Top of the Screen
A & B : Well Geometry Factors - from Bouwer & Rice, Figure 3
rc : Inner Radius of the Well casing
rw : Radius of the Gravel Pack
Yo : Water Level Displacement at time = 0
t : *Arbitrary Time from Recovery vs Time Plot*
Yt : Water Level Displacement at time = t

Determined Values for Variables:

D =	100	feet	
H =	22	feet	Notes:
L =	14.5	feet	If H=L then there should be gravel pack
A =	3.3		drainage or K pack= K formation
B =	0.55		L/rw = 56
rw =	0.26	feet	
rc =	0.083	feet	
Yo =	1.9	feet	
t =	180	minutes	
Yt =	0.1	feet	

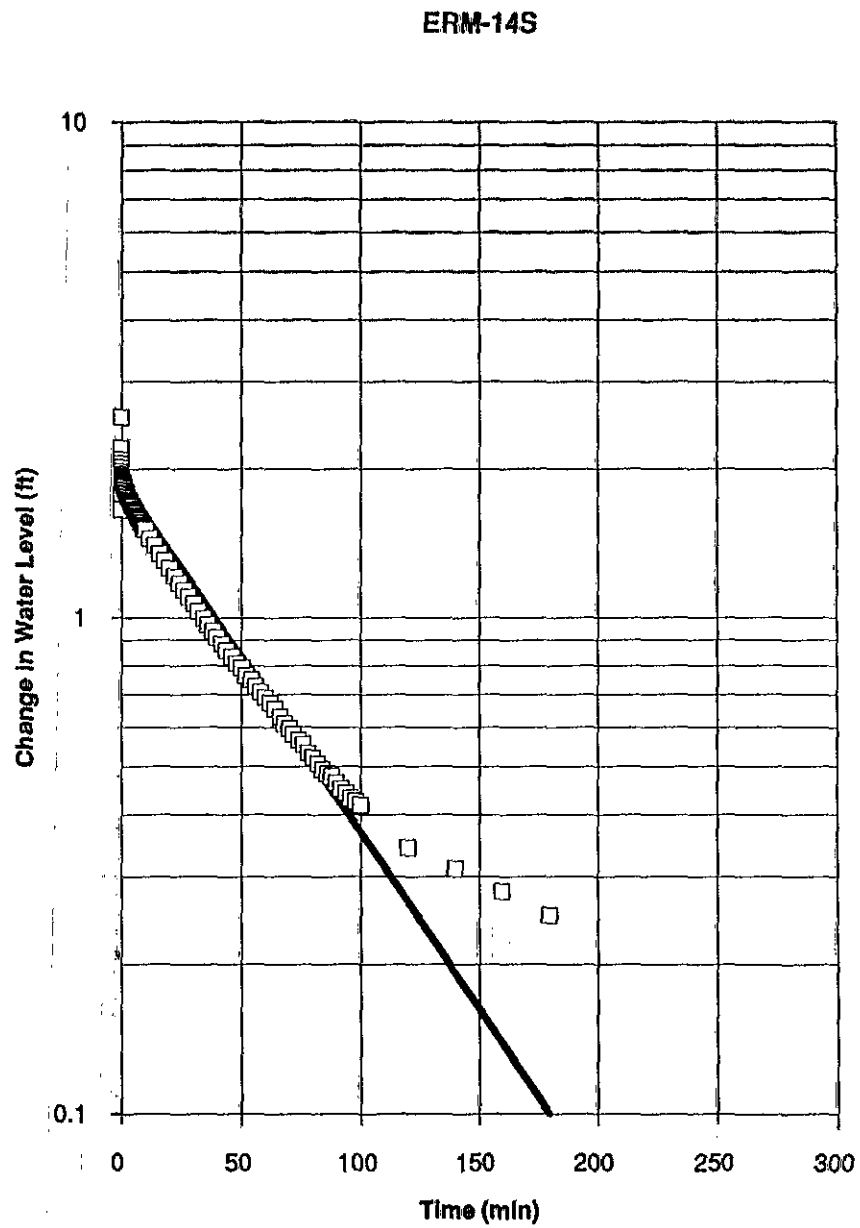
Calculations

(1/t)*ln(Yo/Yt) = 0.0164

ln(Re/rw) = 1/(1.1/ln(H/rw)+(A+B*ln((D-H)/rw))/(L/rw))
= 2.7527

K = (rc*rc*ln(Re/rw)*(1/t)*ln(Yo/Yt))/(2L)
= 0.02 feet/day = 5.43E-06 cm/sec

* Reference: Bouwer,H and Rice,R.C, 1976: A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers With Completely or Partially Penetrating Wells: Water Res. Res. V.12. No. 3



Bouwer and Rice Slug Test Calculations *

Well ERM-14I — Case 4: Well Penetrates to the Aquifer Bottom
Slug In — K gravel pack >> K formation
No Gravel Pack Drainage

Definition Of Variables:

D : Saturated Aquifer Thickness
H : Depth of Water in the Well
H = Static Water Elev. - Elev. of Well Bottom
L : Length of Gravel Pack Below Water Table
Note: L = H if Water level is Below the Top of the Screen
C : Well Geometry Factor - from Bouwer & Rice, Figure 3
rc : Inner Radius of the Well casing
rw : Radius of the Gravel Pack
Yo : Water Level Displacement at time = 0
t : Arbitrary Time from Recovery vs Time Plot
Yt : Water Level Displacement at time = t

Determined Values for Variables:

D =	88	feet	
H =	88	feet	Notes:
L =	26	feet	H = D for this analysis
C =	3.5		L/rw = 78
rw =	0.333	feet	
rc =	0.083	feet	
Yo =	2.25	feet	
t =	1.45	minutes	
Yt =	0.1	feet	

Calculations

(1/t)*ln(Yo/Yt) = 2.1473

ln(Re/rw) = 1/(1.1/ln(H/rw)+C/(L/rw))
= 4.1311

K = (rc*rc*ln(Re/rw)*(1/t)*ln(Yo/Yt))/(2L)
= 1.69 feet/day = 6.0 E-04 cm/sec

* Reference: Bouwer,H and Rice,R.C, 1976: A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers With Completely or Partially Penetrating Wells: Water Res. Res. V.12. No. 3

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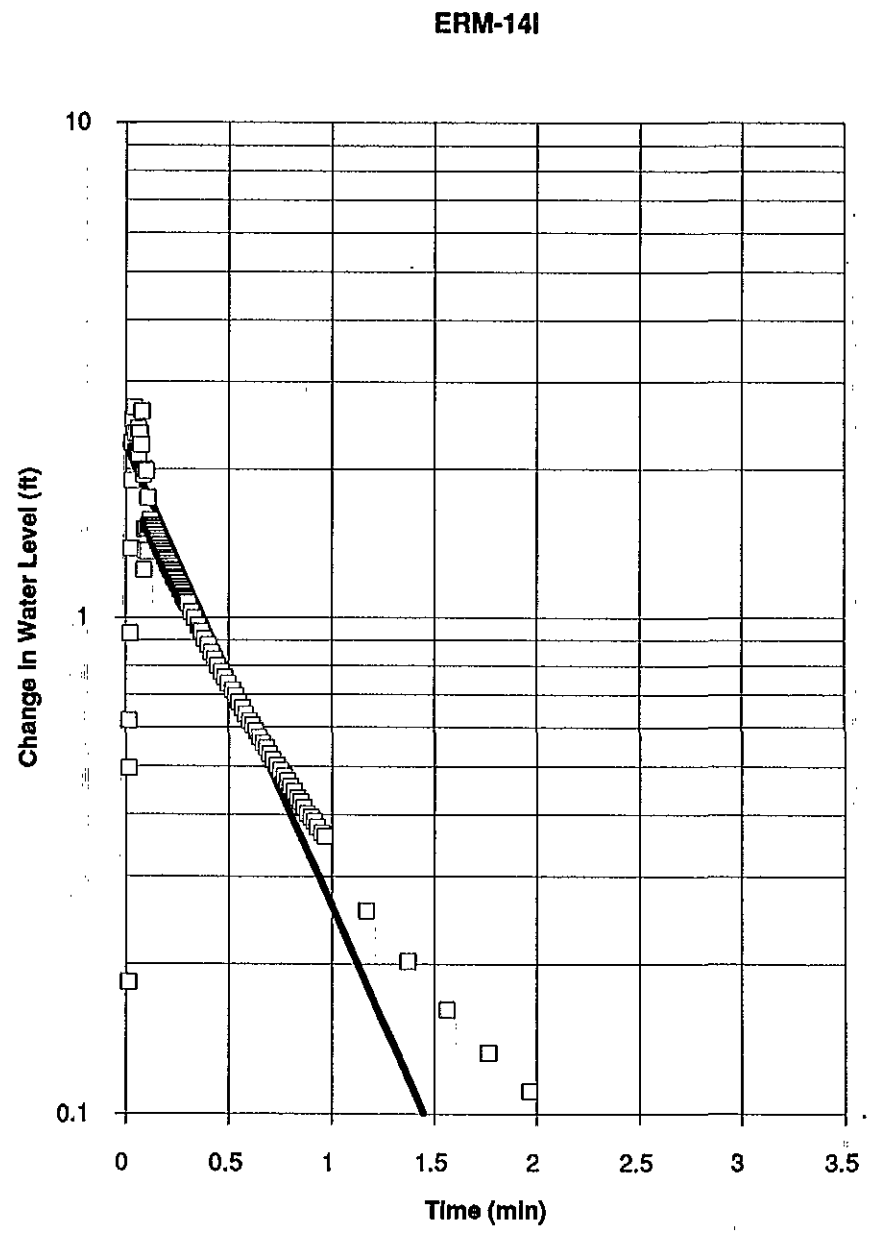


Bouwer and Rice Slug Test Calculations *

Well ERM-14I — Case 4: Well Penetrates to the Aquifer Bottom
Slug Out — K gravel pack >> K formation
No Gravel Pack Drainage

Definition Of Variables:

D : Saturated Aquifer Thickness
H : Depth of Water in the Well
H = Static Water Elev. - Elev. of Well Bottom
L : Length of Gravel Pack Below Water Table
Note: L = H if Water level is Below the Top of the Screen
C : Well Geometry Factor - from Bouwer & Rice, Figure 3
rc : Inner Radius of the Well casing
rw : Radius of the Gravel Pack
Yo : Water Level Displacement at time = 0
t : Arbitrary Time from Recovery vs Time Plot
Yt : Water Level Displacement at time = t

Determined Values for Variables:

D =	88	feet	
H =	88	feet	Notes:
L =	26	feet	H = D for this analysis
C =	3.5		L/rw = 78
rw =	0.333	feet	
rc =	0.083	feet	
Yo =	2.25	feet	
t =	1.45	minutes	
Yt =	0.1	feet	

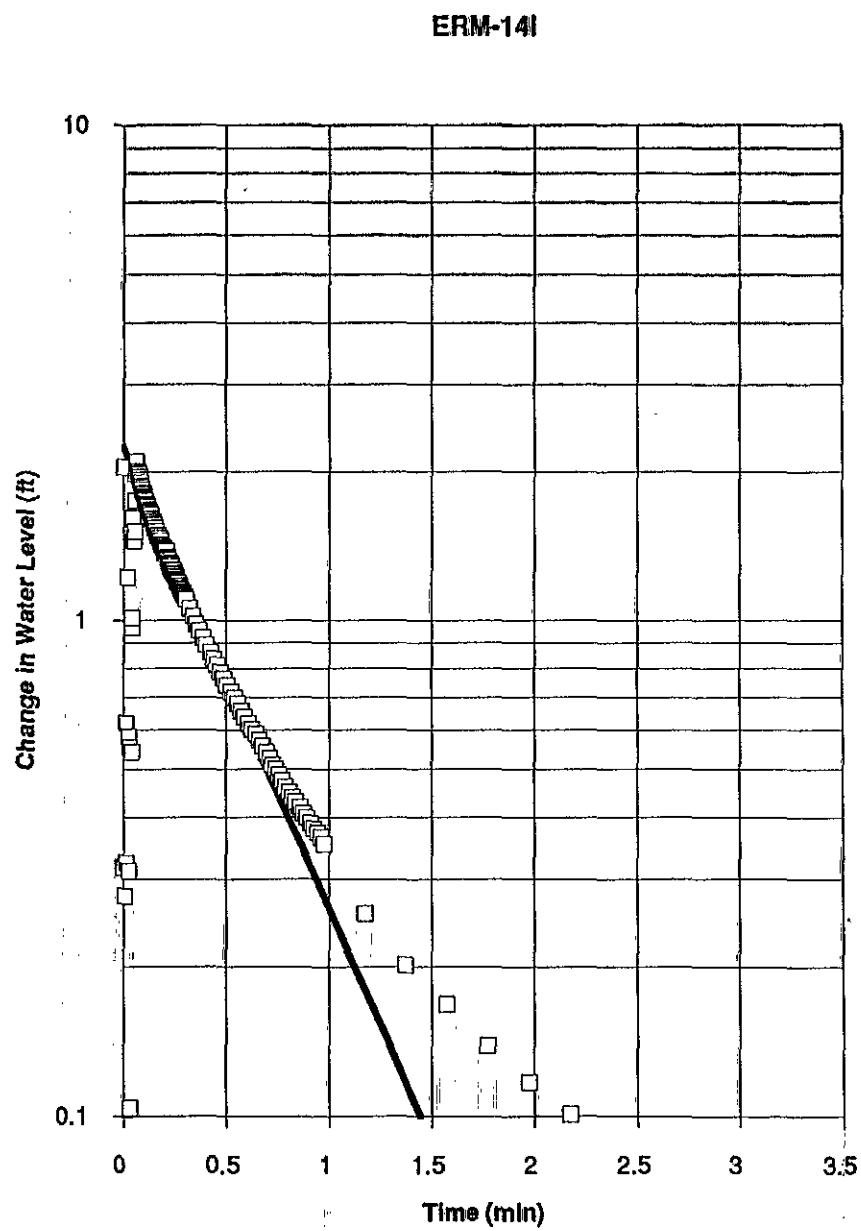
Calculations

(1/t)*ln(Yo/Yt) = 2.1473

ln(Re/rw) = 1/(1.1/ln(H/rw)+C/(L/rw))
= 4.1311

K = (rc*rc*ln(Re/rw)*(1/t)*ln(Yo/Yt))/(2L)
= 1.69 feet/day = 6.0 E-04 cm/sec

* Reference: Bouwer,H and Rice,R.C, 1976: A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers With Completely or Partially Penetrating Wells: Water Res. Res. V.12. No. 3



Bouwer and Rice Slug Test Calculations *

Well ERM-15I — Case 4: Well Penetrates to the Aquifer Bottom
Slug In — K gravel pack >> K formation
No Gravel Pack Drainage

Definition Of Variables:

D : Saturated Aquifer Thickness
H : Depth of Water in the Well
H = Static Water Elev. - Elev. of Well Bottom
L : Length of Gravel Pack Below Water Table
Note: L = H if Water level is Below the Top of the Screen
C : Well Geometry Factor - from Bouwer & Rice, Figure 3
rc : Inner Radius of the Well casing
rw : Radius of the Gravel Pack
Yo : Water Level Displacement at time = 0
t : Arbitrary Time from Recovery vs Time Plot
Yt : Water Level Displacement at time = t

Determined Values for Variables:

D =	89	feet	
H =	89	feet	Notes:
L =	26	feet	H = D for this analysis
C =	3.5		L/rw = 78
rw =	0.333	feet	
rc =	0.083	feet	
Yo =	2.25	feet	
t =	2.2	minutes	
Yt =	0.1	feet	

Calculations

(1/t)*ln(Yo/Yt) = 1.4152

ln(Re/rw) = 1/(1.1/ln(H/rw)+C/(L/rw))
= 4.1379

K = (rc*rc*ln(Re/rw)*(1/t)*ln(Yo/Yt))/(2L)
= 1.12 feet/day = 3.9 E-04 cm/sec

* Reference: Bouwer,H and Rice,R.C, 1976: A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers With Completely or Partially Penetrating Wells: Water Res. Res. V.12. No. 3

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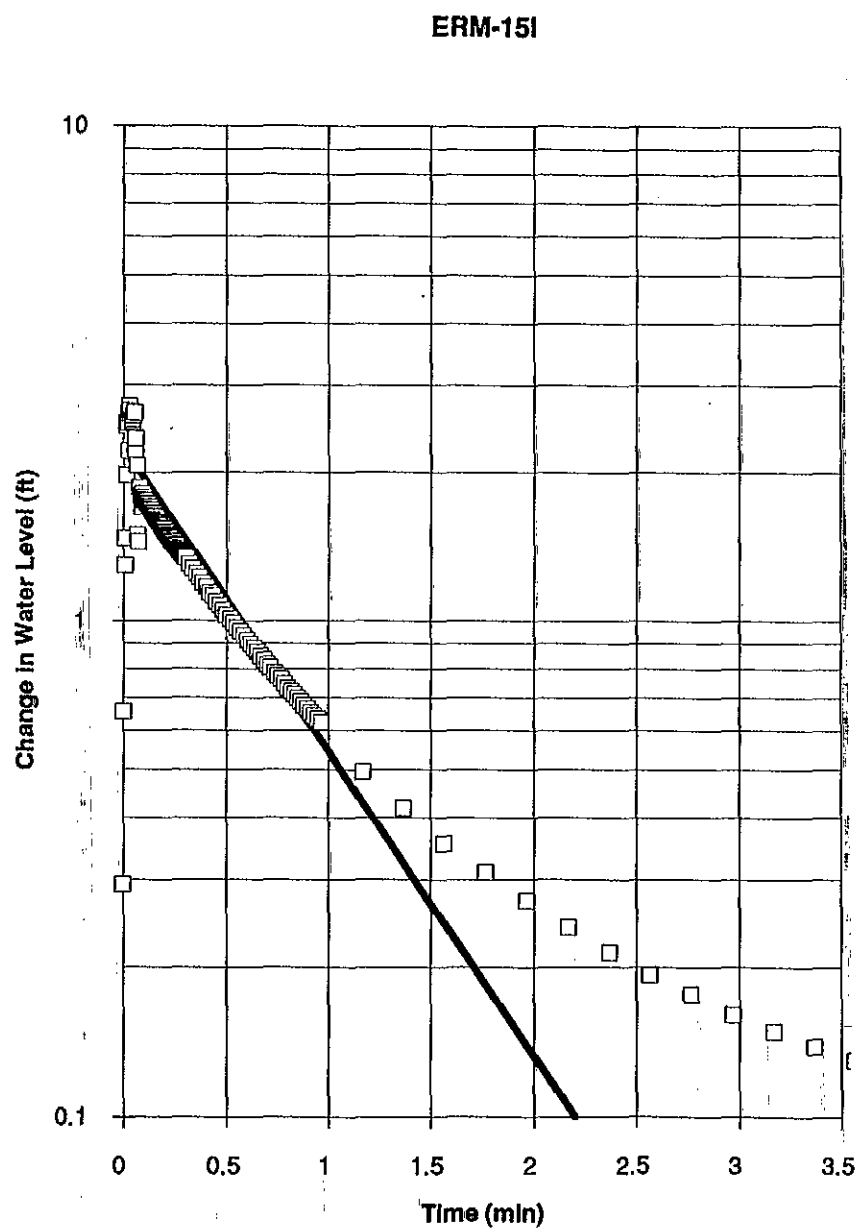


Bouwer and Rice Slug Test Calculations *

Well ERM-15I — Case 4: Well Penetrates to the Aquifer Bottom
Slug Out — K gravel pack >> K formation
No Gravel Pack Drainage

Definition Of Variables:

D : Saturated Aquifer Thickness
H : Depth of Water in the Well
H = Static Water Elev. - Elev. of Well Bottom
L : Length of Gravel Pack Below Water Table
Note: L = H if Water level is Below the Top of the Screen
C : Well Geometry Factor - from Bouwer & Rice, Figure 3
rc : Inner Radius of the Well casing
rw : Radius of the Gravel Pack
Yo : Water Level Displacement at time = 0
t : Arbitrary Time from Recovery vs Time Plot
Yt : Water Level Displacement at time = t

Determined Values for Variables:

D =	89	feet	
H =	89	feet	Notes:
L =	26	feet	H = D for this analysis
C =	3.5		L/rw = 78
rw =	0.333	feet	
rc =	0.083	feet	
Yo =	2.25	feet	
t =	2.2	minutes	
Yt =	0.1	feet	

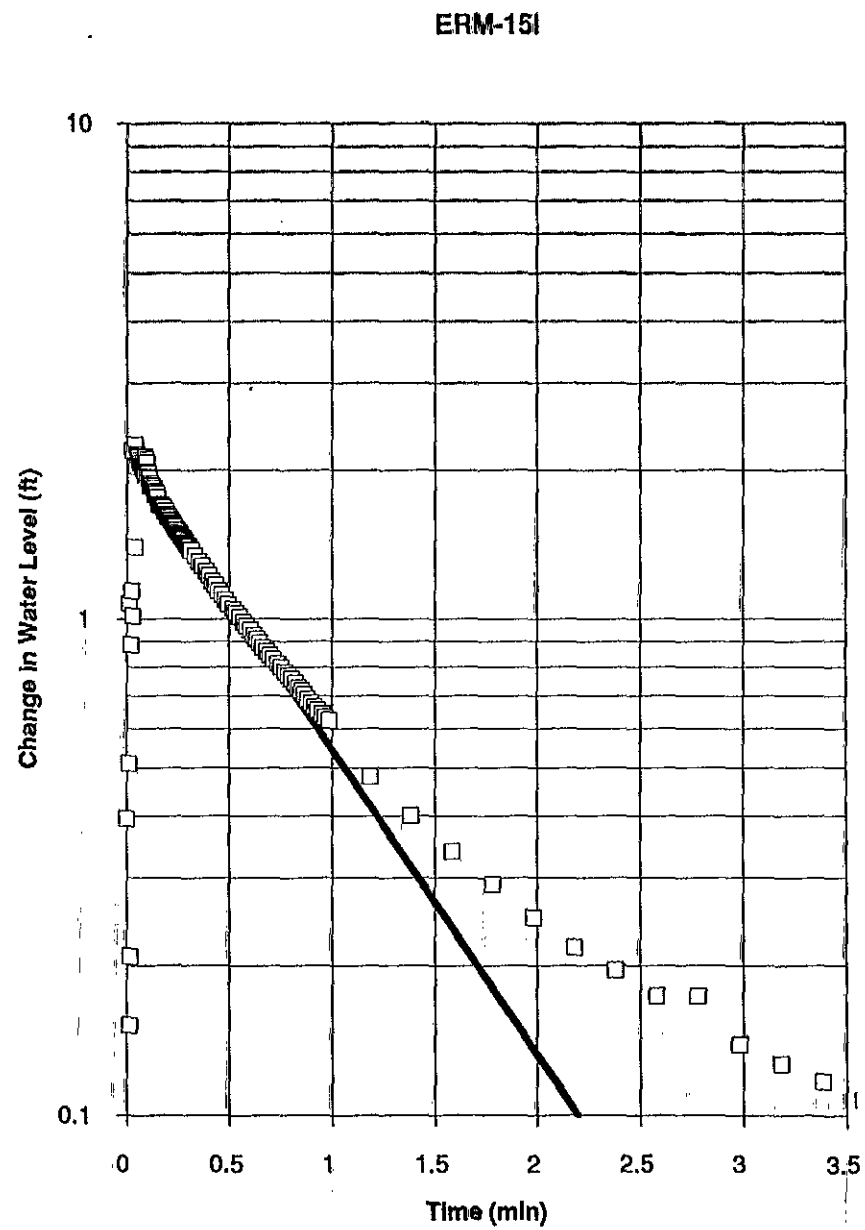
Calculations

(1/t)*ln(Yo/Yt) = 1.4152

ln(Re/rw) = 1/(1.1/ln(H/rw)+C/(L/rw))
= 4.1379

K = (rc*rc*ln(Re/rw)*(1/t)*ln(Yo/Yt))/(2L)
= 1.12 feet/day = 3.9 E-04 cm/sec

* Reference: Bouwer,H and Rice,R.C, 1976: A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers With Completely or Partially Penetrating Wells: Water Res. Res. V.12. No. 3



Bouwer and Rice Slug Test Calculations *

Well ERM-16S — Case 1: Standard Bouwer and Rice
Slug In — K gravel pack >> K formation
No Gravel Pack Drainage

Definition Of Variables:

D : Saturated Aquifer Thickness
H : Depth of Water in the Well
H = Static Water Elev. - Elev. of Well Bottom
L : Length of Gravel Pack Below Water Table
Note: L = H if Water level is Below the Top of the Screen
A & B : Well Geometry Factors - from Bouwer & Rice, Figure 3
rc : Inner Radius of the Well casing
rw : Radius of the Gravel Pack
Yo : Water Level Displacement at time = 0
t : Arbitrary Time from Recovery vs Time Plot
Yt : Water Level Displacement at time = t

Determined Values for Variables:

D =	100	feet
H =	34.5	feet
L =	16	feet
A =	3.45	
B =	0.6	
rw =	0.26	feet
rc =	0.083	feet
Yo =	2.25	feet
t =	8	minutes
Yt =	0.1	feet

Notes:
If H=L then there should be gravel pack drainage or K pack= K formation
L/rw = 62

Calculations

(1/t)*ln(Yo/Yt) = 0.3892

ln(Re/rw) = 1/(1.1/ln(H/rw)+(A+B*ln((D-H)/rw))/(L/rw))
= 2.985

K = (rc*rc*ln(Re/rw)*(1/t)*ln(Yo/Yt))/(2L)
= 0.36 feet/day = 1.27E-04 cm/sec

* Reference: Bouwer,H and Rice,R.C, 1976: A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers With Completely or Partially Penetrating Wells: Water Res. Res. V.12. No. 3

