Appendix H1 - Analysis Methods of Slug Testing Procedures

Data Processing

Slug testing data were downloaded from the data logger and processed using WinSITU 2000 (In-Situ, Inc., 2000) to convert water levels to displacement. Normalized displacement was then calculated in a spreadsheet by dividing measured displacement values by the initial displacement. Processed data were plotted and analyzed using Aqtesolv 3.50 (HydroSOLVE, Inc., 2003). Table H1-1 shows the screen and aquifer depths for each well which were used as input parameters for Aqtesolv. The screen depths are measured from the top of the aquifer (from the water table for an unconfined aquifer) for the analysis.

Methods of Analysis

Three methods, the Kansas Geological Survey model (KGS; Hyder *et al*., 1994), Butler (1998) method, and Bouwer and Rice (1976) method were used to analyze the processed data.

The KGS model can account for a low permeability material around the well screen (i.e., skin), such as the residue of drilling mud that was not removed from the formation during the well development. The KGS model may be used with or without well skin

The Butler method accounts for the momentum balance of the water column in the well; it was used where an oscillatory response was observed or when fitting with the KGS method resulted in a systematic misfit. The oscillatory response is typically recorded in wells installed in aquifers of high conductivity or in wells with a high water column above the top of casing. The Butler method uses a dimensionless damping factor, C(D), which defines the well as critically damped when C(D)=1; it is under-damped when C(D) < 1 and over-damped when C(D) > 1.

For tests conducted on water table wells that were not modeled well by either of the two methods described above, the Bouwer and Rice method was used. This method accounts for the drainage of the gravel pack during tests on wells screened across the water table. Seven of the shallow wells were screened across the water table. Butler (1998) suggests fitting the Bouwer and Rice method solution within a normalized head range of 0.2-0.3 for optimum results.

Estimated Aquifer Properties The main objective was to estimate the horizontal hydraulic conductivity of the aquifer zones screened by the tested wells. All tests that did not exhibit oscillations or the effects of sand-pack drainage were analyzed with the KGS model without skin. The skin effect, specific storage, and anisotropy ratio (K_z/K_r) were held constant because they in general cannot be uniquely resolved from slug tests (e.g., Butler, 1998). The anisotropy ratio was held constant at 0.1 for all three methods to account for higher horizontal than vertical hydraulic conductivity, typical of unconsolidated sediments. The specific storage (S_s) was found to have a minimal impact on the estimation of K_r, so it was fixed to 1.0×10^{-5} ft^{-1} based on a range of plausible values from 9.9×10^{-6} ft^{-1} to 2.69×10^{-4} ft^{-1} for sands and gravels (Table H1-2) calculated using the soil matrix compressibility equation by Domenico and Schwartz (1990). This S_s value was chosen to represent a wide variety of sediments since slug tests were performed on 66 wells. The effect of the value of S_s on the estimated K_r is negligible for slug tests (e.g., Beckie and Harvey, 2002). The estimation of the

hydraulic conductivity of the well skin with the KGS model was attempted for several tests but was inconclusive.

Results of Analysis

Table H1-3 summarizes the methods used for each well in addition to the results of each parameter. This appendix contains the fit curve plots from Aqtesolv. The response of some wells differed when the slug was inserted (slug-in test) into the well than when it was removed (slug-out test); for some wells, different methods were used to analyze the slug-in tests and the slug-out tests. The best fit was selected as the representative result of the test. If, however, the results of the slug-in and slug-out tests were similar, the average was taken as the representative result. Table H1-4 shows the representative hydraulic conductivity results along with the statistical summary.

The average horizontal hydraulic conductivity (K_r) for all wells and methods is 53.5 ft/day. The overall minimum K_r of 0.47 ft/day was estimated for MW24D and the overall maximum of 263.8 ft/day for MW2. The average K_r for the shallow (water table) wells is higher, 67.99 ft/day (Table H1-5), than for the deeper wells, 39.86 ft/day (Table H1-6). For the shallow wells, the minimum K_r of 0.78 was estimated for MW12 and the maximum of 263.8 was estimated for MW2. For the deeper wells, the minimum K_r of 0.47 was estimated for MW24D and the maximum of 131.89 was estimated for MW13B. The Bouwer and Rice method was used to analyze the slug tests of 9 wells. The results of these tests are summarized in Table H1-7. Most of these wells are shallow. Three of the wells were screened across the water table. The average K_r for the 9 wells is 47.7 ft/day. The minimum K_r of 0.78 ft/day was estimated for MW12 and the maximum of 194.3 ft/day for MW6.

The KGS method was used to analyze the slug tests of 29 wells. The results of these tests are summarized in Table H1-7. Three of these wells were screened across the water table. The average K_r for the 29 wells is 21.9 ft/day. The minimum K_r of 0.47 ft/day was estimated for MW24D and the maximum K_r of 113.8 ft/day for MW8A.

The Butler method was used to analyze the slug tests of 31 wells. The results of these tests are summarized in Table H1-7. Only one of these wells was screened across the water table. An oscillatory response was observed in 9 of these wells. The tests at the 22 remaining wells did not exhibit oscillatory response but a systematic misfit for the KGS method indicated that the acceleration of the water column was significant (the misfit was not due to the skin effects because the test response was fast, indicating high K_r). The average K_r for all the tests analyzed by the Butler method is 86.97 ft/day. The average K_r for the wells with oscillating test response is 109 ft/day, with the minimum K_r of 82.2 ft/day at MW25D, and the maximum K_r of 131.9 at MW13B. The average K_r for the non-oscillating tests was 77.96 ft/day, with the minimum K_r of 6.59 ft/day at MW26D and the maximum K_r of 263.8 ft/day at MW2. This minimum result from MW26D is an average of K_r values from the Butler and KGS methods because both methods yielded very similar results (Table H1-2). The K_r values estimated by the Butler method are significantly higher than the K_r values from the KGS or Bouwer and Rice methods.

References

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Table H1-1
Summary of Well Properties for Slug Test Analysis
Omega Chemical Superfund Site

Well ID	Nominal Casing Diameter (in)	Actual Casing Radius (ft)	Borehole Diameter (in)	Borehole Radius (ft)	DTW (ft bgs)	Top of Aquifer (ft bgs)	Bottom of Aquifer (ft bgs)	Aquifer Thickness	Depth to Top of Screen (ft bgs)	Depth to Bottom of Screen (ft bgs)	Top of Screen Depth Below Top of Aquifer (ft)	Bottom of Screen Depth Below Top of Aquifer (ft)	Lithology of Screened Interval [(b)]
MW1A	4	0.167	10	0.417	32.51	38	60	22	45	60	7	22	SW, SM, SP
MW1B	4	0.167	10	0.417	32.39	35	85	50	75	85.4	40	50.4	SP, GP, ML
MW2	4	0.167	10	0.417	29.02	29.02	60	30.98	45	60	15.98	30.98	SW, SM, SP
MW3	4	0.167	10	0.417	28.57	28.57	51	22.43	37.8	48	9.23	19.43	SM, SP, ML
MW4A	4	0.167	10	0.417	24.56	32	53	21	42.7	53	10.7	21	SW, SM, SP
MW4B	2	0.085	10	0.417	24.47	64	79.5	15.5	69.7	80	5.7	16	SP
MW4C	2	0.085	10	0.417	26.1	89	98	9	88.7	99	0	10	ML, SM, SP
MW5	4	0.167	10	0.417	26.31	44	53	9	43.3	53.3	0	9.3	ML, SP, SW
MW6	4	0.167	10	0.417	26.16	26.16	47.5	21.34	37.1	47.5	10.94	21.34	SP, SW
MW7	4	0.167	10	0.417	22.21	30.5	46	15.5	35.8	46	5.3	15.5	SP, SW
MW8A	4	0.167	10	0.417	27.93	29	45	16	30	45	1	16	SP, SW, SM
MW8B	2	0.085	10	0.417	27.72	29	74	45	65	75	36	46	SM, SP
MW8C	2	0.085	10	0.417	28.5	89	93	4	86.7	91.7	0	2.7	SM, ML
MW8D	4	0.167	8	0.333	32.36	63	150	87	110	120	47	57	SP
MW9A	4	0.167	10	0.417	26.25	26.25	48	21.75	25	35	0	8.75	SP, ML, SM
MW9B	4	0.167	10	0.417	29.87	53	61	8	49.8	60	0	7	CL, SP
MW10	4	0.167	10	0.417	33.73	33.73	62	28.27	52	62	18.27	28.27	CL, ML, SW, SM
MW11	4	0.167	10	0.417	36.58	36.58	55	18.42	40	50	3.42	13.42	SP, SW
MW12	2	0.080	6	0.250	83.11	83.11	89	5.89	82	97	0	13.89	ML, SC, CL
MW13B	2	0.080	10	0.417	80.33	122	133	11	123	133	1	11	SP, SM
MW14	2	0.080	6	0.250	46.2	55	76	21	60	75	5	20	SP
MW15	2	0.080	6	0.250	24.41	36	74	38	50	70	14	34	SP, ML, SW
MW16A	2	0.080	8.75	0.365	46.37	46.37	59	12.63	45	60	0	13.63	SP, SM, SW, GP
MW16B	2	0.080	8.75	0.365	47.03	104	115	11	106	116	2	12	SC, GP, GW
MW16C	2	0.080	8.75	0.365	49.35	146	166	20	149	164	3	18	SP, GP, SM
MW17A	2	0.080	8.75	0.365	64.17	64.17	74	9.83	56	71	0	6.83	ML, SP
MW17B	2	0.080	8.75	0.365	63.54	94	104.5	10.5	94	104	0	10	ML, SP
MW17C	2	0.080	8.75	0.365	74.64	169	191.5	22.5	172	182	3	13	SP, SM
MW18A	2	0.080	8.75	0.365	26.88	52.5	80	27.5	56	71	3.5	18.5	SP, SW, SM, GW
MW18B	2	0.080	8.75	0.365	26.89	90	102.5	12.5	90	100	0	10	SP, GP, GM
MW18C	2	0.080	8.75	0.365	28.5	146	185	39	146	161	0	15	ML, SP, SW
MW20A	2	0.080	10	0.417	66.78	68	93	25	75	90	7	22	SP, SM
MW20B	2	0.080	10	0.417	67.22	117	137	20	122	132	5	15	SP
MW20C	2	0.080	10	0.417	81.18	179	194	15	180	190	1	11	SP
MW21	2	0.080	6	0.250	50.1	57	81.5	24.5	64	79	7	22	SP, SW
MW22	2	0.080	6	0.250	62.34	66	94	28	74	89	8	23	SP, ML
MW23A	4	0.158	8	0.333	27.8	27.8	66	38.2	35	55	7.2	27.2	SP
MW23B	2	0.080	10	0.417	28.25	87	97	10	82	97	0	10	SP, SM, GP
MW23C	2	0.080	10	0.417	30.91	133	161.5	28.5	145	160	12	27	SP, SM
MW23D	2	0.080	10	0.417	31.69	175	195	20	175	185	0	10	SP, SM
MW24A	4	0.158	16	0.667	36.8	36.8	74	37.2	50	70	13.2	33.2	SP, GP
MW24B	2	0.080	16	0.667	41.24	108	130	22	110	125	2	17	SP
MW24C	4	0.158	16	0.667	41.6	134	164	30	140	160	6	26	SP
MW24D	2	0.080	16	0.667	41.9	168	190	22	173	178	5	10	CL
MW25A	4	0.158	14.5	0.604	37.46	37.46	70	32.54	45	65	7.54	27.54	SP, SM
MW25B	2	0.080	14.5	0.604	37.55	85	115	30	90	110	5	25	ML, SP, SM
MW25C	4	0.158	14.5	0.604	39.3	138	151	13	140	150	2	12	SM, ML
MW25D	2	0.080	14.5	0.604	51.23	192	209	17	194	209	2	17	CL, SP
MW26A	4	0.158	14.5	0.604	67.6	67.6	95	27.4	70	90	2.4	22.4	SP
MW26B	2	0.080	14.5	0.604	67.69	105	135	30	105	120	0	15	SP, SC, SM

Table H1-1
Summary of Well Properties for Slug Test Analysis
Omega Chemical Superfund Site

Well ID	Nominal Casing Diameter (in)	Actual Casing Radius (ft)	Borehole Diameter (in)	Borehole Radius (ft)	DTW (ft bgs)	Top of Aquifer (ft bgs)	Bottom of Aquifer (ft bgs)	Aquifer Thickness	Depth to Top of Screen (ft bgs)	Depth to Bottom of Screen (ft bgs)	Top of Screen Depth Below Top of Aquifer (ft)	Bottom of Screen Depth Below Top of Aquifer (ft)	Lithology of Screened Interval [b]
MW26C	2	0.080	14.5	0.604	73.56	145	170	25	145	160	0	15	CL, SM
MW26D	2	0.080	14.5	0.604	72.42	180	216	36	185	205	5	25	SP, SM
MW27A	4	0.158	14.5	0.604	77.17	77.17	110	32.83	90	110	12.83	32.83	SP
MW27B	4	0.158	14.5	0.604	76.99	144	164	20	144	164	0	20	SW, SC, SP
MW27C	2	0.080	14.5	0.604	84.32	180	190	10	180	190	0	10	MH
MW27D	2	0.080	14.5	0.604	83.25	200	210	10	200	210	0	10	CL, SP, SM
MW28	4	0.158	8	0.333	73.94	73.94	110	36.06	85	105	11.06	31.06	SP, SC
MW29	4	0.158	8	0.333	80.66	87	113	26	90	110	3	23	SP
MW30	4	0.158	8	0.333	91.88	95	115	20	95	115	0	20	SP
OW3B	4	0.167	10	0.417	72.82	99	140	41	112	122	13	23	SP
OW4A	4	0.168	10	0.417	57.37	57.37	79	21.63	49.8	69.8	0	12.43	ML, SM, CL, SP, SW
OW4B	4	0.168	10	0.417	60.46	108	132	24	112	122.3	4	14.3	SP
OW5	4	0.167	10	0.417	28.55	39	52	13	30	50	0	11	CL, ML, SM, SW, SP
OW6	4	0.168	10	0.417	46.15	46.15	61.5	15.35	38	58	0	11.85	SM, ML, SP
OW7	4	0.168	10	0.417	75.1	75.1 [a]	90.9 [a]	15.8	70.9	90.9	0	15.8	CL, ML
OW8B	4	0.167	10	0.417	75.76	113	129	16	116	126	3	13	ML, SM, SP

[a] Screened in silt/clay - assumed aquifer top and bottom to be equal to screen length
[b] Symbols based on Unified Soil Classification System

Table H1-2
Range of Plausible Values of Specific Storage Coefficient
Omega Chemical Superfund Site

Porosity (n)	**Specific Storage (S_s) (ft^{-1})**			
	dense gravel	*sand*	*sand*	*loose sand*
n=0.1	1.41E-05	2.71E-05	5.40E-05	2.69E-04
n=0.3	1.13E-05	2.14E-05	4.23E-05	2.10E-04
n=0.4	9.90E-06	1.85E-05	3.65E-05	1.80E-04

$S_s = \rho*g*[(1-n)*\beta_p+n*\beta_w]$
Domenico and Schwartz, 1990; eq. 4.33

	symbol	*unit*	*value*
density of water	ρ	kg/m^3	1000
gravitational acceleration	g	m/s^2	9.81
compressibility of water at 25° C	β_w	m^2/N	4.80E-10
compressibility of matrix	β_p	m^2/N	see below

β_p values (m^2/N) from Table 4.1 in Domenico and Schwartz (1990):

1.00E-07	loose sand
2.00E-08	sand
5.20E-09	dense gravel
3.30E-10	rock (upper limit)

Table H1-3														
Summary of Slug Test Analysis Results														
Omega Chemical Superfund Site														
		KGS					**Butler**				**B&R**			
Well ID	**Method(s) Used**	**Kr (ft/min)**	**Kr (ft/day)**	**T (ft^2/day)**	**Ss (ft-1)**	**Kz/Kr**	**K (ft/min)**	**K (ft/day)**	**T (ft^2/day)**	**C(D)**	**K (ft/min)**	**K (ft/day)**	**T (ft^2/day)**	**y(0)**
MW1A	Butler						0.1554	223.776	4923.072	0.8074				
MW1B	KGS	0.003962	5.70528	285.264	1.00E-05	0.1								
MW2	Butler						0.1832	263.808	8172.772	0.9773				
MW3	KGS	0.005344	7.69536	172.6069	1.00E-05	0.1								
MW4A	Butler in						0.1085	156.24	3281.04	1.37				
MW4A	Butler out						0.08731	125.7264	2640.254	1.4				
MW4B	Butler						0.02595	37.368	579.204	1.096				
MW4C	KGS	0.02724	39.2256	353.0304	1.00E-05	0.1								
MW5	KGS	0.03883	55.9152	503.2368	1.00E-05	0.1								
MW6	B&R (in) & Butler (out)						0.1213	174.672	3727.5	1.036	0.1485	213.84	4563.3456	1
MW7	Butler in						0.169	243.36	3772.08	1.05				
MW7	Butler out						0.1189	171.216	2653.848	1.179				
MW8A	KGS - in	0.1121	161.424	2582.784	1.00E-05	0.1								
MW8A	KGS - out	0.07903	113.8032	1820.851	1.00E-05	0.1								
MW8B	KGS	0.02609	37.5696	1690.632	1.00E-05	0.1								
MW8C	KGS	0.0335	48.24	192.96	1.00E-05	0.1								
MW8D	KGS	0.01039	14.9616	1301.659	1.00E-05	0.1								
MW9A	B&R (out) & KGS (in)	0.000896	1.289952	28.05646	1.00E-05	0.1					0.000813	1.171008	25.469424	0.422
MW9B	KGS	0.03663	52.7472	421.9776	1.00E-05	0.1								
MW10	Butler						0.02671	38.4624	1087.332	1.429				
MW11	B&R (in)										0.06883	99.1152	1825.702	1
MW11	B&R (out)										0.04945	71.208	1311.6514	1.051
MW12	B&R										0.00054	0.778032	4.5826085	0.991
MW13B	Butler in						0.09159	131.8896	1450.786	0.5909				
MW13B	Butler out						0.116	167.04	1837.44	0.4175				
MW14	Butler in						0.0777	111.888	2349.648	0.5859				
MW14	Butler out						0.1492	214.848	4511.808	0.586				
MW15	B&R (out) & KGS (in)	0.001418	2.04192	77.59296	1.00E-05	0.1					0.00587	8.4528	321.2064	1
MW16A	Butler (in1) & B&R (out)						0.2513	361.872	4570.443	0.3365	0.01008	14.5152	183.32698	0.813
MW16B	Butler in						0.07416	106.7904	1174.694	0.7013				
MW16B	Butler out						0.07918	114.0192	1254.211	0.4777				
MW16C	KGS	0.01317	18.9648	379.296	1.00E-05	0.1								
MW17A	KGS	0.001116	1.60704	15.7972	1.00E-05	0.1								
MW17B	Butler						0.07317	105.3648	1106.33	0.5823				
MW17C	KGS	0.01958	28.1952	634.392	1.00E-05	0.1								
MW18A	Butler						0.01923	27.6912	761.508	0.8438				
MW18B	KGS	0.003545	5.1048	63.81	1.00E-05	0.1								
MW18C	Butler						0.004553	6.55632	255.6965	2.6				
MW20A	Butler						0.02988	43.0272	1075.68	0.9646				
MW20B	Butler in						0.08789	126.5616	2531.232	0.5242				
MW20B	Butler out						0.04506	64.8864	1297.728	0.6879				
MW20C	Butler in						0.08328	119.9232	1798.848	0.5142				
MW20C	Butler out						0.06205	89.352	1340.28	0.4324				
MW21	Butler in						0.1168	168.192	4120.704	0.5142				
MW21	Butler out						0.03529	50.8176	1245.031	0.861				
MW22	Butler in1						0.2849	410.256	11487.17	0.3942				
MW22	Butler out1						0.0275	39.6	1108.8	0.9226				
MW23A	B&R in										0.0029	4.176	159.5232	1
MW23A	B&R out										0.01796	25.8624	987.94368	0.994
MW23B	KGS	0.004195	6.0408	60.408	1.00E-05	0.1								
MW23C	KGS	0.003311	4.76784	135.8834	1.00E-05	0.1								
MW23D	KGS	0.005925	8.532	170.64	1.00E-05	0.1								
MW24A	Butler in						0.06939	99.9216	3717.084	1.071				
MW24A	Butler out						0.03992	57.4848	2138.435	0.8515				
MW24B	KGS in	0.01343	19.3392	425.4624	1.00E-05	0.1								
MW24B	Butler out						0.01028	14.8032	325.6704	1.209				
MW24C	KGS	0.03151	45.3744	1361.232	1.00E-05	0.1								
MW24D	KGS in	0.000325	0.468	10.296	1.00E-05	0.1								
MW24D	KGS out	0.000255	0.367488	8.084736	1.00E-05	0.1								
MW25A	B&R										0.03645	52.488	1707.9595	0.77
MW25B	KGS	0.004697	6.76368	202.9104	1.00E-05	0.1								
MW25C	KGS	0.000635	0.914832	11.89282	1.00E-05	0.1								
MW25D	Butler in						0.05708	82.1952	1397.318	0.4021				
MW25D	Butler out						0.04122	59.3568	1009.066	0.4058				
MW26A	B&R										0.0355	51.12	1400.688	1.125
MW26B	Butler in						0.05883	84.7152	2541.456	0.5318				
MW26B	Butler out						0.03553	51.1632	1534.896	0.5689				
MW26C	KGS	0.001358	1.95552	48.888	1.00E-05	0.1								
MW26D	KGS in	0.004178	6.01632	216.5875	1.00E-05	0.1								
MW26D	Butler out						0.004972	7.15968	257.7485	1.14				
MW27A	B&R in										0.01026	14.7744	485.04355	1.019
MW27B	Butler in						0.007957	11.45808	229.1616	1.682				
MW27B	Butler out						0.008768	12.62592	252.5184	1.443				
MW27C	KGS	0.00148	2.1312	21.312	1.00E-05	0.1								
MW27D	Butler in						0.0688	99.072	990.72	0.4375				
MW27D	Butler out						0.03482	50.1408	501.408	0.5685				

Table H1-3														
Summary of Slug Test Analysis Results														
Omega Chemical Superfund Site														
		KGS					**Butler**				**B&R**			
Well ID	**Method(s) Used**	**Kr (ft/min)**	**Kr (ft/day)**	**T (ft^2/day)**	**Ss (ft-1)**	**Kz/Kr**	**K (ft/min)**	**K (ft/day)**	**T (ft^2/day)**	**C(D)**	**K (ft/min)**	**K (ft/day)**	**T (ft^2/day)**	**y(0)**
MW28	Butler						0.01939	27.9216	1006.853	1.257				
MW29	Butler						0.04585	66.024	1716.624	1.295				
MW30	Butler						0.04163	59.9472	1198.944	1.303				
OW3B	Butler	0.004842	6.97248	285.8717	1.00E-05	0.1								
OW3B_10_15	Butler	0.005063	7.29072	298.9195	1.00E-05	0.1								
OW4A	KGS in	0.01883	27.1152	586.5018	1.00E-05	0.1								
OW4A	KGS out	0.02855	41.112	889.2526	1.00E-05	0.1								
OW4B	KGS	0.01155	16.632	399.168	1.00E-05	0.1								
OW5	KGS						0.04085	58.824	764.712	1.189				
OW6	Butler						0.06845	98.568	1513.019	1.263				
OW7	B&R in										0.00068	0.979056	15.469085	0.912
OW7	B&R out										0.000713	1.026864	16.224451	0.441
OW8B	Butler						0.02612	37.6128	601.8048	1.409				