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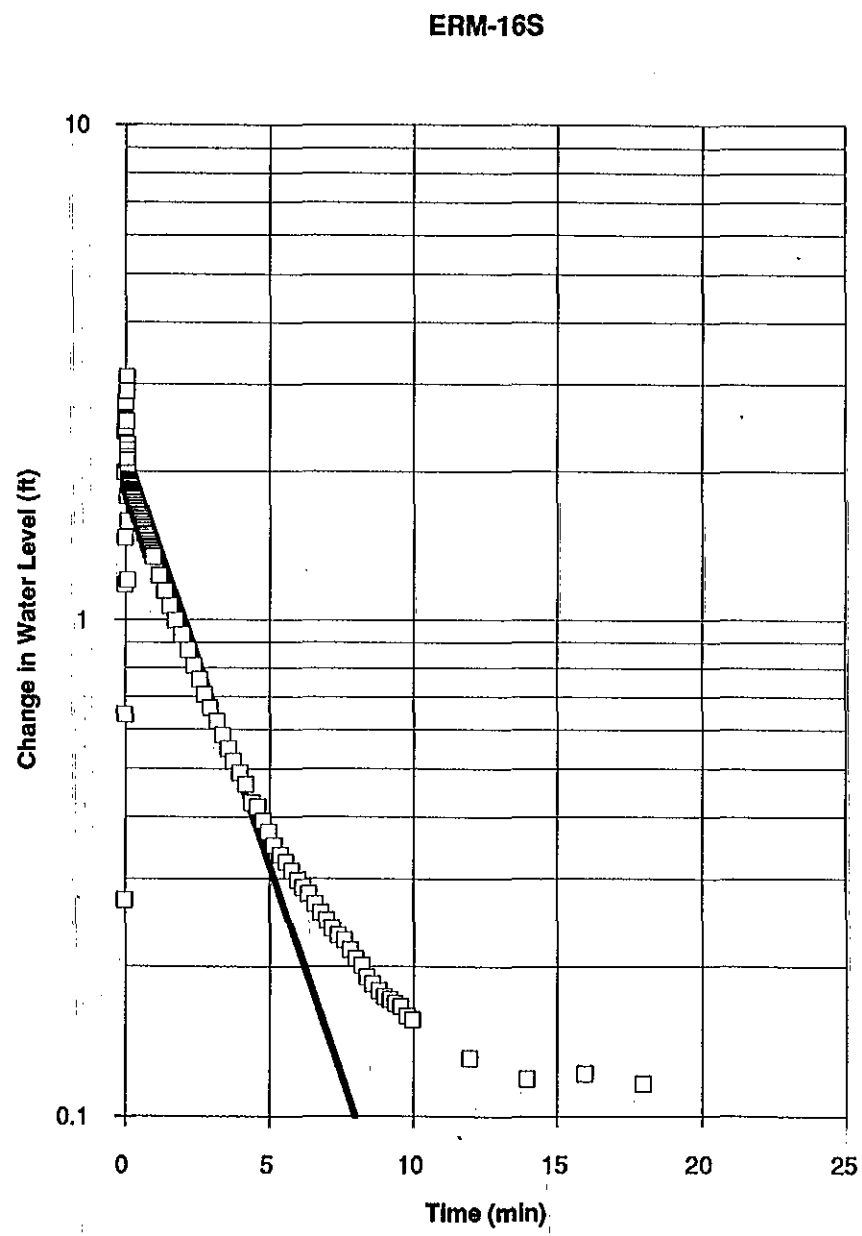


Bouwer and Rice Slug Test Calculations *

Well ERM-16S — Case 1: Standard Bouwer and Rice
Slug Out — K gravel pack >> K formation
No Gravel Pack Drainage

Definition Of Variables:

D : Saturated Aquifer Thickness
H : Depth of Water in the Well
H = Static Water Elev. - Elev. of Well Bottom
L : Length of Gravel Pack Below Water Table
Note: L = H if Water level is Below the Top of the Screen
A & B : Well Geometry Factors - from Bouwer & Rice, Figure 3
rc : Inner Radius of the Well casing
rw : Radius of the Gravel Pack
Yo : Water Level Displacement at time = 0
t : Arbitrary Time from Recovery vs Time Plot
Yt : Water Level Displacement at time = t

Determined Values for Variables:

D =	100	feet	
H =	34.5	feet	Notes:
L =	16	feet	If H=L then there should be gravel pack
A =	3.45		drainage or K pack= K formation
B =	0.6		L/rw = 62
rw =	0.26	feet	
rc =	0.083	feet	
Yo =	2.25	feet	
t =	8	minutes	
Yt =	0.1	feet	

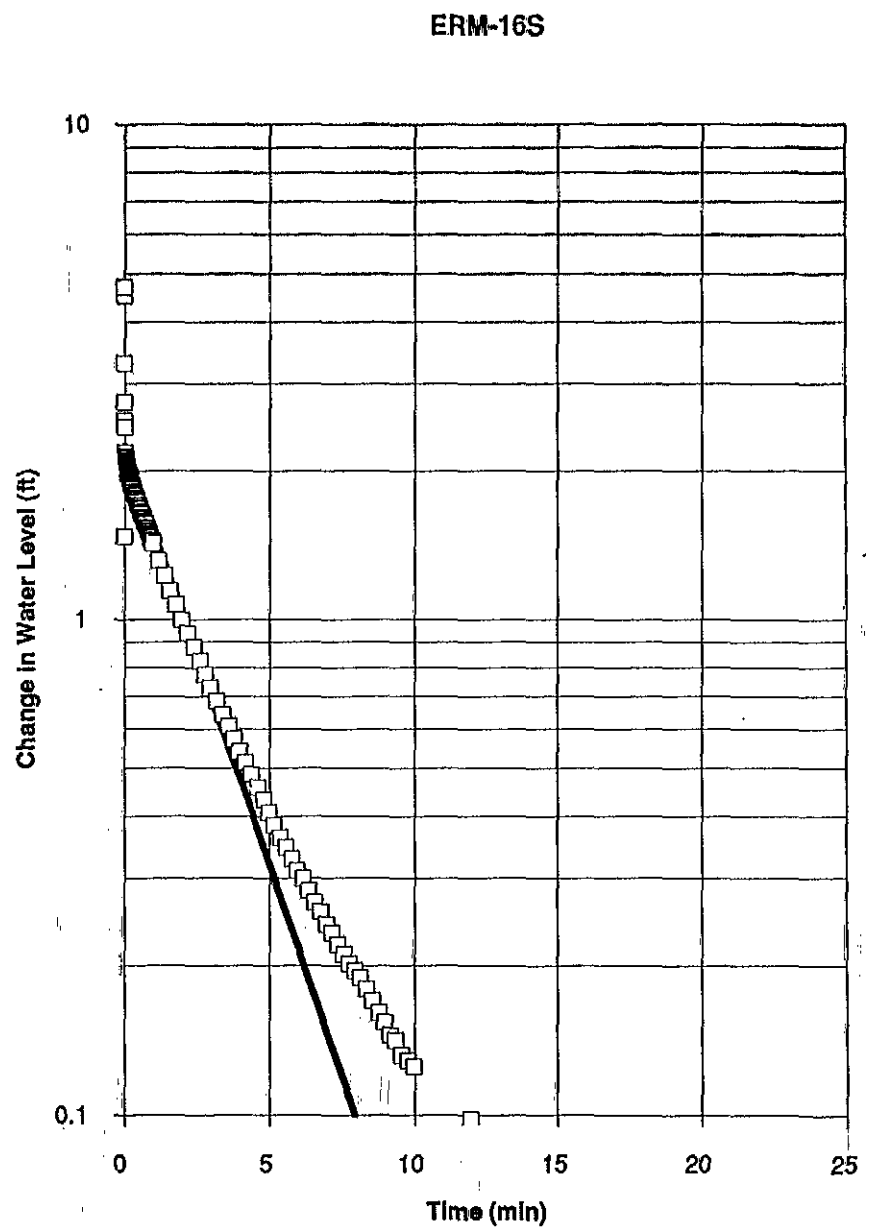
Calculations

(1/t)*ln(Yo/Yt) = 0.3892

ln(Re/rw) = 1/(1.1/ln(H/rw)+(A+B*ln((D-H)/rw))/(L/rw))
= 2.985

K = (rc*rc*ln(Re/rw)*(1/t)*ln(Yo/Yt))/(2L)
= 0.36 feet/day = 1.27E-04 cm/sec

* Reference: Bouwer,H and Rice,R.C, 1976: A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers With Completely or Partially Penetrating Wells: Water Res. Res. V.12, No. 3



Bouwer and Rice Slug Test Calculations *

Well ERM-16I — Case 4: Well Penetrates to the Aquifer Bottom
Slug In — K gravel pack >> K formation
No Gravel Pack Drainage

Definition Of Variables:

D : Saturated Aquifer Thickness
H : Depth of Water in the Well
H = Static Water Elev. - Elev. of Well Bottom
L : Length of Gravel Pack Below Water Table
Note: L = H if Water level is Below the Top of the Screen
C : Well Geometry Factor - from Bouwer & Rice, Figure 3
rc : Inner Radius of the Well casing
rw : Radius of the Gravel Pack
Yo : Water Level Displacement at time = 0
t : Arbitrary Time from Recovery vs Time Plot
Yt : Water Level Displacement at time = t

Determined Values for Variables:

D =	88	feet	
H =	88	feet	Notes:
L =	26	feet	H = D for this analysis
C =	3.5		L/rw = 78
rw =	0.333	feet	
rc =	0.083	feet	
Yo =	2.25	feet	
t =	0.28	minutes	
Yt =	0.1	feet	

Calculations

(1/t)*ln(Yo/Yt) = 11.12

ln(Re/rw) = 1/(1.1/ln(H/rw)+C/(L/rw))
= 4.1311

K = (rc*rc*ln(Re/rw)*(1/t)*ln(Yo/Yt))/(2L)
= 8.76 feet/day = 3.1 E-03 cm/sec

* Reference: Bouwer,H and Rice,R.C, 1976: A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers With Completely or Partially Penetrating Wells: Water Res. Res. V.12. No. 3

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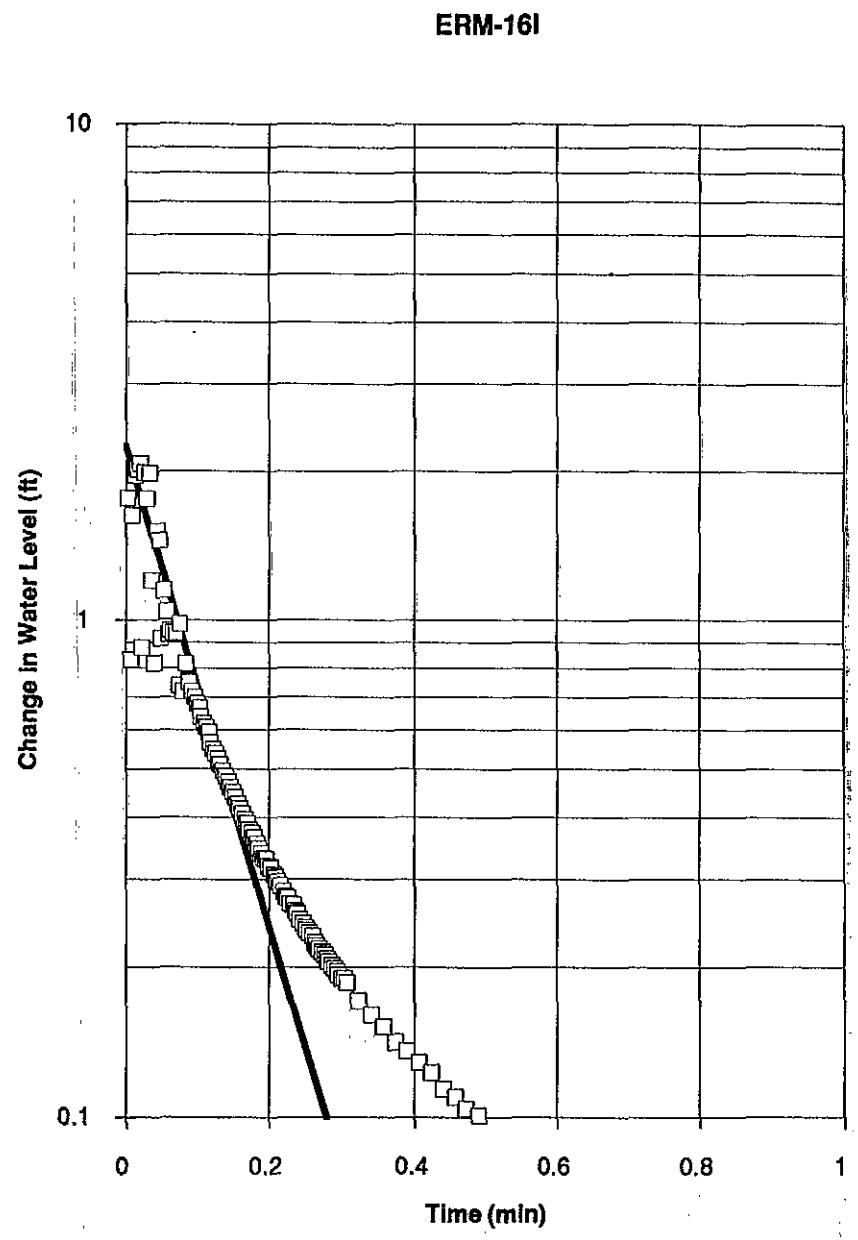


Bouwer and Rice Slug Test Calculations *

Well ERM-16I — Case 4: Well Penetrates to the Aquifer Bottom
Slug Out — K gravel pack >> K formation
No Gravel Pack Drainage

Definition Of Variables:

D : Saturated Aquifer Thickness
H : Depth of Water in the Well
H = Static Water Elev. - Elev. of Well Bottom
L : Length of Gravel Pack Below Water Table
Note: L = H if Water level is Below the Top of the Screen
C : Well Geometry Factor - from Bouwer & Rice, Figure 3
rc : Inner Radius of the Well casing
rw : Radius of the Gravel Pack
Yo : Water Level Displacement at time = 0
t : Arbitrary Time from Recovery vs Time Plot
Yt : Water Level Displacement at time = t

Determined Values for Variables:

D =	88	feet	
H =	88	feet	Notes:
L =	26	feet	H = D for this analysis
C =	3.5		L/rw = 78
rw =	0.333	feet	
rc =	0.083	feet	
Yo =	2.25	feet	
t =	0.28	minutes	
Yt =	0.1	feet	

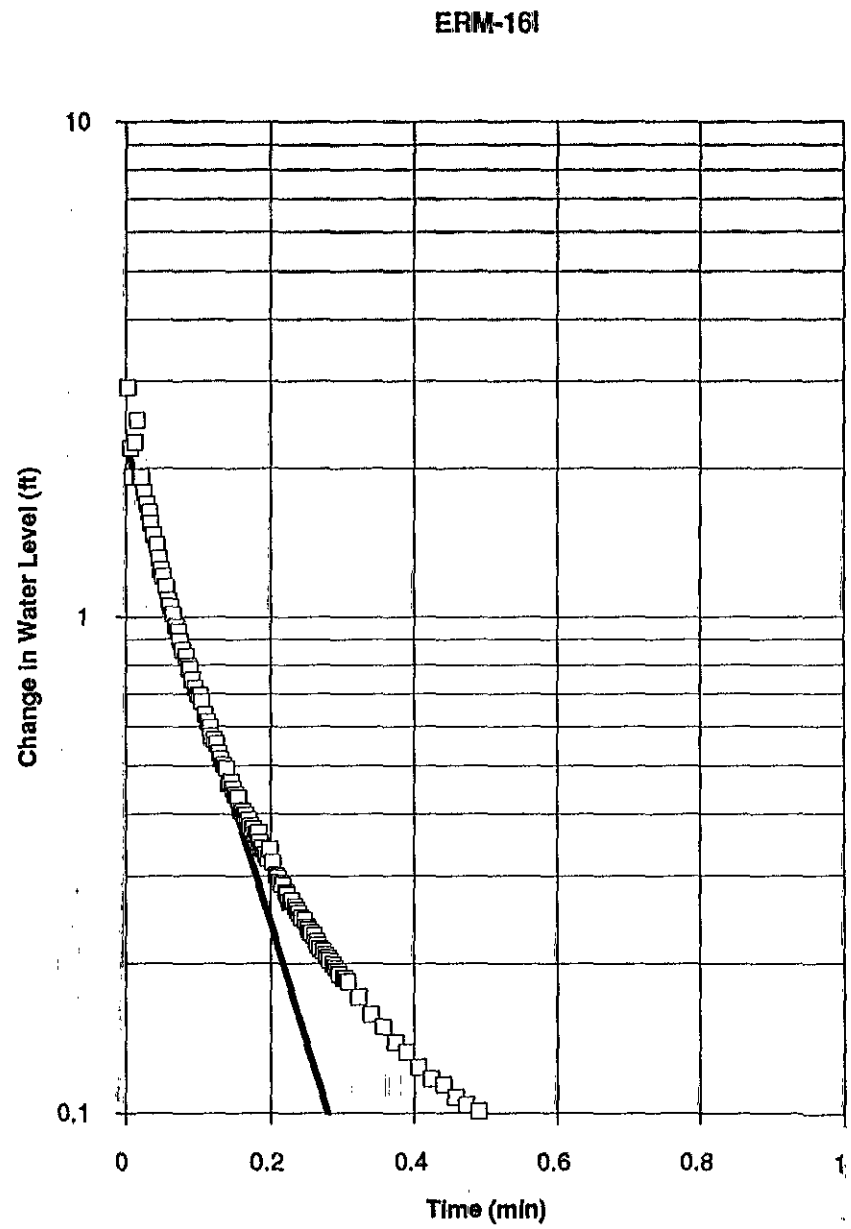
Calculations

(1/t)*ln(Yo/Yt) = 11.12

ln(Re/rw) = 1/(1.1/ln(H/rw)+C/(L/rw))
= 4.1311

K = (rc*rc*ln(Re/rw)*(1/t)*ln(Yo/Yt))/(2L)
= 8.76 feet/day = 3.1 E-03 cm/sec

* Reference: Bouwer,H and Rice,R.C, 1976: A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers With Completely or Partially Penetrating Wells: Water Res. Res. V.12. No. 3



Bouwer and Rice Slug Test Calculations *

Well ERM-17S — Case 1: Standard Bouwer and Rice
Slug In — K gravel pack >> K formation
No Gravel Pack Drainage

Definition Of Variables:

D : Saturated Aquifer Thickness
H : Depth of Water in the Well
H = Static Water Elev. - Elev. of Well Bottom
L : Length of Gravel Pack Below Water Table
Note: L = H if Water level is Below the Top of the Screen
A & B : Well Geometry Factors - from Bouwer & Rice, Figure 3
rc : Inner Radius of the Well casing
rw : Radius of the Gravel Pack
Yo : Water Level Displacement at time = 0
t : Arbitrary Time from Recovery vs Time Plot
Yt : Water Level Displacement at time = t

Determined Values for Variables:

D =	100	feet	
H =	24.5	feet	Notes:
L =	15	feet	If H=L then there should be gravel pack
A =	3.4		drainage or K pack= K formation
B =	0.6		L/rw = 58
rw =	0.26	feet	
rc =	0.083	feet	
Yo =	2.25	feet	
t =	3	minutes	
Yt =	0.1	feet	

Calculations

(1/t)*ln(Yo/Yt) = 1.0378

ln(Re/rw) = 1/(1.1/ln(H/rw)+(A+B*ln((D-H)/rw))/(L/rw))
= 2.7786

K = (rc*rc*ln(Re/rw)*(1/t)*ln(Yo/Yt))/(2L)
= 0.95 feet/day = 3.36E-04 cm/sec

* Reference: Bouwer,H and Rice,R.C, 1976: A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers With Completely or Partially Penetrating Wells: Water Res. Res. V.12. No. 3

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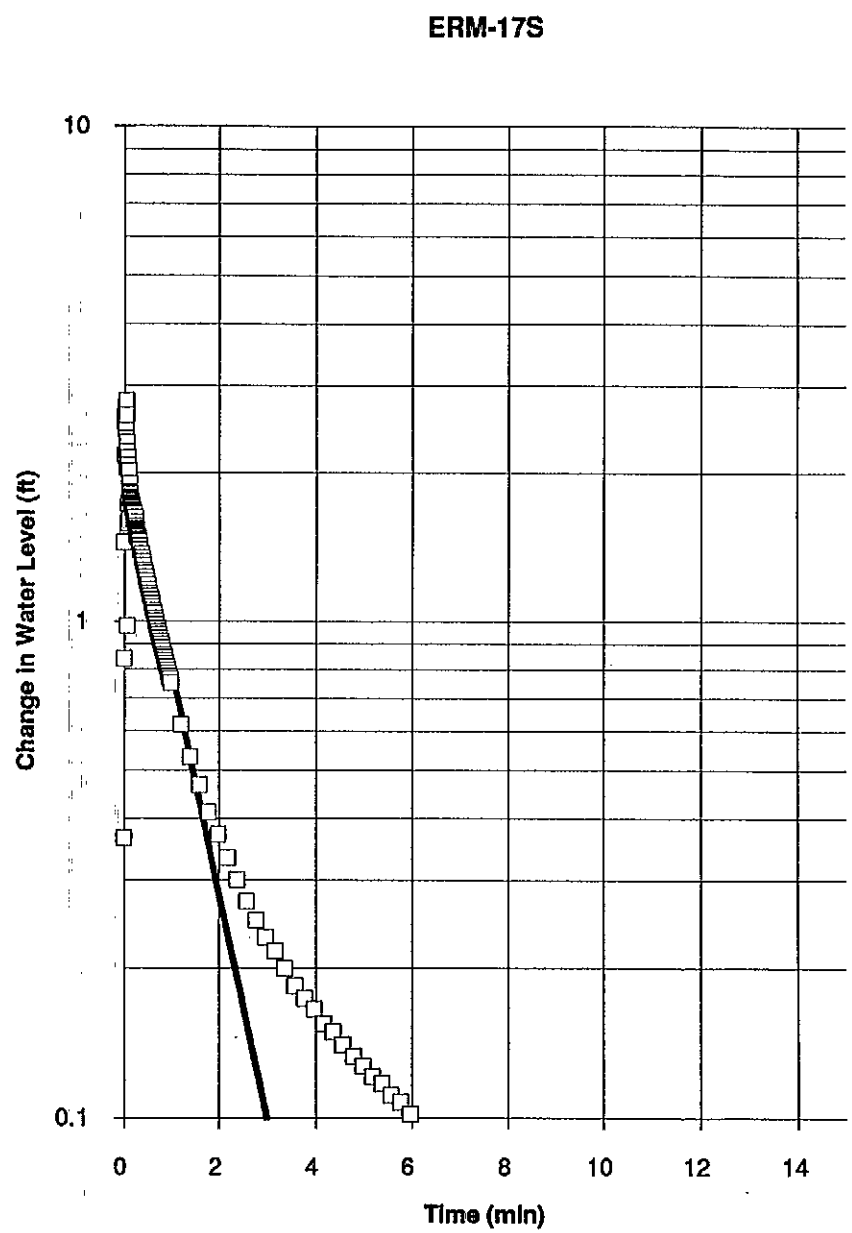


Bouwer and Rice Slug Test Calculations *

Well ERM-17S — Case 1: Standard Bouwer and Rice
Slug Out — K gravel pack >> K formation
No Gravel Pack Drainage

Definition Of Variables:

D : Saturated Aquifer Thickness
H : Depth of Water in the Well
H = Static Water Elev. - Elev. of Well Bottom
L : Length of Gravel Pack Below Water Table
Note: L = H if Water level is Below the Top of the Screen
A & B : Well Geometry Factors - from Bouwer & Rice, Figure 3
rc : Inner Radius of the Well casing
rw : Radius of the Gravel Pack
Yo : Water Level Displacement at time = 0
t : Arbitrary Time from Recovery vs Time Plot
Yt : Water Level Displacement at time = t

Determined Values for Variables:

D =	100	feet	
H =	24.5	feet	Notes:
L =	15	feet	If H=L then there should be gravel pack
A =	3.4		drainage or K pack= K formation
B =	0.6		L/rw = 58
rw =	0.26	feet	
rc =	0.083	feet	
Yo =	2.25	feet	
t =	3	minutes	
Yt =	0.1	feet	

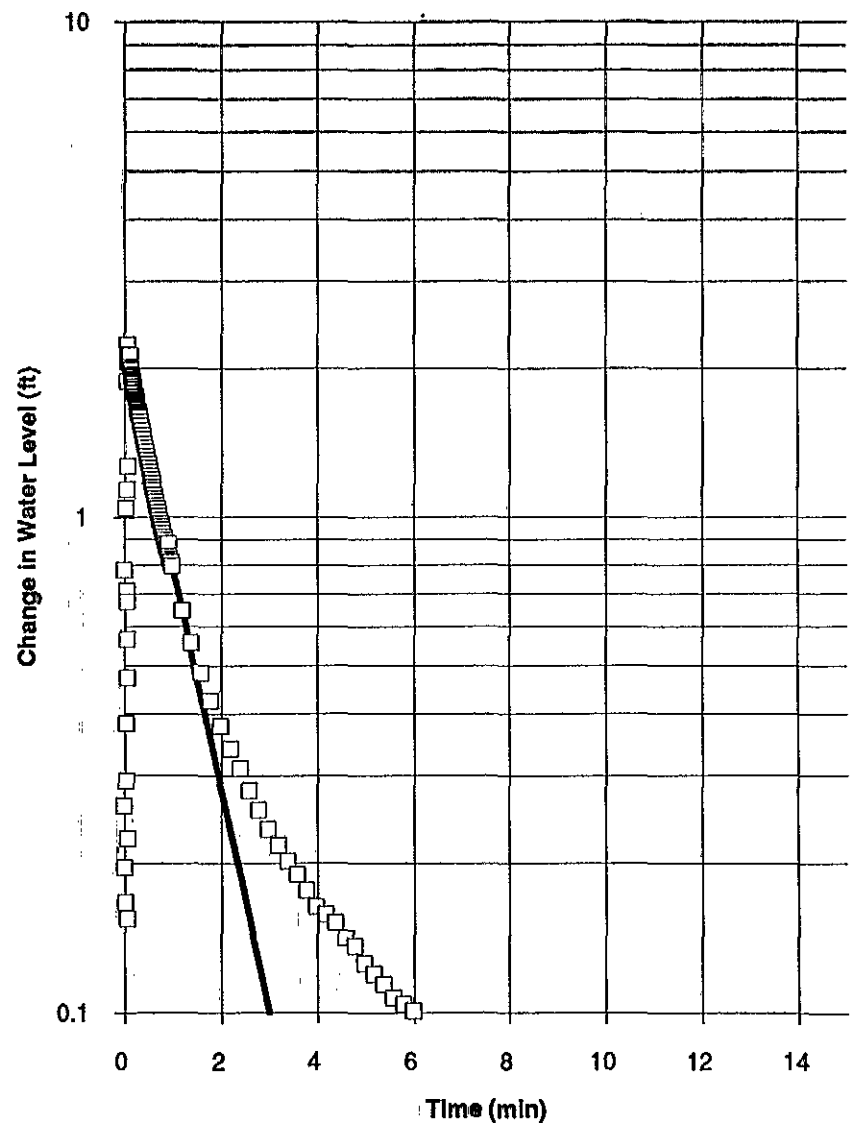
Calculations

(1/t)*ln(Yo/Yt) = 1.0378

ln(Re/rw) = 1/(1.1/ln(H/rw)+(A+B*ln((D-H)/rw))/(L/rw))
= 2.7786

K = (rc*rc*ln(Re/rw)*(1/t)*ln(Yo/Yt))/(2L)
= 0.95 feet/day = 3.36E-04 cm/sec

* Reference: Bouwer,H and Rice,R.C, 1976: A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers With Completely or Partially Penetrating Wells: Water Res. Res. V.12. No. 3



Bouwer and Rice Slug Test Calculations *

Well ERM-17I — Case 4: Well Penetrates to the Aquifer Bottom
Slug In — K gravel pack >> K formation
No Gravel Pack Drainage

Definition Of Variables:

D : Saturated Aquifer Thickness
H : Depth of Water in the Well
H = Static Water Elev. - Elev. of Well Bottom
L : Length of Gravel Pack Below Water Table
Note: L = H if Water level is Below the Top of the Screen
C : Well Geometry Factor - from Bouwer & Rice, Figure 3
rc : Inner Radius of the Well casing
rw : Radius of the Gravel Pack
Yo : Water Level Displacement at time = 0
t : Arbitrary Time from Recovery vs Time Plot
Yt : Water Level Displacement at time = t

Determined Values for Variables:

D =	80	feet	
H =	80	feet	Notes:
L =	24	feet	H = D for this analysis
C =	3.4		L/rw = 72
rw =	0.333	feet	
rc =	0.083	feet	
Yo =	2.25	feet	
t =	2.4	minutes	
Yt =	0.1	feet	

Calculations

(1/t)*ln(Yo/Yt) = 1.2973

ln(Re/rw) = 1/(1.1/ln(H/rw)+C/(L/rw))
= 4.0348

K = (rc*rc*ln(Re/rw)*(1/t)*ln(Yo/Yt))/(2L)
= 1.08 feet/day = 3.8 E-04 cm/sec

* Reference: Bouwer,H and Rice,R.C, 1976: A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers With Completely or Partially Penetrating Wells: Water Res. Res. V.12. No. 3

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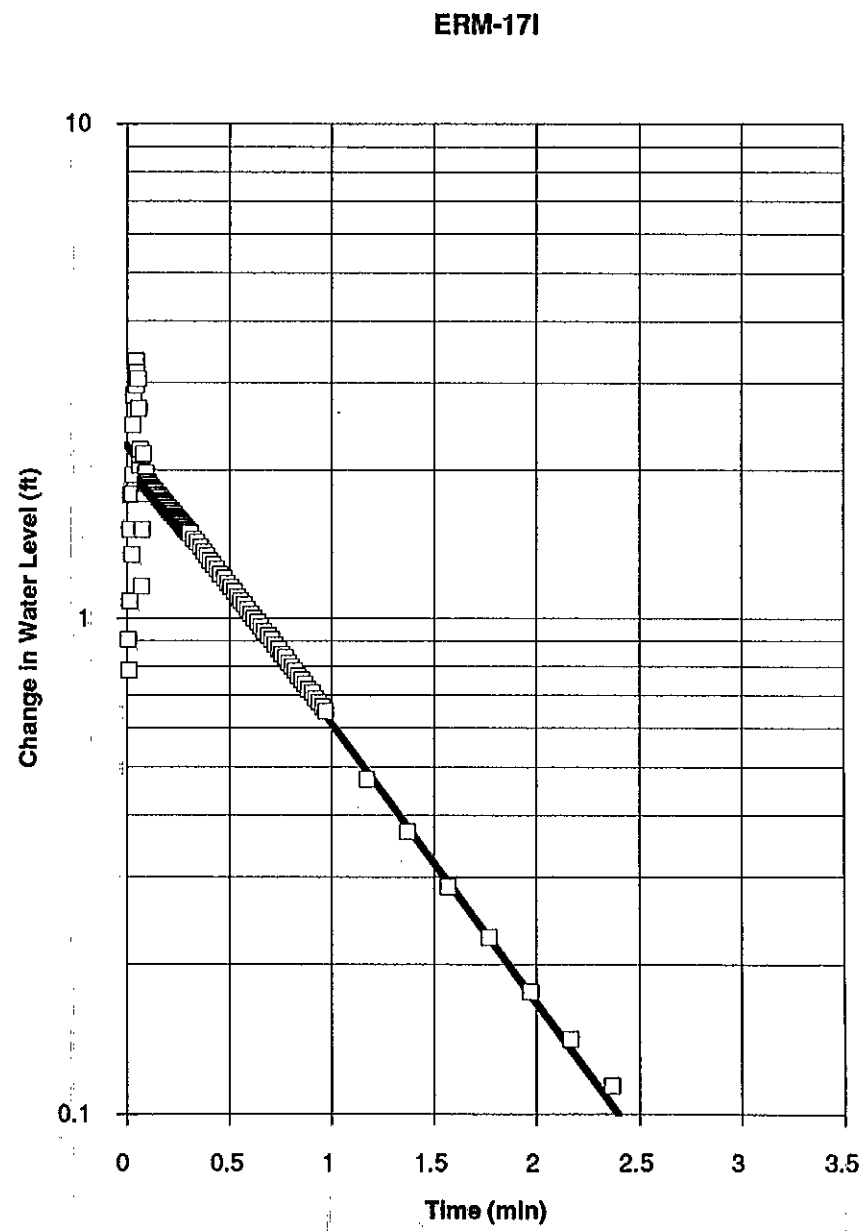


Bouwer and Rice Slug Test Calculations *

Well ERM-17I — Case 4: Well Penetrates to the Aquifer Bottom
Slug Out — K gravel pack >> K formation
No Gravel Pack Drainage

Definition Of Variables:

D : Saturated Aquifer Thickness
H : Depth of Water in the Well
H = Static Water Elev. - Elev. of Well Bottom
L : Length of Gravel Pack Below Water Table
Note: L = H if Water level is Below the Top of the Screen
C : Well Geometry Factor - from Bouwer & Rice, Figure 3
rc : Inner Radius of the Well casing
rw : Radius of the Gravel Pack
Yo : Water Level Displacement at time = 0
t : Arbitrary Time from Recovery vs Time Plot
Yt : Water Level Displacement at time = t

Determined Values for Variables:

D =	80	feet	
H =	80	feet	Notes:
L =	24	feet	H = D for this analysis
C =	3.4		L/rw = 72
rw =	0.333	feet	
rc =	0.083	feet	
Yo =	2.25	feet	
t =	2.5	minutes	
Yt =	0.1	feet	

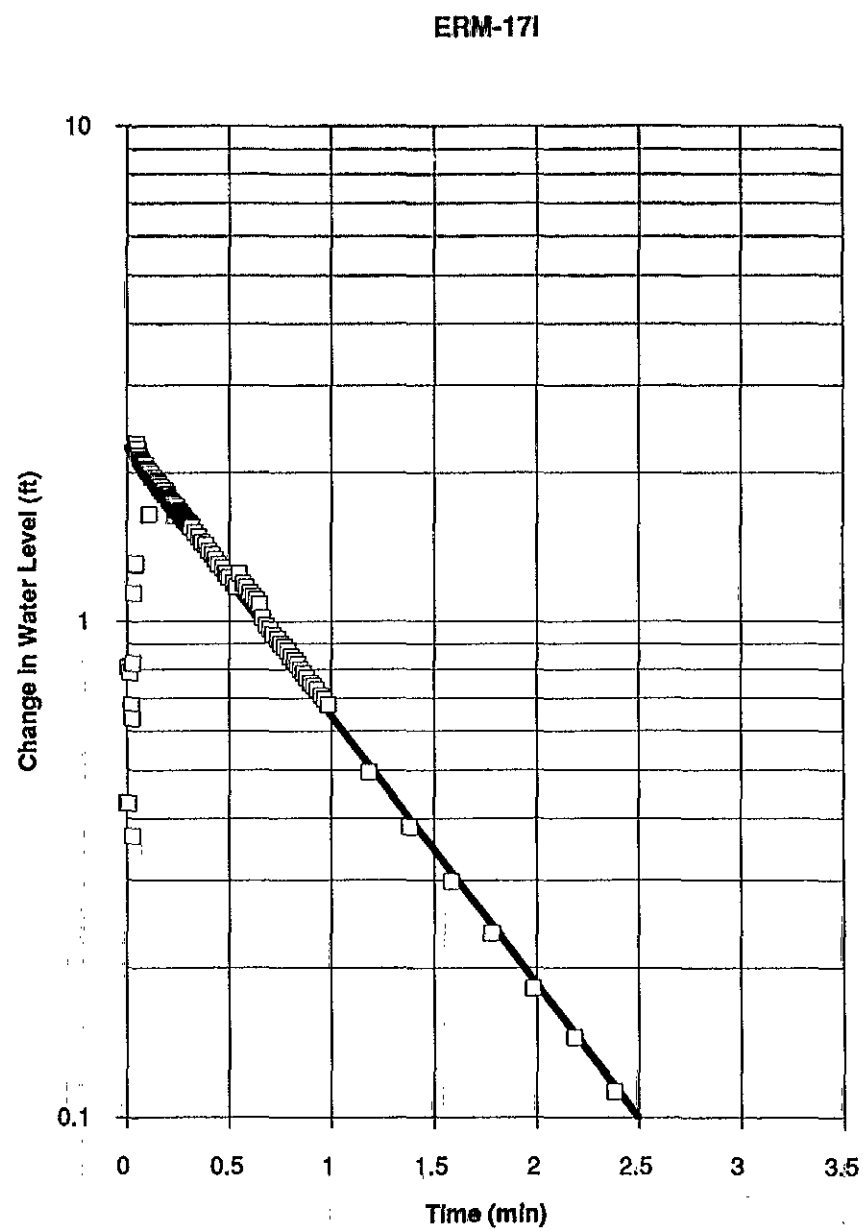
Calculations

(1/t)*ln(Yo/Yt) = 1.2454

ln(Re/rw) = 1/(1.1/ln(H/rw)+C/(L/rw))
= 4.0348

K = (rc*rc*ln(Re/rw)*(1/t)*ln(Yo/Yt))/(2L)
= 1.04 feet/day = 3.7 E-04 cm/sec

* Reference: Bouwer,H and Rice,R.C, 1976: A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers With Completely or Partially Penetrating Wells: Water Res. Res. V.12. No. 3



Bouwer and Rice Slug Test Calculations *

Well ERM-18S — Case 3: Gravel Pack Drainage
Slug In — K gravel pack >> K formation
Water Level Below Top of the Gravel Pack

Definition Of Variables:

D : Saturated Aquifer Thickness
H : Depth To the Bottom of the Gravel Pack minus the Static Depth to Water
L = H for Well with Gravel Pack Drainage
A & B : Well Geometry Factors - from Bouwer & Rice, Figure 3
rc : Inner Radius of the Well casing
rw : Radius of the Gravel Pack
Yo : Water Level Displacement at time = 0
t : Arbitrary Time from Recovery vs Time Plot
Yt : Water Level Displacement at time = t

Determined Values for Variables:

D =	100	feet	
H =	3.34	feet	Notes:
L =	3.34	feet	L = H
A =	1.8		L/rw = 7
B =	0.27		
rw =	0.5	feet	
rc =	0.083	feet	
Yo =	0.18	feet	
t =	0.35	minutes	
Yt =	0.1	feet	

Calculations

(1/t)*ln(Yo/Yt) = 1.6794

ln(Re/rw) = 1/[(1.1/ln(H/rw)+(A+Bln((D-H)/rw)))/(L/rw)]
= 0.9421

K = [(rc*rc)+0.3*(rw*rw-rc*rc)]*ln(Re/rw)*(1/t)*ln(Yo/Yt))/(2L)
= 27.22 feet/day = 9.60E-03 cm/sec

* Reference: Bouwer,H and Rice,R.C, 1976: A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers With Completely or Partially Penetrating Wells: Water Res. Res. V.12. No. 3

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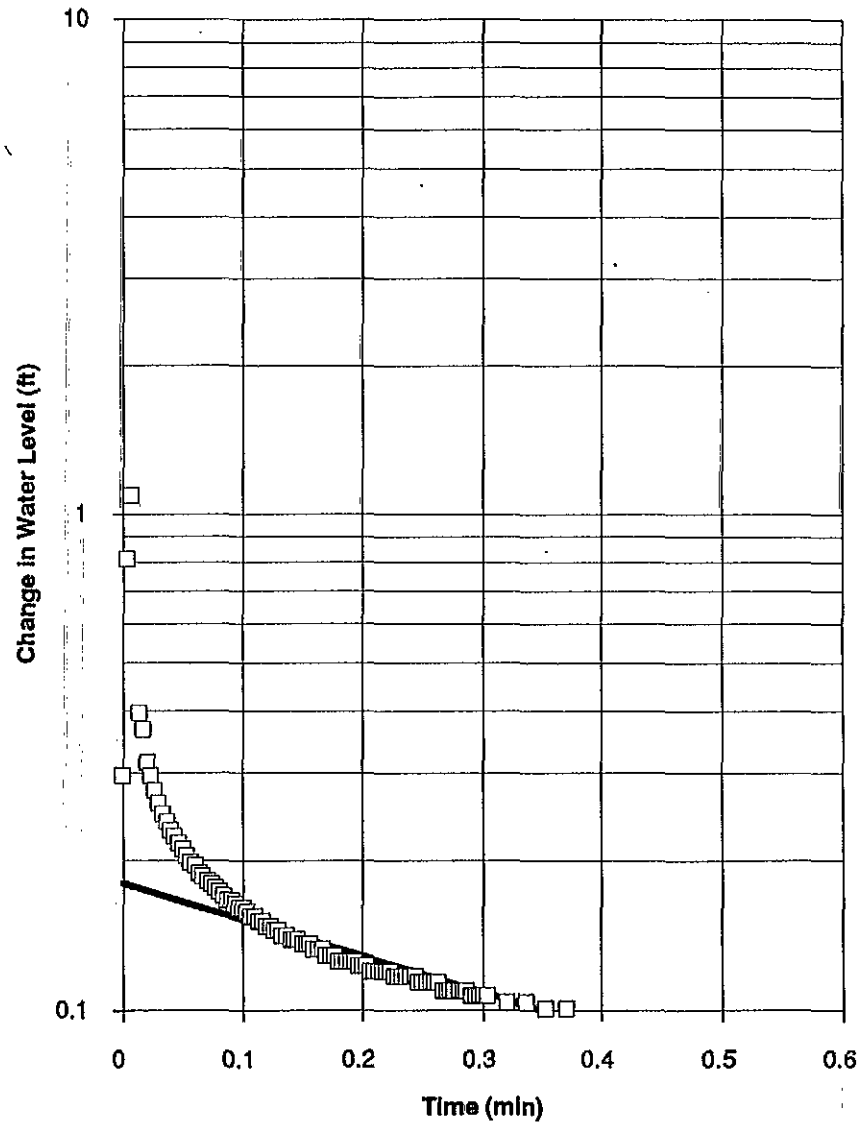


Bouwer and Rice Slug Test Calculations *

Well ERM-18S — Case 3: Gravel Pack Drainage
Slug Out — K gravel pack >> K formation
Water Level Below Top of the Gravel Pack

Definition Of Variables:

D : Saturated Aquifer Thickness
H : Depth To the Bottom of the Gravel Pack minus the Static Depth to Water
L = H for Well with Gravel Pack Drainage
A & B : Well Geometry Factors - from Bouwer & Rice, Figure 3
rc : Inner Radius of the Well casing
rw : Radius of the Gravel Pack
Yo : Water Level Displacement at time = 0
t : Arbitrary Time from Recovery vs Time Plot
Yt : Water Level Displacement at time = t

Determined Values for Variables:

D =	100	feet	
H =	3.34	feet	Notes:
L =	3.34	feet	L = H
A =	1.8		L/rw = 7
B =	0.27		
rw =	0.5	feet	
rc =	0.083	feet	
Yo =	0.21	feet	
t =	0.44	minutes	
Yt =	0.1	feet	

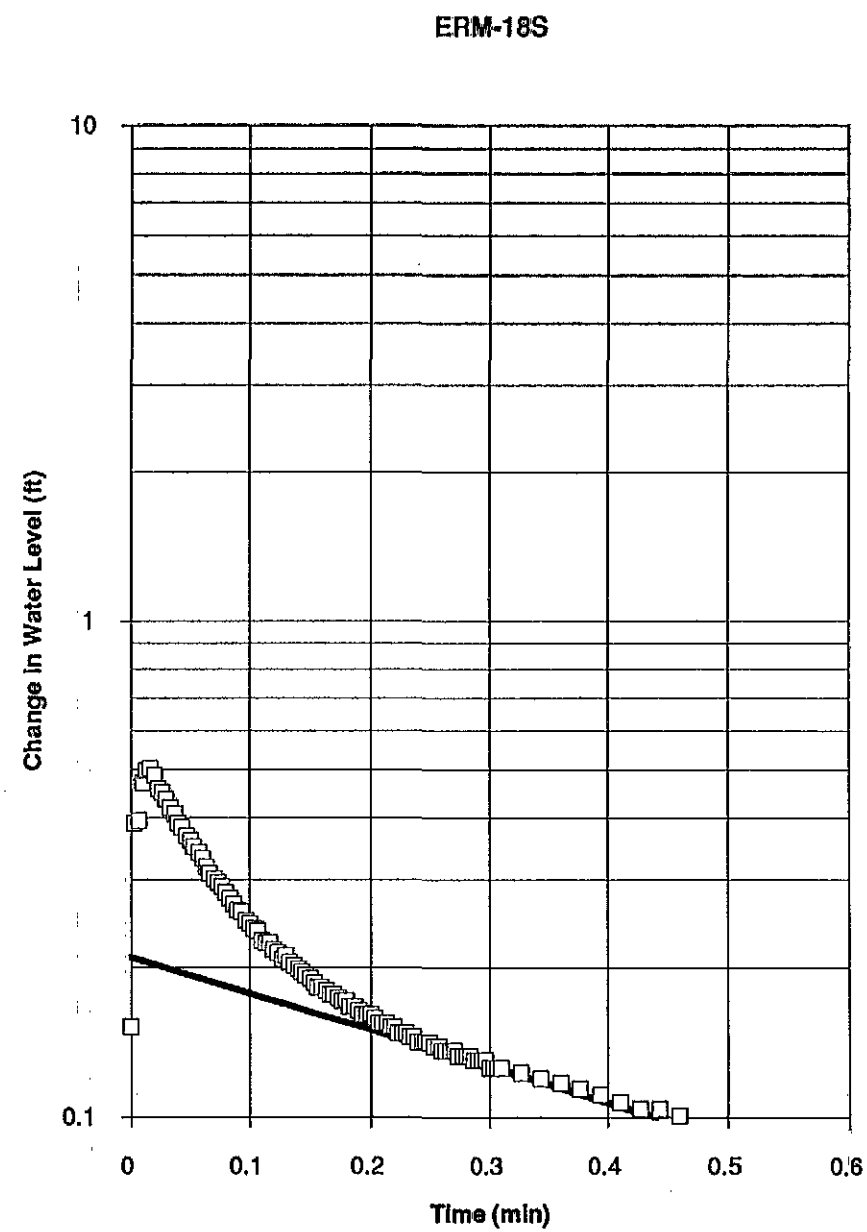
Calculations

(1/t)*ln(Yo/Yt) = 1.6862

ln(Re/rw) = 1/[(1.1/ln(H/rw)+(A+Bln((D-H)/rw)))/(L/rw)]
= 0.9421

K = [(rc*rc)+0.3*(rw*rw-rc*rc)]*ln(Re/rw)*(1/t)*ln(Yo/Yt))/(2L)
= 27.34 feet/day = 9.64E-03 cm/sec

* Reference: Bouwer,H and Rice,R.C, 1976: A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers With Completely or Partially Penetrating Wells: Water Res. Res. V.12. No. 3



Bouwer and Rice Slug Test Calculations *

Well ERM-19S — Case 3: Gravel Pack Drainage
Slug In — K gravel pack >> K formation
Water Level Below Top of the Gravel Pack

Definition Of Variables:

D : Saturated Aquifer Thickness
H : Depth To the Bottom of the Gravel Pack minus the Static Depth to Water
L = H for Well with Gravel Pack Drainage
A & B : Well Geometry Factors - from Bouwer & Rice, Figure 3
rc : Inner Radius of the Well casing
rw : Radius of the Gravel Pack
Yo : Water Level Displacement at time = 0
t : Arbitrary Time from Recovery vs Time Plot
Yt : Water Level Displacement at time = t

Determined Values for Variables:

D =	100	feet	
H =	6.16	feet	Notes:
L =	6.16	feet	L = H
A =	2		L/rw = 12
B =	0.3		
rw =	0.5	feet	
rc =	0.083	feet	
Yo =	0.22	feet	
t =	3.3	minutes	
Yt =	0.01	feet	

Calculations

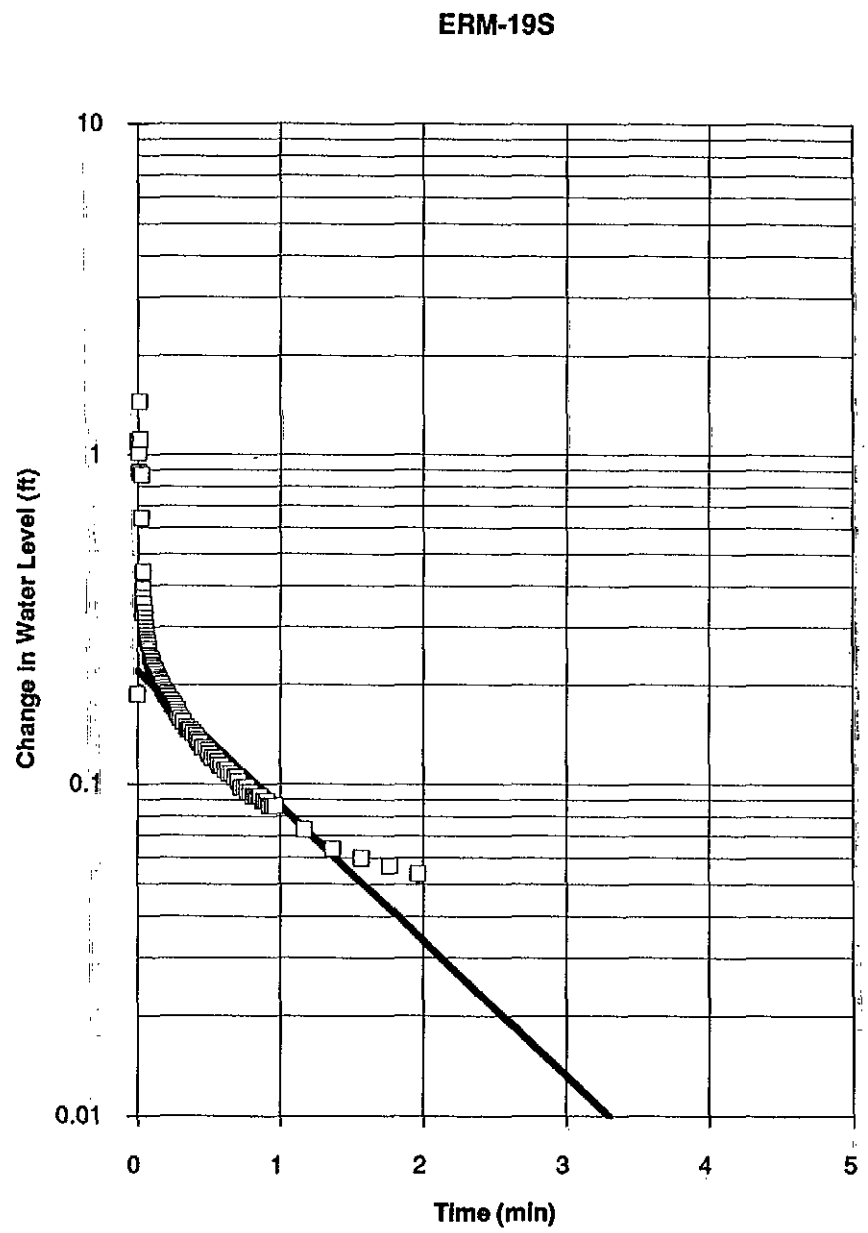
(1/t)*ln(Yo/Yt) = 0.9367

ln(Re/rw) = 1/[(1.1/ln(H/rw)+(A+Bln((D-H)/rw)))/(L/rw)]
= 1.3739

K = [(rc*rc)+0.3*(rw*rw-rc*rc)]*ln(Re/rw)*(1/t)*ln(Yo/Yt))/(2L)
= 12.01 feet/day = 4.24E-03 cm/sec

* Reference: Bouwer,H and Rice,R.C, 1976: A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers With Completely or Partially Penetrating Wells: Water Res. Res. V.12. No. 3

THE ERM GROUP



Bouwer and Rice Slug Test Calculations *

Well ERM-20S — Case 2:
Slug Out — K gravel pack ≈ K formation
No Gravel Pack Drainage

Definition Of Variables:

D : Saturated Aquifer Thickness
H : Depth of Water in the Well
H = Static Water Elev. - Elev. of Well Bottom
L : Length of screen Below Water Table
Note: L = H if Water level is Below the Top of the Screen
A & B : Well Geometry Factors - from Bouwer & Rice, Figure 3
rc : Inner Radius of the Well casing
rw : Radius of the Gravel Pack
Yo : Water Level Displacement at time = 0
t : Arbitrary Time from Recovery vs Time Plot
Yt : Water Level Displacement at time = t