Taken as Representative K Result

Average of the Values are Taken as the Representative K Result

Table H1-4
Summary of Hydraulic Conductivity Results From Slug Tests
Omega Chemical Superfund Site

Well ID	Method of Analysis	Representative K (ft/min)	Representative K (ft/day)
MW1A	Butler	0.1554	224
MW1B	KGS	0.0040	5.7
MW2	Butler	0.1832	264
MW3	KGS	0.0053	7.7
MW4A	Butler	0.0979	141
MW4B	Butler	0.0260	37.4
MW4C	KGS	0.0272	39.2
MW5	KGS	0.0388	55.9
MW6	B&R, Butler	0.1349	194
MW7	Butler	0.1440	207
MW8A	KGS	0.0790	114
MW8B	KGS	0.0261	37.6
MW8C	KGS	0.0335	48.2
MW8D	KGS	0.0104	15.0
MW9A	KGS	0.0009	1.3
MW9B	KGS	0.0366	52.7
MW10	Butler	0.0267	38.5
MW11	B&R	0.0591	85.2
MW12	B&R	0.0005	0.8
MW13B	Butler	0.0916	132
MW14	Butler	0.0777	112
MW15	KGS	0.0014	2.0
MW16A	B&R	0.0101	14.5
MW16B	Butler	0.0742	107
MW16C	KGS	0.0132	19.0
MW17A	KGS	0.0011	1.6
MW17B	Butler	0.0732	105
MW17C	KGS	0.0196	28.2
MW18A	Butler	0.0192	27.7
MW18B	Butler	0.0254	36.5
MW18C	KGS	0.0035	5.1
MW20A	Butler	0.0299	43.0
MW20B	Butler	0.0879	127
MW20C	Butler	0.0833	120
MW21	Butler	0.0353	50.8
MW22	Butler	0.0275	39.6
MW23A	B&R	0.0104	15.0
MW23B	KGS	0.0042	6.0
MW23C	KGS	0.0033	4.8
MW23D	KGS	0.0059	8.5
MW24A	Butler	0.0547	78.7
MW24B	Butler, KGS	0.0119	17.1
MW24C	KGS	0.0315	45.4
MW24D	KGS	0.0003	0.5
MW25A	B&R	0.0365	52.5
MW25B	KGS	0.0047	6.76
MW25C	KGS	0.0006	0.9
MW25D	Butler	0.0571	82.2
MW26A	B&R	0.0355	51.1

Table H1-4
Summary of Hydraulic Conductivity Results From Slug Tests
Omega Chemical Superfund Site

Well ID	Method of Analysis	Representative K (ft/min)	Representative K (ft/day)
MW26B	Butler	0.0588	84.7
MW26C	KGS	0.0014	2.0
MW26D	Butler, KGS	0.0046	6.6
MW27A	B&R	0.0103	14.8
MW27B	Butler	0.0084	12.0
MW27C	KGS	0.0015	2.1
MW27D	Butler	0.0688	99.1
MW28	Butler	0.0194	27.9
MW29	Butler	0.0459	66.0
MW30	Butler	0.0416	59.9
OW3B	Butler	0.0050	7.1
OW4A	KGS	0.0188	27.1
OW4B	KGS	0.0116	16.6
OW5	KGS	0.0409	58.8
OW6	Butler	0.0685	98.6
OW7	B&R	0.0007	1.0
OW8B	Butler	0.0261	37.6

Notes:
B&R = Bouwer and Rice (1976)
Butler (1998)
KGS (Hyder et al., 1994)

Table H1-5
Summary of Hydraulic Conductivity Results From Slug Tests on Shallow Wells
Omega Chemical Superfund Site

Well ID	Representative K (ft/min)	Representative K (ft/day)	Height of water column above top of screen (ft)
MW1A	0.1554	224	12.5
MW2	0.1832	264	16.0
MW3	0.0053	7.70	9.23
MW4A	0.0979	141	18.1
MW5	0.0388	55.9	17.0
MW6	0.1349	194	10.9
MW7	0.1440	207	13.6
MW8A	0.0790	114	2.07
MW9A	0.0009	1.29	0
MW10	0.0267	38.5	18.3
MW11	0.0591	85.2	3.42
MW12	0.0005	0.78	0
MW14	0.0777	112	13.8
MW15	0.0014	2.04	25.6
MW16A	0.0101	14.5	0
MW17A	0.0011	1.61	0
MW18A	0.0192	27.7	29.1
MW20A	0.0299	43.0	8.22
MW21	0.0353	50.8	13.9
MW22	0.0275	39.6	11.7
MW23A	0.0104	15.0	7.2
MW24A	0.0547	78.7	13.2
MW25A	0.0365	52.5	7.54
MW26A	0.0355	51.1	2.4
MW27A	0.0103	14.8	12.8
MW28	0.0194	27.9	11.1
MW29	0.0459	66.0	9.34
MW30	0.0416	59.9	3.12
OW4A	0.0188	27.1	0
OW5	0.0409	58.8	1.45
OW6	0.0685	98.6	0
OW7	0.0007	0.98	0

Table H1-6
Summary of Hydraulic Conductivity Results From Slug Tests on Deep Wells
Omega Chemical Superfund Site

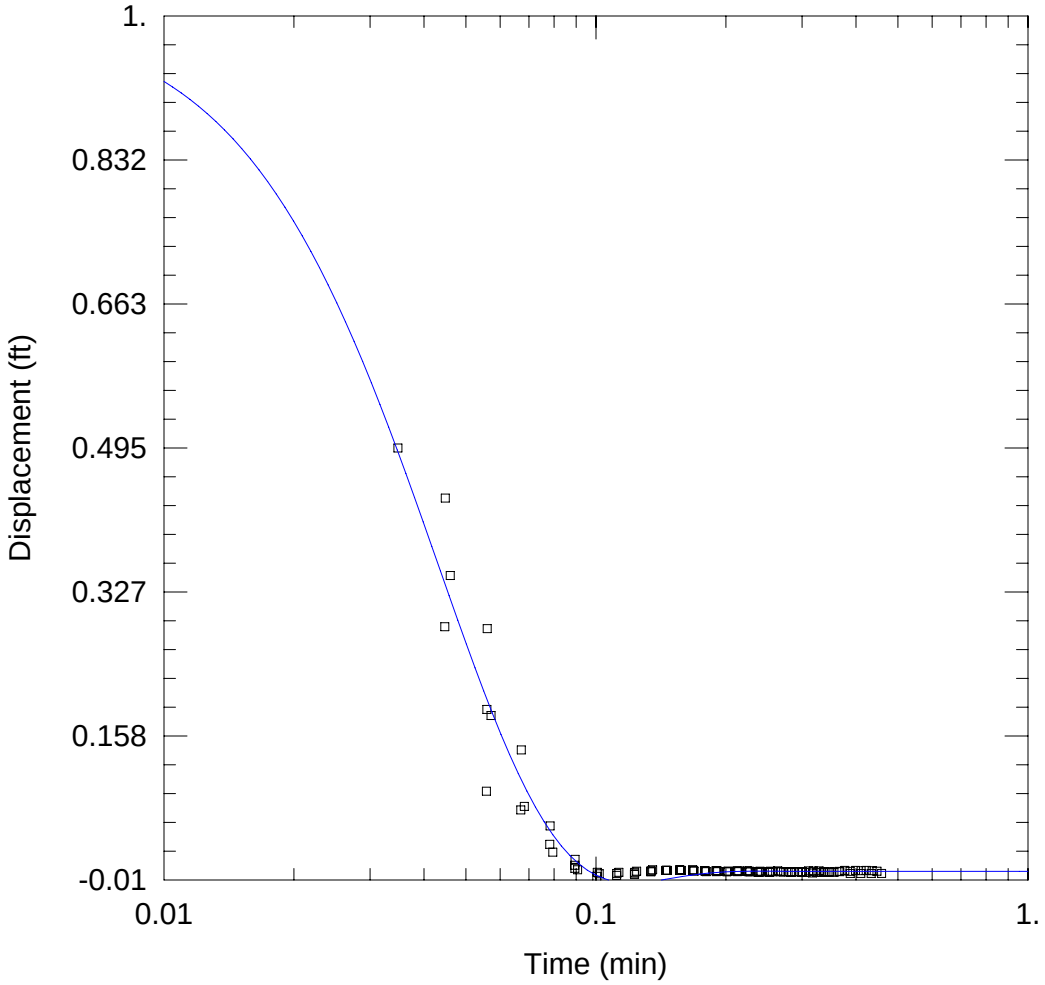
Well ID	Representative K (ft/min)	Representative K (ft/day)	Height of water column above top of screen (ft)
MW1B	0.0040	5.71	42.6
MW4B	0.0260	37.4	45.2
MW4C	0.0272	39.2	62.6
MW8B	0.0261	37.6	37.3
MW8C	0.0335	48.2	58.2
MW8D	0.0104	15.0	77.6
MW9B	0.0366	52.7	19.9
MW13B	0.0916	132	42.7
MW16B	0.0742	107	59.0
MW16C	0.0132	19.0	99.7
MW17B	0.0732	105	30.5
MW17C	0.0196	28.2	97.4
MW18B	0.0254	36.5	63.1
MW18C	0.0035	5.10	118
MW20B	0.0879	127	54.8
MW20C	0.0833	120	98.8
MW23B	0.0042	6.04	53.8
MW23C	0.0033	4.77	114
MW23D	0.0059	8.53	143
MW24B	0.0119	17.1	68.8
MW24C	0.0315	45.4	98.4
MW24D	0.0003	0.47	131
MW25B	0.0047	6.76	52.5
MW25C	0.0006	0.91	101
MW25D	0.0571	82.2	143
MW26B	0.0588	84.7	37.3
MW26C	0.0014	1.96	71.4
MW26D	0.0046	6.59	113
MW27B	0.0084	12.0	67.0
MW27C	0.0015	2.13	95.7
MW27D	0.0688	99.1	117
OW3B	0.0050	7.13	39.2
OW4B	0.0116	16.6	51.5
OW8B	0.0261	37.6	40.2

Table H1-7
Summary of Hydraulic Conductivity Results From Slug Tests by Method of Analysis
Omega Chemical Superfund Site

Well ID	Representative K (ft/min)	Representative K (ft/day)	Height of water column above top of screen (ft)
Bouwer and Rice Method			
MW11	0.0591	85.2	3.42
MW12	0.0005	0.78	0
MW16A	0.0101	14.5	0
MW23A	0.0104	15.0	7.20
MW25A	0.0365	52.5	7.54
MW26A	0.0355	51.1	2.40
MW27A	0.0103	14.8	12.8
OW7	0.0007	0.98	0
MW6	0.1349	194	10.9
Butler Method			
MW13B	0.0916	132	42.7
MW14	0.0777	112	13.8
MW16B	0.0742	107	59.0
MW17B	0.0732	105	30.5
MW20B	0.0879	127	54.8
MW20C	0.0833	120	98.8
MW25D	0.0571	82.2	143
MW26B	0.0588	84.7	37.3
MW27D	0.0688	99.1	117
MW6	0.1349	194	10.9
MW1A	0.1554	224	12.5
MW2	0.1832	264	16.0
MW4A	0.0979	141	18.1
MW4B	0.0260	37.4	45.2
MW7	0.1440	207	13.6
MW10	0.0267	38.5	18.3
MW18A	0.0192	27.7	29.1
MW18B	0.0254	36.5	63.1
MW20A	0.0299	43.0	8.22
MW21	0.0353	50.8	13.9
MW22	0.0275	39.6	11.7
MW24A	0.0547	78.7	13.2
MW27B	0.0084	12.0	67.0
MW28	0.0194	27.9	11.1
MW29	0.0459	66.0	9.34
MW30	0.0416	59.9	3.12
OW3B	0.0050	7.13	39.2
OW6	0.0685	98.6	0
OW8B	0.0261	37.6	40.2
MW24B	0.0119	17.1	68.8
MW26D	0.0046	6.59	113
KGS Method			
MW24B	0.0119	17.1	68.8
MW26D	0.0046	6.59	113
MW1B	0.0040	5.71	42.6
MW3	0.0053	7.70	9.23
MW4C	0.0272	39.2	62.6
MW5	0.0388	55.9	17.0
MW8A	0.0790	114	2.07
MW8B	0.0261	37.6	37.3
MW8C	0.0335	48.2	58.2
MW8D	0.0104	15.0	77.6
MW9A	0.0009	1.29	0
MW9B	0.0366	52.7	19.9
MW15	0.0014	2.04	25.6
MW16C	0.0132	19.0	99.7
MW17A	0.0011	1.61	0
MW17C	0.0196	28.2	97.4
MW18C	0.0035	5.10	118
MW23B	0.0042	6.04	53.8
MW23C	0.0033	4.77	114
MW23D	0.0059	8.53	143
MW24C	0.0315	45.4	98.4

Table H1-7
Summary of Hydraulic Conductivity Results From Slug Tests by Method of Analysis
Omega Chemical Superfund Site

Well ID	Representative K (ft/min)	Representative K (ft/day)	Height of water column above top of screen (ft)
MW24D	0.0003	0.47	131
MW25B	0.0047	6.76	52.5
MW25C	0.0006	0.91	101
MW26C	0.0014	1.96	71.4
MW27C	0.0015	2.13	95.7
OW4A	0.0188	27.1	0
OW4B	0.0116	16.6	51.5
OW5	0.0409	58.8	1.45



WELL TEST ANALYSIS

Data Set: R:\...\Best_MW1A_Butler.aqt
Date: 07/31/07 Time: 16:09:30

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 335392
Location: RIV
Test Well: MW1A
Test Date: 2006

AQUIFER DATA

Saturated Thickness: 22. ft
Anisotropy Ratio (Kz/Kr): 0.1

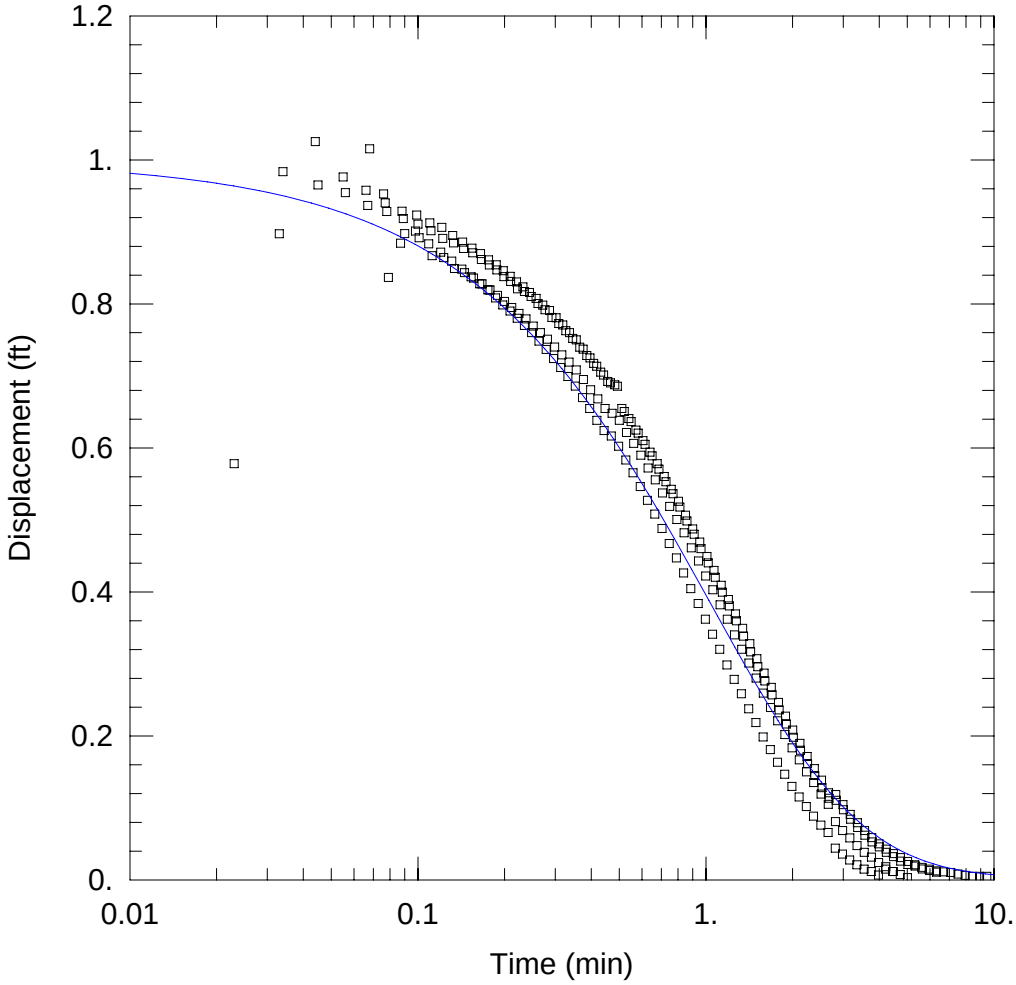
WELL DATA (MW1A)

Initial Displacement: 1. ft
Total Well Penetration Depth: 22. ft
Casing Radius: 0.167 ft
Static Water Column Height: 27.49 ft
Screen Length: 15. ft
Wellbore Radius: 0.209 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Butler

K = 0.1554 ft/min
C(D) = 0.8074



WELL TEST ANALYSIS

Data Set: R:\...\Best_MW1B_KGSnoskin.aqt
Date: 07/31/07 Time: 16:13:03

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 335392
Location: RIV
Test Well: MW1B
Test Date: 2006

AQUIFER DATA

Saturated Thickness: 50. ft

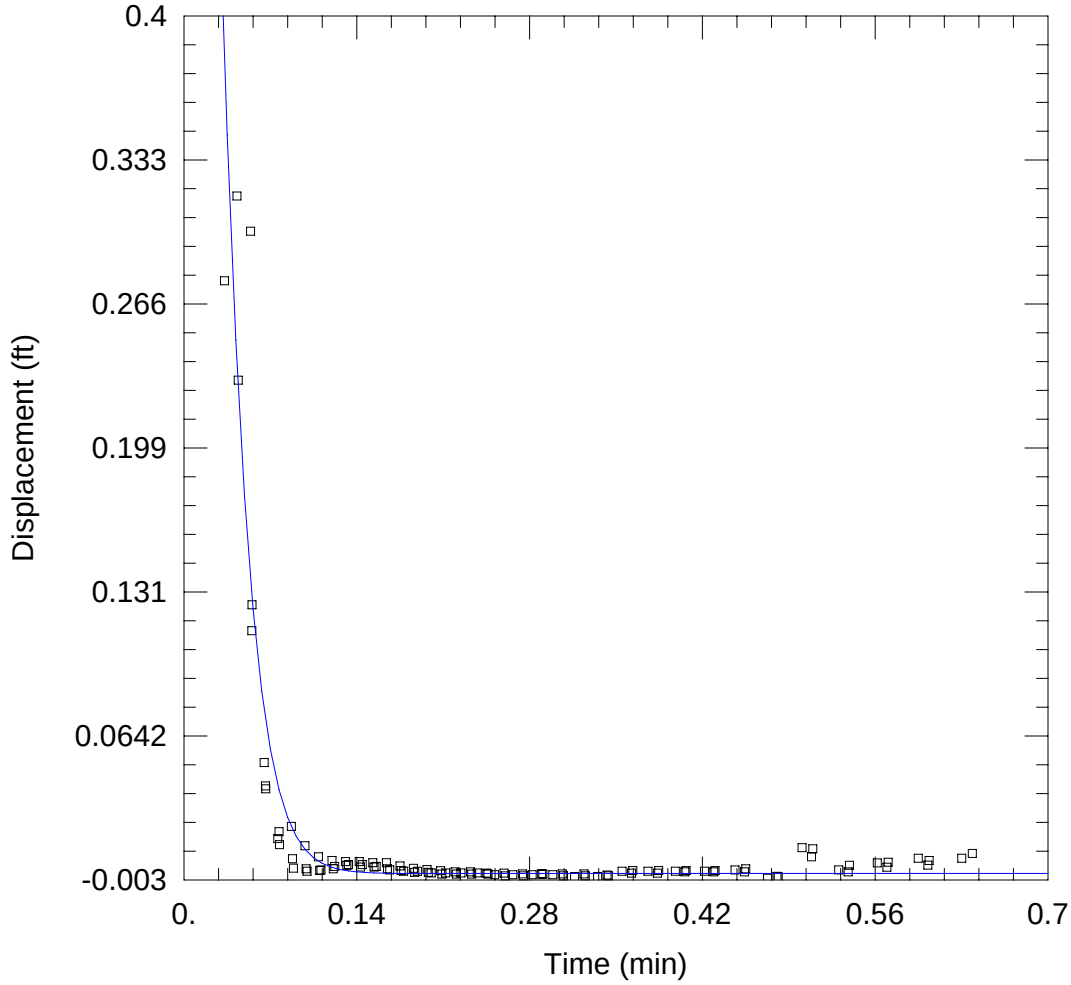
WELL DATA (MW1B)

Initial Displacement: 1. ft
Total Well Penetration Depth: 50. ft
Casing Radius: 0.167 ft
Static Water Column Height: 82.39 ft
Screen Length: 15. ft
Wellbore Radius: 0.209 ft

SOLUTION

Aquifer Model: Confined
Solution Method: KGS Model

Kr = 0.003962 ft/min
Kz/Kr = 0.1
Ss = 1.0E-5 ft^{-1}



WELL TEST ANALYSIS

Data Set: R:\...\Best_MW2_in_Butler.aqt
Date: 08/01/07 Time: 08:49:36

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 335392
Location: RIV
Test Well: MW2
Test Date: 2006