Determined Values for Variables:

D =	100	feet	
H =	7.67	feet	Notes:
L =	7.67	feet	rw not used in Case 2 calculations
A =	4.3		L/rc = 92
B =	0.75		
rw =	0.5	feet	
rc =	0.083	feet	
Yo =	2.25	feet	
t =	0.038	minutes	
Yt =	0.01	feet	

Calculations

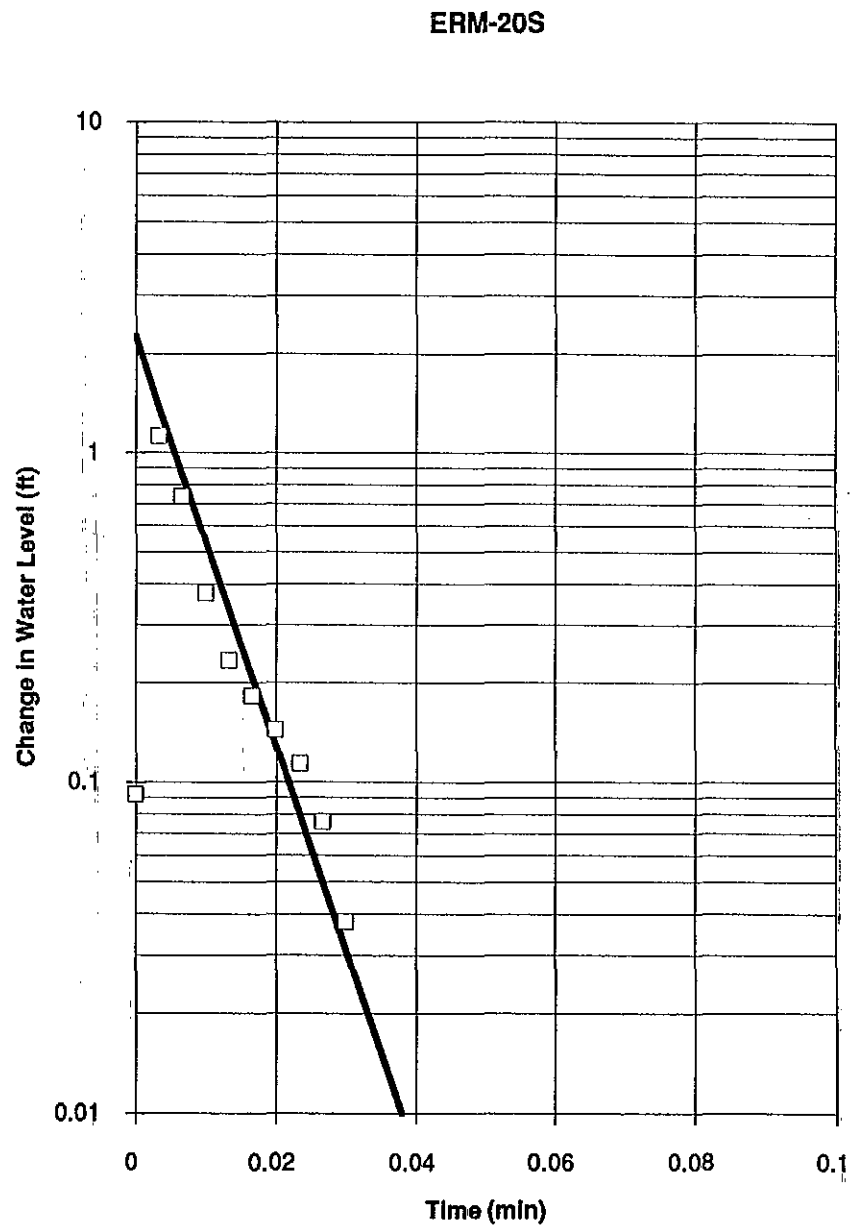
(1/t)*ln(Yo/Yt) = 142.53

ln(Re/rc) = 1/(1.1/ln(H/rc)+(A+B*ln((D-H)/rc))/(L/rc))
= 2.9563

K = (rc*rc*ln(Re/rc)*(1/t)*ln(Yo/Yt))/(2L)
= 272.49 feet/day = 9.61E-02 cm/sec

* Reference: Bouwer,H and Rice,R.C, 1976: A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers With Completely or Partially Penetrating Wells: Water Res. Res. V.12: No. 3

THE ERM GROUP



Bouwer and Rice Slug Test Calculations *

Well ERM-20I — Case 4: Well Penetrates to the Aquifer Bottom
Slug In — K gravel pack >> K formation
No Gravel Pack Drainage

Definition Of Variables:

D : Saturated Aquifer Thickness
H : Depth of Water in the Well
H = Static Water Elev. - Elev. of Well Bottom
L : Length of Gravel Pack Below Water Table
Note: L = H if Water level is Below the Top of the Screen
C : Well Geometry Factor - from Bouwer & Rice, Figure 3
rc : Inner Radius of the Well casing
rw : Radius of the Gravel Pack
Yo : Water Level Displacement at time = 0
t : Arbitrary Time from Recovery vs Time Plot
Yt : Water Level Displacement at time = t

Determined Values for Variables:

D =	105	feet	
H =	105	feet	Notes:
L =	26	feet	H = D for this analysis
C =	3.5		L/rw = 78
rw =	0.333	feet	
rc =	0.083	feet	
Yo =	2.25	feet	
t =	1	minutes	
Yt =	0.1	feet	

Calculations

(1/t)*ln(Yo/Yt) = 3.1135

ln(Re/rw) = 1/(1.1/ln(H/rw)+C/(L/rw))
= 4.2371

K = (rc*rc*ln(Re/rw)*(1/t)*ln(Yo/Yt))/(2L)
= 2.52 feet/day = 8.9 E-04 cm/sec

* Reference: Bouwer,H and Rice,R.C, 1976: A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers With Completely or Partially Penetrating Wells: Water Res. Res. V.12. No. 3

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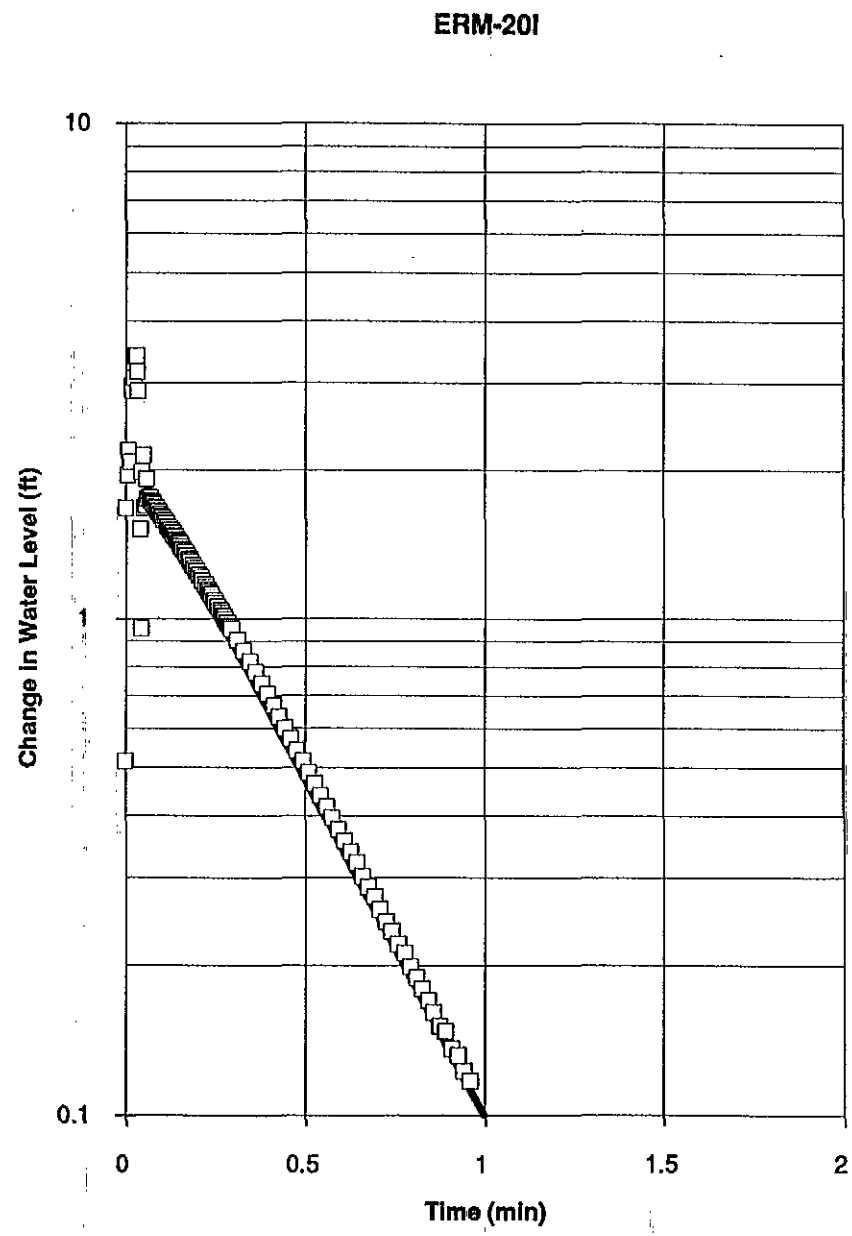


Bouwer and Rice Slug Test Calculations *

Well ERM-20I — Case 4: Well Penetrates to the Aquifer Bottom
Slug Out — K gravel pack >> K formation
No Gravel Pack Drainage

Definition Of Variables:

D : Saturated Aquifer Thickness
H : Depth of Water in the Well
H = Static Water Elev. - Elev. of Well Bottom
L : Length of Gravel Pack Below Water Table
Note: L = H if Water level is Below the Top of the Screen
C : Well Geometry Factor - from Bouwer & Rice, Figure 3
rc : Inner Radius of the Well casing
rw : Radius of the Gravel Pack
Yo : Water Level Displacement at time = 0
t : Arbitrary Time from Recovery vs Time Plot
Yt : Water Level Displacement at time = t

Determined Values for Variables:

D =	105	feet	
H =	105	feet	Notes:
L =	26	feet	H = D for this analysis
C =	3.5		L/rw = 78
rw =	0.333	feet	
rc =	0.083	feet	
Yo =	2.25	feet	
t =	1.2	minutes	
Yt =	0.1	feet	

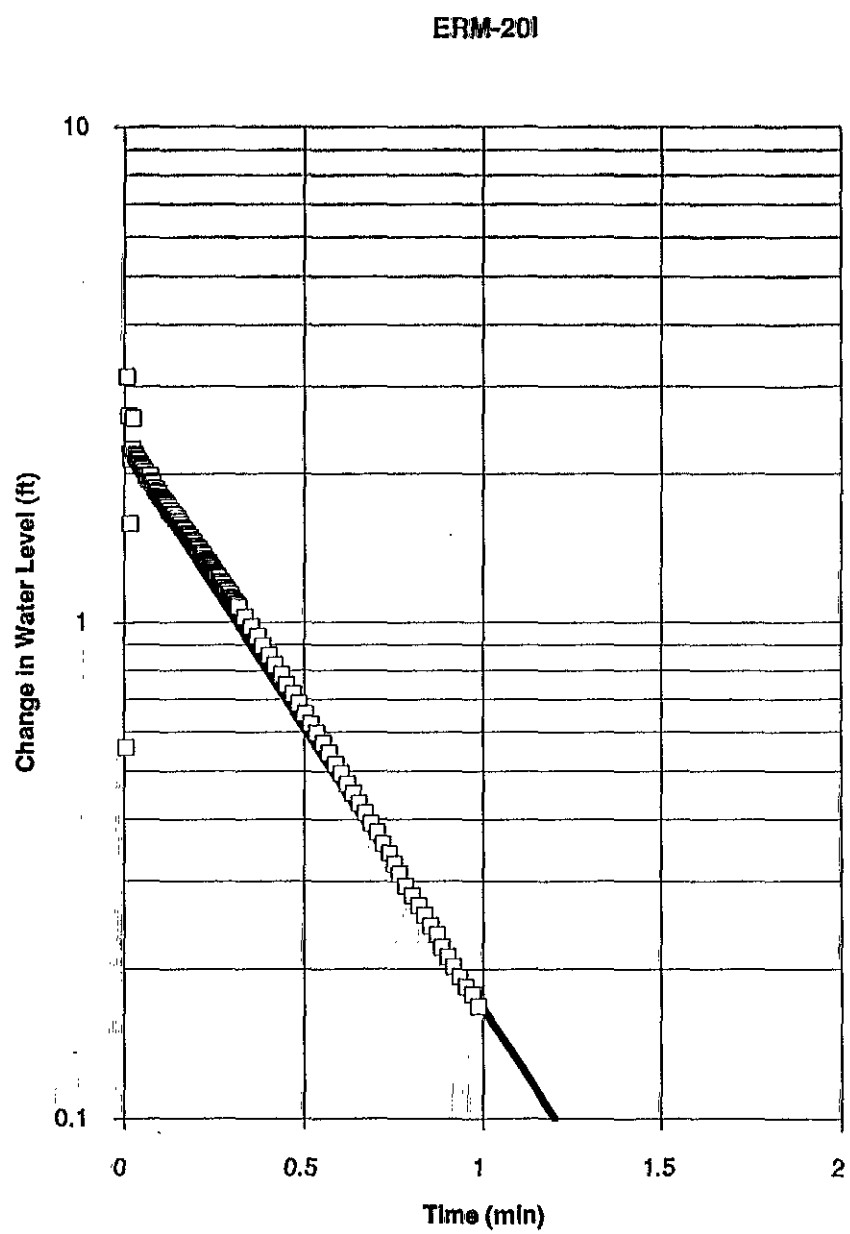
Calculations

(1/t)*ln(Yo/Yt) = 2.5946

ln(Re/rw) = 1/(1.1/ln(H/rw)+C/(L/rw))
= 4.2371

K = (rc*rc*ln(Re/rw)*(1/t)*ln(Yo/Yt))/(2L)
= 2.10 feet/day = 7.4 E-04 cm/sec

* Reference: Bouwer,H and Rice,R.C, 1976: A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers With Completely or Partially Penetrating Wells: Water Res. Res. V.12, No. 3



Bouwer and Rice Slug Test Calculations *

Well ERM-27S

Case 3: Gravel Pack Drainage
K gravel pack >> K formation
Water Level Below Top of the Gravel Pack

Definition Of Variables:

D : Saturated Aquifer Thickness
H : Depth To the Bottom of the Gravel Pack minus the Static Depth to Water
L = H for Well with Gravel Pack Drainage
A & B : Well Geometry Factors - from Bouwer & Rice, Figure 3
rc : Inner Radius of the Well casing
rw : Radius of the Gravel Pack
Yo : Water Level Displacement at time = 0
t : Arbitrary Time from Recovery vs Time Plot
Yt : Water Level Displacement at time = t

Determined Values for Variables:

D =	100	feet		
H =	6.16	feet	Notes:	
L =	6.16	feet	L = H	
A =	2		L/rw =	12
B =	0.8			
rw =	0.5	feet		
rc =	0.083	feet		
Yo =	0.2	feet		
t =	1.5	minutes		
Yt =	0.01	feet		

Calculations

(1/t)*ln(Yo/Yt) = 1.9972

ln(Re/rw) = 1/[(1.1/ln(H/rw)+(A+Bln((D-H)/rw)))/(L/rw)]
= 1.3739

K = [(rc*rc)+0.3*(rw*rw-rc*rc)]*ln(Re/rw)*(1/t)*ln(Yo/Yt))/(2L)
= 25.60 feet/day = 9.03E-03 cm/sec

* Reference: Bouwer,H and Rice,R.C, 1976: A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers With Completely or Partially Penetrating Wells: Water Res. Res. V.12. No. 3

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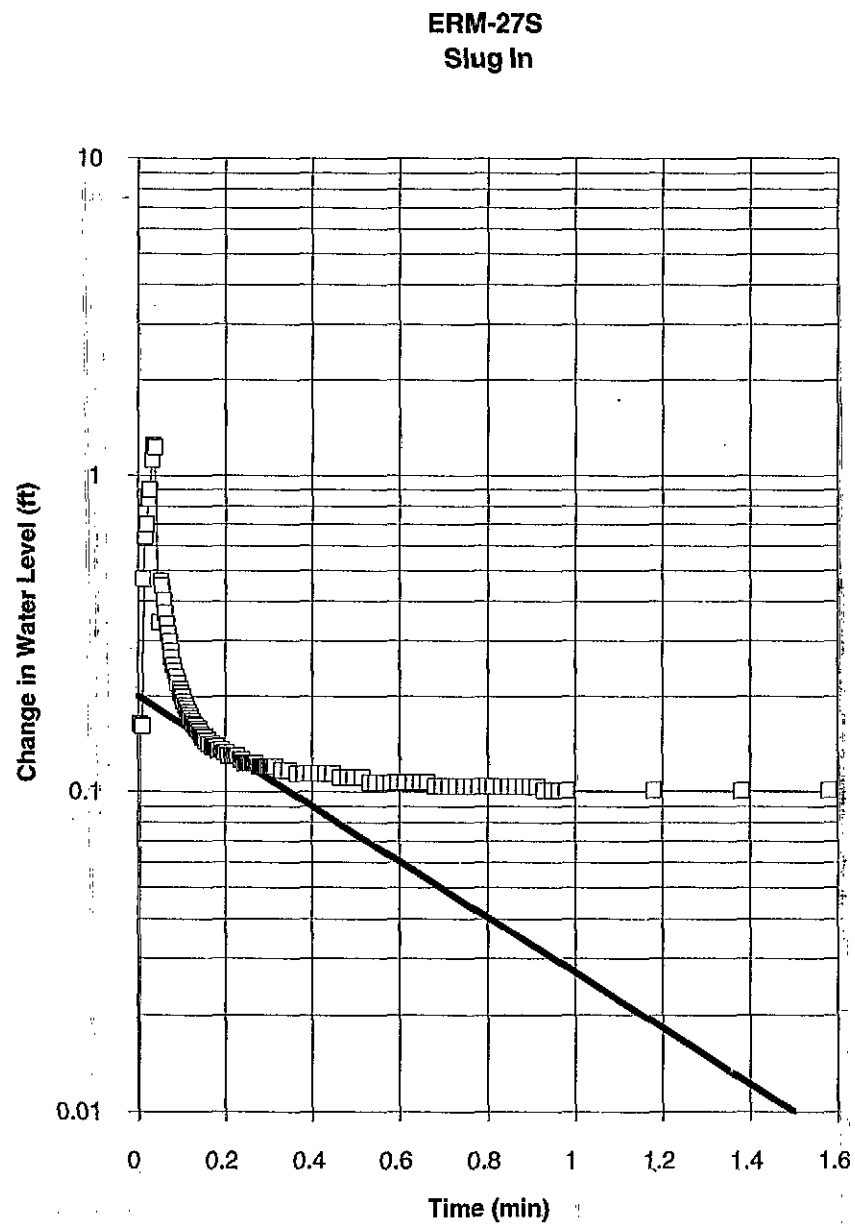


Bouwer and Rice Slug Test Calculations *

Well ERM-27S — Case 3; Gravel Pack Drainage
K gravel pack >> K formation
Water Level Below Top of the Gravel Pack

Definition Of Variables:

D : Saturated Aquifer Thickness
H : Depth To the Bottom of the Gravel Pack minus the Static Depth to Water
L = H for Well with Gravel Pack Drainage
A & B : Well Geometry Factors - from Bouwer & Rice, Figure 3
rc : Inner Radius of the Well casing
rw : Radius of the Gravel Pack
Yo : Water Level Displacement at time = 0
t : Arbitrary Time from Recovery vs Time Plot
Yt : Water Level Displacement at time = t

Determined Values for Variables:

D =	100	feet	
H =	6.16	feet	Notes:
L =	6.16	feet	L = H
A =	2		L/rw = 12
B =	0.3		
rw =	0.5	feet	
rc =	0.083	feet	
Yo =	0.2	feet	
t =	0.6	minutes	
Yt =	0.01	feet	

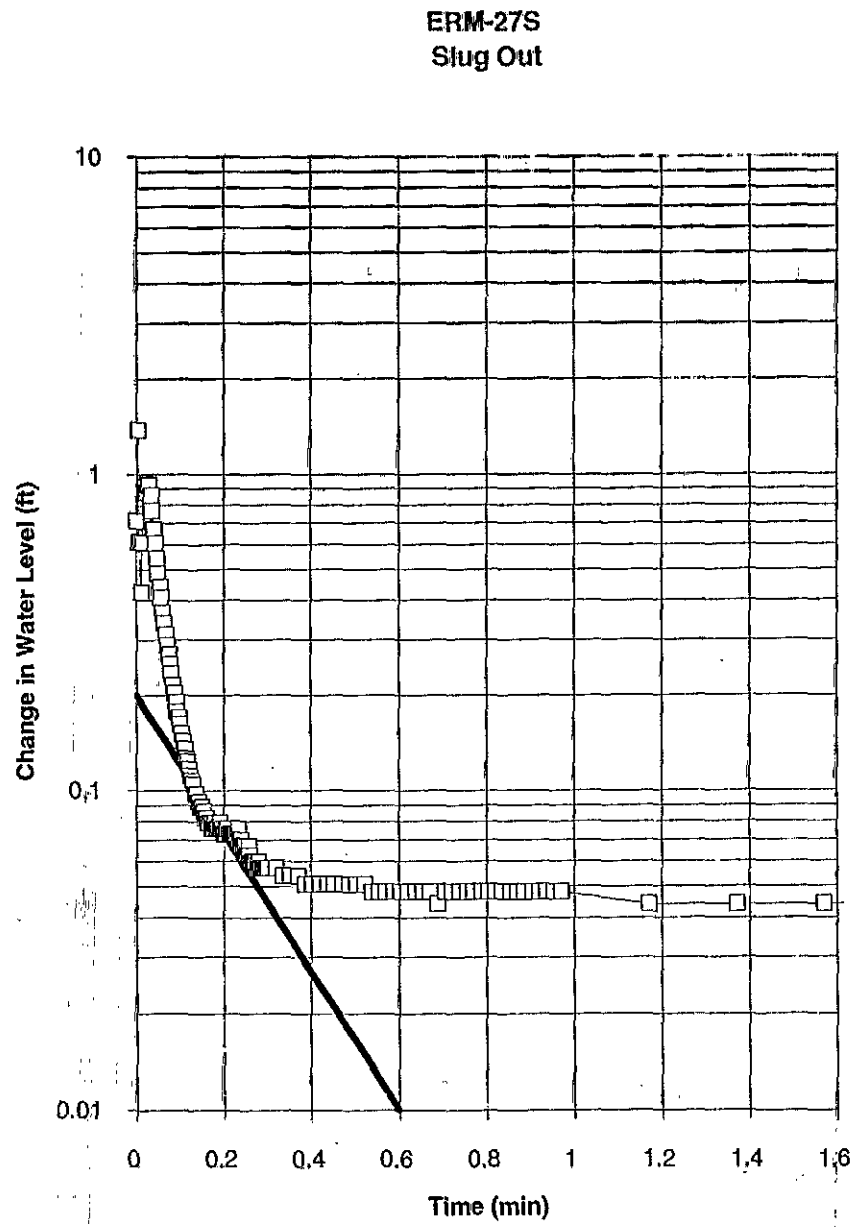
Calculations

(1/t)*ln(Yo/Yt) = 4.9929

ln(Re/rw) = 1/[(1.1/ln(H/rw)+(A+Bln((D-H)/rw)))/(L/rw)]
= 1.3739

K = [(rc*rc)+0.3*(rw*rw-rc*rc)]*ln(Re/rw)*(1/t)*ln(Yo/Yt))/(2L)
= 64.00 feet/day = 2.26E-02 cm/sec

* Reference: Bouwer,H and Rice,R.C, 1976: A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers With Completely or Partially Penetrating Wells: Water Res. Res. V.12. No. 3



Bouwer and Rice Slug Test Calculations *

Well ERM-28S — Case 1: Standard Bouwer and Rice
Slug In — K gravel pack >> K formation
No Gravel Pack Drainage

Definition Of Variables:

D : Saturated Aquifer Thickness
H : Depth of Water in the Well
H = Static Water Elev. - Elev. of Well Bottom
L : Length of Gravel Pack Below Water Table
Note: L = H if Water level is Below the Top of the Screen
A & B : Well Geometry Factors - from Bouwer & Rice, Figure 3
rc : Inner Radius of the Well casing
rw : Radius of the Gravel Pack
Yo : Water Level Displacement at time = 0
t : Arbitrary Time from Recovery vs Time Plot
Yt : Water Level Displacement at time = t

Determined Values for Variables:

D =	100	feet	
H =	12.71	feet	Notes:
L =	12.5	feet	If H=L then there should be gravel pack
A =	2.3		drainage or K pack= K formation
B =	0.35		L/rw = 25
rw =	0.5	feet	
rc =	0.083	feet	
Yo =	1.3	feet	
t =	15	minutes	
Yt =	0.1	feet	

Calculations

(1/t)*ln(Yo/Yt) = 0.171

ln(Re/rw) = 1/(1.1/ln(H/rw)+(A+B*ln((D-H)/rw))/(L/rw))
= 1.9832

K = (rc*rc*ln(Re/rw)*(1/t)*ln(Yo/Yt))/(2L)
= 0.13 feet/day = 4.75E-05 cm/sec

* Reference: Bouwer,H and Rice,R.C, 1976: A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers With Completely or Partially Penetrating Wells: Water Res. Res. V.12. No. 3

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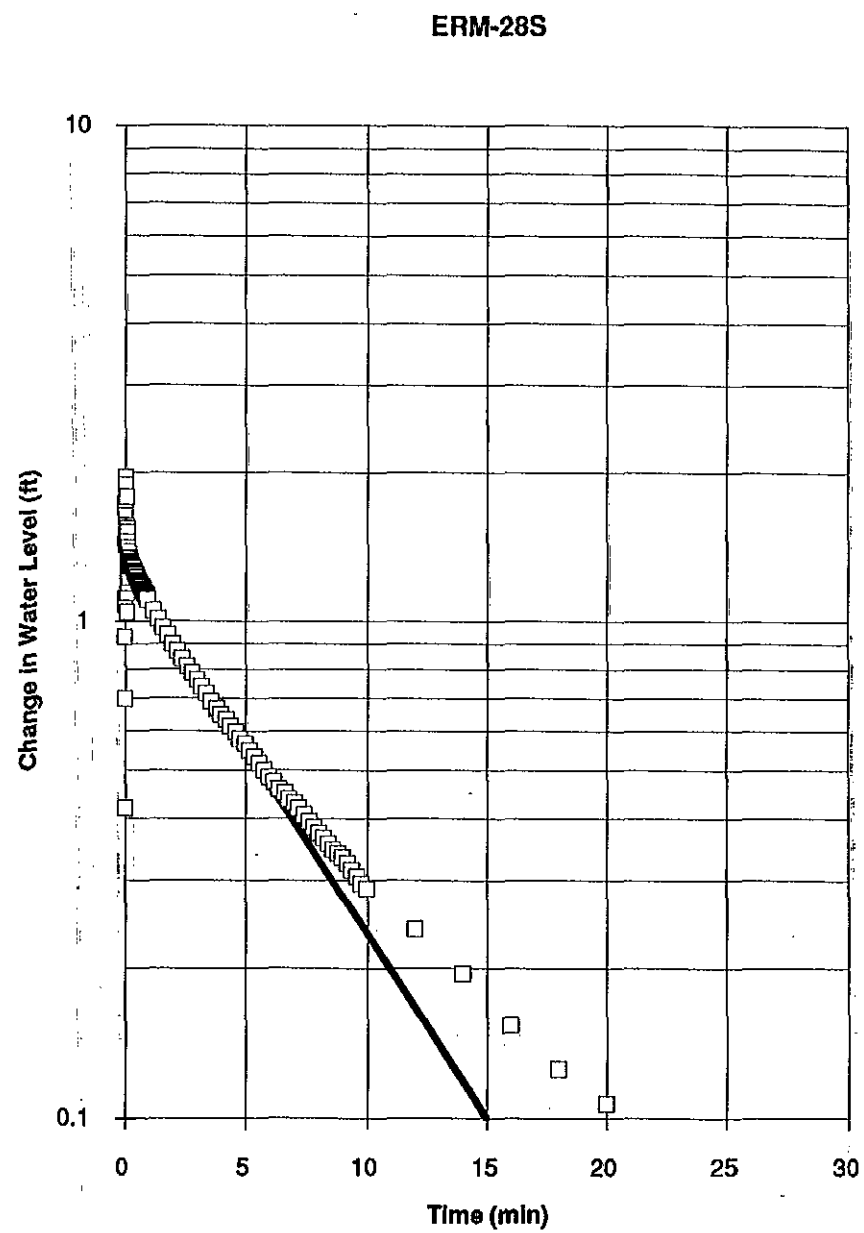


Bouwer and Rice Slug Test Calculations *

Well ERM-28S — Case 1: Standard Bouwer and Rice
Slug Out — K gravel pack >> K formation
No Gravel Pack Drainage

Definition Of Variables:

D : Saturated Aquifer Thickness
H : Depth of Water in the Well
H = Static Water Elev. - Elev. of Well Bottom
L : Length of Gravel Pack Below Water Table
Note: L = H if Water level is Below the Top of the Screen
A & B : Well Geometry Factors - from Bouwer & Rice, Figure 3
rc : Inner Radius of the Well casing
rw : Radius of the Gravel Pack
Yo : Water Level Displacement at time = 0
t : Arbitrary Time from Recovery vs Time Plot
Yt : Water Level Displacement at time = t

Determined Values for Variables:

D =	100	feet	
H =	12.71	feet	Notes:
L =	12.5	feet	If H=L then there should be gravel pack
A =	2.3		drainage or K pack= K formation
B =	0.35		L/rw = 25
rw =	0.5	feet	
rc =	0.083	feet	
Yo =	1.5	feet	
t =	18	minutes	
Yt =	0.1	feet	

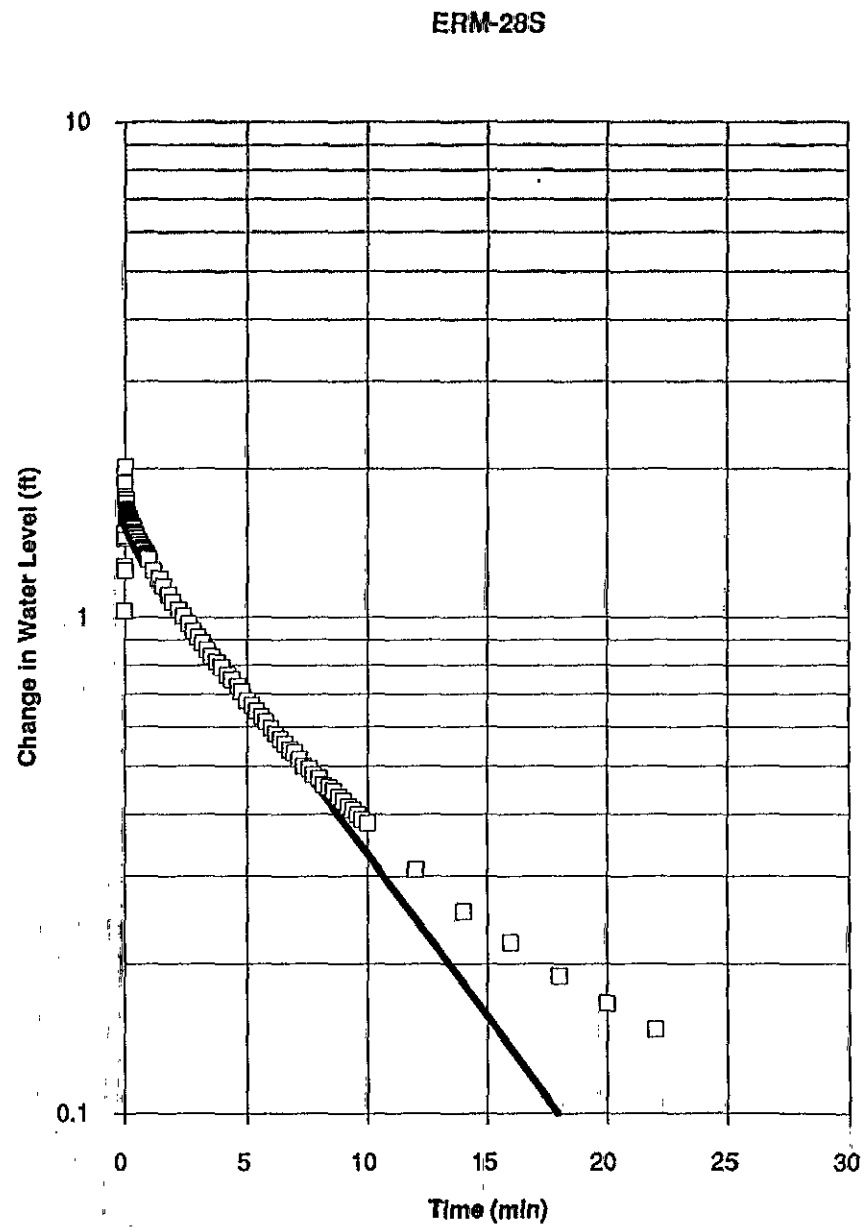
Calculations

(1/t)*ln(Yo/Yt) = 0.1504

ln(Re/rw) = 1/(1.1/ln(H/rw)+(A+B*ln((D-H)/rw))/(L/rw))
= 1.9832

K = (rc*rc*ln(Re/rw)*(1/t)*ln(Yo/Yt))/(2L)
= 0.12 feet/day = 4.18E-05 cm/sec

* Reference: Bouwer,H and Rice,R.C, 1976: A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers With Completely or Partially Penetrating Wells: Water Res. Res. V.12, No. 3



Bouwer and Rice Slug Test Calculations *

Well ERM-29S — Case 1: Standard Bouwer and Rice
Slug Out — *K gravel pack >> K formation*
No Gravel Pack Drainage

Definition Of Variables:

D : Saturated Aquifer Thickness
H : Depth of Water in the Well
H = Static Water Elev. - Elev. of Well Bottom
L : Length of Gravel Pack Below Water Table
Note: L = H if Water level is Below the Top of the Screen
A & B : Well Geometry Factors - from Bouwer & Rice, Figure 3
rc : Inner Radius of the Well casing
rw : Radius of the Gravel Pack
Yo : Water Level Displacement at time = 0
t : Arbitrary Time from Recovery vs Time Plot
Yt : Water Level Displacement at time = t

Determined Values for Variables:

D =	100	feet	
H =	13.75	feet	Notes:
L =	13.5	feet	If H=L then there should be gravel pack
A =	3.2		drainage or K pack= K formation
B =	0.55		L/rw = 52
rw =	0.26	feet	
rc =	0.083	feet	
Yo =	2.25	feet	
t =	1.2	minutes	
Yt =	0.1	feet	

Calculations

(1/t)*ln(Yo/Yt) = 2.5946

ln(Re/rw) = 1/(1.1/ln(H/rw)+(A+B*ln((D-H)/rw))/(L/rw))
= 2.498

K = (rc*rc*ln(Re/rw)*(1/t)*ln(Yo/Yt))/(2L)
= 2.38 feet/day = 8.40E-04 cm/sec

* Reference: Bouwer,H and Rice,R.C, 1976: A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers With Completely or Partially Penetrating Wells: Water Res. Res. V.12. No. 3

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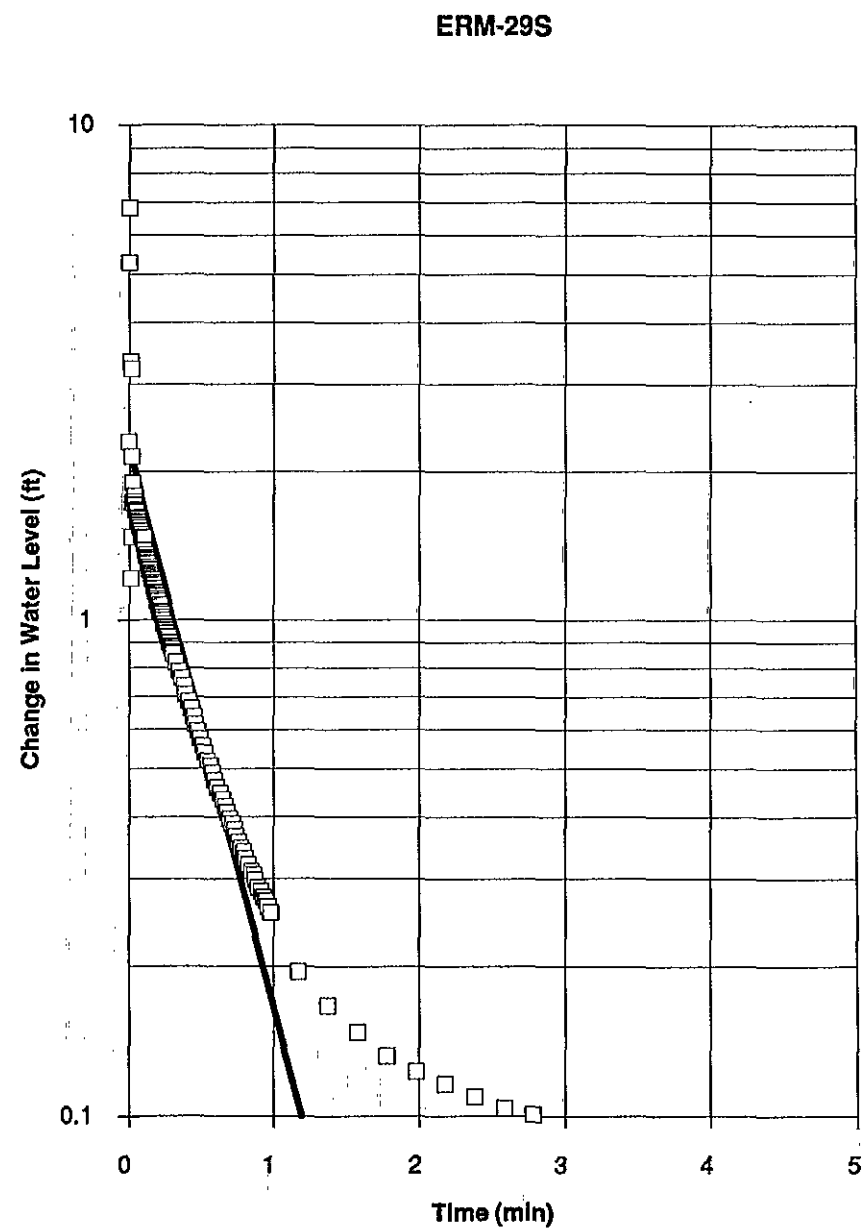

Bouwer and Rice Slug Test Calculations *

Well ERM-29I — Case 4: Well Penetrates to the Aquifer Bottom
Slug In — K gravel pack >> K formation
No Gravel Pack Drainage

Definition Of Variables:

D : Saturated Aquifer Thickness
H : Depth of Water in the Well
H = Static Water Elev. - Elev. of Well Bottom
L : Length of Gravel Pack Below Water Table
Note: L = H if Water level is Below the Top of the Screen
C : Well Geometry Factor - from Bouwer & Rice, Figure 3
rc : Inner Radius of the Well casing
rw : Radius of the Gravel Pack
Yo : Water Level Displacement at time = 0
t : Arbitrary Time from Recovery vs Time Plot
Yt : Water Level Displacement at time = t

Determined Values for Variables:

D =	80	feet	
H =	80	feet	Notes:
L =	26	feet	H = D for this analysis
C =	3.5		L/rw = 78
rw =	0.333	feet	
rc =	0.083	feet	
Yo =	2.25	feet	
t =	1.2	minutes	
Yt =	0.1	feet	

Calculations

(1/t)*ln(Yo/Yt) = 2.5946

ln(Re/rw) = 1/(1.1/ln(H/rw)+C/(L/rw))
= 4.0734

K = (rc*rc*ln(Re/rw)*(1/t)*ln(Yo/Yt))/(2L)
= 2.02 feet/day = 7.1 E-04 cm/sec

* Reference: Bouwer,H and Rice,R.C, 1976: A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers With Completely or Partially Penetrating Wells: Water Res. Res. V.12. No. 3

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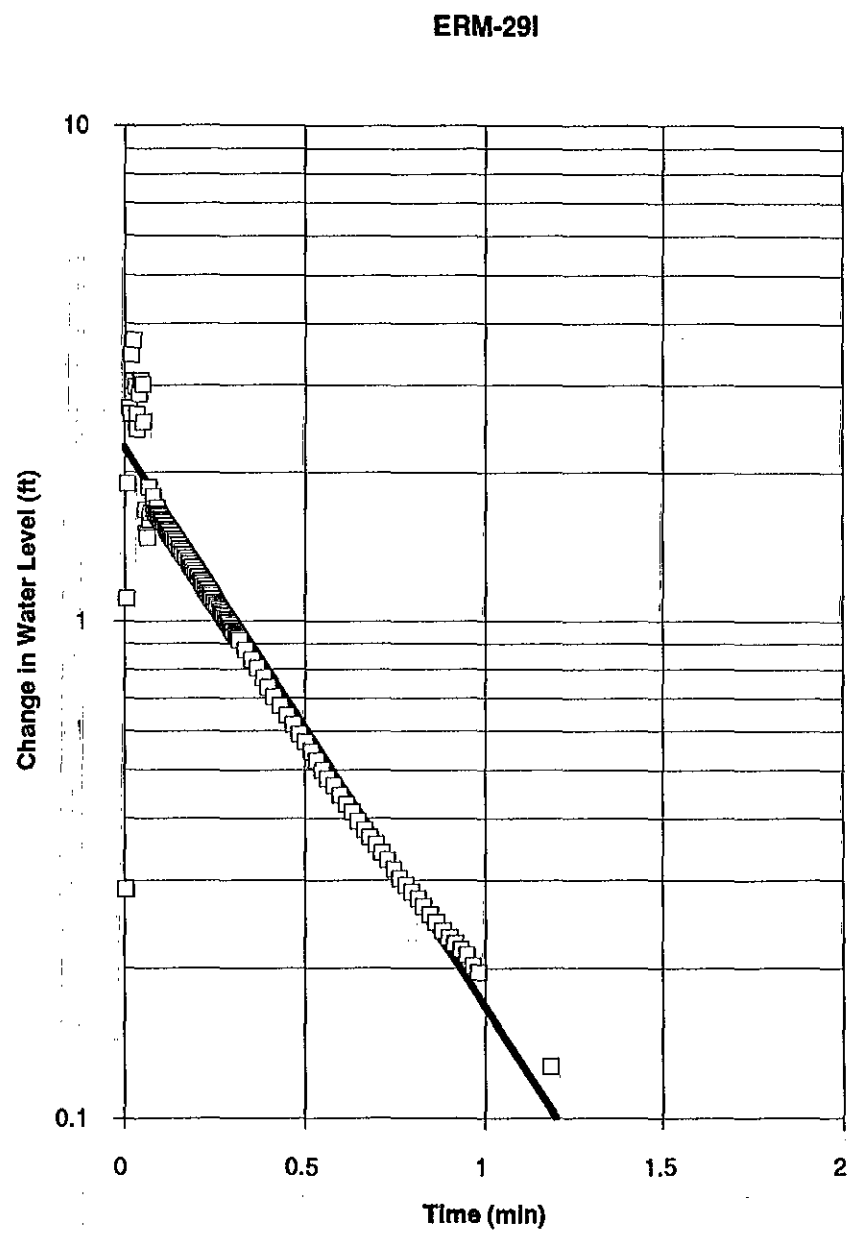


Bouwer and Rice Slug Test Calculations *

Well ERM-29I — Case 4: Well Penetrates to the Aquifer Bottom
Slug Out — K gravel pack >> K formation
No Gravel Pack Drainage

Definition Of Variables:

D : Saturated Aquifer Thickness
H : Depth of Water in the Well
H = Static Water Elev. - Elev. of Well Bottom
L : Length of Gravel Pack Below Water Table
Note: L = H if Water level is Below the Top of the Screen
C : Well Geometry Factor - from Bouwer & Rice, Figure 3
rc : Inner Radius of the Well casing
rw : Radius of the Gravel Pack
Yo : Water Level Displacement at time = 0
t : Arbitrary Time from Recovery vs Time Plot
Yt : Water Level Displacement at time = t

Determined Values for Variables:

D =	80	feet	
H =	80	feet	Notes:
L =	26	feet	H = D for this analysis
C =	3.5		L/rw = 78
rw =	0.333	feet	
rc =	0.083	feet	
Yo =	2.25	feet	
t =	1.4	minutes	
Yt =	0.1	feet	

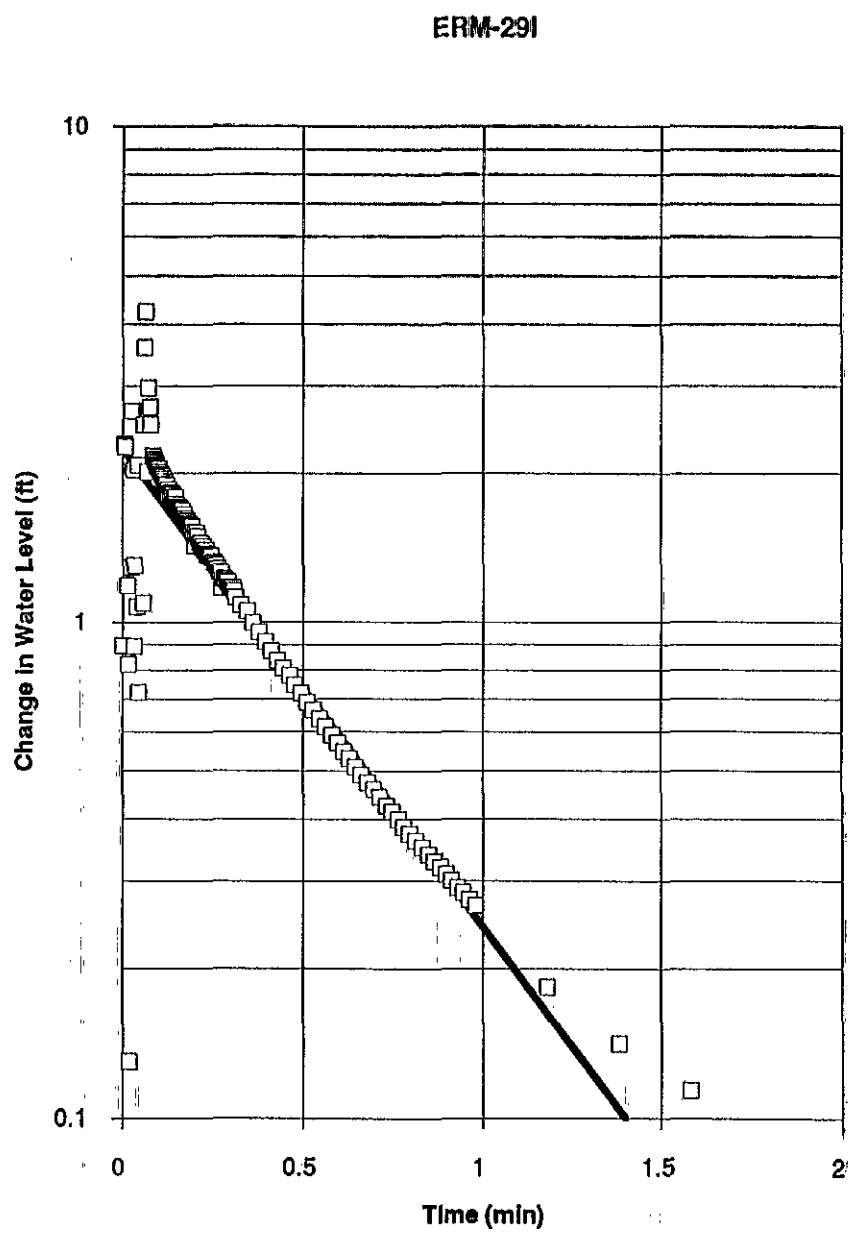
Calculations

(1/t)*ln(Yo/Yt) = 2.2239

ln(Re/rw) = 1/(1.1/ln(H/rw)+C/(L/rw))
= 4.0734

K = (rc*rc*ln(Re/rw)*(1/t)*ln(Yo/Yt))/(2L)
= 1.73 feet/day = 6.1 E-04 cm/sec

* Reference: Bouwer,H and Rice,R.C, 1976: A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers With Completely or Partially Penetrating Wells: Water Res. Res. V.12, No. 3



Bouwer and Rice Slug Test Calculations *

Well ERM-30S — Case 1: Standard Bouwer and Rice
Slug In — K gravel pack >> K formation
No Gravel Pack Drainage

Definition Of Variables:

D : Saturated Aquifer Thickness
H : Depth of Water in the Well
H = Static Water Elev. - Elev. of Well Bottom
L : Length of Gravel Pack Below Water Table
Note: L = H if Water level is Below the Top of the Screen
A & B : Well Geometry Factors - from Bouwer & Rice, Figure 3
rc : Inner Radius of the Well casing
rw : Radius of the Gravel Pack
Yo : Water Level Displacement at time = 0
t : Arbitrary Time from Recovery vs Time Plot
Yt : Water Level Displacement at time = t

Determined Values for Variables:

D =	100	feet	
H =	13.32	feet	Notes:
L =	13.32	feet	If H=L then there should be gravel pack
A =	3.1		drainage or K pack= K formation
B =	0.53		L/rw = 51
rw =	0.26	feet	
rc =	0.083	feet	
Yo =	2.25	feet	
t =	1.2	minutes	
Yt =	0.1	feet	

Calculations

(1/t)*ln(Yo/Yt) = 2.5946

ln(Re/rw) = 1/(1.1/ln(H/rw)+(A+B*ln((D-H)/rw))/(L/rw))
= 2.4996

K = (rc*rc*ln(Re/rw)*(1/t)*ln(Yo/Yt))/(2L)
= 2.42 feet/day = 8.52E-04 cm/sec

* Reference: Bouwer,H and Rice,R.C, 1976: A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers With Completely or Partially Penetrating Wells: Water Res. Res. V.12. No. 3

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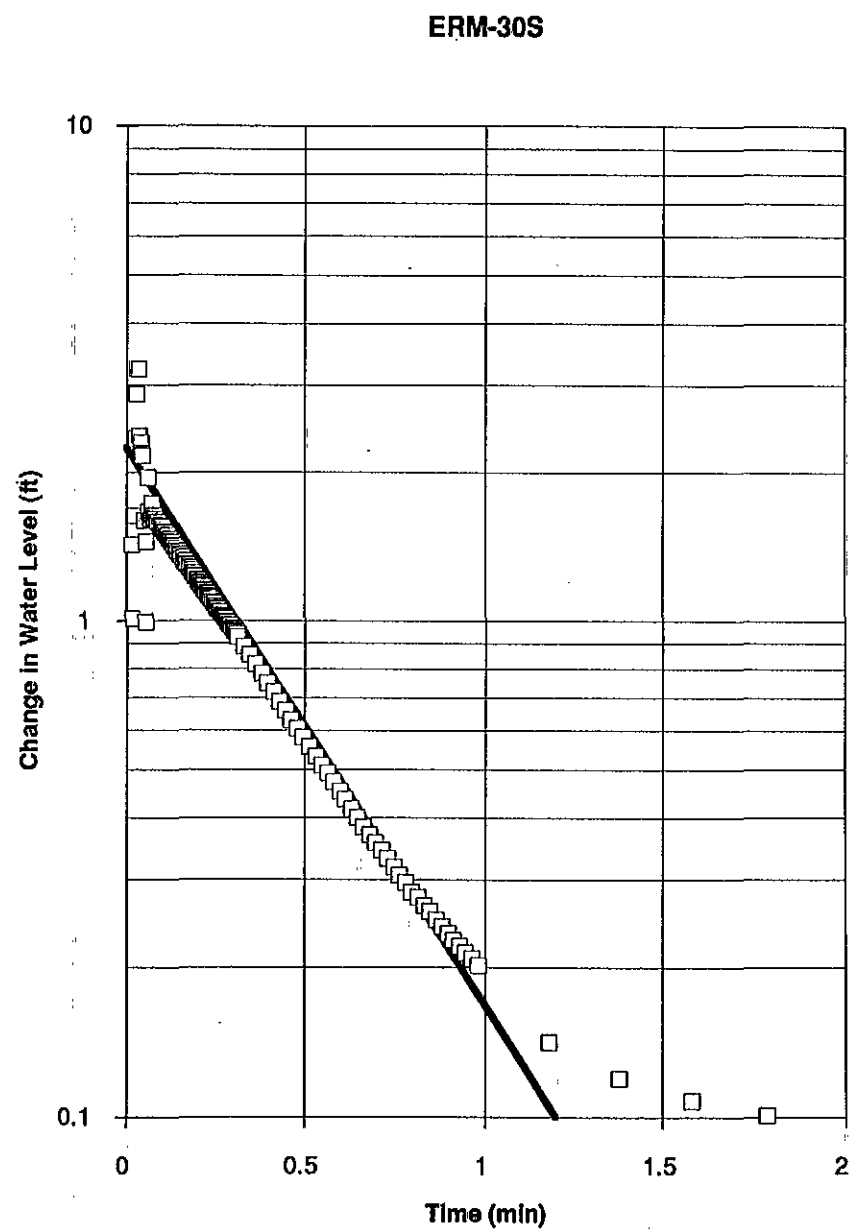