AQUIFER DATA

Saturated Thickness: 30.98 ft Anisotropy Ratio (Kz/Kr): 0.1

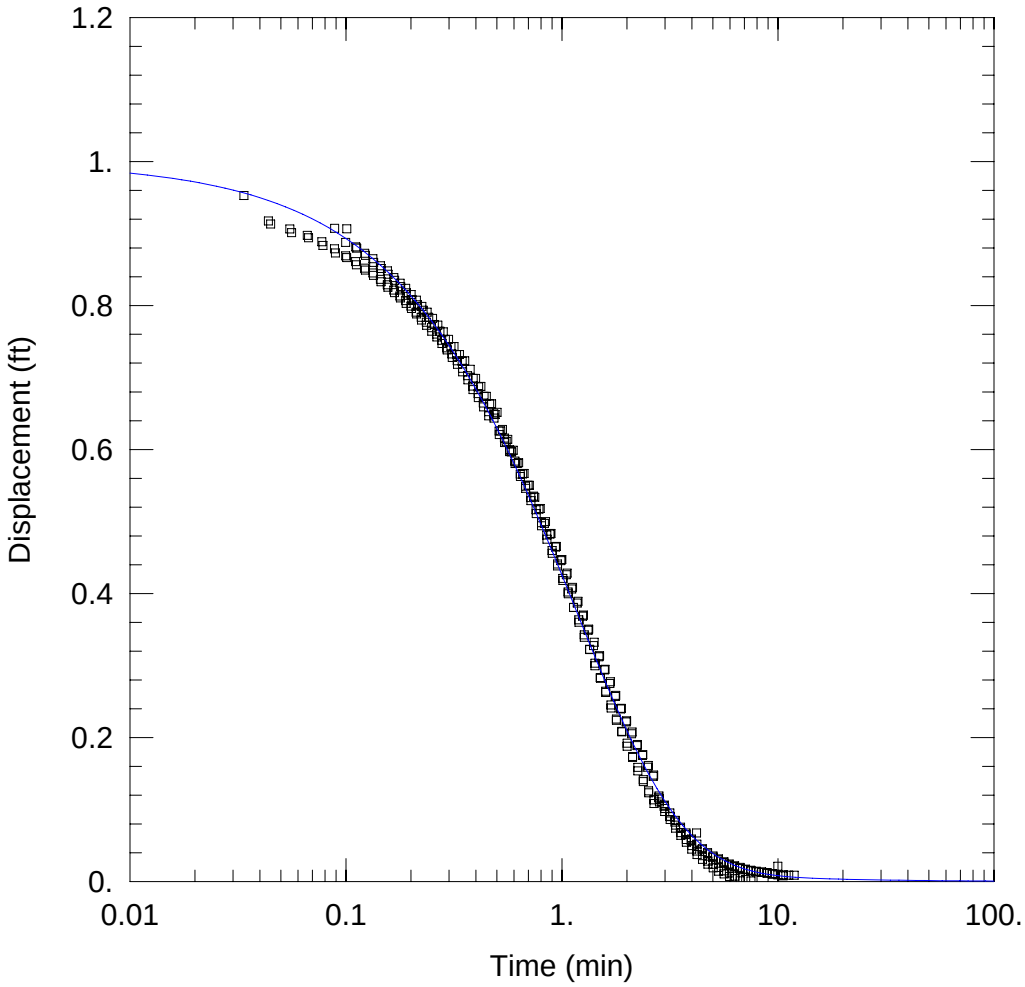
WELL DATA (MW2)

Initial Displacement: 1. ft
Total Well Penetration Depth: 30.98 ft
Casing Radius: 0.167 ft
Static Water Column Height: 30.98 ft
Screen Length: 15. ft
Wellbore Radius: 0.209 ft

SOLUTION

Aquifer Model: Confined Solution Method: Butler

K = 0.1832 ft/min C(D) = 0.9773



WELL TEST ANALYSIS

Data Set: R:\...\Best_MW3_KGSnoskin.aqt
Date: 08/01/07 Time: 08:51:54

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 335392
Location: RIV
Test Well: MW3
Test Date: 2006

AQUIFER DATA

Saturated Thickness: 22.43 ft

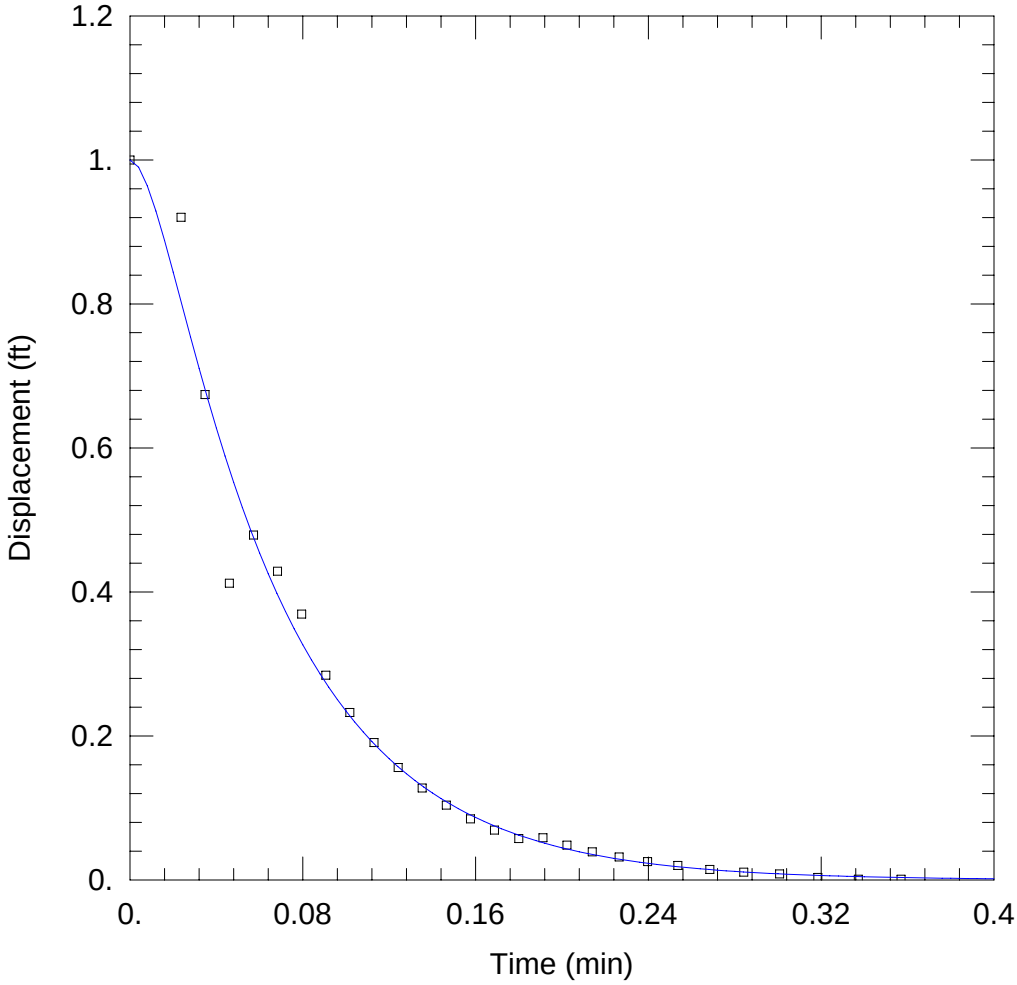
WELL DATA (MW3)

Initial Displacement: 1. ft
Total Well Penetration Depth: 22.43 ft
Casing Radius: 0.167 ft
Static Water Column Height: 22.43 ft
Screen Length: 10.2 ft
Wellbore Radius: 0.209 ft

SOLUTION

Aquifer Model: Confined
Solution Method: KGS Model

Kr = 0.005344 ft/min
Kz/Kr = 0.1
Ss = 1.0E-5 ft^{-1}



WELL TEST ANALYSIS

Data Set: R:\...\Best_MW4A_in_Butler.aqt
Date: 08/01/07 Time: 08:53:56

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 335392
Location: RIV
Test Well: MW4A
Test Date: 2006

AQUIFER DATA

Saturated Thickness: 21. ft Anisotropy Ratio (Kz/Kr): 0.1

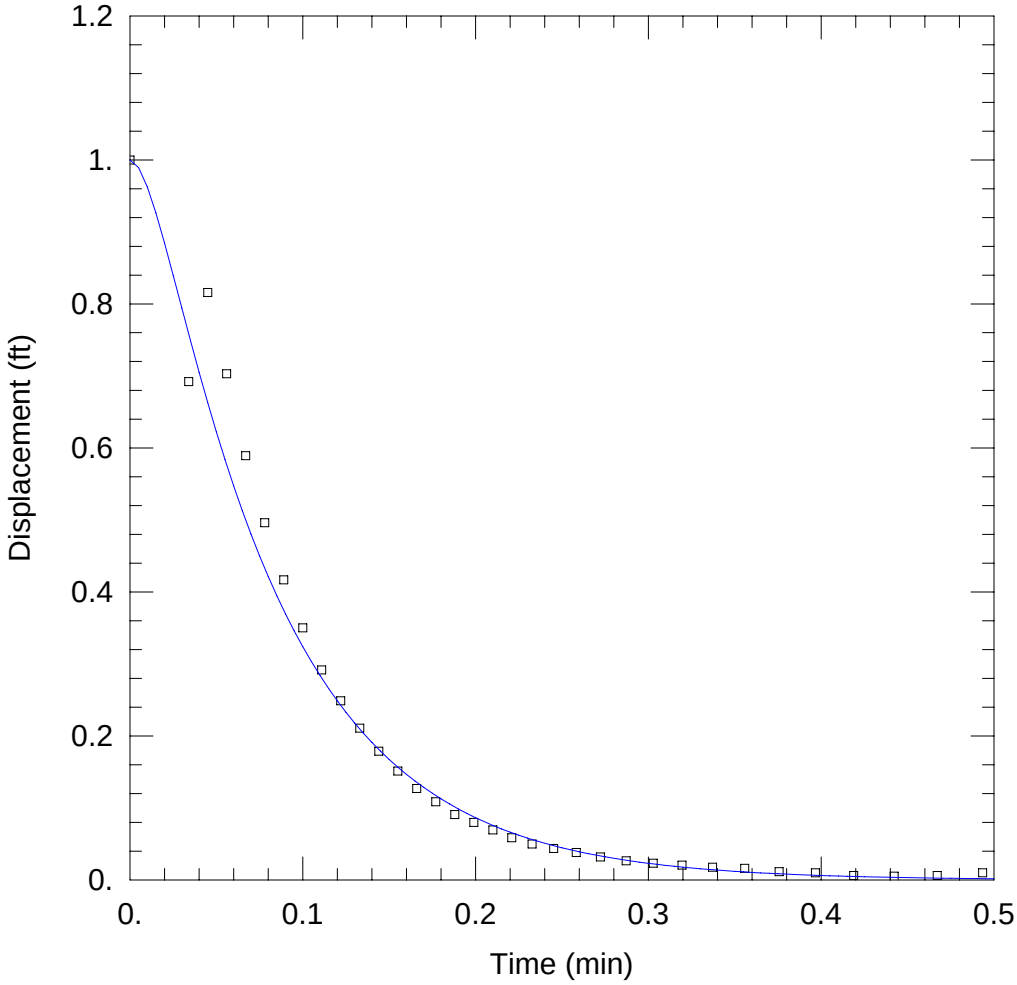
WELL DATA (MW4A)

Initial Displacement: 1. ft Static Water Column Height: 21. ft
Total Well Penetration Depth: 21. ft Screen Length: 10.3 ft
Casing Radius: 0.167 ft Wellbore Radius: 0.209 ft

SOLUTION

Aquifer Model: Confined Solution Method: Butler

K = 0.1085 ft/min C(D) = 1.37



WELL TEST ANALYSIS

Data Set: R:\...\MW4A_out_Butler.aqt
Date: 07/24/07 Time: 14:40:52

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 335392
Location: RIV
Test Well: MW4A
Test Date: 2006

AQUIFER DATA

Saturated Thickness: 21. ft Anisotropy Ratio (Kz/Kr): 0.1

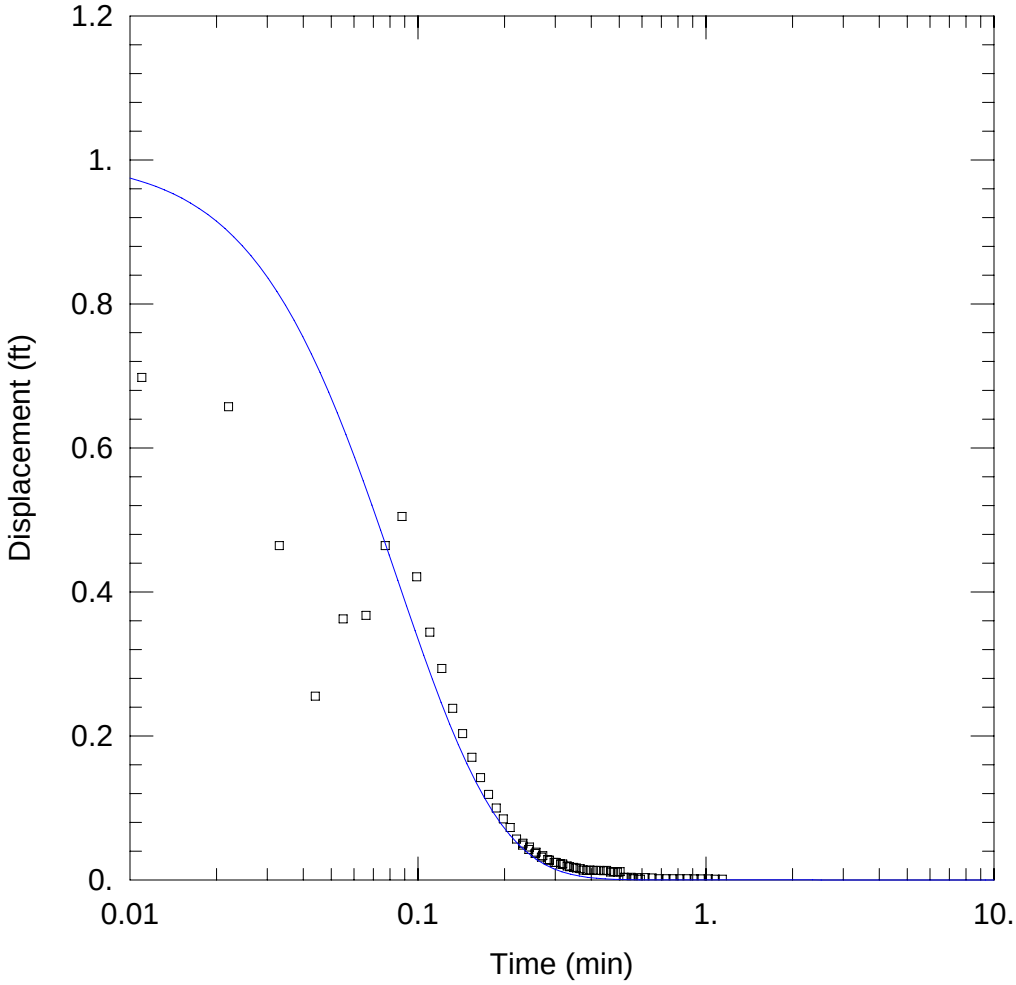
WELL DATA (MW4A)

Initial Displacement: 1. ft Static Water Column Height: 21. ft
Total Well Penetration Depth: 21. ft Screen Length: 10.3 ft
Casing Radius: 0.167 ft Wellbore Radius: 0.209 ft

SOLUTION

Aquifer Model: Confined Solution Method: Butler

K = 0.08731 ft/min C(D) = 1.4



WELL TEST ANALYSIS

Data Set: R:\...\Best_MW4B_out_Butler.aqt
Date: 08/01/07 Time: 08:56:55

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 335392
Location: RIV
Test Well: MW4B
Test Date: 2006

AQUIFER DATA

Saturated Thickness: 15.5 ft Anisotropy Ratio (Kz/Kr): 0.1

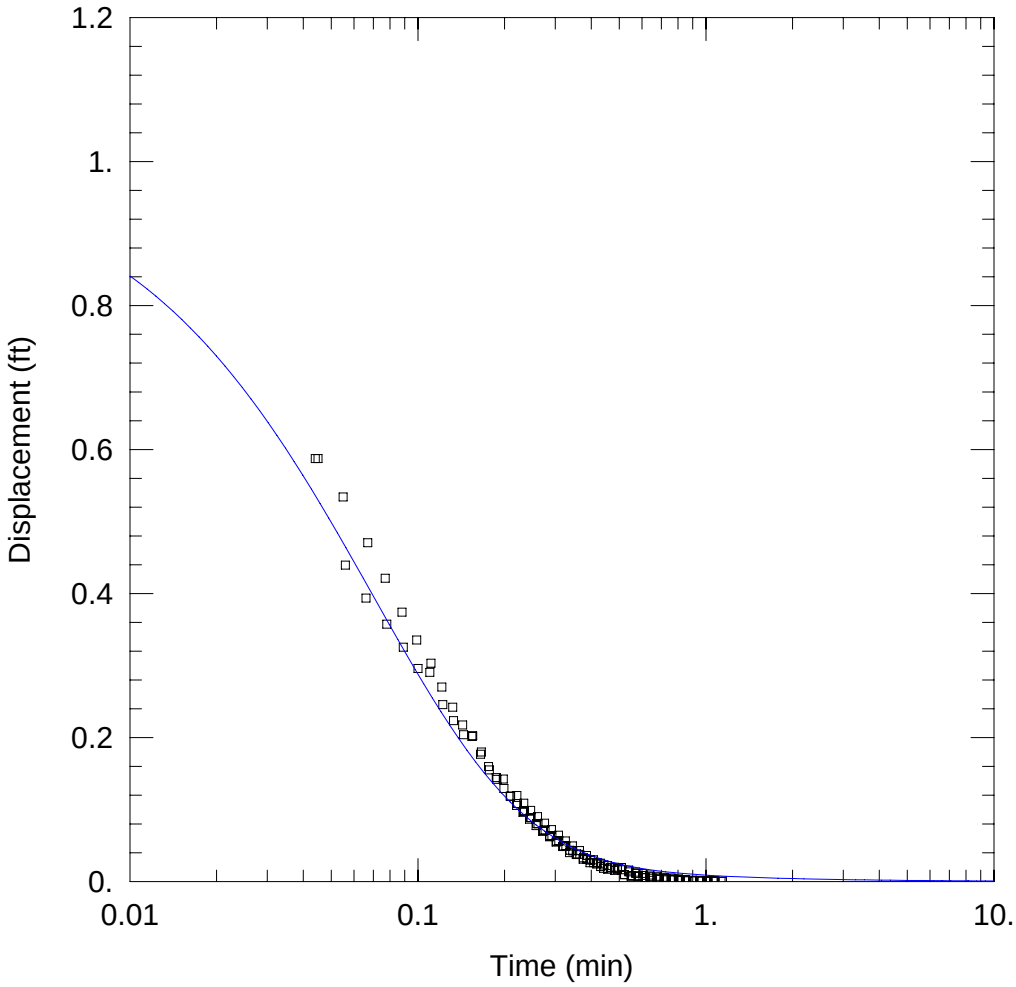
WELL DATA (MW4B)

Initial Displacement: 1. ft Static Water Column Height: 15.5 ft
Total Well Penetration Depth: 15.5 ft Screen Length: 10. ft
Casing Radius: 0.085 ft Wellbore Radius: 0.104 ft

SOLUTION

Aquifer Model: Confined Solution Method: Butler

K = 0.02595 ft/min C(D) = 1.096



WELL TEST ANALYSIS

Data Set: R:\...\Best_MW4C_KGSnoskin.aqt
Date: 08/01/07 Time: 08:58:21

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 335392
Location: RIV
Test Well: MW4C
Test Date: 2006

AQUIFER DATA

Saturated Thickness: 9. ft

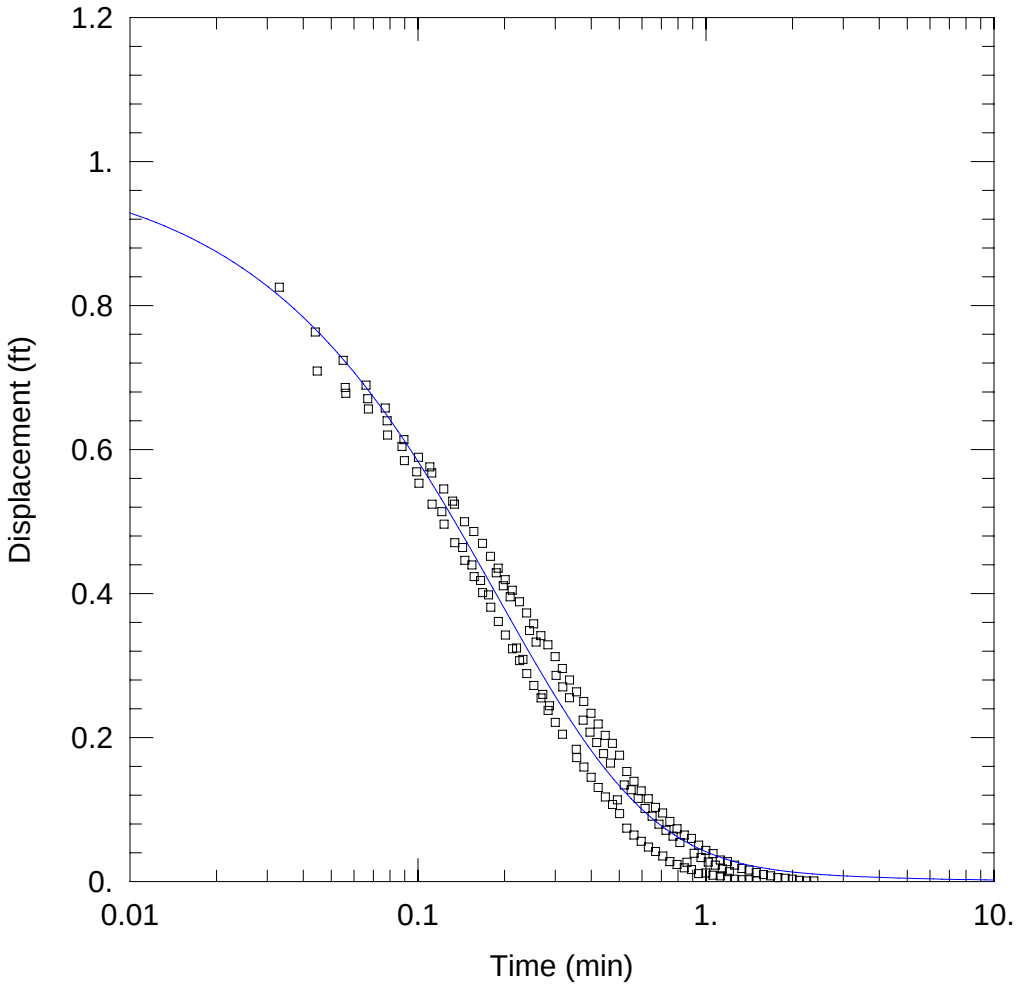
WELL DATA (MW4C)

Initial Displacement: 1. ft
Total Well Penetration Depth: 9. ft
Casing Radius: 0.085 ft
Static Water Column Height: 9. ft
Screen Length: 9. ft
Wellbore Radius: 0.104 ft

SOLUTION

Aquifer Model: Confined
Solution Method: KGS Model

Kr = 0.02724 ft/min
Kz/Kr = 0.1
Ss = 1.0E-5 ft^{-1}



WELL TEST ANALYSIS

Data Set: R:\...\Best_MW5_KGSnoskin.aqt
Date: 08/01/07 Time: 09:00:08

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 335392
Location: RIV
Test Well: MW5
Test Date: 2006

AQUIFER DATA

Saturated Thickness: 9. ft

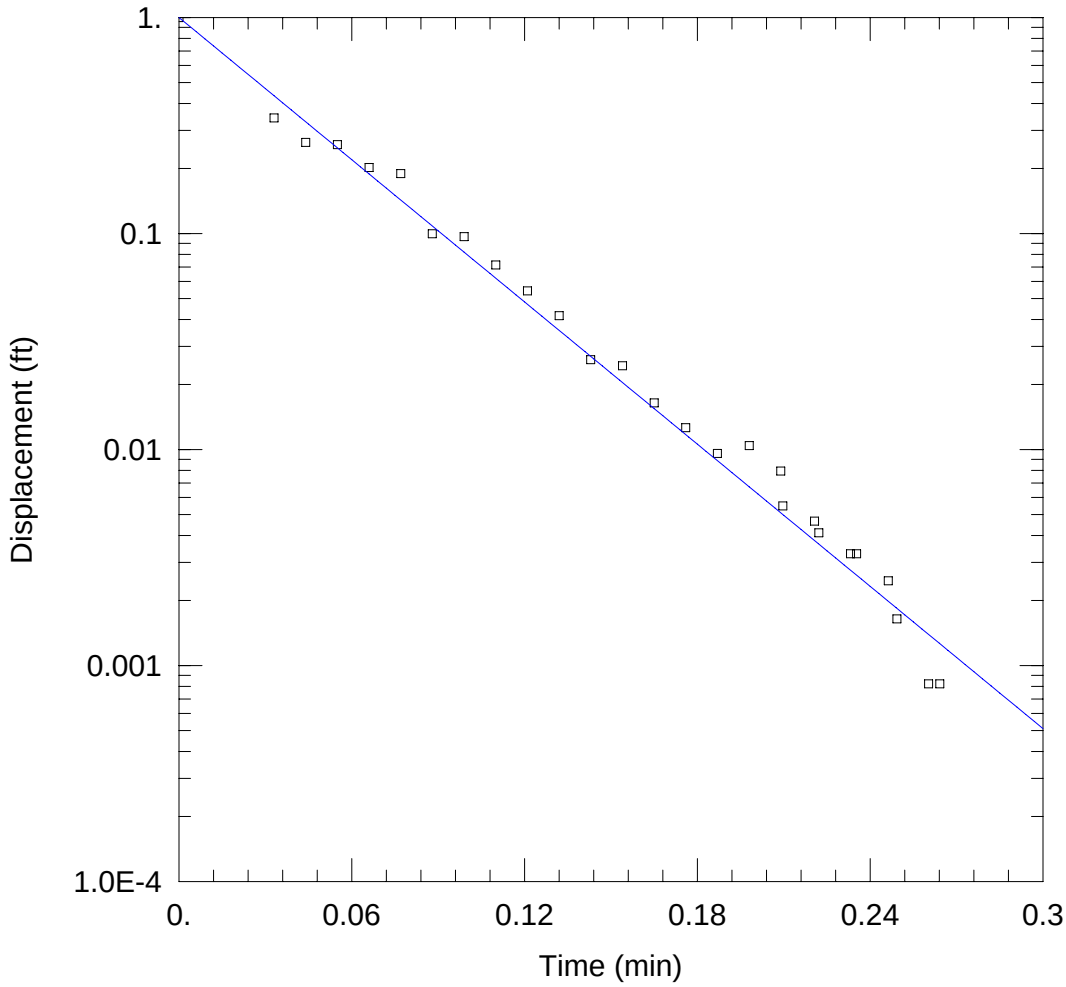
WELL DATA (MW5)

Initial Displacement: 1. ft
Total Well Penetration Depth: 9. ft
Casing Radius: 0.167 ft
Static Water Column Height: 9. ft
Screen Length: 9. ft
Wellbore Radius: 0.209 ft

SOLUTION

Aquifer Model: Confined
Solution Method: KGS Model

Kr = 0.03883 ft/min
Kz/Kr = 0.1
Ss = 1.0E-5 ft^{-1}



WELL TEST ANALYSIS

Data Set: R:\...\Best_MW6_in_B&R.aqt
Date: 08/01/07 Time: 09:01:50

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 335392
Location: RIV
Test Well: MW6
Test Date: 2006

AQUIFER DATA

Saturated Thickness: 21.34 ft
Anisotropy Ratio (Kz/Kr): 0.1

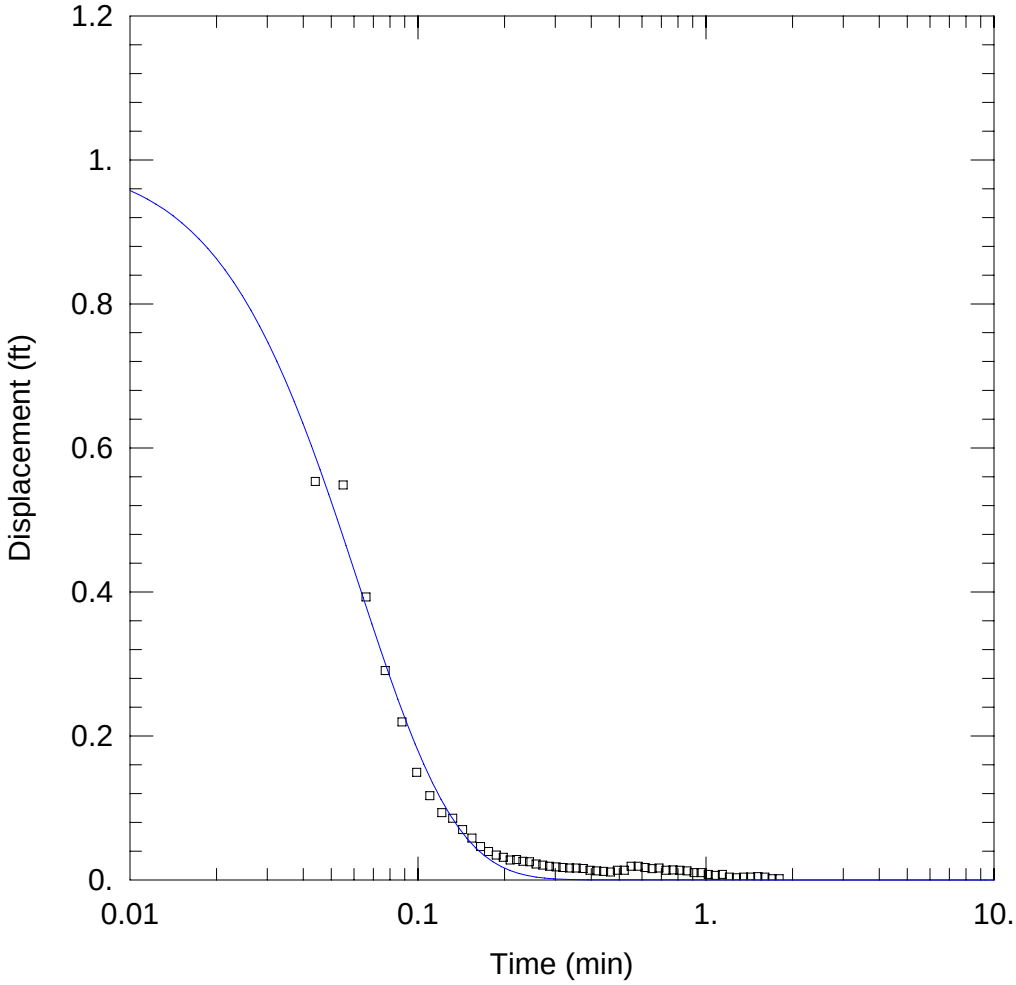
WELL DATA (MW6)

Initial Displacement: 1. ft
Total Well Penetration Depth: 21.34 ft
Casing Radius: 0.167 ft
Static Water Column Height: 21.34 ft
Screen Length: 10.4 ft
Wellbore Radius: 0.209 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 0.1485 ft/min
y0 = 1. ft



WELL TEST ANALYSIS

Data Set: R:\...\Best_MW6_out_Butler.aqt
Date: 08/01/07 Time: 09:03:02

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 335392
Location: RIV
Test Well: MW6
Test Date: 2006

AQUIFER DATA

Saturated Thickness: 21.34 ft Anisotropy Ratio (Kz/Kr): 0.1

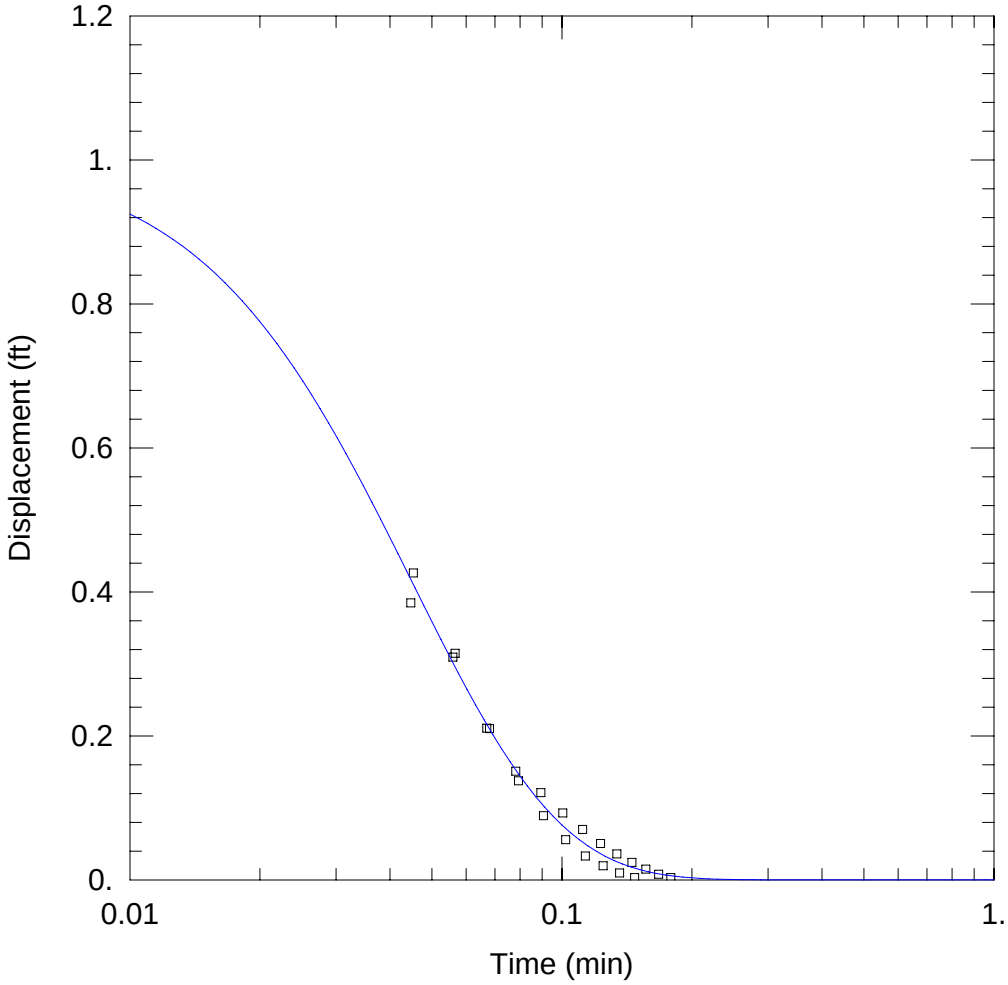
WELL DATA (MW6)

Initial Displacement: 1. ft Static Water Column Height: 21.34 ft
Total Well Penetration Depth: 21.34 ft Screen Length: 10.4 ft
Casing Radius: 0.167 ft Wellbore Radius: 0.209 ft

SOLUTION

Aquifer Model: Confined Solution Method: Butler

K = 0.1213 ft/min C(D) = 1.036



WELL TEST ANALYSIS

Data Set: R:\...\Best_MW7_in_Butler.aqt
Date: 08/01/07 Time: 09:04:20

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 335392
Location: RIV
Test Well: MW7
Test Date: 2006

AQUIFER DATA

Saturated Thickness: 15.5 ft Anisotropy Ratio (Kz/Kr): 0.1

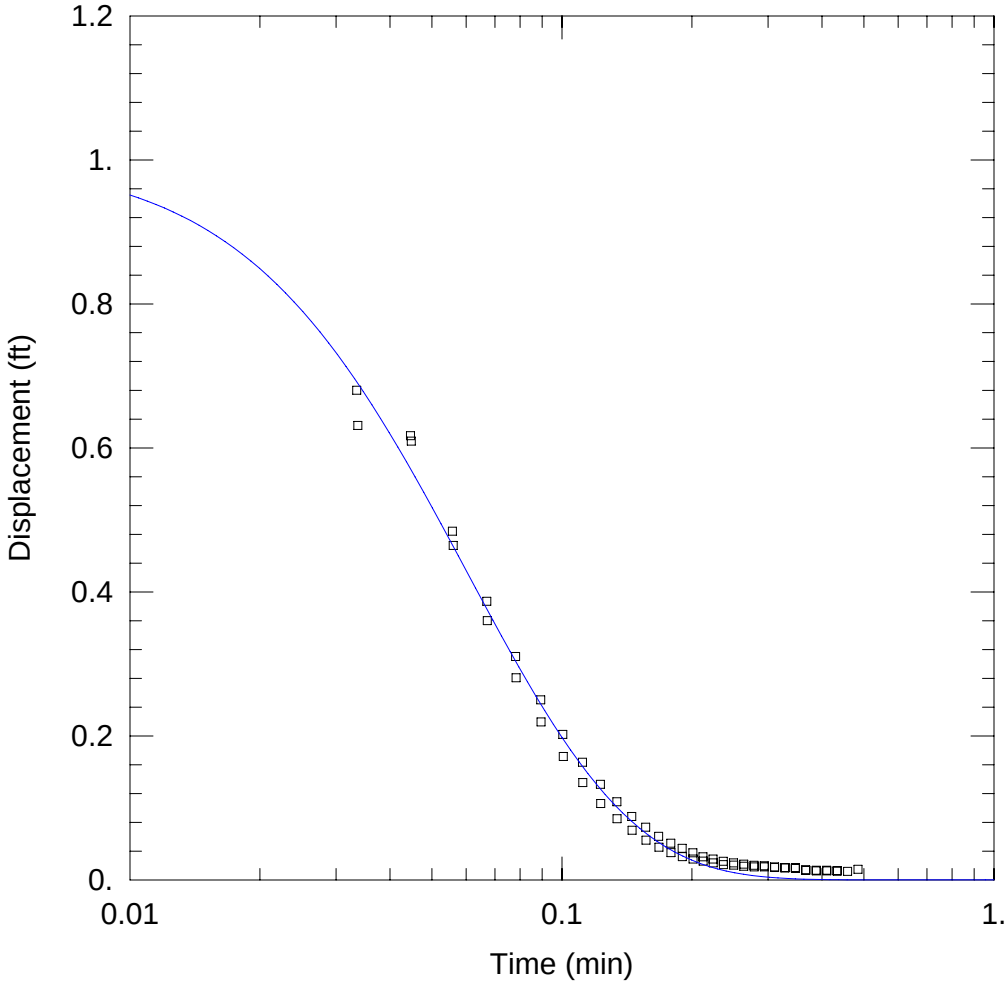
WELL DATA (MW7)

Initial Displacement: 1. ft
Total Well Penetration Depth: 15.5 ft
Casing Radius: 0.167 ft
Static Water Column Height: 15.5 ft
Screen Length: 10.2 ft
Wellbore Radius: 0.209 ft

SOLUTION

Aquifer Model: Confined Solution Method: Butler

K = 0.169 ft/min C(D) = 1.05



WELL TEST ANALYSIS

Data Set: R:\...\Best_MW7_out_Butler.aqt
Date: 08/01/07 Time: 09:05:34

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 335392
Location: RIV
Test Well: MW7
Test Date: 2006

AQUIFER DATA

Saturated Thickness: 15.5 ft
Anisotropy Ratio (Kz/Kr): 0.1

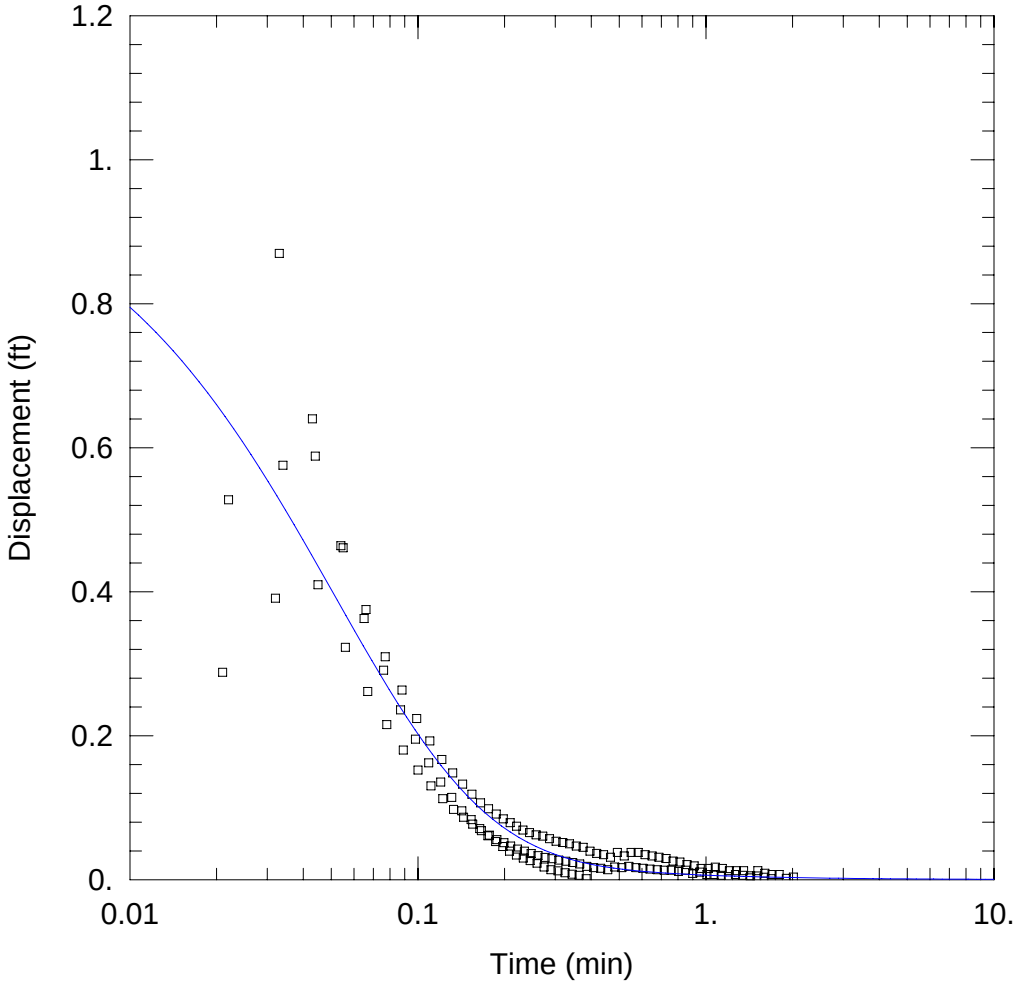
WELL DATA (MW7)

Initial Displacement: 1. ft
Total Well Penetration Depth: 15.5 ft
Casing Radius: 0.167 ft
Static Water Column Height: 15.5 ft
Screen Length: 10.2 ft
Wellbore Radius: 0.209 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Butler

K = 0.1189 ft/min
C(D) = 1.179



WELL TEST ANALYSIS

Data Set: R:\335392OmegaWA275\Field_Sampling\Slug_Testing\analysis\MW8A\MW8A_out_KGS.aqt
Date: 08/01/07 Time: 09:08:52

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 335392
Location: RIV
Test Well: MW8A
Test Date: 2006

AQUIFER DATA

Saturated Thickness: 16. ft

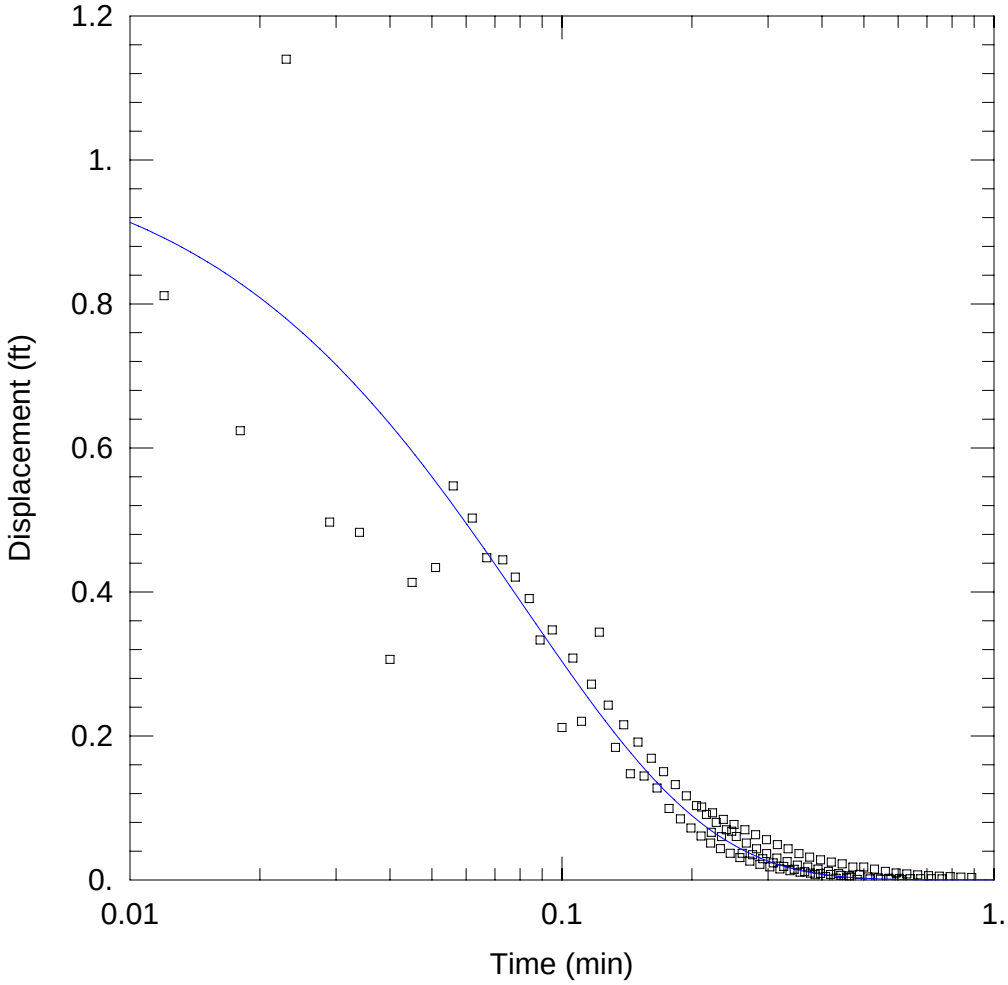
WELL DATA (MW8A)

Initial Displacement: 1. ft
Total Well Penetration Depth: 16. ft
Casing Radius: 0.167 ft
Static Water Column Height: 16. ft
Screen Length: 15. ft
Wellbore Radius: 0.209 ft

SOLUTION

Aquifer Model: Confined
Solution Method: KGS Model

Kr = 0.07903 ft/min
Kz/Kr = 0.1
Ss = 1.0E-5 ft^{-1}



WELL TEST ANALYSIS

Data Set: R:\...\Best_MW8B_Butler.aqt
Date: 08/01/07 Time: 09:12:59

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 335392
Location: RIV
Test Well: MW8
Test Date: 2006