Bouwer and Rice Slug Test Calculations *

Well ERM-30S — Case 1: Standard Bouwer and Rice
Slug Out — K gravel pack >> K formation
No Gravel Pack Drainage

Definition Of Variables:

D : Saturated Aquifer Thickness
H : Depth of Water in the Well
H = Static Water Elev. - Elev. of Well Bottom
L : Length of Gravel Pack Below Water Table
Note: L = H if Water level is Below the Top of the Screen
A & B : Well Geometry Factors - from Bouwer & Rice, Figure 3
rc : Inner Radius of the Well casing
rw : Radius of the Gravel Pack
Yo : Water Level Displacement at time = 0
t : Arbitrary Time from Recovery vs Time Plot
Yt : Water Level Displacement at time = t

Determined Values for Variables:

D =	100	feet	
H =	13.32	feet	Notes:
L =	13.32	feet	If H=L then there should be gravel pack
A =	3.1		drainage or K pack= K formation
B =	0.53		L/rw = 51
rw =	0.26	feet	
rc =	0.083	feet	
Yo =	2.25	feet	
t =	1.5	minutes	
Yt =	0.1	feet	

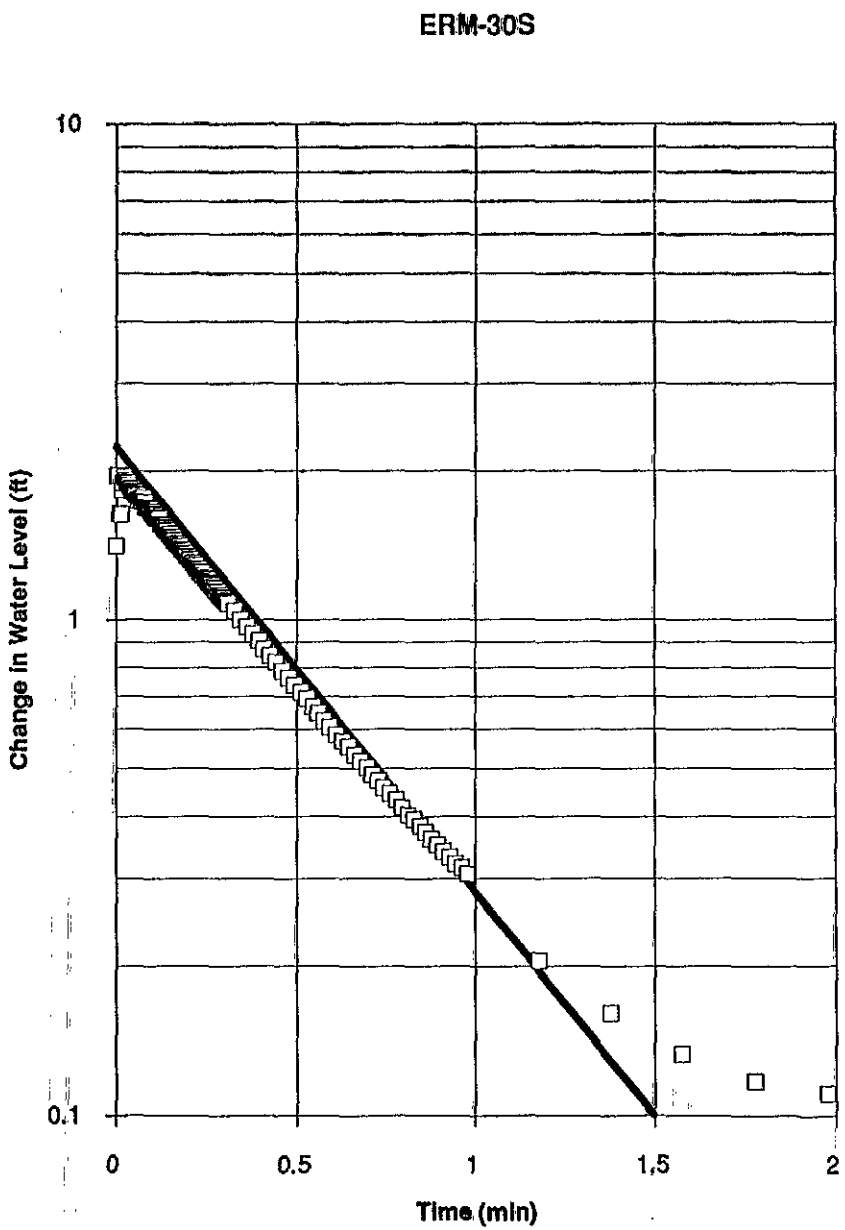
Calculations

(1/t)*ln(Yo/Yt) = 2.0757

ln(Re/rw) = 1/(1.1/ln(H/rw)+(A+B*ln((D-H)/rw))/(L/rw))
= 2.4996

K = (rc*rc*ln(Re/rw)*(1/t)*ln(Yo/Yt))/(2L)
= 1.93 feet/day = 6.82E-04 cm/sec

* Reference: Bouwer,H and Rice,R.C, 1976: A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers With Completely or Partially Penetrating Wells: Water Res. Res. V.12. No. 3



Bouwer and Rice Slug Test Calculations *

Well ERM-30I — Case 4: Well Penetrates to the Aquifer Bottom
Slug In — K gravel pack >> K formation
No Gravel Pack Drainage

Definition Of Variables:

D : Saturated Aquifer Thickness
H : Depth of Water in the Well
H = Static Water Elev. - Elev. of Well Bottom
L : Length of Gravel Pack Below Water Table
Note: L = H if Water level is Below the Top of the Screen
C : Well Geometry Factor - from Bouwer & Rice, Figure 3
rc : Inner Radius of the Well casing
rw : Radius of the Gravel Pack
Yo : Water Level Displacement at time = 0
t : Arbitrary Time from Recovery vs Time Plot
Yt : Water Level Displacement at time = t

Determined Values for Variables:

D =	94	feet	
H =	94	feet	Notes:
L =	26	feet	H = D for this analysis
C =	3.5		L/rw = 78
rw =	0.333	feet	
rc =	0.083	feet	
Yo =	2.25	feet	
t =	0.65	minutes	
Yt =	0.1	feet	

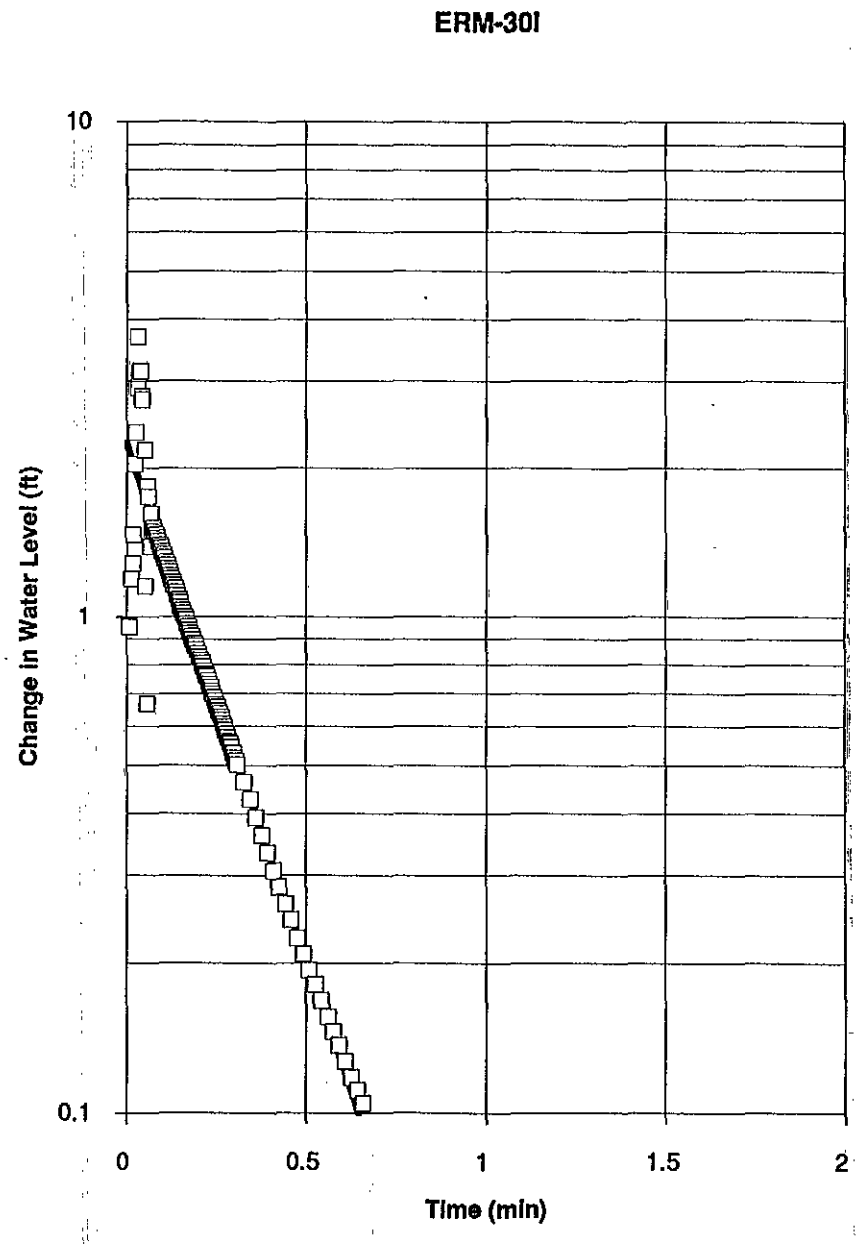
Calculations

(1/t)*ln(Yo/Yt) = 4.79

ln(Re/rw) = 1/(1.1/ln(H/rw)+C/(L/rw))
= 4.1708

K = (rc*rc*ln(Re/rw)*(1/t)*ln(Yo/Yt))/(2L)
= 3.81 feet/day = 1.3 E-03 cm/sec

* Reference: Bouwer,H and Rice,R.C, 1976: A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers With Completely or Partially Penetrating Wells: Water Res. Res. V.12. No. 3



Bouwer and Rice Slug Test Calculations *

Well ERM-30I — Case 4: Well Penetrates to the Aquifer Bottom
Slug Out — K gravel pack >> K formation
No Gravel Pack Drainage

Definition Of Variables:

D : Saturated Aquifer Thickness
H : Depth of Water in the Well
H = Static Water Elev. - Elev. of Well Bottom
L : Length of Gravel Pack Below Water Table
Note: L = H if Water level is Below the Top of the Screen
C : Well Geometry Factor - from Bouwer & Rice, Figure 3
rc : Inner Radius of the Well casing
rw : Radius of the Gravel Pack
Yo : Water Level Displacement at time = 0
t : Arbitrary Time from Recovery vs Time Plot
Yt : Water Level Displacement at time = t

Determined Values for Variables:

D =	94	feet	
H =	94	feet	Notes:
L =	26	feet	H = D for this analysis
C =	3.5		L/rw = 78
rw =	0.333	feet	
rc =	0.083	feet	
Yo =	2.25	feet	
t =	0.66	minutes	
Yt =	0.1	feet	

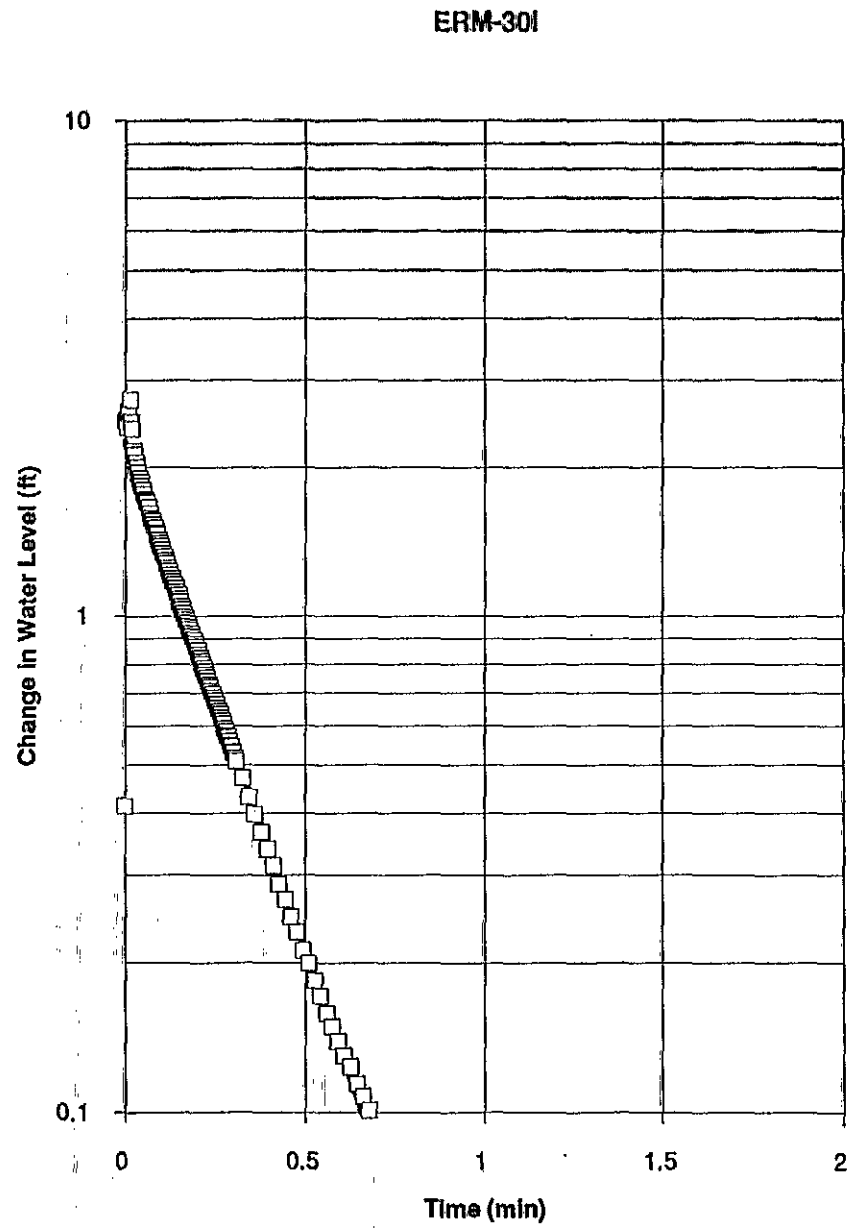
Calculations

(1/t)*ln(Yo/Yt) = 4.7174

ln(Re/rw) = 1/(1.1/ln(H/rw)+C/(L/rw))
= 4.1708

K = (rc*rc*ln(Re/rw)*(1/t)*ln(Yo/Yt))/(2L)
= 3.75 feet/day = 1.3 E-03 cm/sec

* Reference: Bouwer,H and Rice,R.C, 1976: A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers With Completely or Partially Penetrating Wells: Water Res. Res. V.12. No. 3



Bouwer and Rice Slug Test Calculations *

Well ERM-31I — Case 4: Well Penetrates to the Aquifer Bottom
Slug In — K gravel pack >> K formation
No Gravel Pack Drainage

Definition Of Variables:

D : Saturated Aquifer Thickness
H : Depth of Water in the Well
H = Static Water Elev. - Elev. of Well Bottom
L : Length of Gravel Pack Below Water Table
Note: L = H if Water level is Below the Top of the Screen
C : Well Geometry Factor - from Bouwer & Rice, Figure 3
rc : Inner Radius of the Well casing
rw : Radius of the Gravel Pack
Yo : Water Level Displacement at time = 0
t : Arbitrary Time from Recovery vs Time Plot
Yt : Water Level Displacement at time = t

Determined Values for Variables:

D =	185	feet	
H =	185	feet	Notes:
L =	25.5	feet	H = D for this analysis
C =	4.25		L/rw = 98
rw =	0.26	feet	
rc =	0.083	feet	
Yo =	2.25	feet	
t =	88	minutes	
Yt =	0.1	feet	

Calculations

(1/t)*ln(Yo/Yt) = 0.0354

ln(Re/rw) = 1/(1.1/ln(H/rw)+C/(L/rw))
= 4.7432

K = (rc*rc*ln(Re/rw)*(1/t)*ln(Yo/Yt))/(2L)
= *0.03 feet/day* = *1.2 E-05 cm/sec*

* Reference: Bouwer,H and Rice,R.C, 1976: A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers With Completely or Partially Penetrating Wells: Water Res. Res. V.12. No. 3

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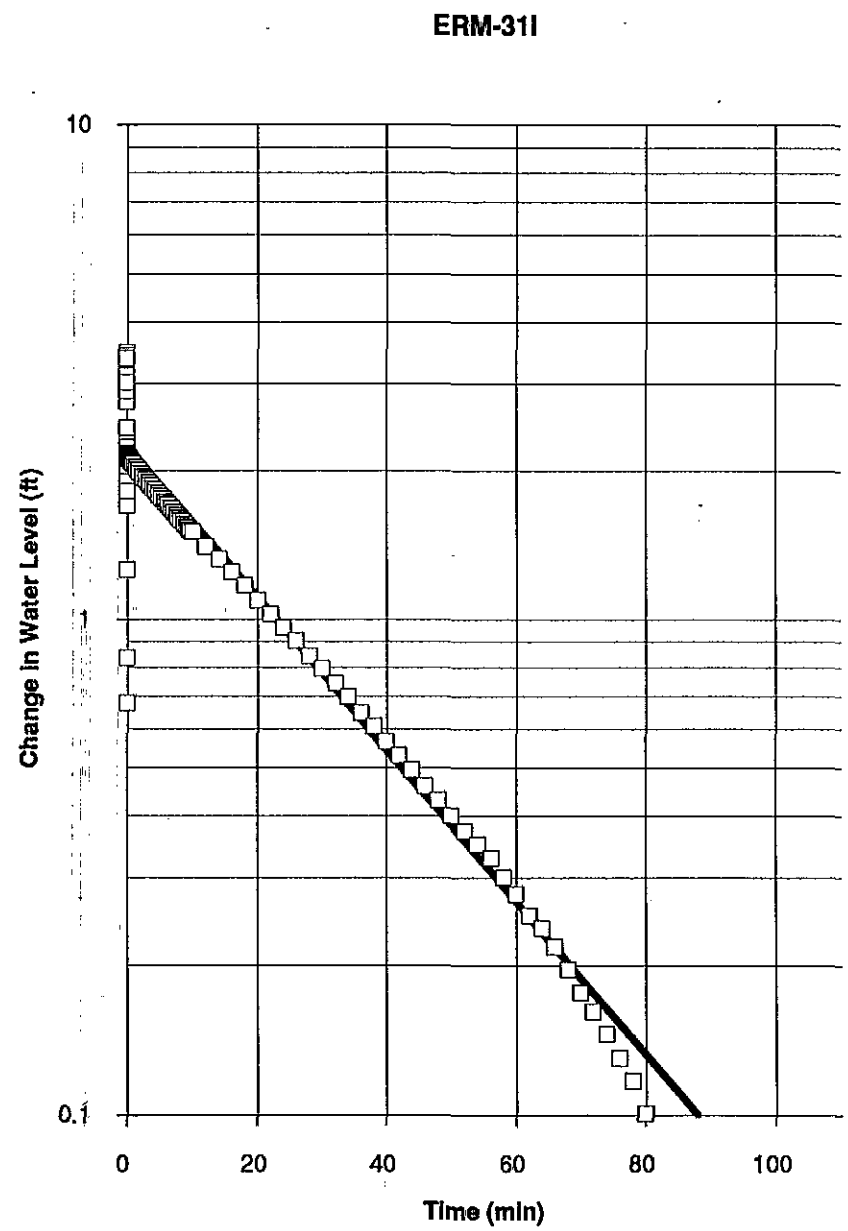


Bouwer and Rice Slug Test Calculations *

Well ERM-31I — Case 4: *Well Penetrates to the Aquifer Bottom*
Slug Out — K gravel pack >> K formation
No Gravel Pack Drainage

Definition Of Variables:

D : Saturated Aquifer Thickness
H : Depth of Water in the Well
H = Static Water Elev. - Elev. of Well Bottom
L : Length of Gravel Pack Below Water Table
Note: L = H if Water level is Below the Top of the Screen
C : Well Geometry Factor - from Bouwer & Rice, Figure 3
rc : Inner Radius of the Well casing
rw : Radius of the Gravel Pack
Yo : Water Level Displacement at time = 0
t : Arbitrary Time from Recovery vs Time Plot
Yt : Water Level Displacement at time = t

Determined Values for Variables:

D =	185	feet	
H =	185	feet	Notes:
L =	25.5	feet	H = D for this analysis
C =	4.25		L/rw = 98
rw =	0.26	feet	
rc =	0.083	feet	
Yo =	2.25	feet	
t =	120	minutes	
Yt =	0.1	feet	

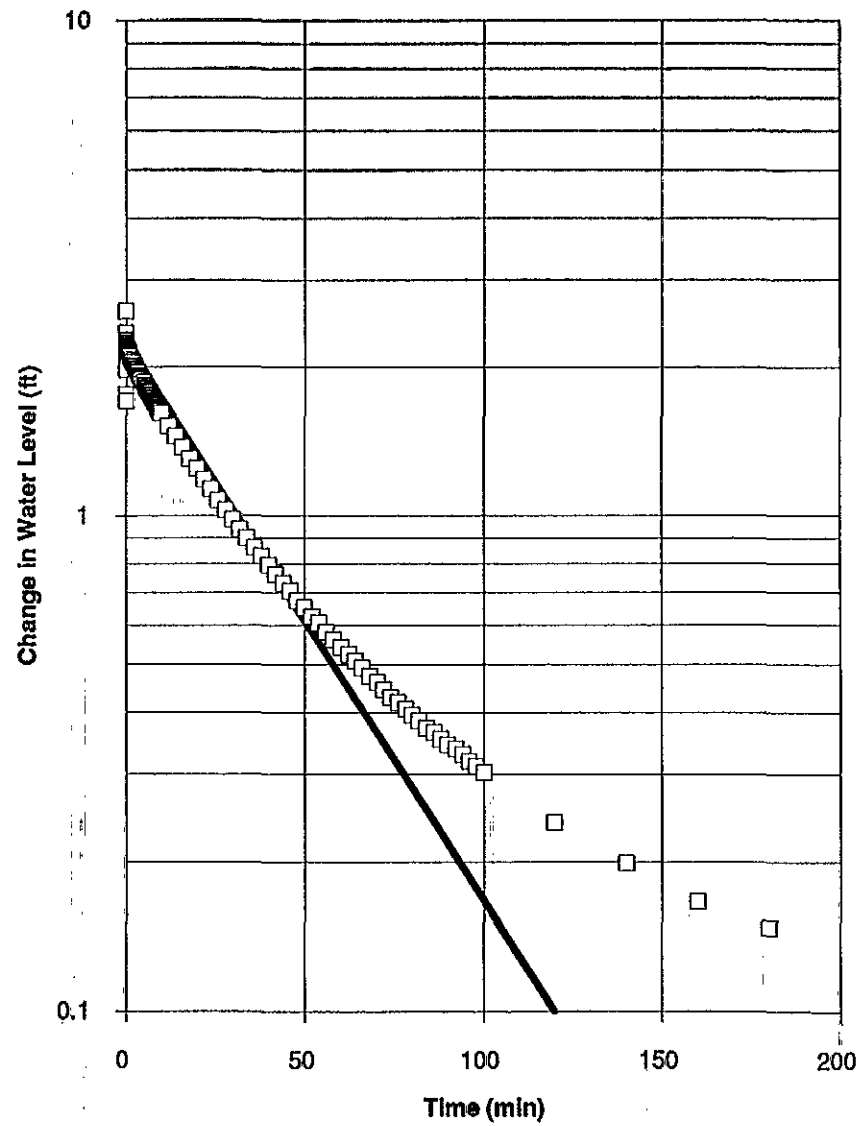
Calculations

(1/t)*ln(Yo/Yt) = 0.0259

ln(Re/rw) = 1/(1.1/ln(H/rw)+C/(L/rw))
= 4.7432

K = (rc*rc*ln(Re/rw)*(1/t)*ln(Yo/Yt))/(2L)
= 0.02 feet/day = 8.4 E-06 cm/sec

* Reference: Bouwer,H and Rice,R.C, 1976: A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers With Completely or Partially Penetrating Wells: Water Res. Res. V.12. No. 3



Bouwer and Rice Slug Test Calculations *

Well ERM-32I — Case 4: Well Penetrates to the Aquifer Bottom
Slug In — K gravel pack >> K formation
No Gravel Pack Drainage

Definition Of Variables:

D : Saturated Aquifer Thickness
H : Depth of Water in the Well
H = Static Water Elev. - Elev. of Well Bottom
L : Length of Gravel Pack Below Water Table
Note: L = H if Water level is Below the Top of the Screen
C : Well Geometry Factor - from Bouwer & Rice, Figure 3
rc : Inner Radius of the Well casing
rw : Radius of the Gravel Pack
Yo : Water Level Displacement at time = 0
t : Arbitrary Time from Recovery vs Time Plot
Yt : Water Level Displacement at time = t

Determined Values for Variables:

D =	89	feet	
H =	89	feet	Notes:
L =	25	feet	H = D for this analysis
C =	3.5		L/rw = 75
rw =	0.333	feet	
rc =	0.083	feet	
Yo =	2.25	feet	
t =	1.4	minutes	
Yt =	0.1	feet	

Calculations

(1/t)*ln(Yo/Yt) = 2.2239

ln(Re/rw) = 1/(1.1/ln(H/rw)+C/(L/rw))
= 4.1074

K = (rc*rc*ln(Re/rw)*(1/t)*ln(Yo/Yt))/(2L)
= 1.81 feet/day = 6.4 E-04 cm/sec

* Reference: Bouwer,H and Rice,R.C, 1976: A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers With Completely or Partially Penetrating Wells: Water Res. Res. V.12. No. 3

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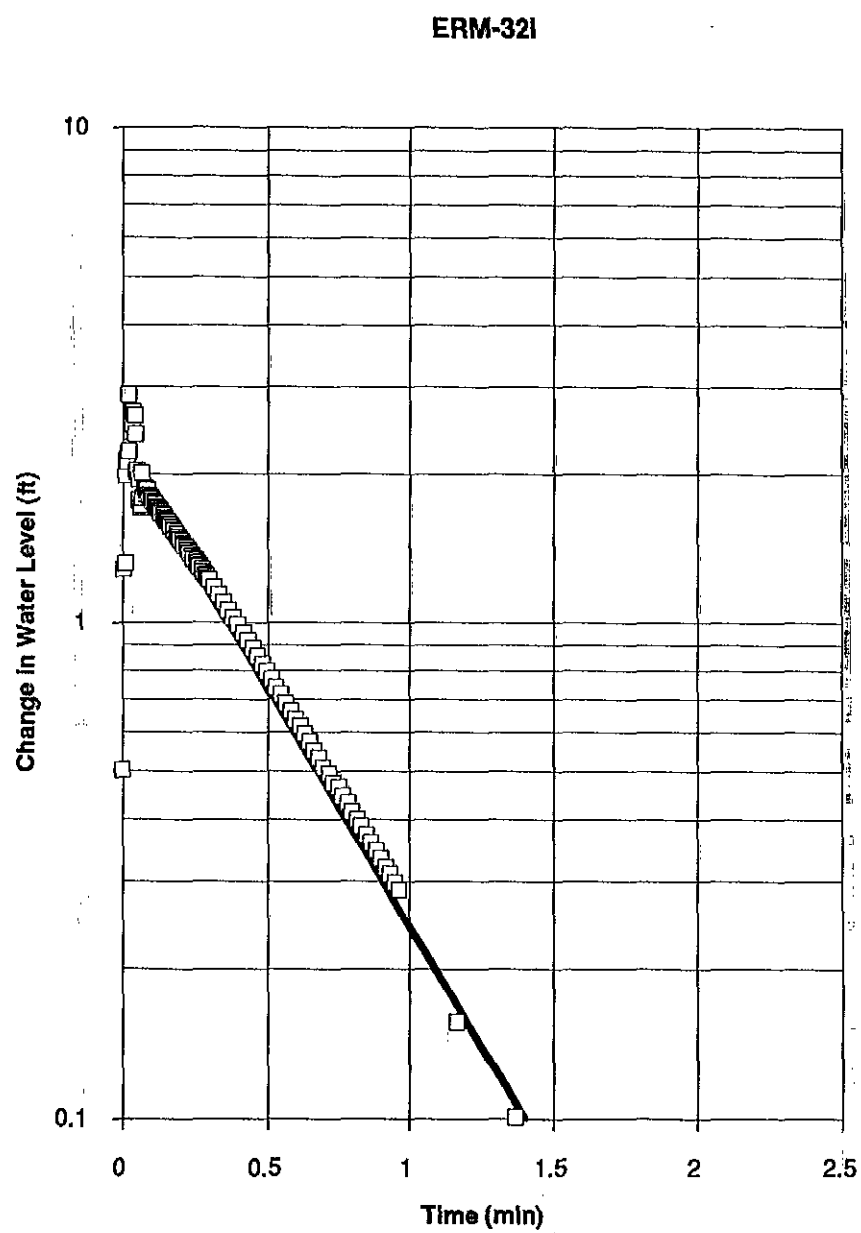


Bouwer and Rice Slug Test Calculations *

Well ERM-32I — Case 4: Well Penetrates to the Aquifer Bottom
Slug Out — K gravel pack >> K formation
No Gravel Pack Drainage

Definition Of Variables:

D : Saturated Aquifer Thickness
H : Depth of Water in the Well
H = Static Water Elev. - Elev. of Well Bottom
L : Length of Gravel Pack Below Water Table
Note: L = H if Water level is Below the Top of the Screen
C : Well Geometry Factor - from Bouwer & Rice, Figure 3
rc : Inner Radius of the Well casing
rw : Radius of the Gravel Pack
Yo : Water Level Displacement at time = 0
t : Arbitrary Time from Recovery vs Time Plot
Yt : Water Level Displacement at time = t

Determined Values for Variables:

D =	185	feet	
H =	185	feet	Notes:
L =	25	feet	H = D for this analysis
C =	3.5		L/rw = 75
rw =	0.333	feet	
rc =	0.083	feet	
Yo =	2.25	feet	
t =	1.4	minutes	
Yt =	0.1	feet	

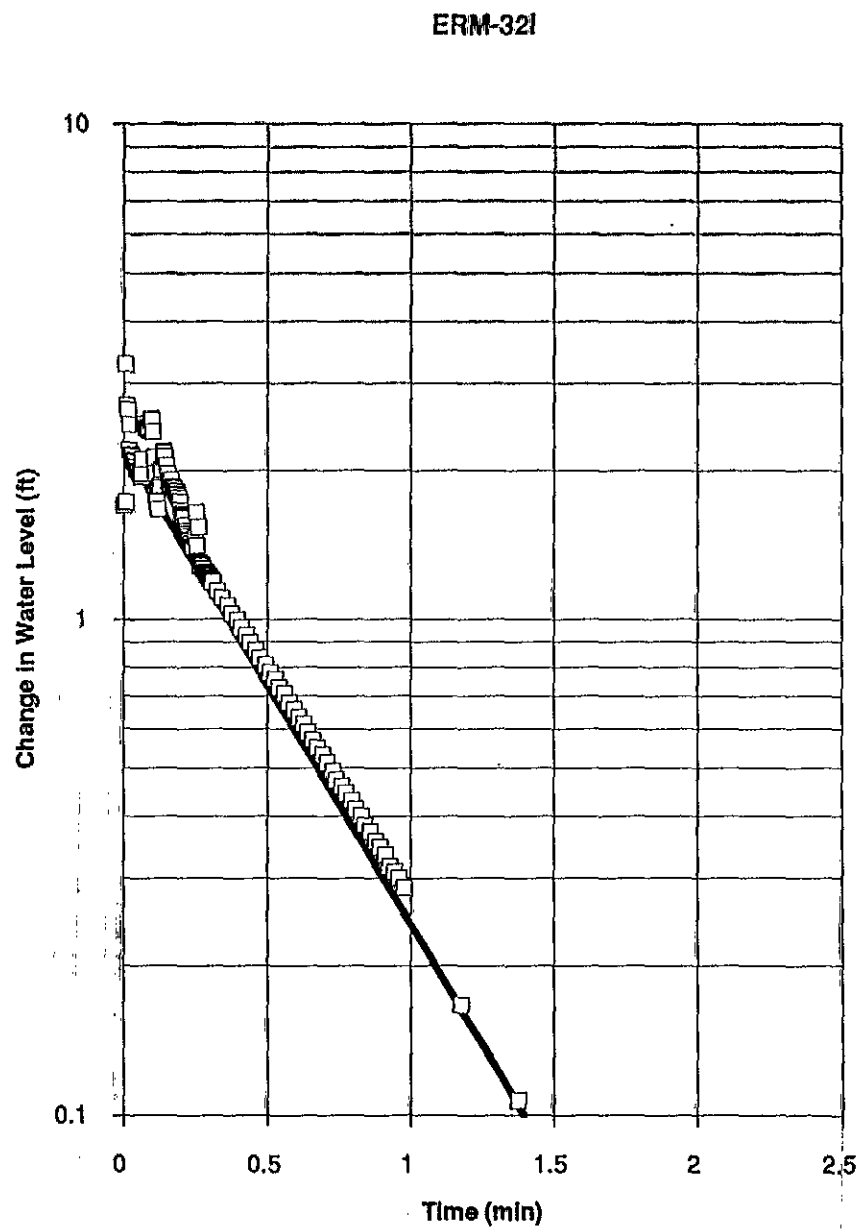
Calculations

(1/t)*ln(Yo/Yt) = 2.2239

ln(Re/rw) = 1/(1.1/ln(H/rw)+C/(L/rw))
= 4.5316

K = (rc*rc*ln(Re/rw)*(1/t)*ln(Yo/Yt))/(2L)
= 2.00 feet/day = 7.1 E-04 cm/sec

* Reference: Bouwer,H and Rice,R.C, 1976: A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers With Completely or Partially Penetrating Wells: Water Res. Res. V.12. No. 3



Bouwer and Rice Slug Test Calculations *

Well ERM-33I — Case 4: Well Penetrates to the Aquifer Bottom
Slug In — K gravel pack >> K formation
No Gravel Pack Drainage

Definition Of Variables:

D : Saturated Aquifer Thickness
H : Depth of Water in the Well
H = Static Water Elev. - Elev. of Well Bottom
L : Length of Gravel Pack Below Water Table
Note: L = H if Water level is Below the Top of the Screen
C : Well Geometry Factor - from Bouwer & Rice, Figure 3
rc : Inner Radius of the Well casing
rw : Radius of the Gravel Pack
Yo : Water Level Displacement at time = 0
t : Arbitrary Time from Recovery vs Time Plot
Yt : Water Level Displacement at time = t

Determined Values for Variables:

D =	133	feet	
H =	133	feet	Notes:
L =	35	feet	H = D for this analysis
C =	4.3		L/rw = 105
rw =	0.333	feet	
rc =	0.083	feet	
Yo =	2.25	feet	
t =	35	minutes	
Yt =	0.1	feet	

Calculations

(1/t)*ln(Yo/Yt) = 0.089

ln(Re/rw) = 1/(1.1/ln(H/rw)+C/(L/rw))
= 4.4533

K = (rc*rc*ln(Re/rw)*(1/t)*ln(Yo/Yt))/(2L)
= 0.06 feet/day = 2.0 E-05 cm/sec

* Reference: Bouwer,H and Rice,R.C, 1976: A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers With Completely or Partially Penetrating Wells: Water Res. Res. V.12. No. 3

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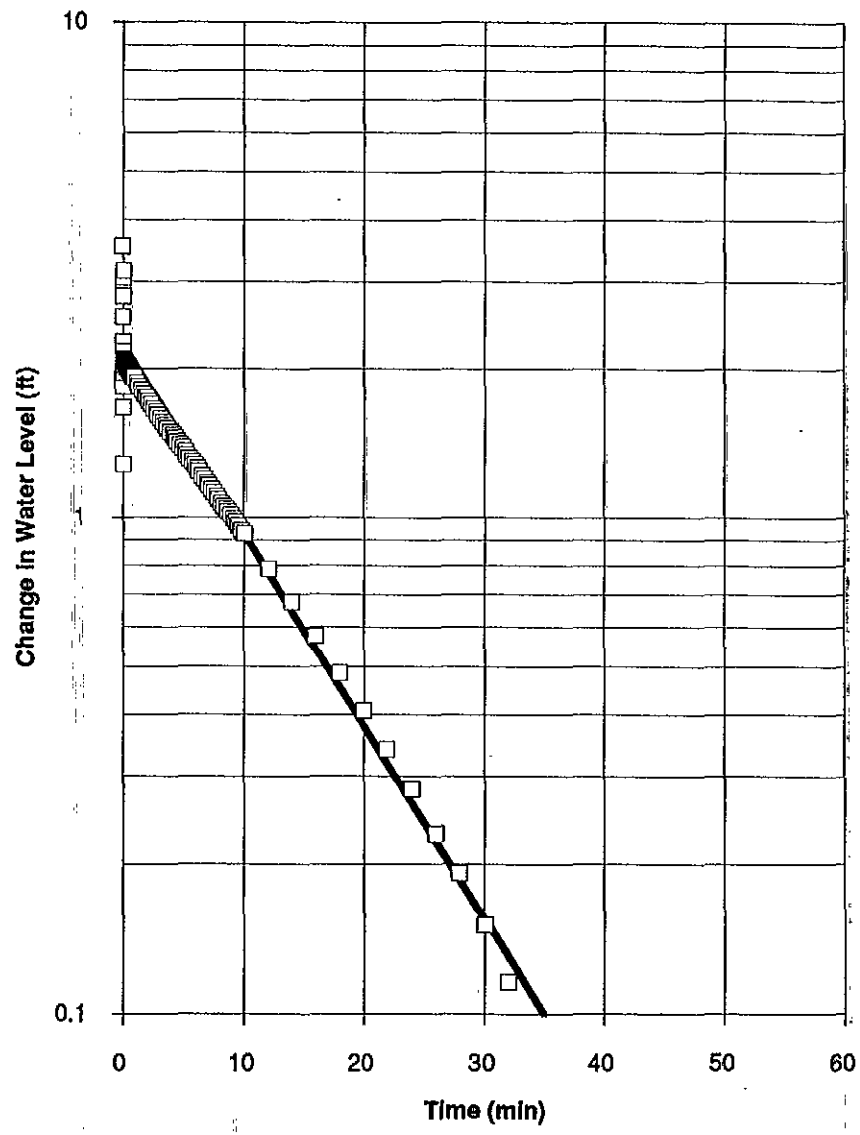


Bouwer and Rice Slug Test Calculations *

Well ERM-33I — Case 4: Well Penetrates to the Aquifer Bottom
Slug Out — K gravel pack >> K formation
No Gravel Pack Drainage

Definition Of Variables:

D : Saturated Aquifer Thickness
H : Depth of Water in the Well
H = Static Water Elev. - Elev. of Well Bottom
L : Length of Gravel Pack Below Water Table
Note: L = H if Water level is Below the Top of the Screen
C : Well Geometry Factor - from Bouwer & Rice, Figure 3
rc : Inner Radius of the Well casing
rw : Radius of the Gravel Pack
Yo : Water Level Displacement at time = 0
t : Arbitrary Time from Recovery vs Time Plot
Yt : Water Level Displacement at time = t

Determined Values for Variables:

D =	133	feet	
H =	133	feet	Notes:
L =	35	feet	H = D for this analysis
C =	4.3		L/rw = 105
rw =	0.333	feet	
rc =	0.083	feet	
Yo =	2.25	feet	
t =	49	minutes	
Yt =	0.1	feet	

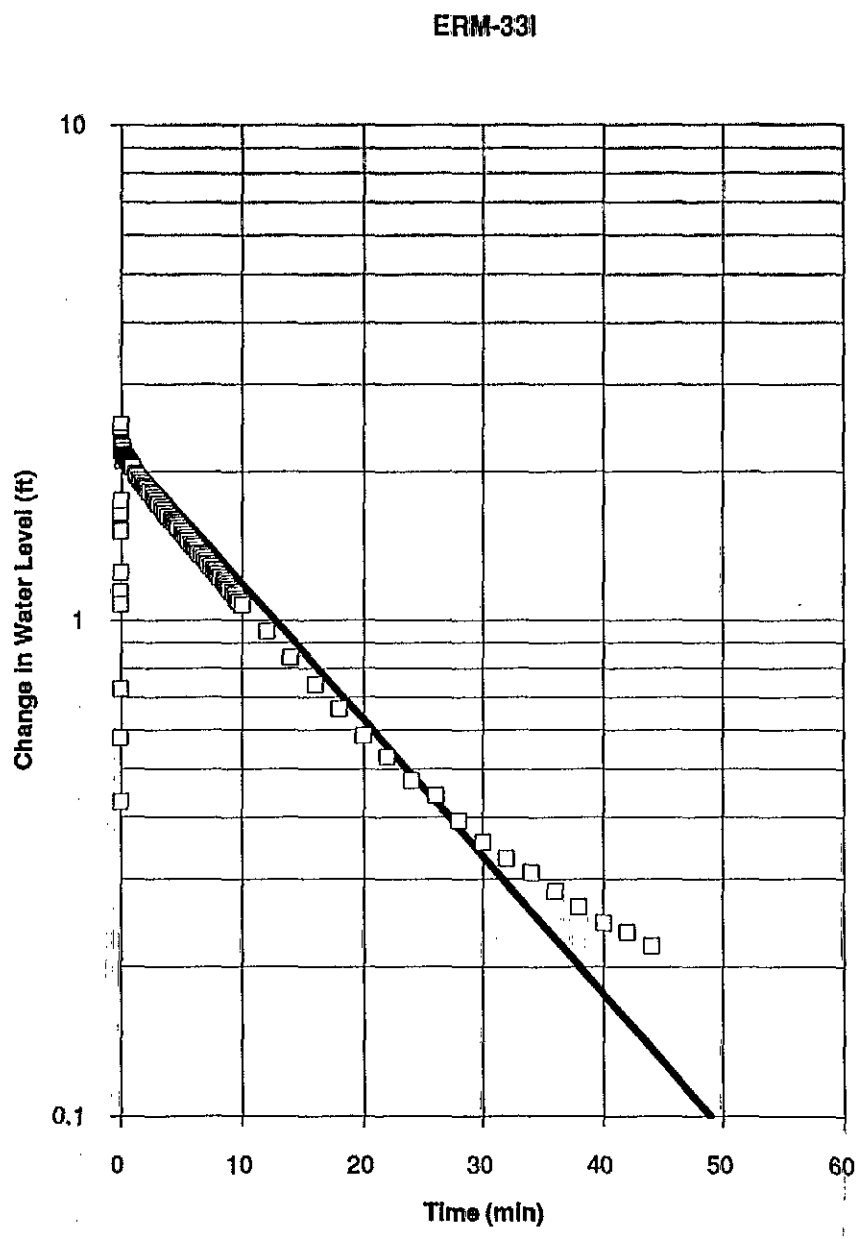
Calculations

(1/t)*ln(Yo/Yt) = 0.0635

ln(Re/rw) = 1/(1.1/ln(H/rw)+C/(L/rw))
= 4.4533

K = (rc*rc*ln(Re/rw)*(1/t)*ln(Yo/Yt))/(2L)
= 0.04 feet/day = 1.4 E-05 cm/sec

* Reference: Bouwer,H and Rice,R.C, 1976: A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers With Completely or Partially Penetrating Wells: Water Res. Res. V.12. No. 3



Bouwer and Rice Slug Test Calculations *

Well ERM-34S

Case 3: Gravel Pack Drainage
K gravel pack >> K formation
Water Level Below Top of the Gravel Pack

Definition Of Variables:

D : Saturated Aquifer Thickness
H : Depth To the Bottom of the Gravel Pack minus the Static Depth to Water
L = H for Well with Gravel Pack Drainage
A & B : Well Geometry Factors - from Bouwer & Rice, Figure 3
rc : Inner Radius of the Well casing
rw : Radius of the Gravel Pack
Yo : Water Level Displacement at time = 0
t : Arbitrary Time from Recovery vs Time Plot
Yt : Water Level Displacement at time = t

Determined Values for Variables:

D =	100	feet		
H =	9.62	feet	Notes:	
L =	9.62	feet	L = H	
A =	2		L/rw =	19
B =	0.3			
rw =	0.5	feet		
rc =	0.083	feet		
Yo =	0.2	feet		
t =	0.23	minutes		
Yt =	0.01	feet		

Calculations

(1/t)*ln(Yo/Yt) = 13.025

ln(Re/rw) = 1/[(1.1/ln(H/rw)+(A+Bln((D-H)/rw)))/(L/rw)]
= 1.7954

K = [(rc*rc)+0.3*(rw*rw-rc*rc)]*ln(Re/rw)*(1/t)*ln(Yo/Yt))/(2L)
= 139.70 feet/day = 4.93E-02 cm/sec

* Reference: Bouwer,H and Rice,R.C, 1976: A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers With Completely or Partially Penetrating Wells: Water Res. Res. V.12. No. 3

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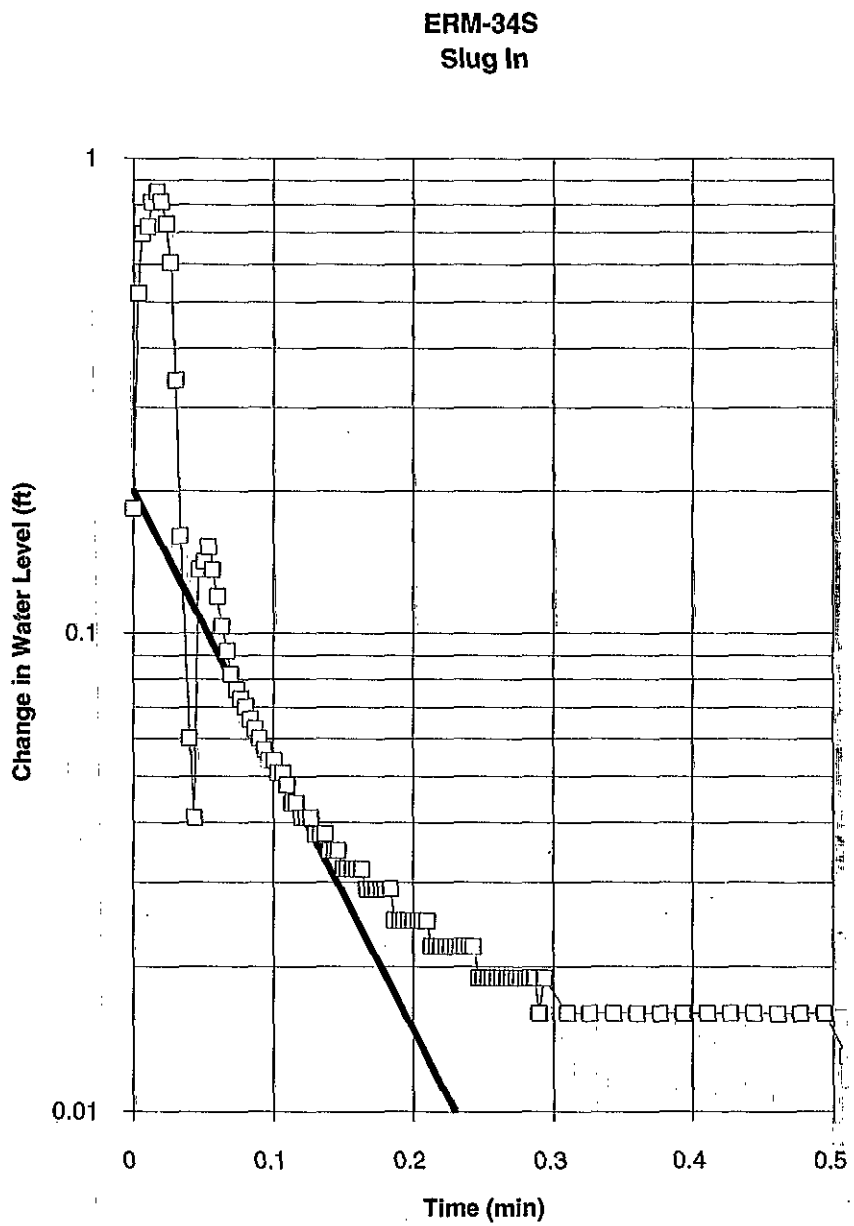


Bouwer and Rice Slug Test Calculations *

Well ERM-34S

Case 3: Gravel Pack Drainage
K gravel pack >> K formation
Water Level Below Top of the Gravel Pack

Definition Of Variables:

D : Saturated Aquifer Thickness
H : Depth To the Bottom of the Gravel Pack minus
the Static Depth to Water
L = H for Well with Gravel Pack Drainage
A & B : Well Geometry Factors - from Bouwer & Rice, Figure 3
rc : Inner Radius of the Well casing
rw : Radius of the Gravel Pack
Yo : Water Level Displacement at time = 0
t : Arbitrary Time from Recovery vs Time Plot
Yt : Water Level Displacement at time = t

Determined Values for Variables:

D =	100	feet	
H =	9.62	feet	Notes:
L =	9.62	feet	L = H
A =	2		L/rw = 19
B =	0.25		
rw =	0.5	feet	
rc =	0.083	feet	
Yo =	0.2	feet	
t =	0.25	minutes	
Yt =	0.01	feet	

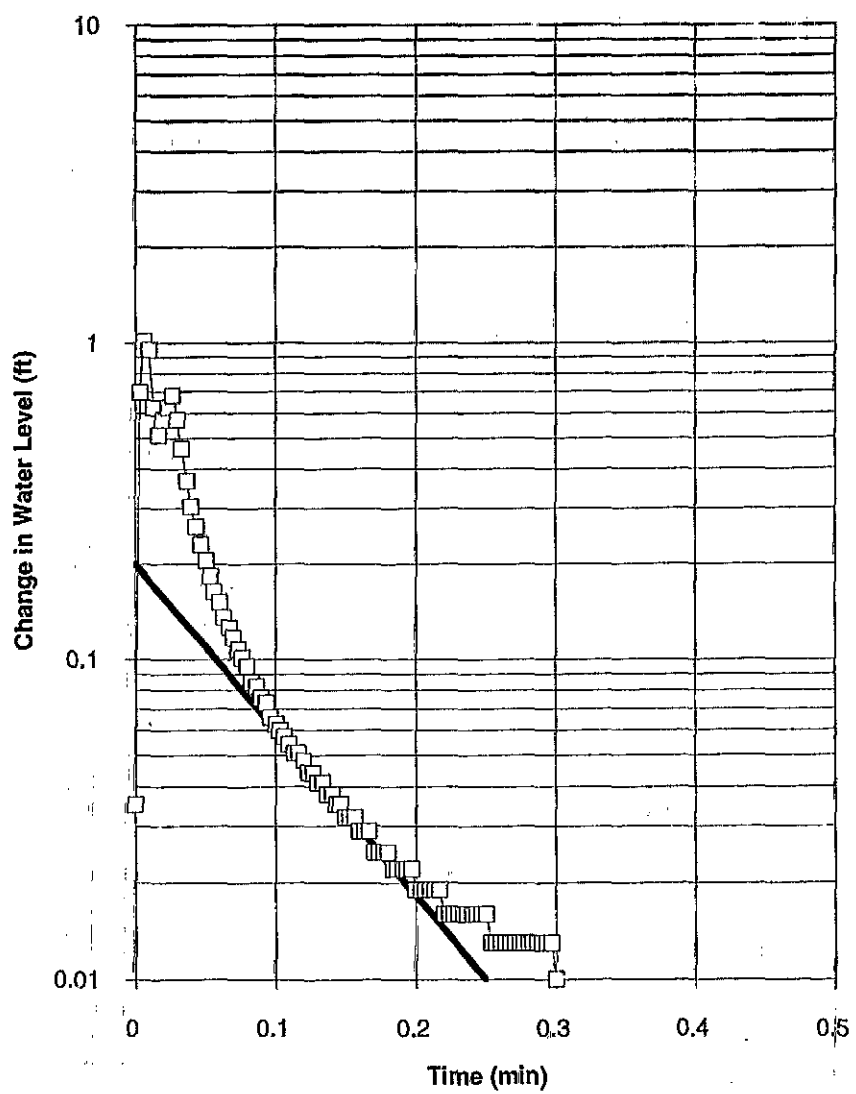
Calculations

(1/t)*ln(Yo/Yt) = 11.983

ln(Re/rw) = 1/[(1.1/ln(H/rw)+(A+Bln((D-H)/rw)))/(L/rw)]
= 1.84

K = [(rc*rc)+0.3*(rw*rw-rc*rc)]*ln(Re/rw)*(1/t)*ln(Yo/Yt)]/(2L)
= 131.72 feet/day = 4.65E-02 cm/sec

* Reference: Bouwer,H and Rice,R.C, 1976: A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers With Completely or Partially Penetrating Wells: Water Res. Res. V.12. No. 3



Bouwer and Rice Slug Test Calculations *

Well ERM-34I — Case 5: Well Penetrates to the Aquifer Bottom
Slug In — K gravel pack ≈ K formation
No Gravel Pack Drainage

Definition Of Variables:

D : Saturated Aquifer Thickness
H : Depth of Water in the Well
H = Static Water Elev. - Elev. of Well Bottom
L : Length of Screen Below Water Table
Note: L = H if Water level is Below the Top of the Screen
C : Well Geometry Factor - from Bouwer & Rice, Figure 3
rc : Inner Radius of the Well casing
rw : Radius of the Gravel Pack
Yo : Water Level Displacement at time = 0
t : Arbitrary Time from Recovery vs Time Plot
Yt : Water Level Displacement at time = t

Determined Values for Variables:

D =	93	feet	
H =	93	feet	Notes:
L =	25	feet	H = D for this analysis
C =	8.75		rw not used in this analusis
rw =	0.333	feet	L/rc = 301
rc =	0.083	feet	
Yo =	2.25	feet	
t =	0.2	minutes	
Yt =	0.003	feet	

Calculations

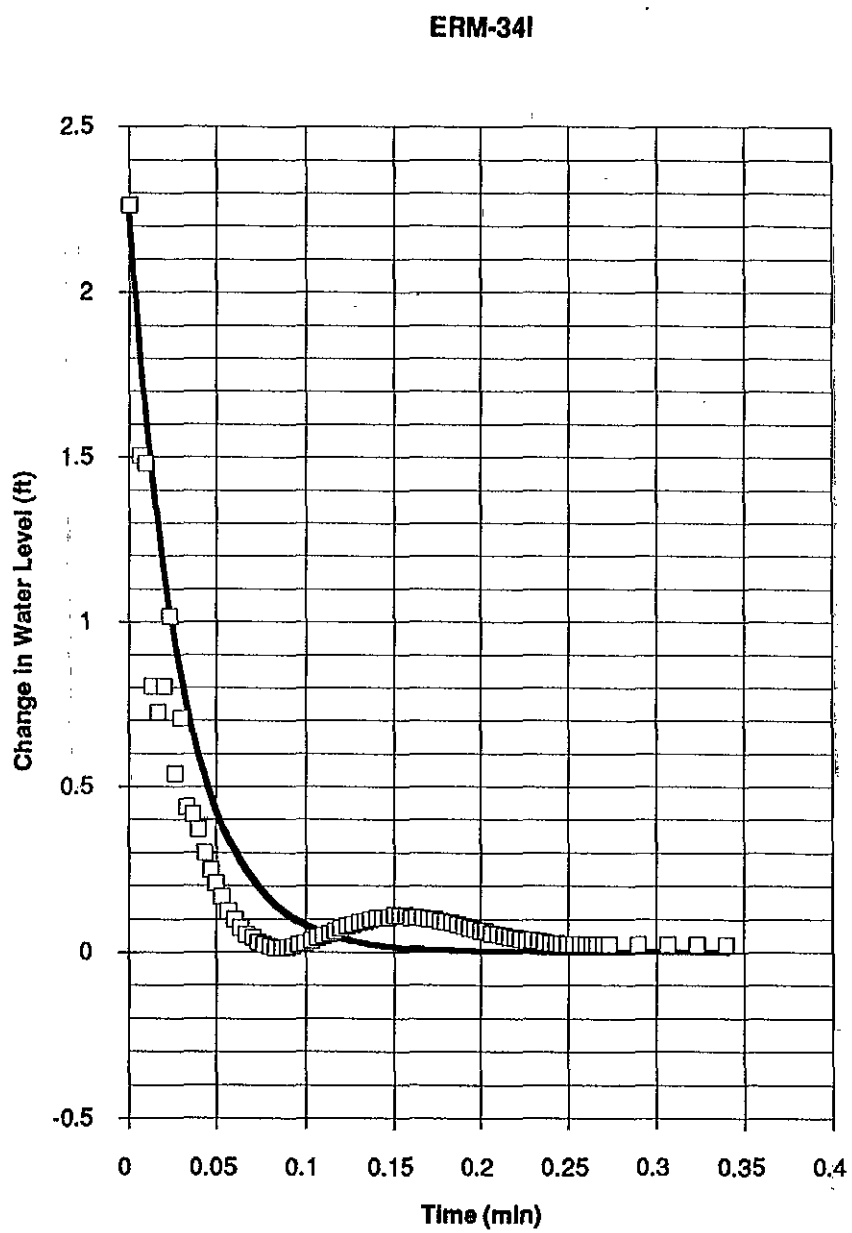
(1/t)*ln(Yo/Yt) = 33.1

ln(Re/rc) = 1/(1.1/ln(H/rc)+C/(L/rc))
= 5.3847

K = (rc*rc*ln(Re/rc)*(1/t)*ln(Yo/Yt))/(2L)
= 35.36 feet/day = 1.2 E-02 cm/sec

* Reference: Bouwer,H and Rice,R.C, 1976: A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers With Completely or Partially Penetrating Wells: Water Res. Res. V.12. No. 3

THE ERM GROUP



Bouwer and Rice Slug Test Calculations *

Well ERM-34I — Case 5: Well Penetrates to the Aquifer Bottom
Slug Out — K gravel pack ≈ K formation
No Gravel Pack Drainage

Definition Of Variables:

D : Saturated Aquifer Thickness
H : Depth of Water in the Well
H ≈ Static Water Elev. - Elev. of Well Bottom
L : Length of Screen Below Water Table
Note: L = H if Water level is Below the Top of the Screen
C : Well Geometry Factor - from Bouwer & Rice, Figure 3
rc : Inner Radius of the Well casing
rw : Radius of the Gravel Pack
Yo : Water Level Displacement at time = 0
t : Arbitrary Time from Recovery vs Time Plot
Yt : Water Level Displacement at time = t

Determined Values for Variables:

D =	93	feet	
H =	93	feet	Notes:
L =	25	feet	H = D for this analysis
C =	8.75		rw not used in this analusis
rw =	0.333	feet	L/rc = 301
rc =	0.083	feet	
Yo =	2.25	feet	
t =	0.19	minutes	
Yt =	0.01	feet	

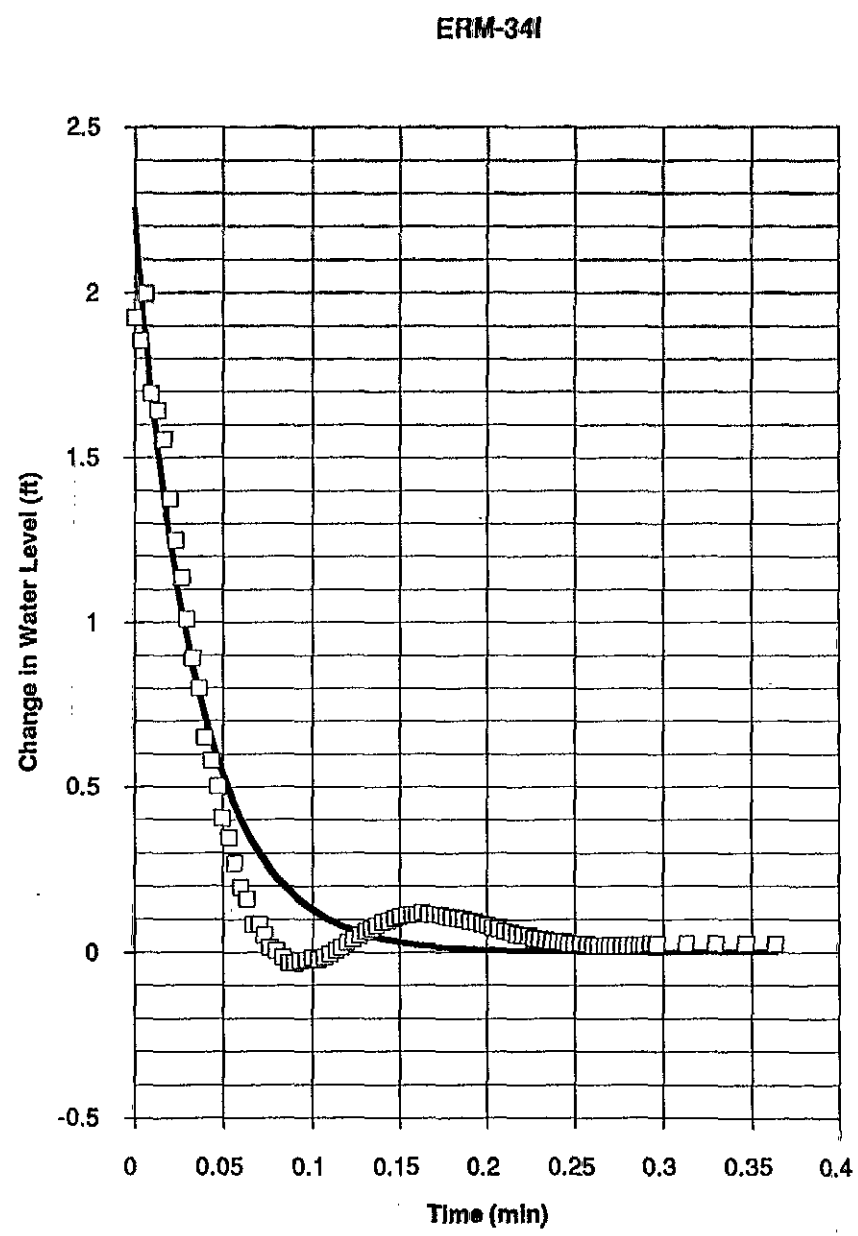
Calculations

(1/t)*ln(Yo/Yt) = 28.506

ln(Re/rc) = 1/(1.1/ln(H/rc)+C/(L/rc))
= 5.3847

K = (rc*rc*ln(Re/rc)*(1/t)*ln(Yo/Yt))/(2L)
= 30.45 feet/day = 1.1 E-02 cm/sec

* Reference: Bouwer,H and Rice,R.C, 1976: A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers With Completely or Partially Penetrating Wells: Water Res. Res. V.12. No. 3



Bouwer and Rice Slug Test Calculations *

Well ERM-35S — Case 3: Gravel Pack Drainage
Slug In — K gravel pack >> K formation
Water Level Below Top of the Gravel Pack

Definition Of Variables:

D : Saturated Aquifer Thickness
H : Depth To the Bottom of the Gravel Pack minus the Static Depth to Water
L = H for Well with Gravel Pack Drainage
A & B : Well Geometry Factors - from Bouwer & Rice, Figure 3
rc : Inner Radius of the Well casing
rw : Radius of the Gravel Pack
Yo : Water Level Displacement at time = 0
t : Arbitrary Time from Recovery vs Time Plot
Yt : Water Level Displacement at time = t

Determined Values for Variables:

D =	100	feet	
H =	9.62	feet	Notes:
L =	9.62	feet	L = H
A =	2.1		L/rw = 17
B =	0.3		
rw =	0.583	feet	
rc =	0.083	feet	
Yo =	0.15	feet	
t =	2	minutes	
Yt =	0.01	feet	

Calculations

(1/t)*ln(Yo/Yt) = 1.354

ln(Re/rw) = 1/[(1.1/ln(H/rw)+(A+Bln((D-H)/rw)))/(L/rw)]
= 1.6357

K = [(rc*rc)+0.3*(rw*rw-rc*rc)]*ln(Re/rw)*(1/t)*ln(Yo/Yt))/(2L)
= 17.70 feet/day = 6.24E-03 cm/sec

* Reference: Bouwer,H and Rice,R.C, 1976: A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers With Completely or Partially Penetrating Wells: Water Res. Res. V.12. No. 3

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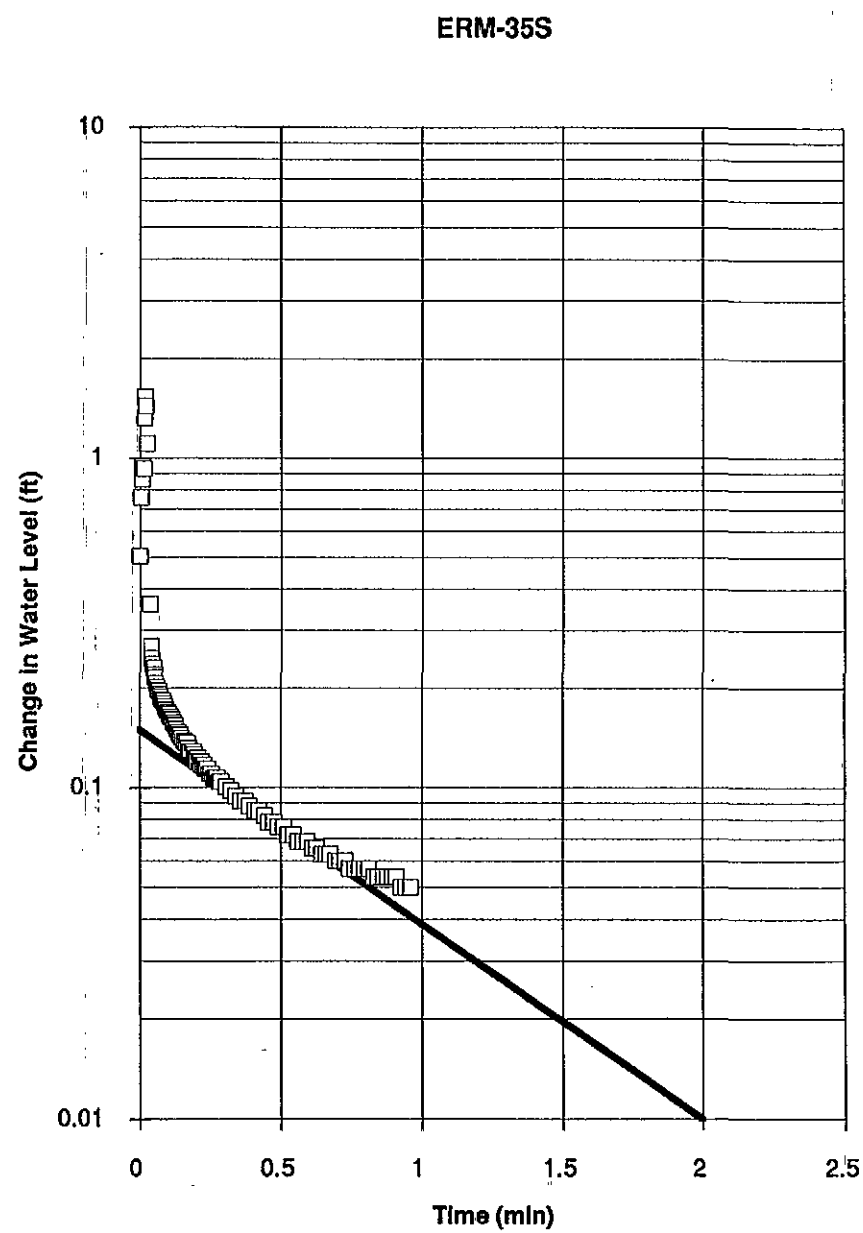

Bouwer and Rice Slug Test Calculations *

Well ERM-35I — Case 4: Well Penetrates to the Aquifer Bottom
Slug In — K gravel pack >> K formation
No Gravel Pack Drainage

Definition Of Variables:

D : Saturated Aquifer Thickness
H : Depth of Water in the Well
H = Static Water Elev. - Elev. of Well Bottom
L : Length of Gravel Pack Below Water Table
Note: L = H if Water level is Below the Top of the Screen
C : Well Geometry Factor - from Bouwer & Rice, Figure 3
rc : Inner Radius of the Well casing
rw : Radius of the Gravel Pack
Yo : Water Level Displacement at time = 0
t : Arbitrary Time from Recovery vs Time Plot
Yt : Water Level Displacement at time = t

Determined Values for Variables:

D =	90	feet	
H =	90	feet	Notes:
L =	24.6	feet	H = D for this analysis
C =	4.3		L/rw = 74
rw =	0.333	feet	
rc =	0.083	feet	
Yo =	2.25	feet	
t =	1.45	minutes	
Yt =	0.1	feet	

Calculations

(1/t)*ln(Yo/Yt) = 2.1473

ln(Re/rw) = 1/(1.1/ln(H/rw)+C/(L/rw))
= 3.9269

K = (rc*rc*ln(Re/rw)*(1/t)*ln(Yo/Yt))/(2L)
= 1.70 feet/day = 6.0 E-04 cm/sec

* Reference: Bouwer,H and Rice,R.C, 1976: A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers With Completely or Partially Penetrating Wells: Water Res. Res. V.12. No. 3

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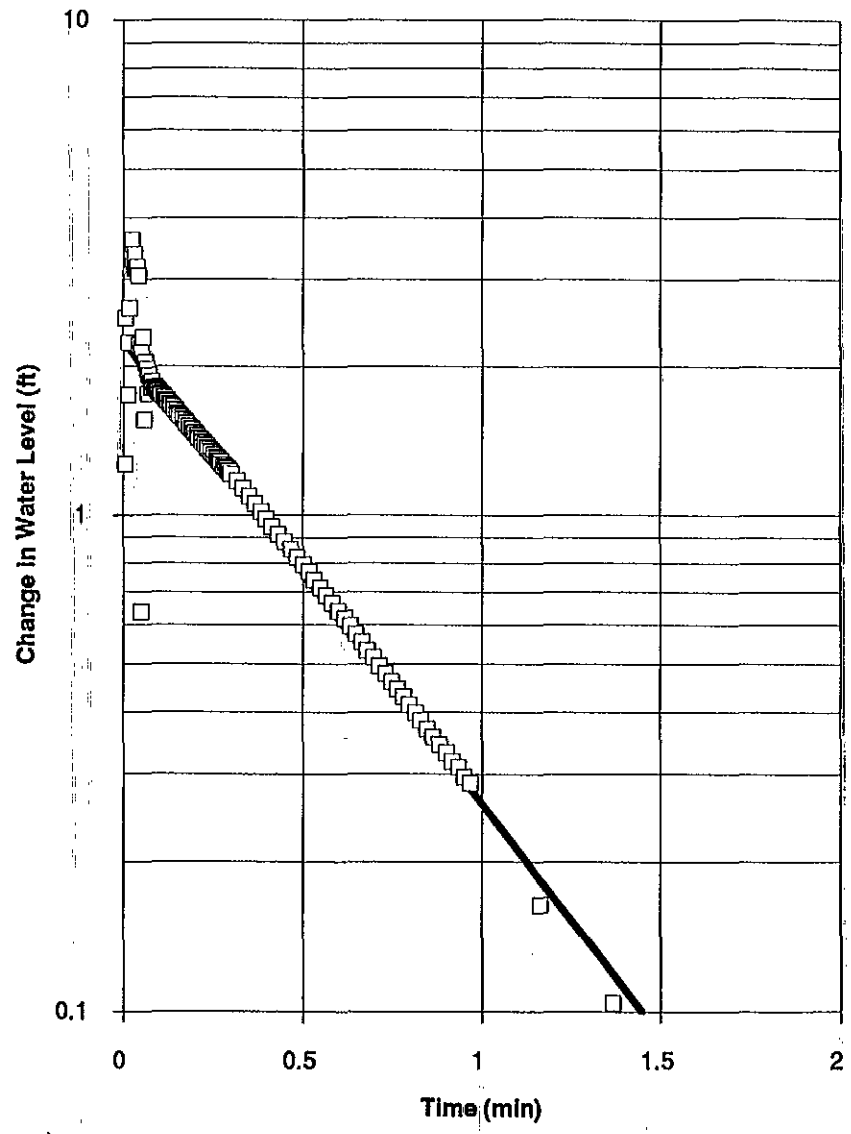


Bouwer and Rice Slug Test Calculations *

Well ERM-35I — Case 4: Well Penetrates to the Aquifer Bottom
Slug Out — K gravel pack >> K formation
No Gravel Pack Drainage

Definition Of Variables:

D : Saturated Aquifer Thickness
H : Depth of Water in the Well
H = Static Water Elev. - Elev. of Well Bottom
L : Length of Gravel Pack Below Water Table
Note: L = H if Water level is Below the Top of the Screen
C : Well Geometry Factor - from Bouwer & Rice, Figure 3
rc : Inner Radius of the Well casing
rw : Radius of the Gravel Pack
Yo : Water Level Displacement at time = 0
t : Arbitrary Time from Recovery vs Time Plot
Yt : Water Level Displacement at time = t

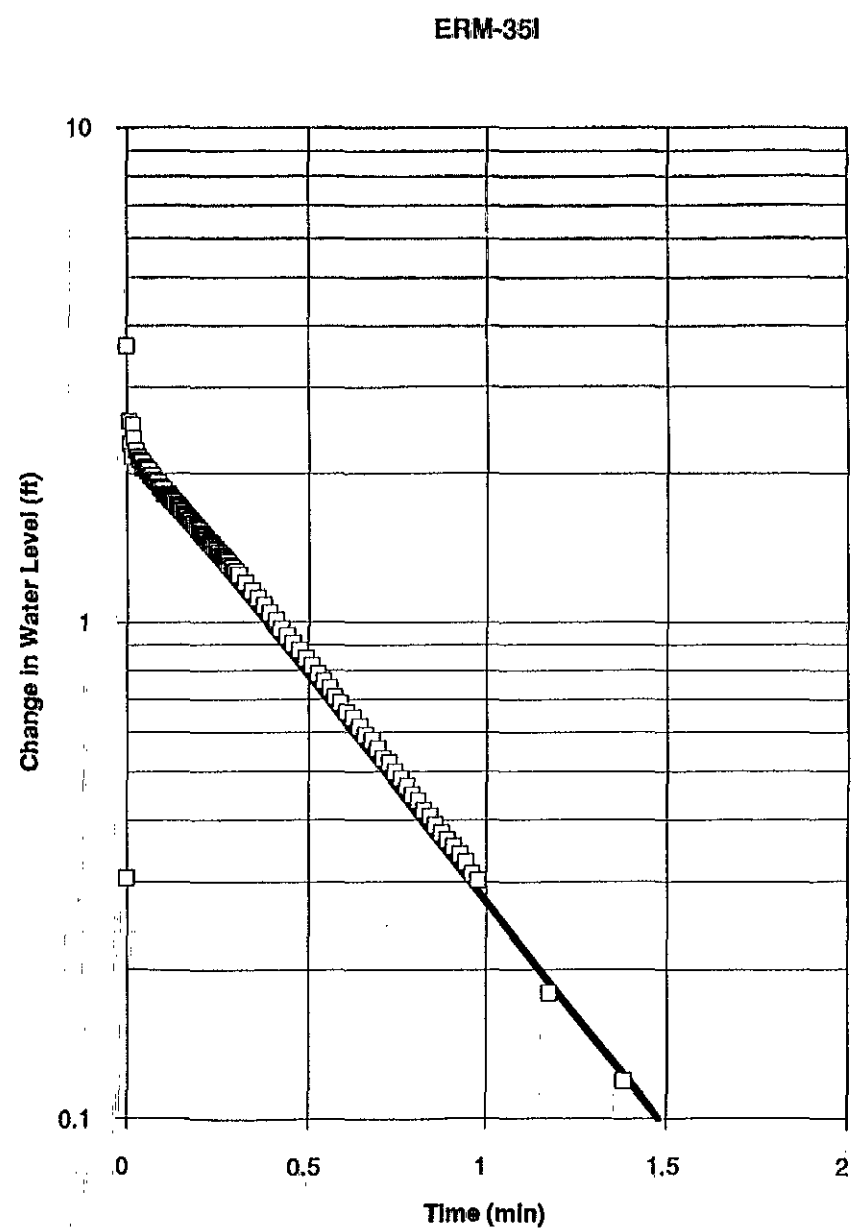
Determined Values for Variables:

D =	90	feet	
H =	90	feet	Notes:
L =	24.6	feet	H = D for this analysis
C =	4.3		L/rw = 74
rw =	0.333	feet	
rc =	0.083	feet	
Yo =	2.25	feet	
t =	1.48	minutes	
Yt =	0.1	feet	

Calculations

(1/t)*ln(Yo/Yt) = 2.1037

ln(Re/rw) = 1/(1.1/ln(H/rw)+C/(L/rw))
= 3.9269

K = (rc*rc*ln(Re/rw)*(1/t)*ln(Yo/Yt))/(2L)
= 1.67 feet/day = 5.9 E-04 cm/sec

* Reference: Bouwer,H and Rice,R.C, 1976: A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers With Completely or Partially Penetrating Wells: Water Res. Res. V.12. No. 3