AQUIFER DATA

Saturated Thickness: 10. ft Anisotropy Ratio (Kz/Kr): 0.1

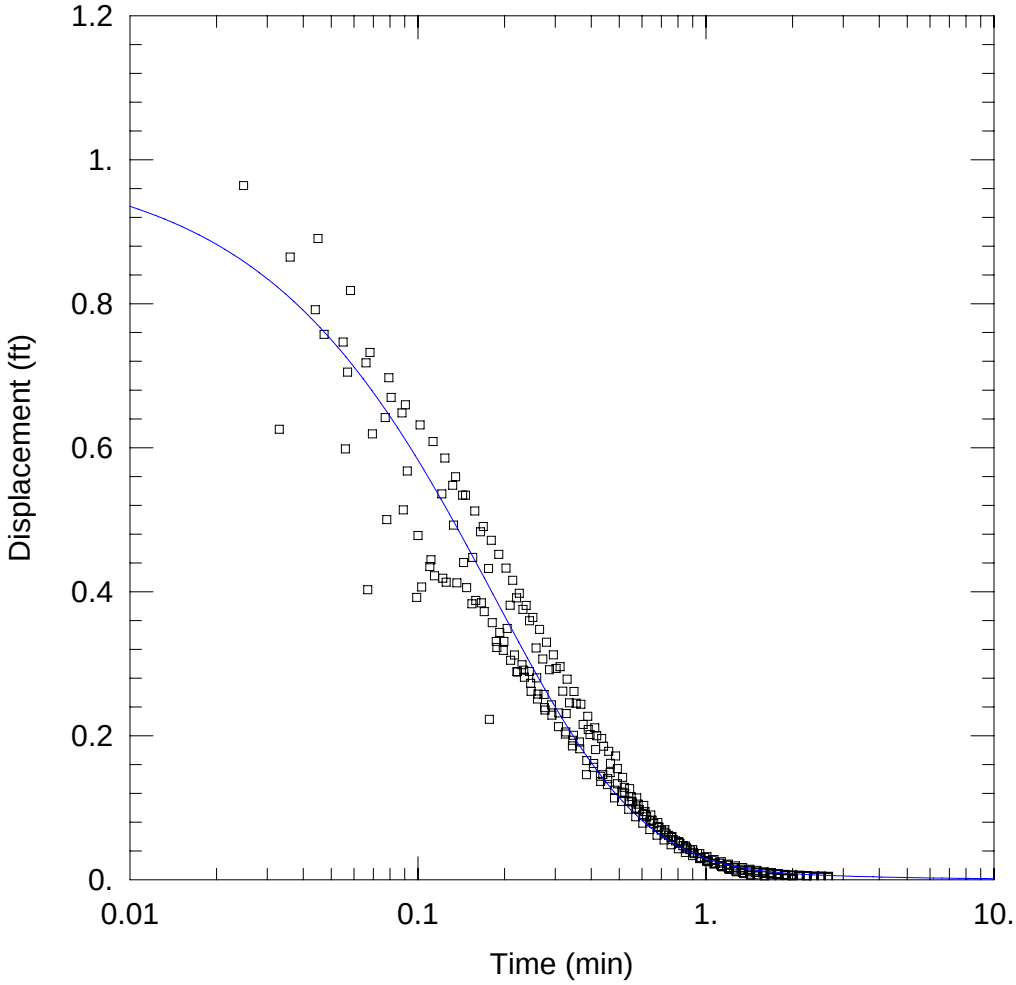
WELL DATA (MW8B)

Initial Displacement: 1. ft Static Water Column Height: 10. ft
Total Well Penetration Depth: 10. ft Screen Length: 10. ft
Casing Radius: 0.085 ft Wellbore Radius: 0.1 ft

SOLUTION

Aquifer Model: Confined Solution Method: Butler

K = 0.02272 ft/min C(D) = 2.884



WELL TEST ANALYSIS

Data Set: R:\...\Best_MW8C_KGS_2.aqt
Date: 08/01/07 Time: 09:15:59

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 335392
Location: RIV
Test Well: MW8C
Test Date: 2006

AQUIFER DATA

Saturated Thickness: 4. ft

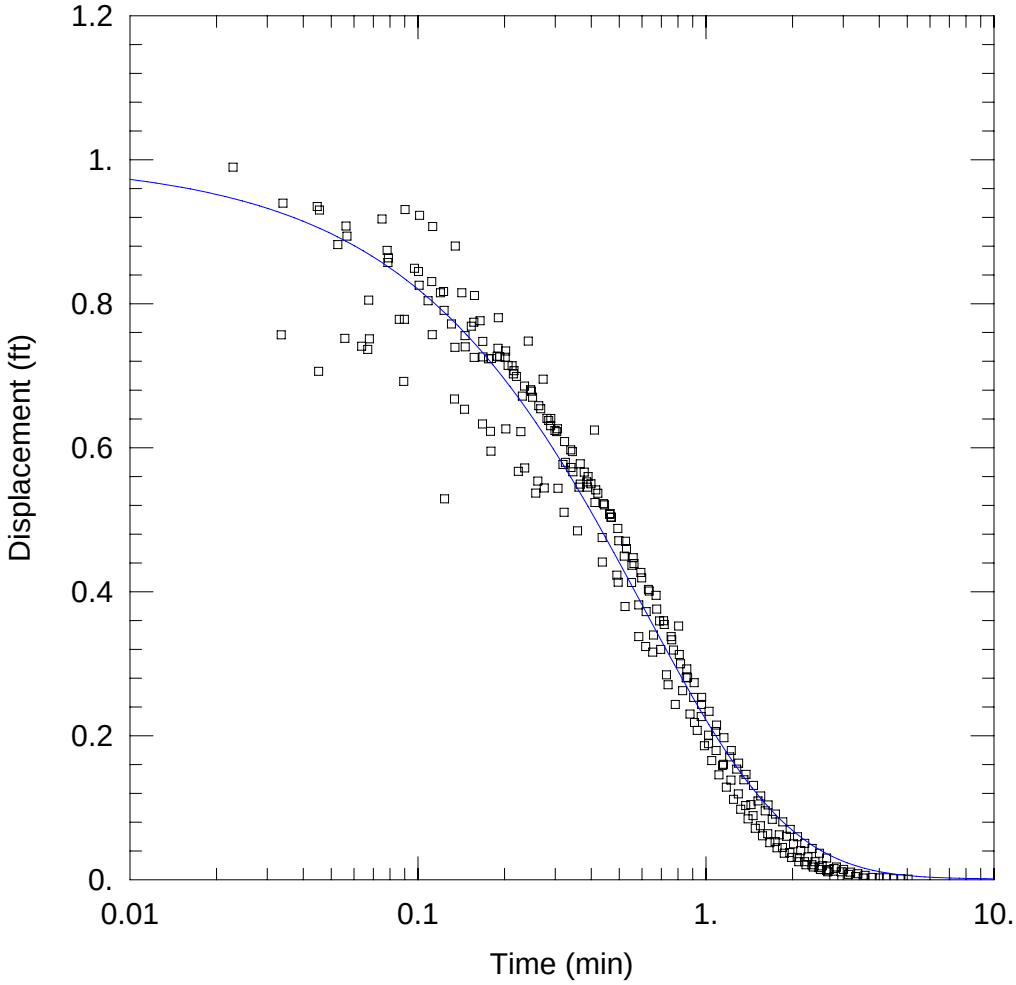
WELL DATA (MW8C)

Initial Displacement: 1. ft
Total Well Penetration Depth: 4. ft
Casing Radius: 0.085 ft
Static Water Column Height: 4. ft
Screen Length: 2.7 ft
Wellbore Radius: 0.104 ft

SOLUTION

Aquifer Model: Confined
Solution Method: KGS Model

Kr = 0.0335 ft/min
Kz/Kr = 0.1
Ss = 1.0E-5 ft^{-1}



WELL TEST ANALYSIS

Data Set: R:\335392OmegaWA275\Field_Sampling\Slug_Testing\analysis\MW8D\MW8D_KGS.aqt
Date: 08/01/07 Time: 09:39:52

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 335392
Location: RIV
Test Well: MW8D
Test Date: 2006

AQUIFER DATA

Saturated Thickness: 87. ft

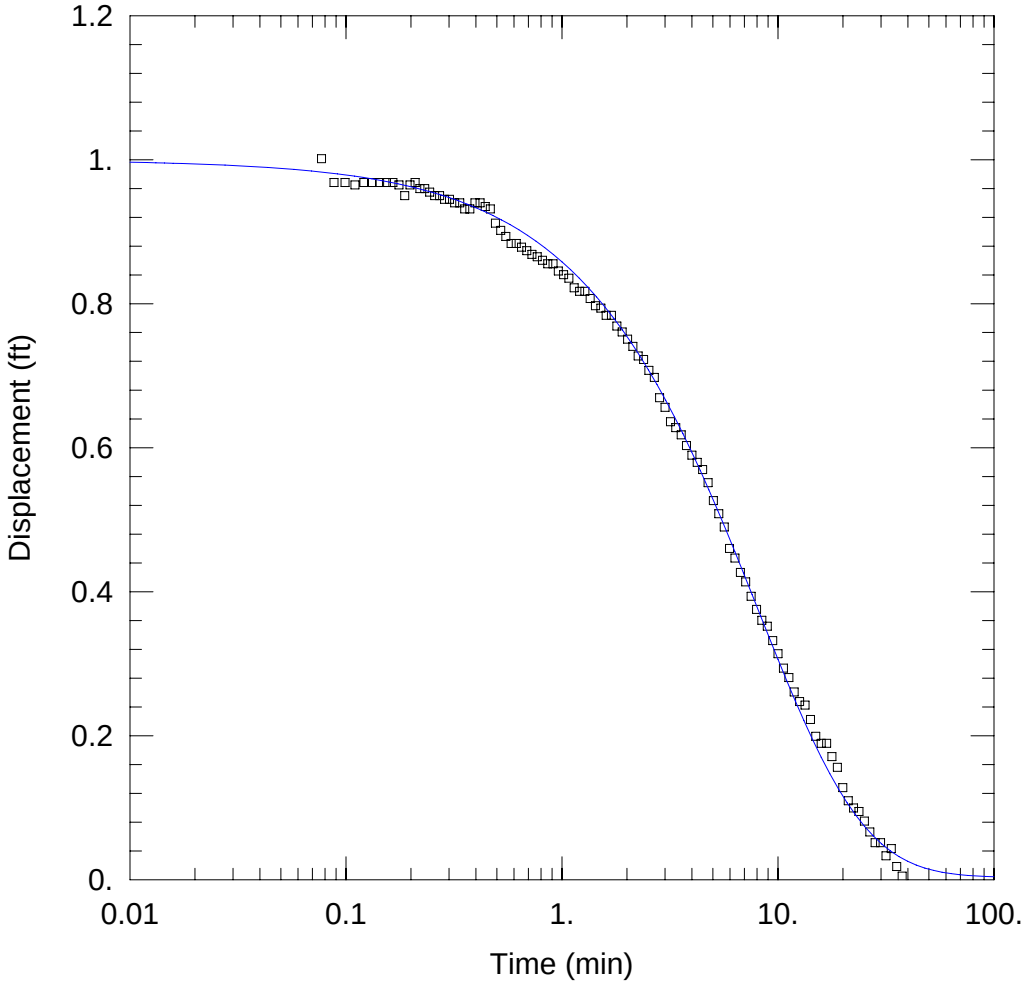
WELL DATA (MW8D)

Initial Displacement: 1. ft
Total Well Penetration Depth: 87. ft
Casing Radius: 0.167 ft
Static Water Column Height: 87. ft
Screen Length: 10. ft
Wellbore Radius: 0.209 ft

SOLUTION

Aquifer Model: Confined
Solution Method: KGS Model

Kr = 0.01039 ft/min
Kz/Kr = 0.1
Ss = 1.0E-5 ft^{-1}



WELL TEST ANALYSIS

Data Set: R:\...\Best_MW9A_in2_KGS.aqt
Date: 08/01/07 Time: 09:48:42

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 335392
Location: RIV
Test Well: MW9A
Test Date: 2006

AQUIFER DATA

Saturated Thickness: 21.75 ft

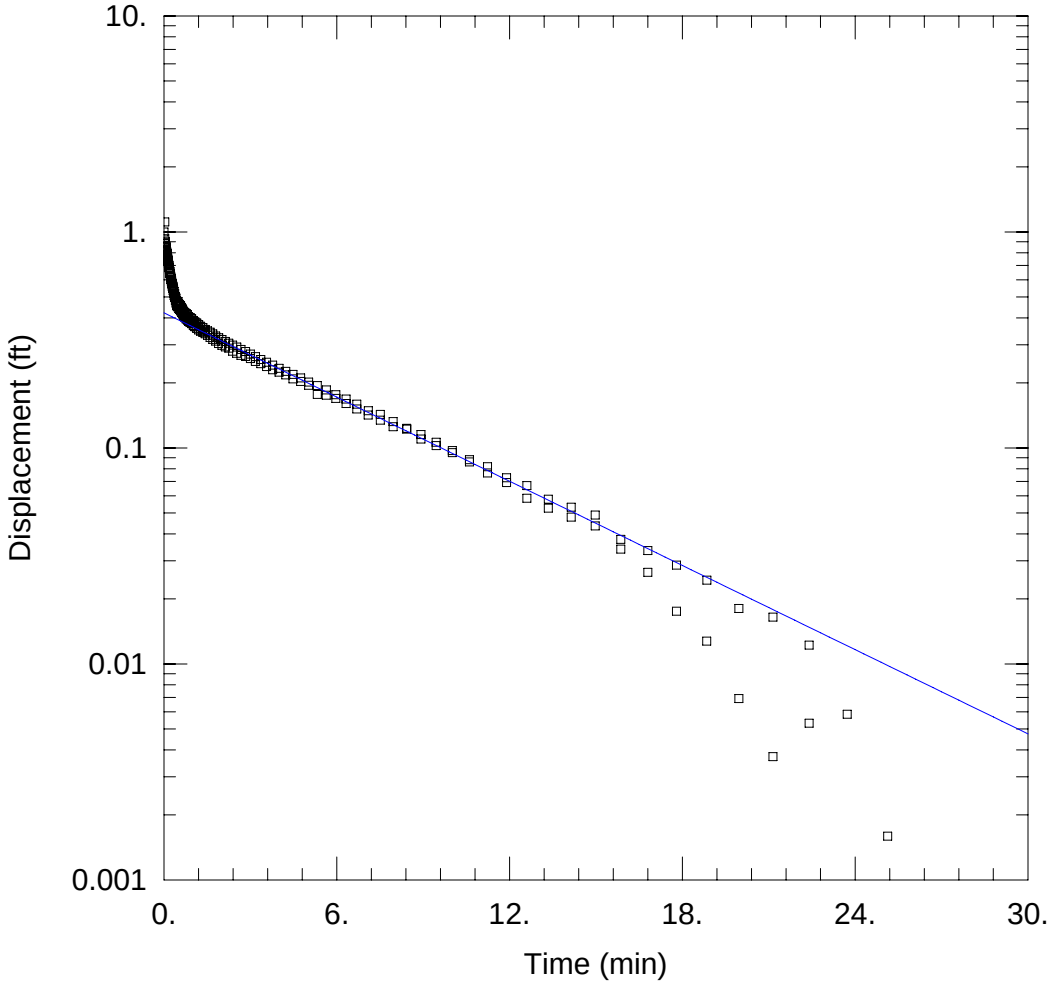
WELL DATA (MW9A)

Initial Displacement: 1. ft
Total Well Penetration Depth: 21.75 ft
Casing Radius: 0.167 ft
Static Water Column Height: 21.75 ft
Screen Length: 8.75 ft
Wellbore Radius: 0.209 ft

SOLUTION

Aquifer Model: Confined
Solution Method: KGS Model

Kr = 0.0008958 ft/min
Kz/Kr = 0.1
Ss = 1.0E-5 ft^{-1}



WELL TEST ANALYSIS

Data Set: R:\335392OmegaWA275\Field_Sampling\Slug_Testing\analysis\MW9A\MW9A_out_B&R.aqt
Date: 08/01/07 Time: 09:53:07

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 335392
Location: RIV
Test Well: MW9A
Test Date: 2006

AQUIFER DATA

Saturated Thickness: 21.75 ft
Anisotropy Ratio (Kz/Kr): 1.

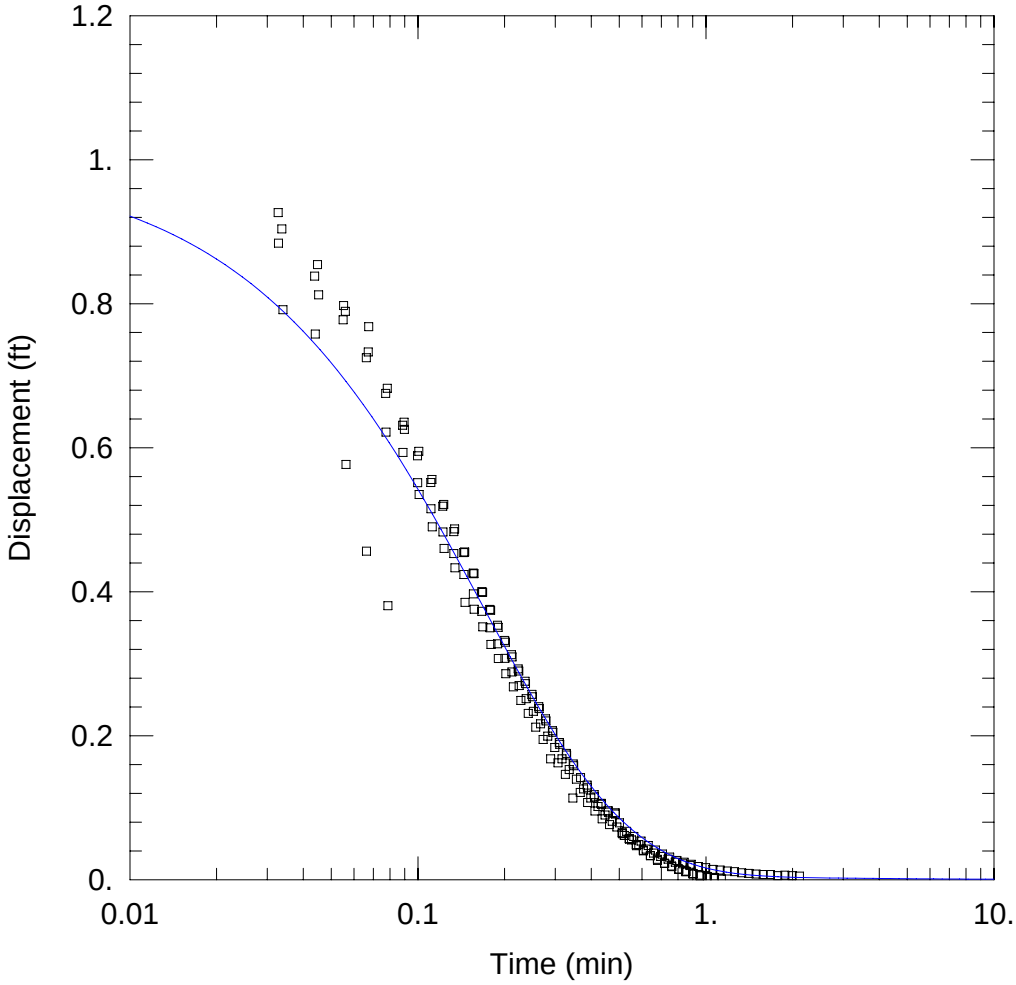
WELL DATA (MW9A)

Initial Displacement: 1. ft
Total Well Penetration Depth: 21.75 ft
Casing Radius: 0.167 ft
Static Water Column Height: 21.75 ft
Screen Length: 8.75 ft
Wellbore Radius: 0.209 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 0.0008132 ft/min
y0 = 0.4219 ft



WELL TEST ANALYSIS

Data Set: R:\335392OmegaWA275\Field_Sampling\Slug_Testing\analysis\MW9B\MW9B_KGS.aqt
Date: 08/01/07 Time: 10:04:21

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 335392
Location: RIV
Test Well: MW9B
Test Date: 2006

AQUIFER DATA

Saturated Thickness: 31.13 ft

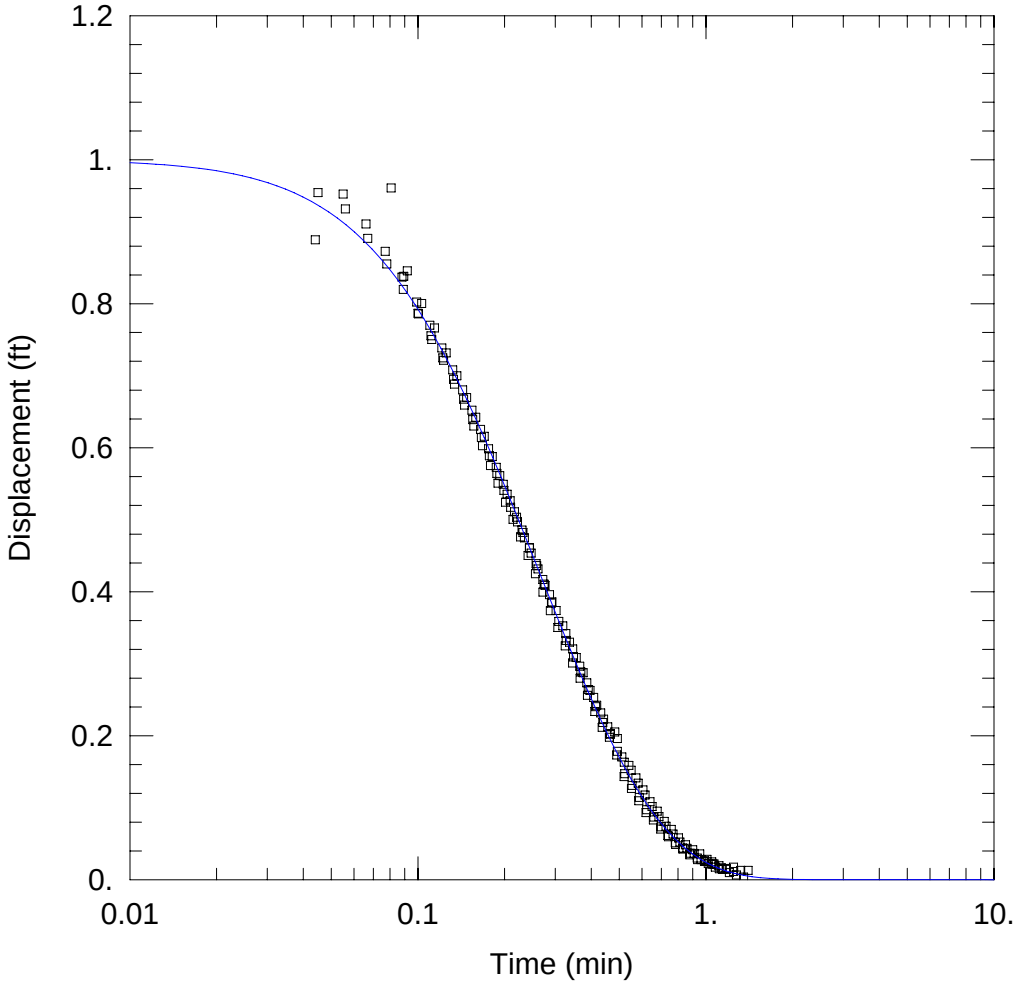
WELL DATA (MW9B)

Initial Displacement: 1. ft
Total Well Penetration Depth: 31.13 ft
Casing Radius: 0.167 ft
Static Water Column Height: 31.13 ft
Screen Length: 10.2 ft
Wellbore Radius: 0.209 ft

SOLUTION

Aquifer Model: Confined
Solution Method: KGS Model

Kr = 0.03663 ft/min
Kz/Kr = 0.1
Ss = 1.0E-5 ft^{-1}



WELL TEST ANALYSIS

Data Set: R:\...\Best_MW10_Butler.aqt
Date: 08/01/07 Time: 10:10:31

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 335392
Location: RIV
Test Well: MW10
Test Date: 2006

AQUIFER DATA

Saturated Thickness: 28.27 ft Anisotropy Ratio (Kz/Kr): 0.1

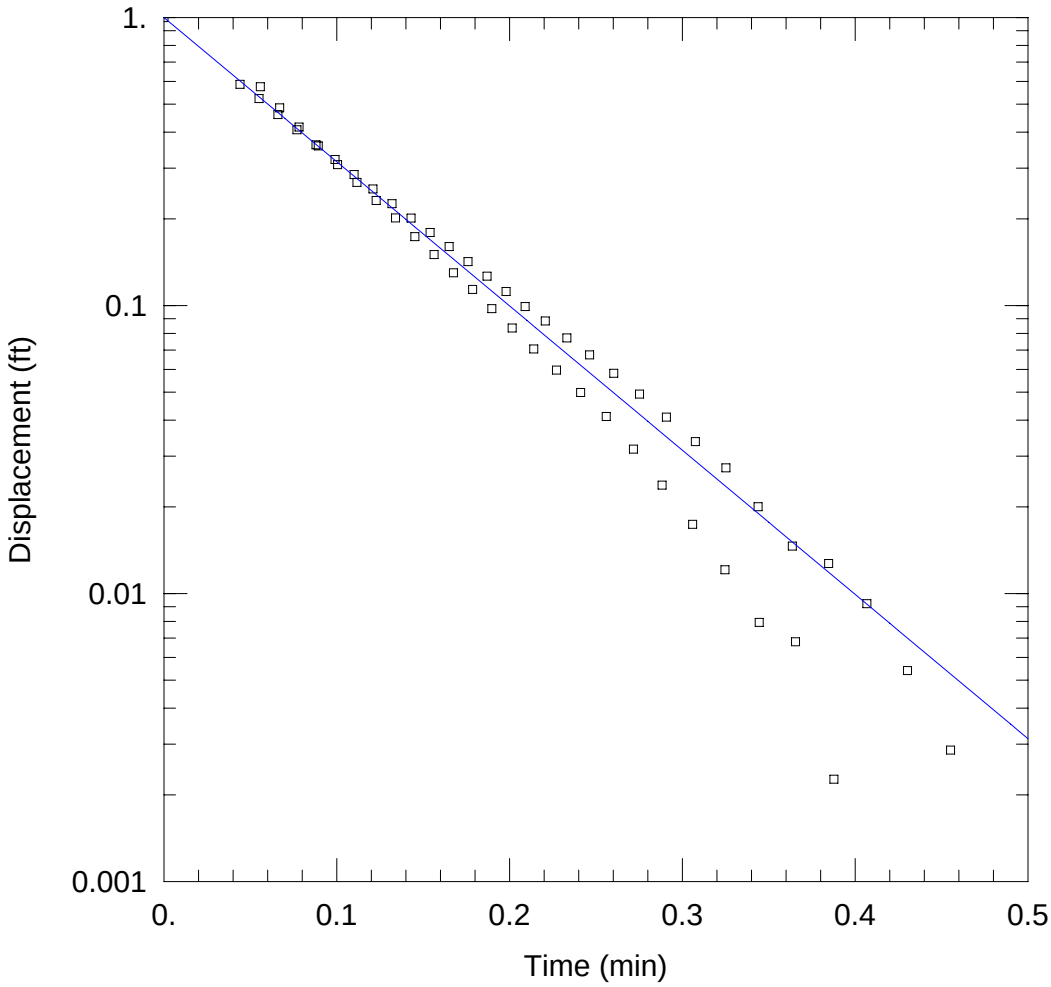
WELL DATA (MW10)

Initial Displacement: 1. ft
Total Well Penetration Depth: 28.27 ft
Casing Radius: 0.167 ft
Static Water Column Height: 28.27 ft
Screen Length: 10. ft
Wellbore Radius: 0.209 ft

SOLUTION

Aquifer Model: Confined Solution Method: Butler

K = 0.02671 ft/min C(D) = 1.429



WELL TEST ANALYSIS

Data Set: R:\...\Best_MW11_in_B&R.aqt
Date: 08/01/07 Time: 10:14:33

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 335392
Location: RIV
Test Well: MW11
Test Date: 2006

AQUIFER DATA

Saturated Thickness: 18.42 ft
Anisotropy Ratio (Kz/Kr): 0.1

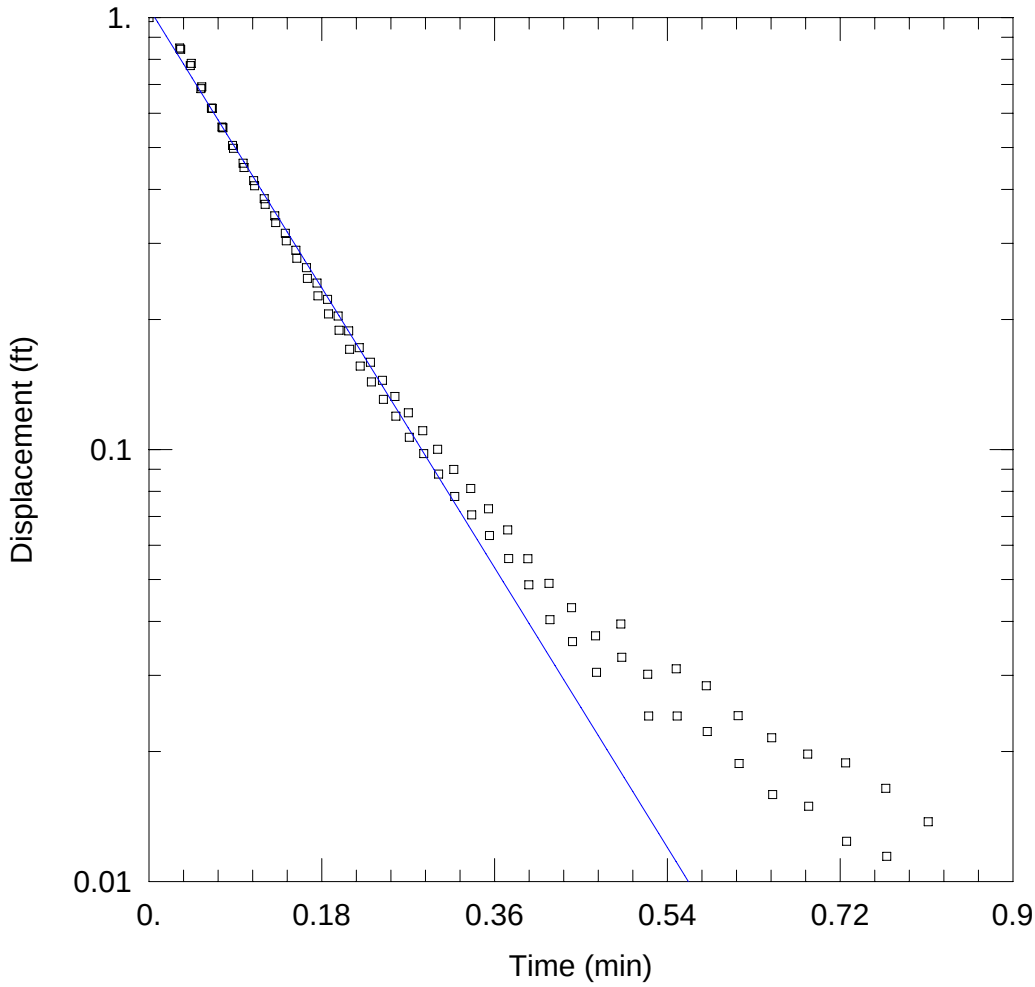
WELL DATA (MW11)

Initial Displacement: 1. ft
Total Well Penetration Depth: 18.42 ft
Casing Radius: 0.167 ft
Static Water Column Height: 18.42 ft
Screen Length: 10. ft
Wellbore Radius: 0.209 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 0.06883 ft/min
y0 = 1. ft



WELL TEST ANALYSIS

Data Set: R:\...\Best_MW11_out_B&R.aqt
Date: 08/01/07 Time: 10:17:14

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 335392
Location: RIV
Test Well: MW11
Test Date: 2006

AQUIFER DATA

Saturated Thickness: 18.42 ft Anisotropy Ratio (Kz/Kr): 0.1

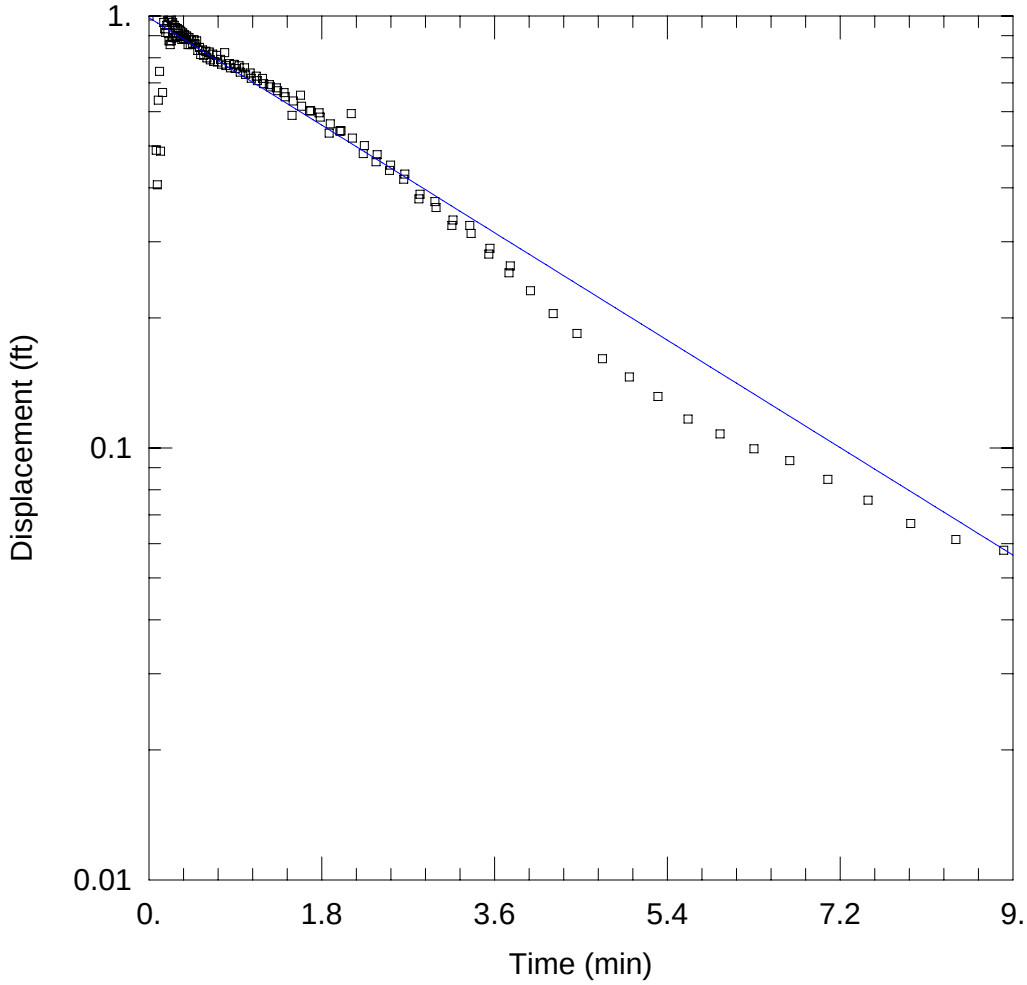
WELL DATA (MW11)

Initial Displacement: 1. ft
Total Well Penetration Depth: 18.42 ft
Casing Radius: 0.167 ft
Static Water Column Height: 18.42 ft
Screen Length: 10. ft
Wellbore Radius: 0.209 ft

SOLUTION

Aquifer Model: Confined Solution Method: Bouwer-Rice

K = 0.04945 ft/min y0 = 1.051 ft



WELL TEST ANALYSIS

Data Set: R:\335392OmegaWA275\Field_Sampling\Slug_Testing\analysis\MW12\MW12_out_B&R.aqt
Date: 08/01/07 Time: 10:36:30

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 335392
Location: RIV
Test Well: MW12
Test Date: 2006

AQUIFER DATA

Saturated Thickness: 5.89 ft
Anisotropy Ratio (Kz/Kr): 0.1

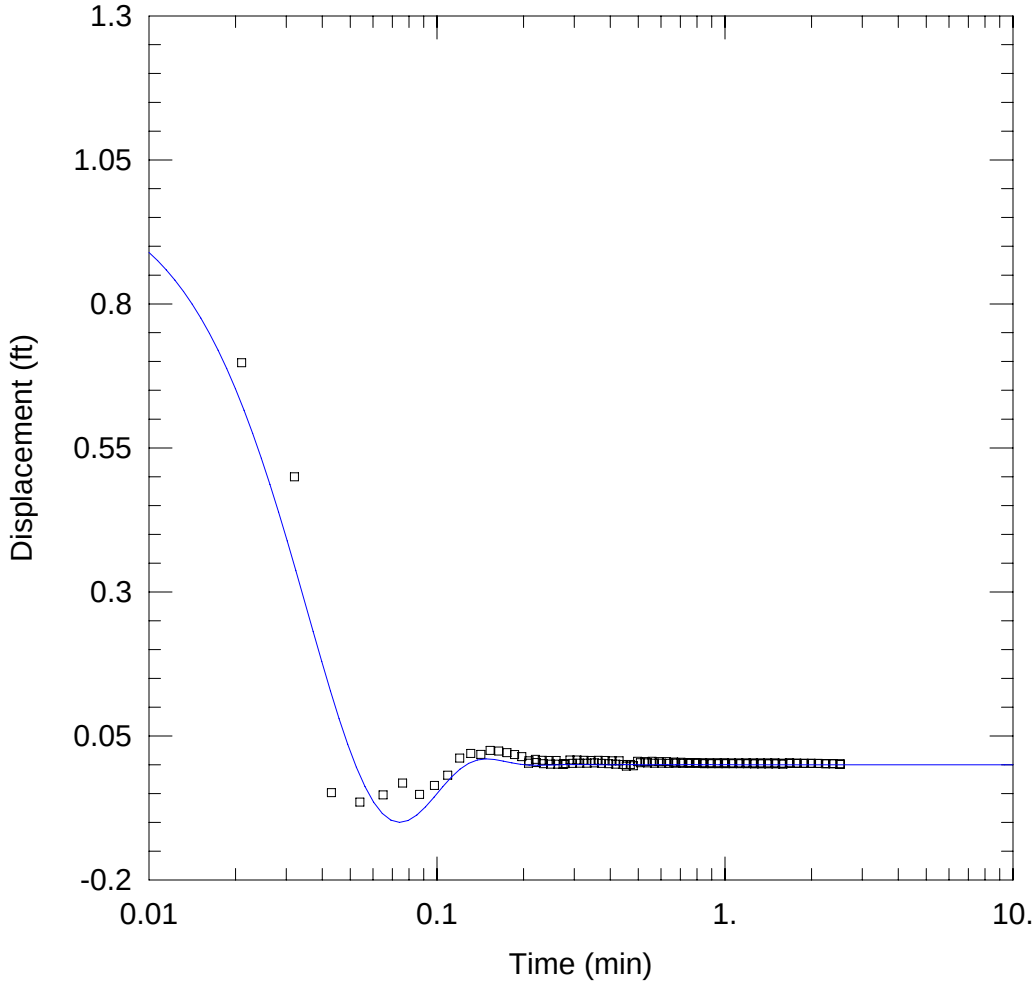
WELL DATA (MW12)

Initial Displacement: 1. ft
Total Well Penetration Depth: 5.89 ft
Casing Radius: 0.08 ft
Static Water Column Height: 5.89 ft
Screen Length: 5.89 ft
Wellbore Radius: 0.1 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 0.0005403 ft/min
y0 = 0.9905 ft



WELL TEST ANALYSIS

Data Set: R:\...\Best_MW13B_in_Butler.aqt
Date: 08/01/07 Time: 10:39:40

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 335392
Location: RIV
Test Well: MW13B
Test Date: 2006

AQUIFER DATA

Saturated Thickness: 11. ft Anisotropy Ratio (Kz/Kr): 0.1

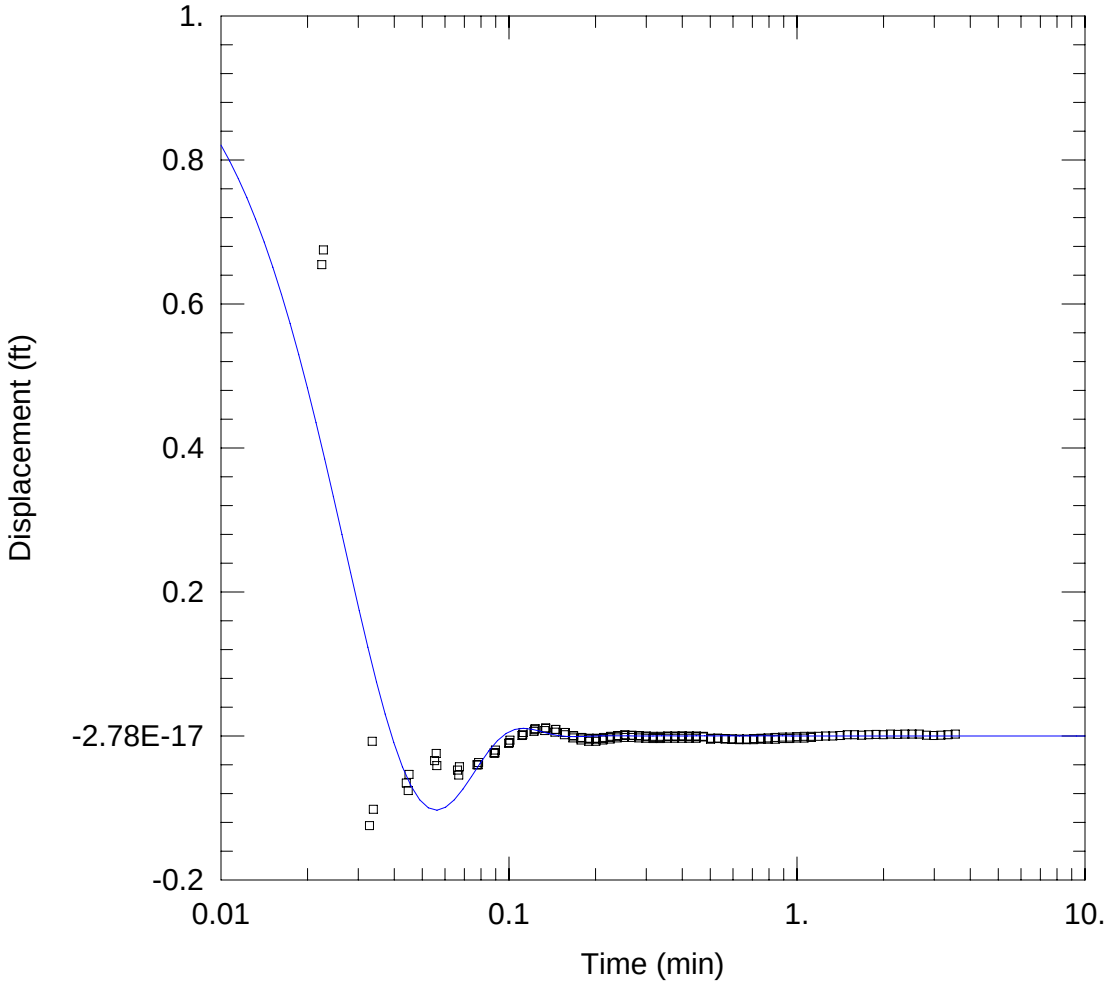
WELL DATA (MW13B)

Initial Displacement: 1. ft Static Water Column Height: 11. ft
Total Well Penetration Depth: 11. ft Screen Length: 10. ft
Casing Radius: 0.08 ft Wellbore Radius: 0.1 ft

SOLUTION

Aquifer Model: Confined Solution Method: Butler

K = 0.09159 ft/min C(D) = 0.5909



WELL TEST ANALYSIS

Data Set: C:\...\MW14_in_Butler.aqt
Date: 10/11/07 Time: 10:54:34

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 335392
Location: RIV
Test Well: MW14
Test Date: 2006

AQUIFER DATA

Saturated Thickness: 21. ft Anisotropy Ratio (Kz/Kr): 0.1

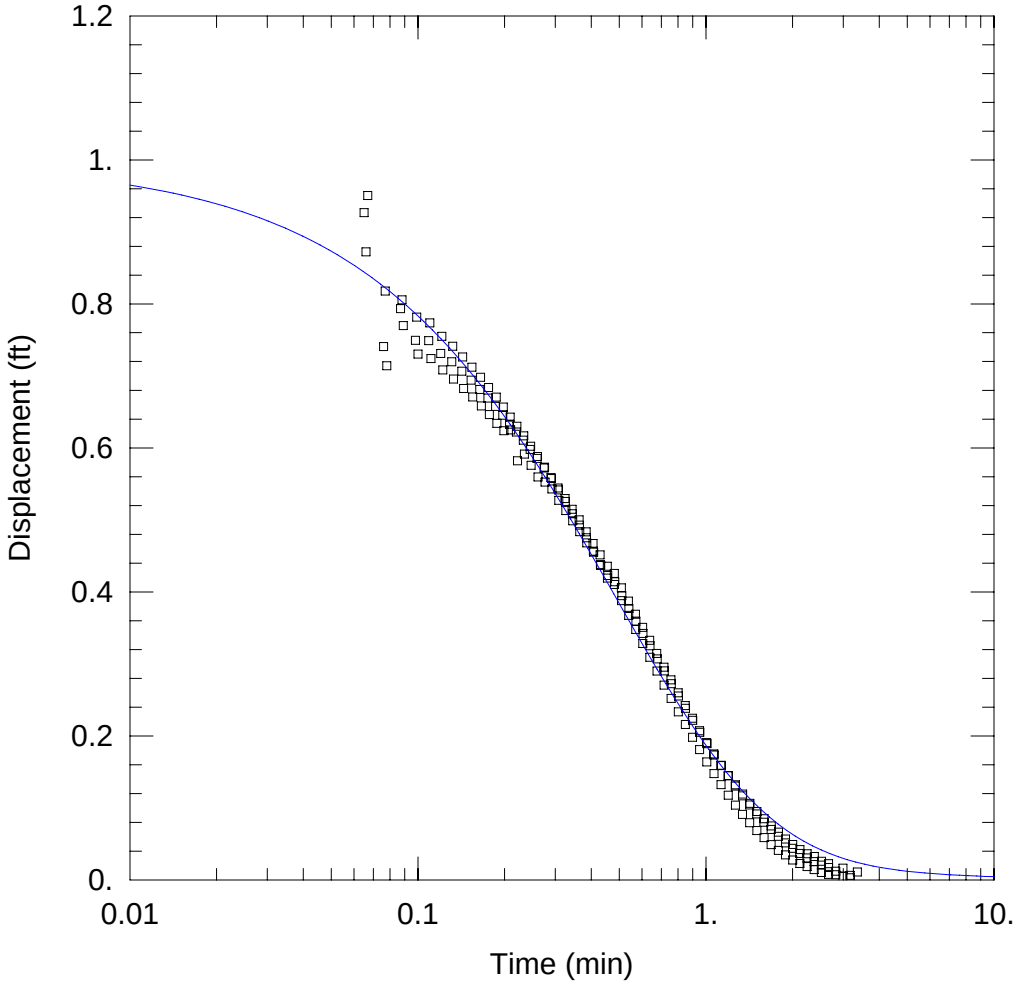
WELL DATA (MW14)

Initial Displacement: 1. ft Static Water Column Height: 20. ft
Total Well Penetration Depth: 20. ft Screen Length: 15. ft
Casing Radius: 0.08 ft Wellbore Radius: 0.1 ft

SOLUTION

Aquifer Model: Confined Solution Method: Butler

K = 0.0777 ft/min C(D) = 0.586



WELL TEST ANALYSIS

Data Set: R:\...\Best_MW15_in_KGS_2.aqt
Date: 08/01/07 Time: 10:48:46

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 335392
Location: RIV
Test Well: MW15
Test Date: 2006

AQUIFER DATA

Saturated Thickness: 38. ft

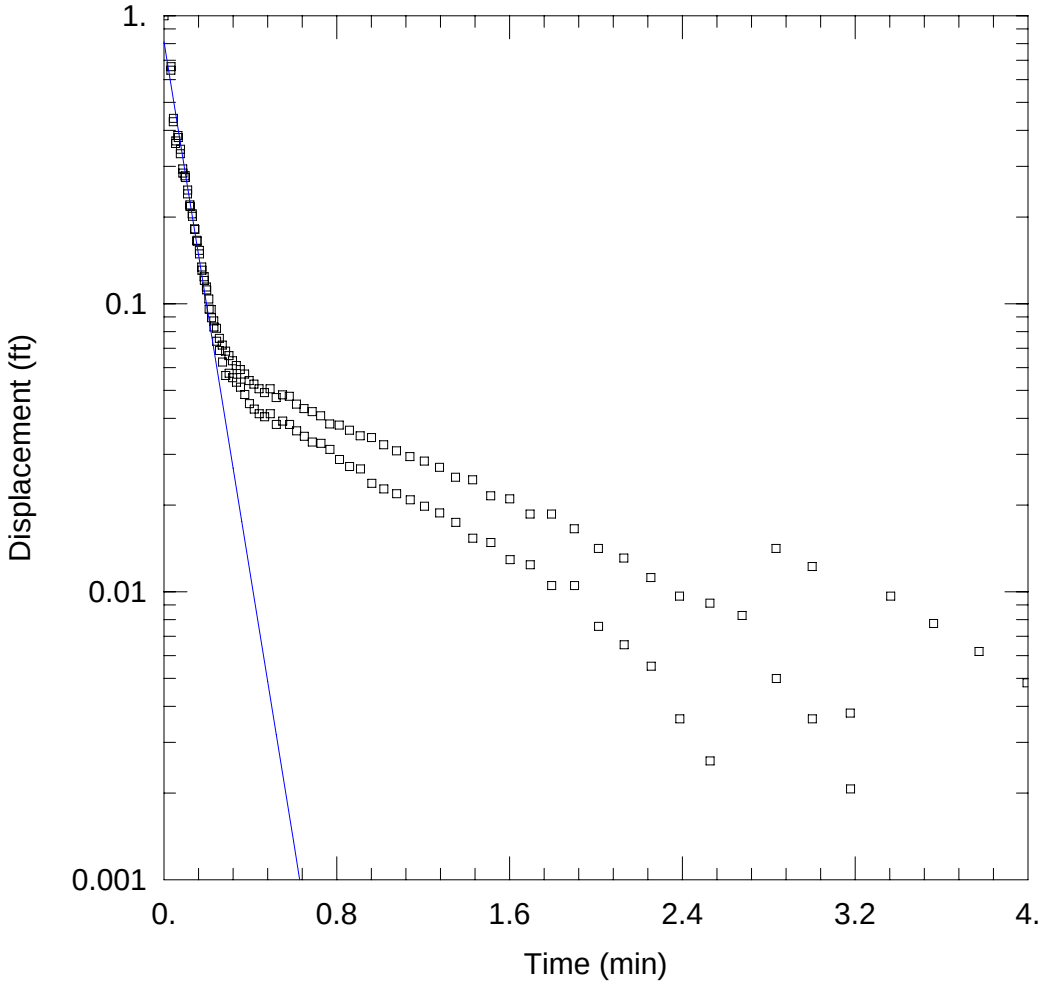
WELL DATA (MW15)

Initial Displacement: 1. ft
Total Well Penetration Depth: 38. ft
Casing Radius: 0.08 ft
Static Water Column Height: 38. ft
Screen Length: 20. ft
Wellbore Radius: 0.1 ft

SOLUTION

Aquifer Model: Confined
Solution Method: KGS Model

Kr = 0.001418 ft/min
Kz/Kr = 0.1
Ss = 1.0E-5 ft^{-1}



WELL TEST ANALYSIS

Data Set: R:\...\Best_MW16A_out_B&R.aqt
Date: 08/01/07 Time: 10:52:46

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 335392
Location: RIV
Test Well: MW16A
Test Date: 2006

AQUIFER DATA

Saturated Thickness: 12.63 ft
Anisotropy Ratio (Kz/Kr): 0.1

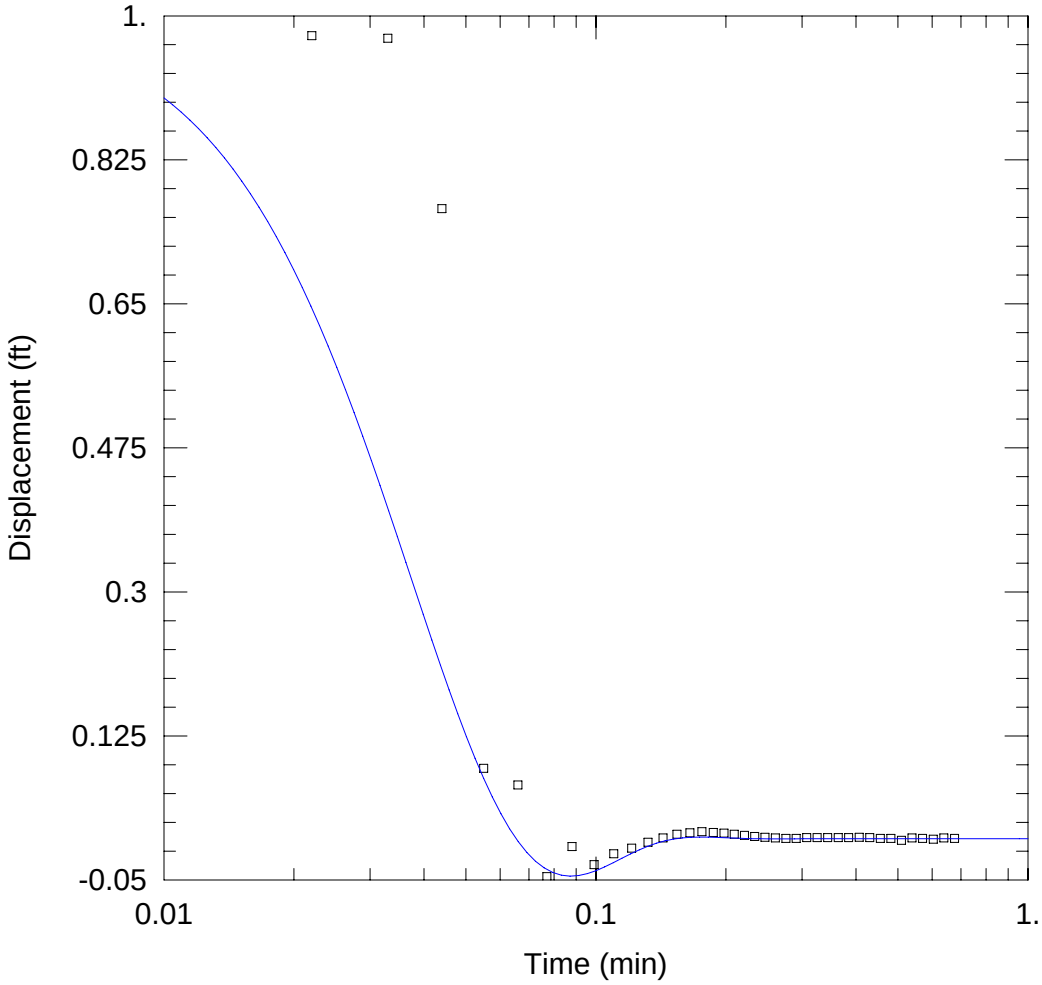
WELL DATA (MW16A)

Initial Displacement: 1. ft
Total Well Penetration Depth: 12.63 ft
Casing Radius: 0.08 ft
Static Water Column Height: 12.63 ft
Screen Length: 12.63 ft
Wellbore Radius: 0.1 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 0.01008 ft/min
y0 = 0.8126 ft



WELL TEST ANALYSIS

Data Set: R:\...\MW16B_in_Butler.aqt
Date: 08/01/07 Time: 10:55:56

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 335392
Location: RIV
Test Well: MW16B
Test Date: 2006

AQUIFER DATA

Saturated Thickness: 11. ft Anisotropy Ratio (Kz/Kr): 0.1

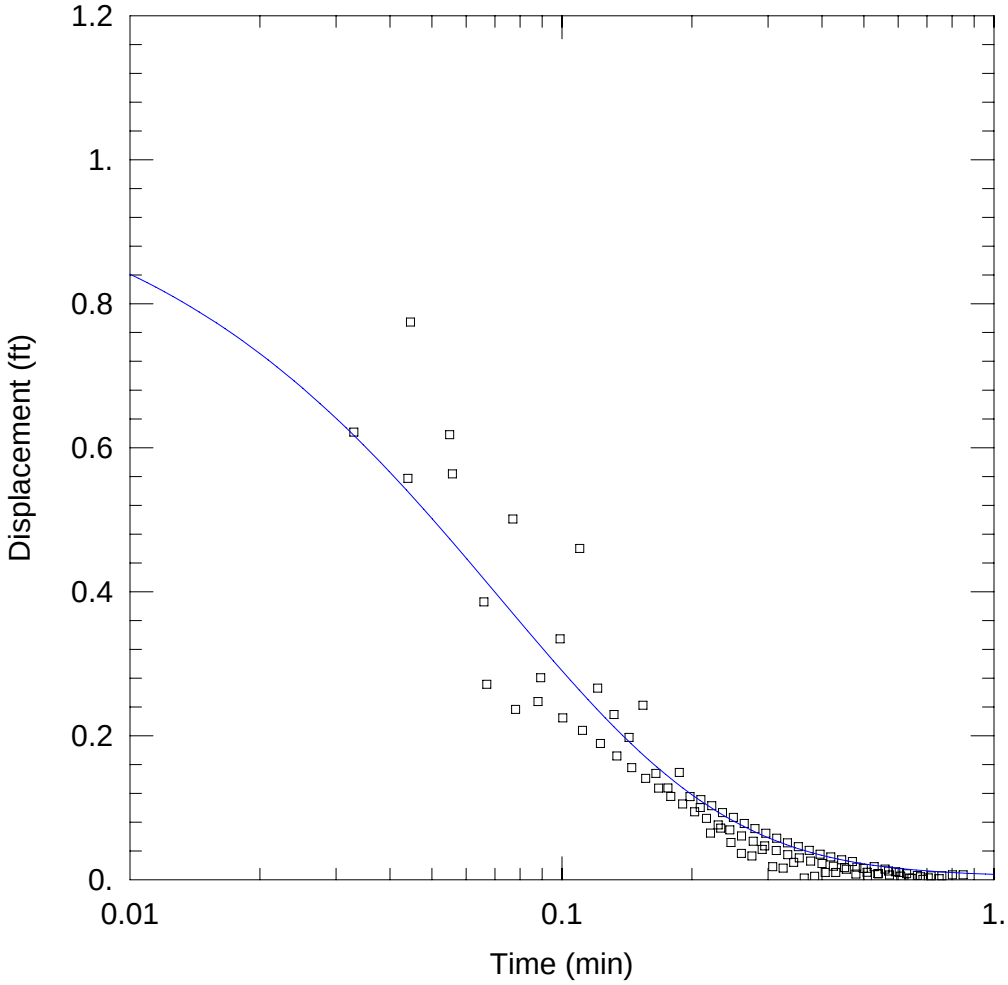
WELL DATA (MW16B)

Initial Displacement: 1. ft Static Water Column Height: 11. ft
Total Well Penetration Depth: 11. ft Screen Length: 10. ft
Casing Radius: 0.08 ft Wellbore Radius: 0.1 ft

SOLUTION

Aquifer Model: Confined Solution Method: Butler

K = 0.07416 ft/min C(D) = 0.7013



WELL TEST ANALYSIS

Data Set: R:\335392OmegaWA275\Field_Sampling\Slug_Testing\analysis\MW16C\MW16C_KGS.aqt
Date: 08/01/07 Time: 10:56:57

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 335392
Location: RIV
Test Well: MW16C
Test Date: 2006

AQUIFER DATA

Saturated Thickness: 20. ft

WELL DATA (MW16C)

Initial Displacement: 1. ft
Total Well Penetration Depth: 20. ft
Casing Radius: 0.08 ft

Static Water Column Height: 20. ft
Screen Length: 15. ft
Wellbore Radius: 0.1 ft

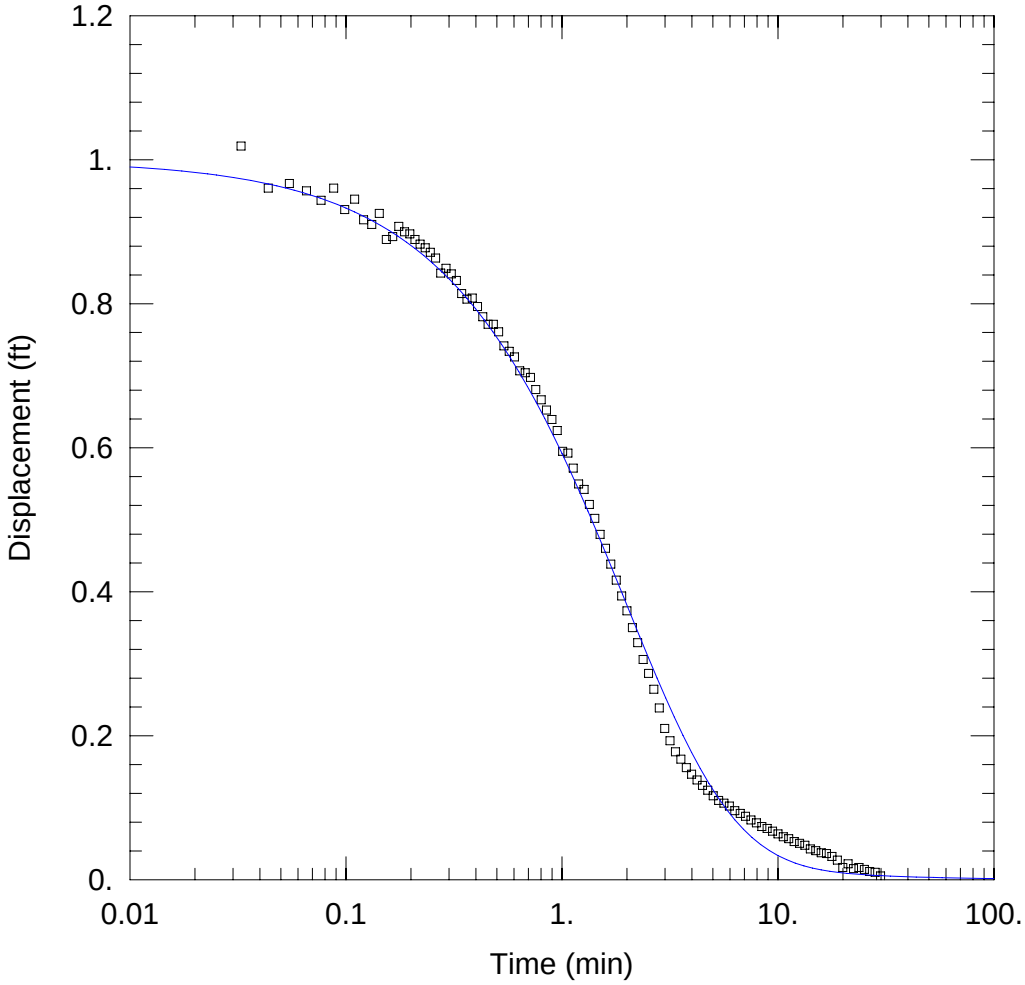
SOLUTION

Aquifer Model: Confined

Kr = 0.01317 ft/min
Kz/Kr = 0.1

Solution Method: KGS Model

Ss = 1.0E-5 ft^{-1}



WELL TEST ANALYSIS

Data Set: R:\...\Best_MW17A_out_KGS_2.aqt
Date: 08/01/07 Time: 11:01:49

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 335392
Location: RIV
Test Well: MW17A
Test Date: 2006

AQUIFER DATA

Saturated Thickness: 9.83 ft

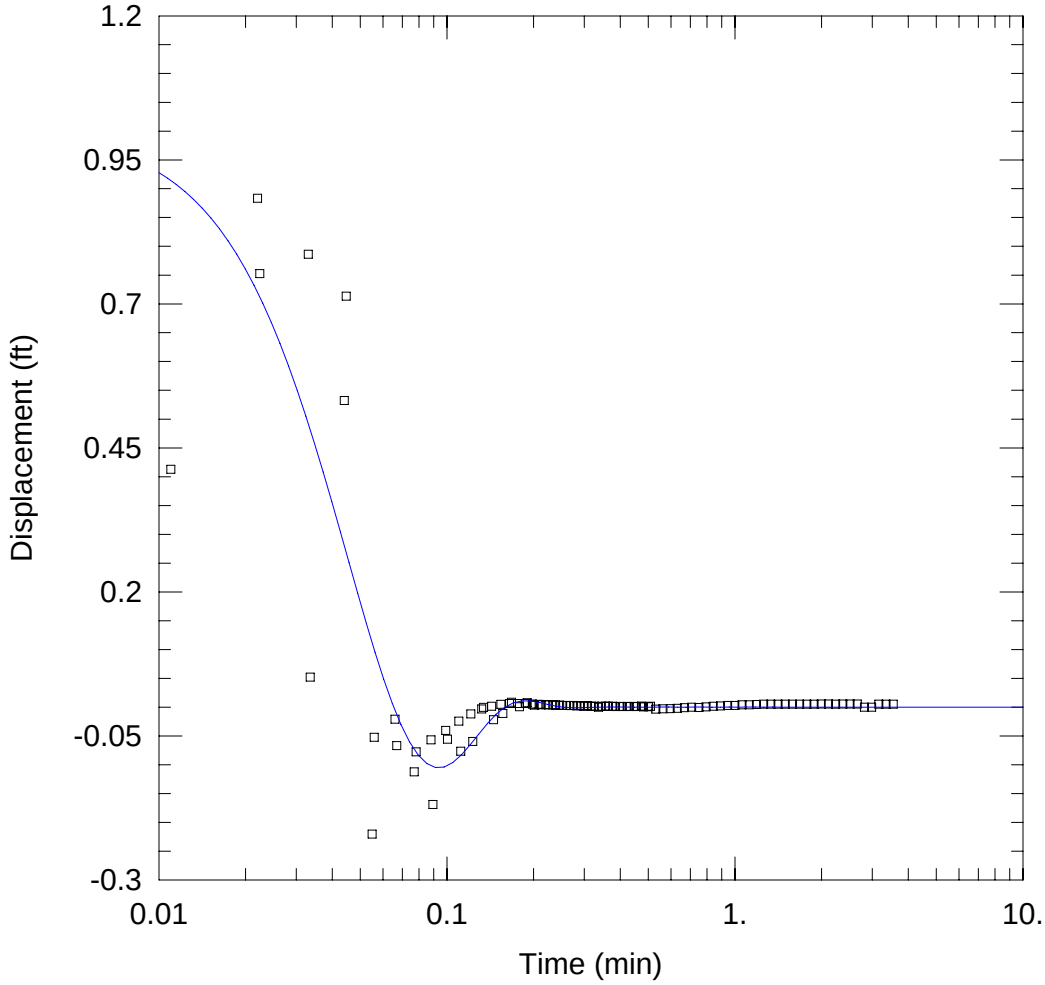
WELL DATA (MW17A)

Initial Displacement: 1. ft
Total Well Penetration Depth: 9.83 ft
Casing Radius: 0.08 ft
Static Water Column Height: 9.83 ft
Screen Length: 6.83 ft
Wellbore Radius: 0.1 ft

SOLUTION

Aquifer Model: Confined
Solution Method: KGS Model

Kr = 0.001116 ft/min
Kz/Kr = 0.1
Ss = 1.0E-5 ft^{-1}



WELL TEST ANALYSIS

Data Set: R:\...\Best_MW17B_in_Butler.aqt
Date: 08/01/07 Time: 11:05:28

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 335392
Location: RIV
Test Well: MW17B
Test Date: 2006

AQUIFER DATA

Saturated Thickness: 10.5 ft Anisotropy Ratio (Kz/Kr): 0.1

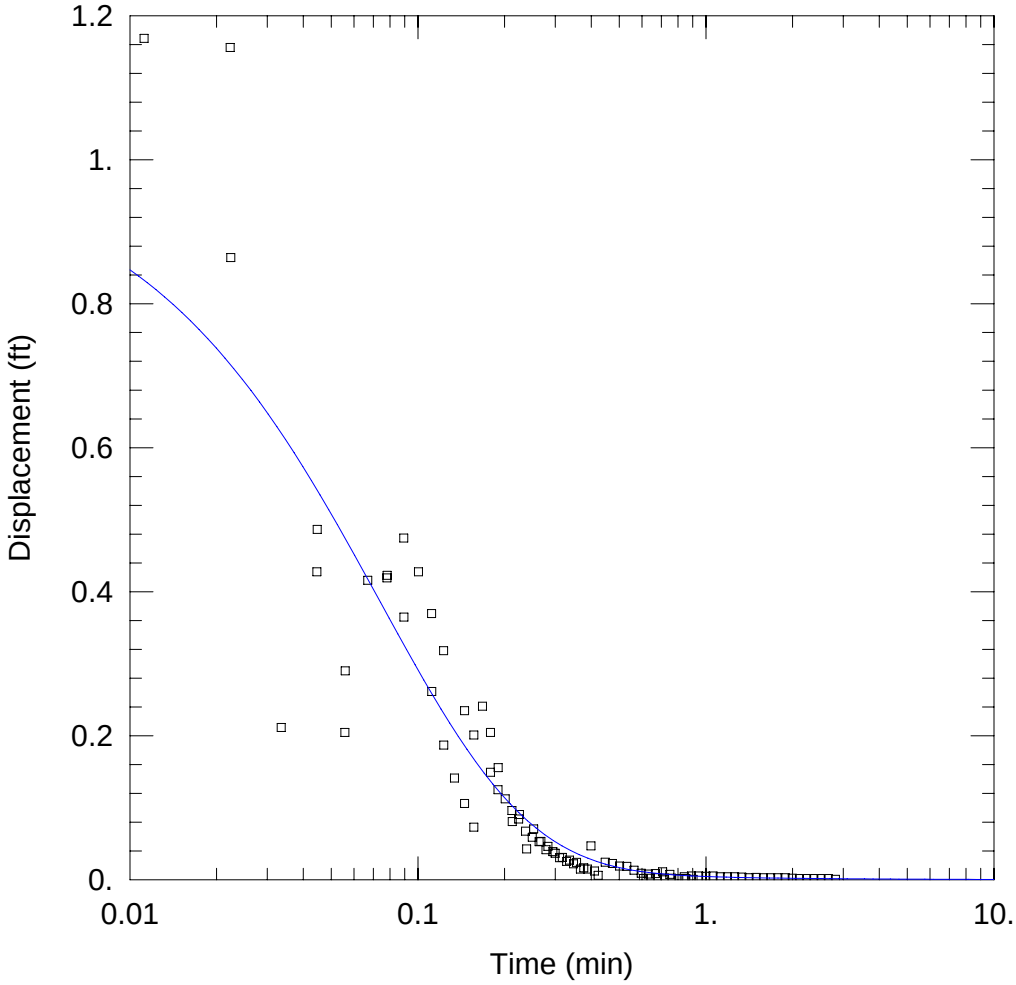
WELL DATA (MW17B)

Initial Displacement: 1. ft Static Water Column Height: 10.5 ft
Total Well Penetration Depth: 10.5 ft Screen Length: 10. ft
Casing Radius: 0.08 ft Wellbore Radius: 0.1 ft

SOLUTION

Aquifer Model: Confined Solution Method: Butler

K = 0.07317 ft/min C(D) = 0.5823



WELL TEST ANALYSIS

Data Set: R:\...\Best_MW17C_out_KGS_2.aqt
Date: 08/01/07 Time: 11:06:51

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 335392
Location: RIV
Test Well: MW17C
Test Date: 2006

AQUIFER DATA

Saturated Thickness: 22.5 ft

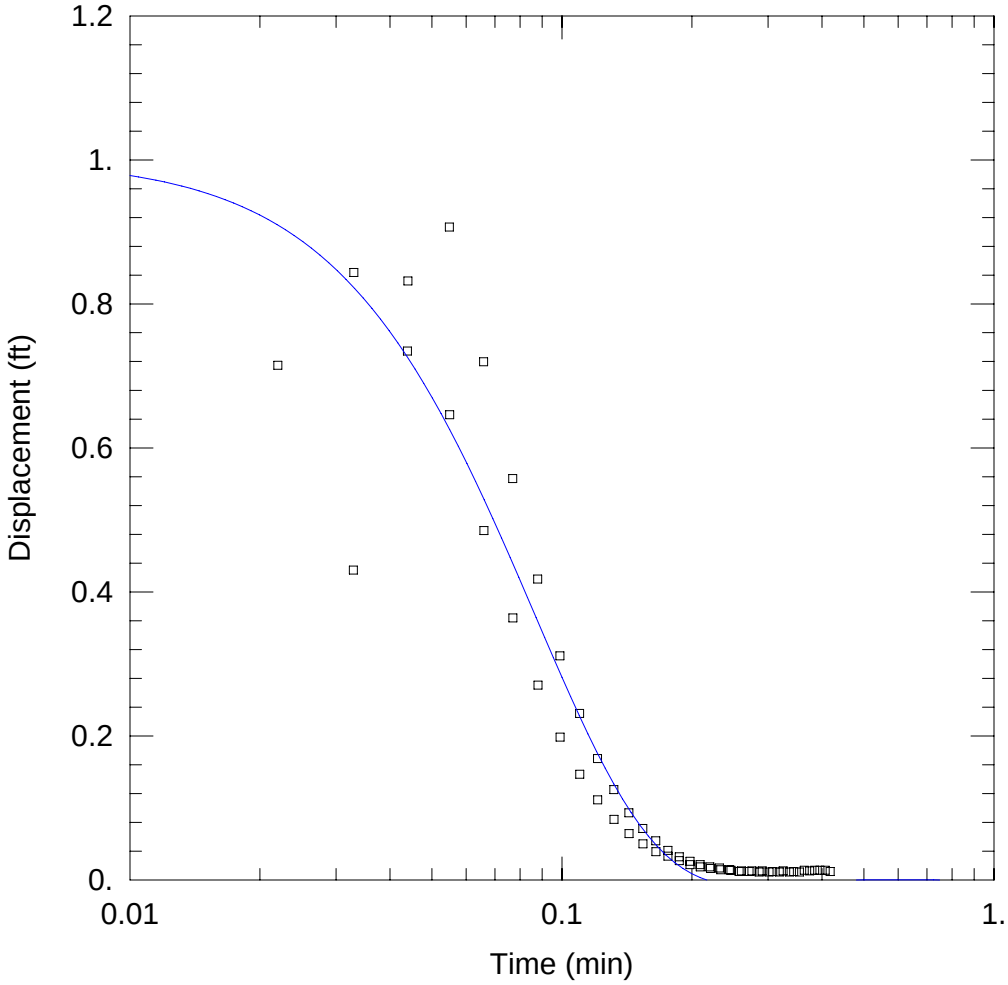
WELL DATA (MW17C)

Initial Displacement: 1. ft
Total Well Penetration Depth: 10.5 ft
Casing Radius: 0.08 ft
Static Water Column Height: 22.5 ft
Screen Length: 10. ft
Wellbore Radius: 0.1 ft

SOLUTION

Aquifer Model: Confined
Solution Method: KGS Model

Kr = 0.01958 ft/min
Kz/Kr = 0.1
Ss = 1.0E-5 ft^{-1}



WELL TEST ANALYSIS

Data Set: R:\335392OmegaWA275\Field_Sampling\Slug_Testing\analysis\MW18A\Best_MW18A.aqt
Date: 08/01/07 Time: 11:19:45

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 335392
Location: RIV
Test Well: MW18A
Test Date: 2006

AQUIFER DATA

Saturated Thickness: 27.5 ft
Anisotropy Ratio (Kz/Kr): 0.1

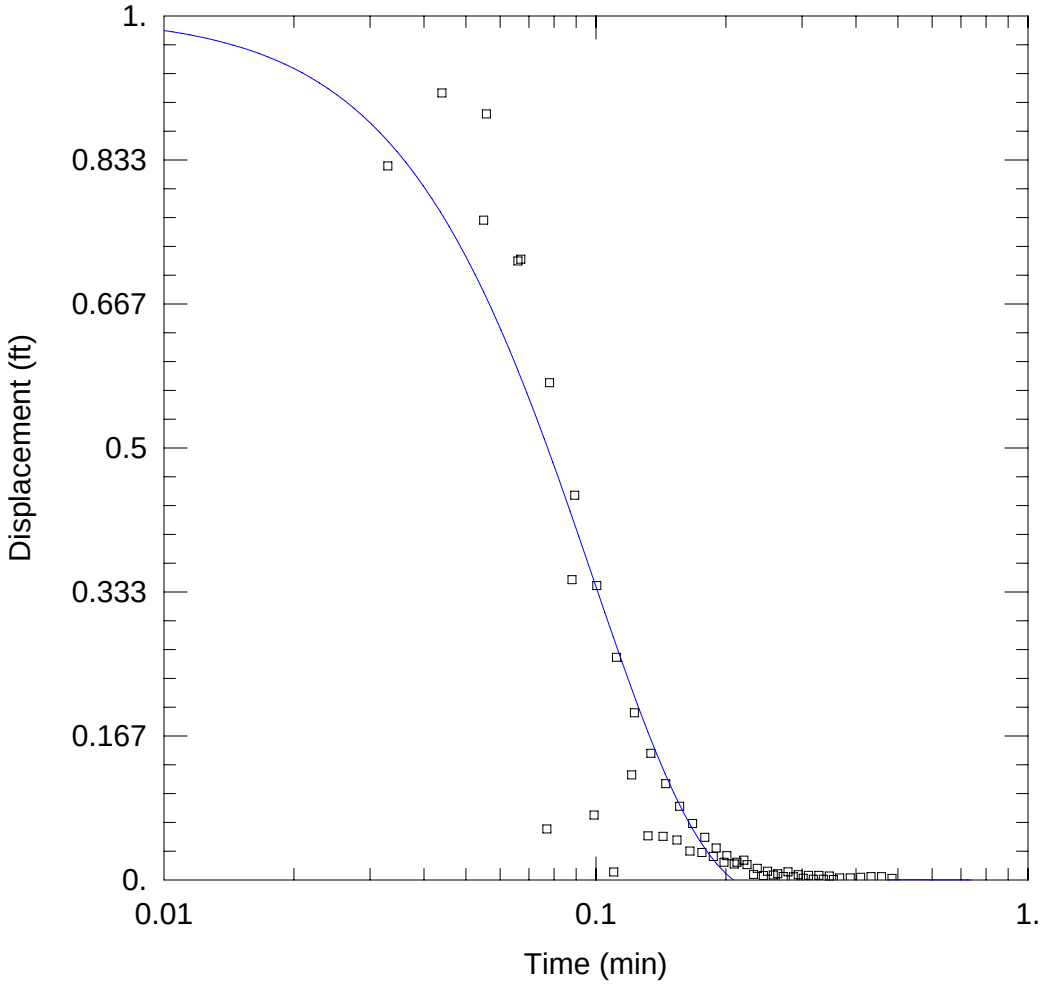
WELL DATA (MW18A)

Initial Displacement: 1. ft
Static Water Column Height: 27.5 ft
Total Well Penetration Depth: 27.5 ft
Screen Length: 15. ft
Casing Radius: 0.08 ft
Wellbore Radius: 0.1 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Butler

K = 0.01923 ft/min
C(D) = 0.8438



WELL TEST ANALYSIS

Data Set: R:\335392OmegaWA275\Field_Sampling\Slug_Testing\analysis\MW18B\Best_MW18B.aqt
Date: 08/01/07 Time: 11:40:27

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 335392
Location: RIV
Test Well: MW18B
Test Date: 2006

AQUIFER DATA

Saturated Thickness: 12.5 ft
Anisotropy Ratio (Kz/Kr): 0.1

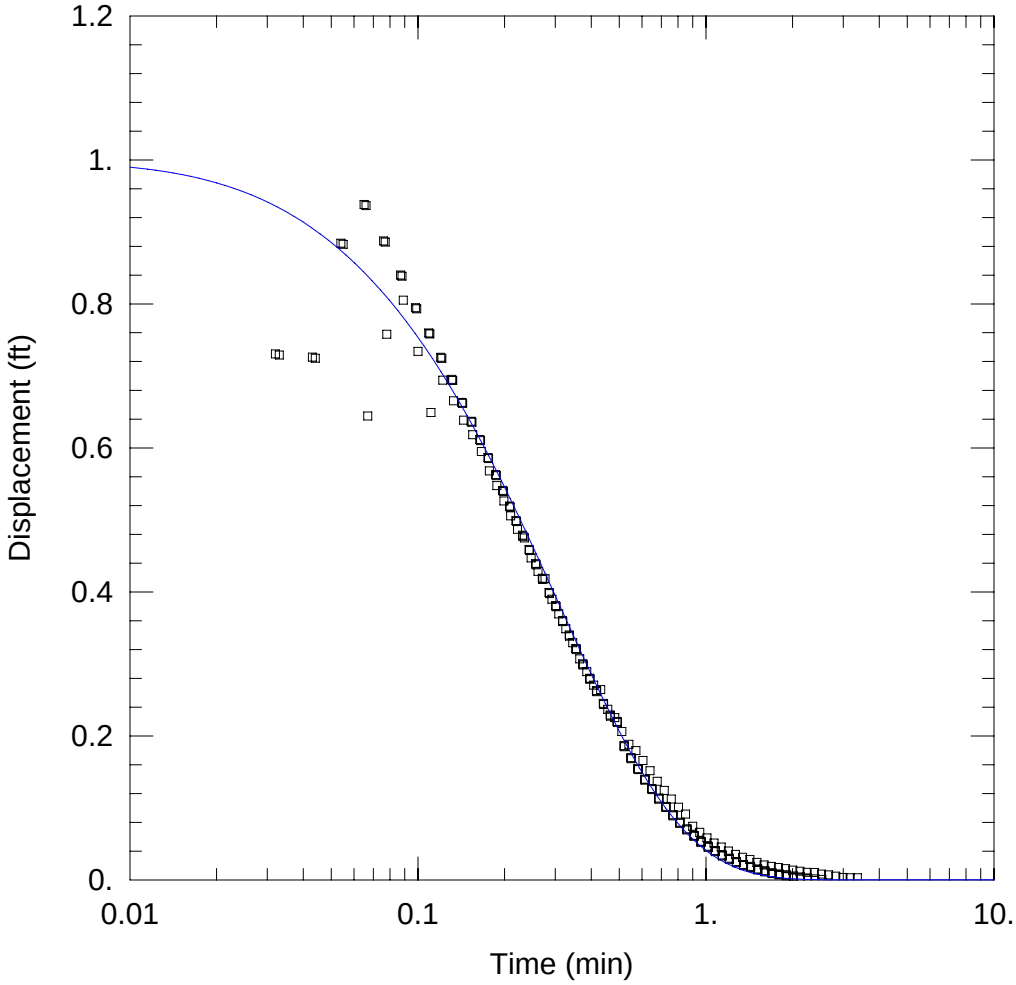
WELL DATA (MW18B)

Initial Displacement: 1. ft
Static Water Column Height: 12.5 ft
Total Well Penetration Depth: 12.5 ft
Screen Length: 10. ft
Casing Radius: 0.08 ft
Wellbore Radius: 0.1 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Butler

K = 0.02535 ft/min
C(D) = 0.7875



WELL TEST ANALYSIS

Data Set: R:\...\Best_MW18C_Butler.aqt
Date: 08/01/07 Time: 11:43:50

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 335392
Location: RIV
Test Well: MW18C
Test Date: 2006

AQUIFER DATA

Saturated Thickness: 39. ft
Anisotropy Ratio (Kz/Kr): 0.1

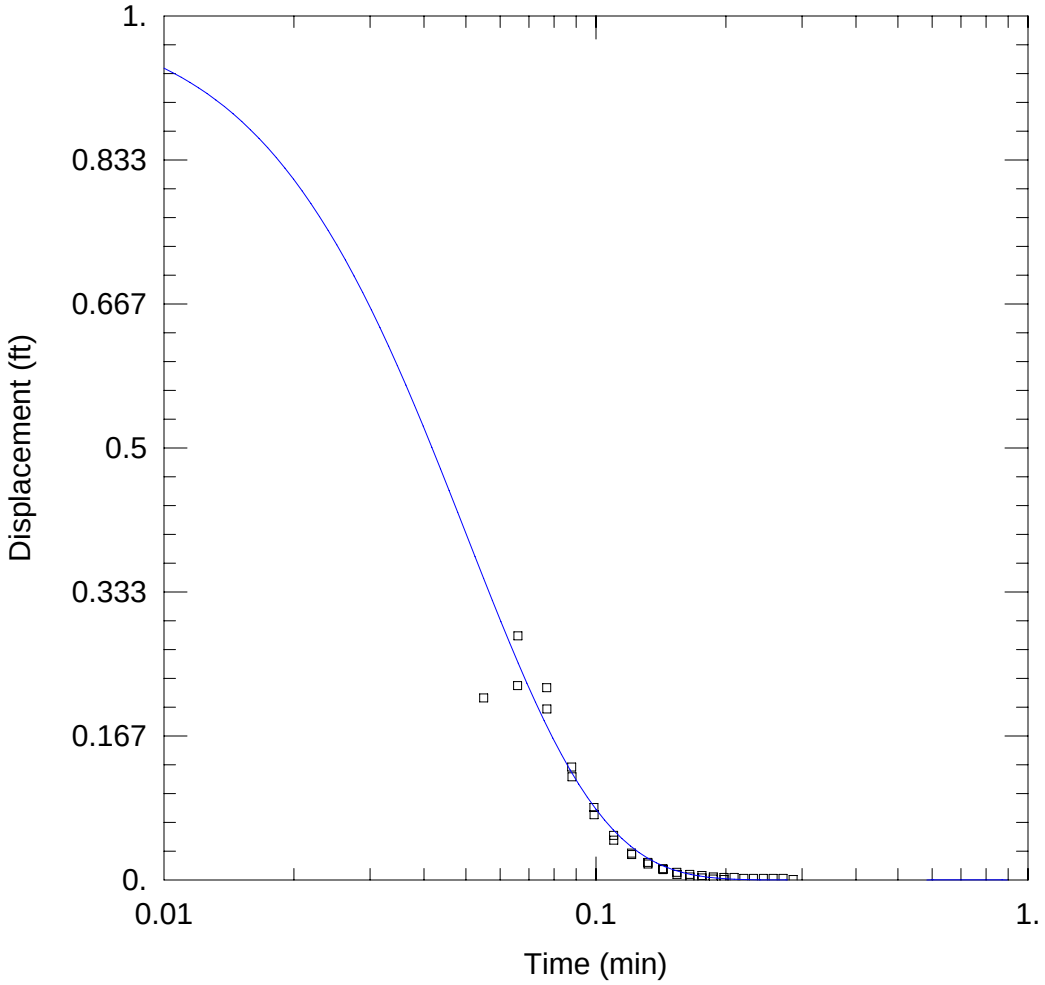
WELL DATA (MW18C)

Initial Displacement: 1. ft
Total Well Penetration Depth: 39. ft
Casing Radius: 0.08 ft
Static Water Column Height: 39. ft
Screen Length: 15. ft
Wellbore Radius: 0.1 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Butler

K = 0.004553 ft/min
C(D) = 2.6



WELL TEST ANALYSIS

Data Set: R:\...\Best_MW20A_out_Butler.aqt
Date: 08/01/07 Time: 11:53:25

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 335392
Location: RIV
Test Well: MW20A
Test Date: 2006

AQUIFER DATA

Saturated Thickness: 25. ft Anisotropy Ratio (Kz/Kr): 0.1

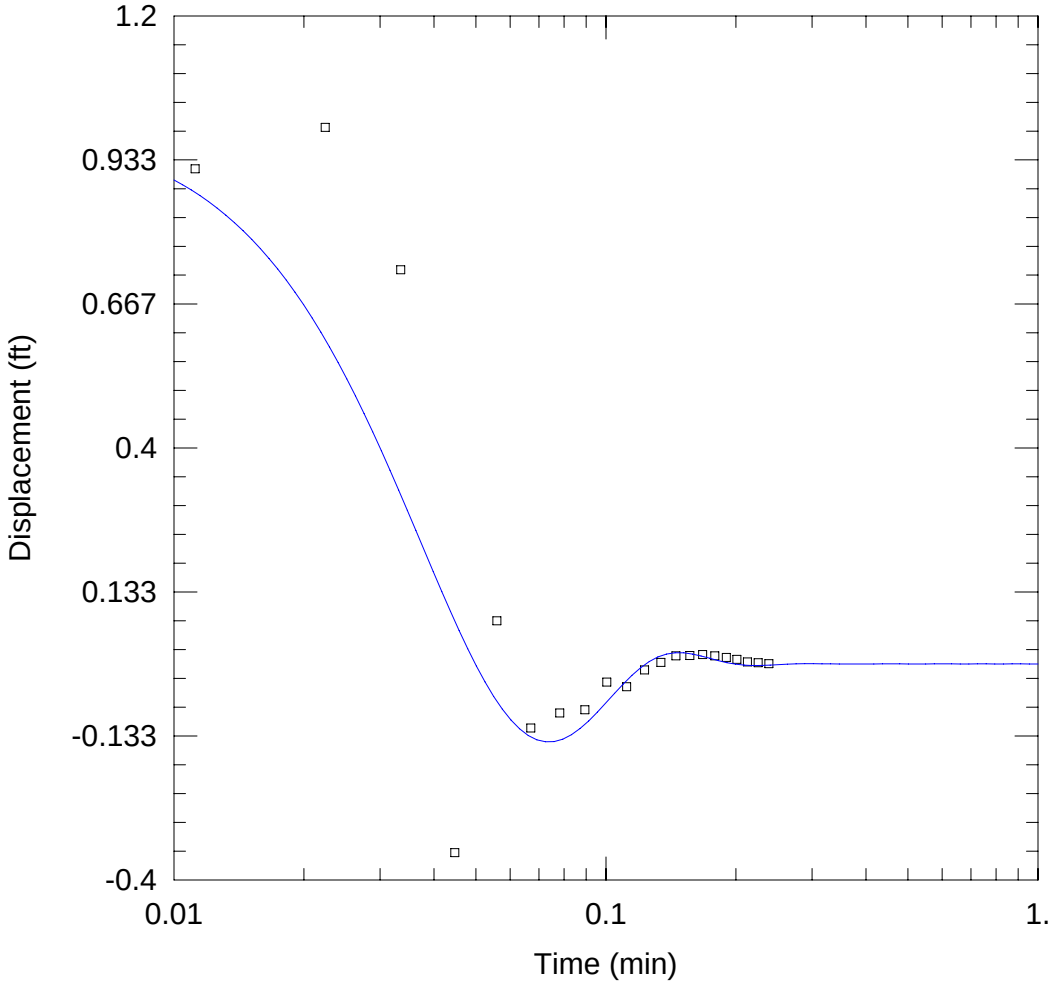
WELL DATA (MW20A)

Initial Displacement: 1. ft Static Water Column Height: 25. ft
Total Well Penetration Depth: 25. ft Screen Length: 15. ft
Casing Radius: 0.08 ft Wellbore Radius: 0.1 ft

SOLUTION

Aquifer Model: Confined Solution Method: Butler

K = 0.02988 ft/min C(D) = 0.9646



WELL TEST ANALYSIS

Data Set: C:\...\MW20B_in_Butler.aqt
Date: 10/11/07 Time: 10:58:27

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 335392
Location: RIV
Test Well: MW20B
Test Date: 2006

AQUIFER DATA

Saturated Thickness: 20. ft Anisotropy Ratio (Kz/Kr): 0.1

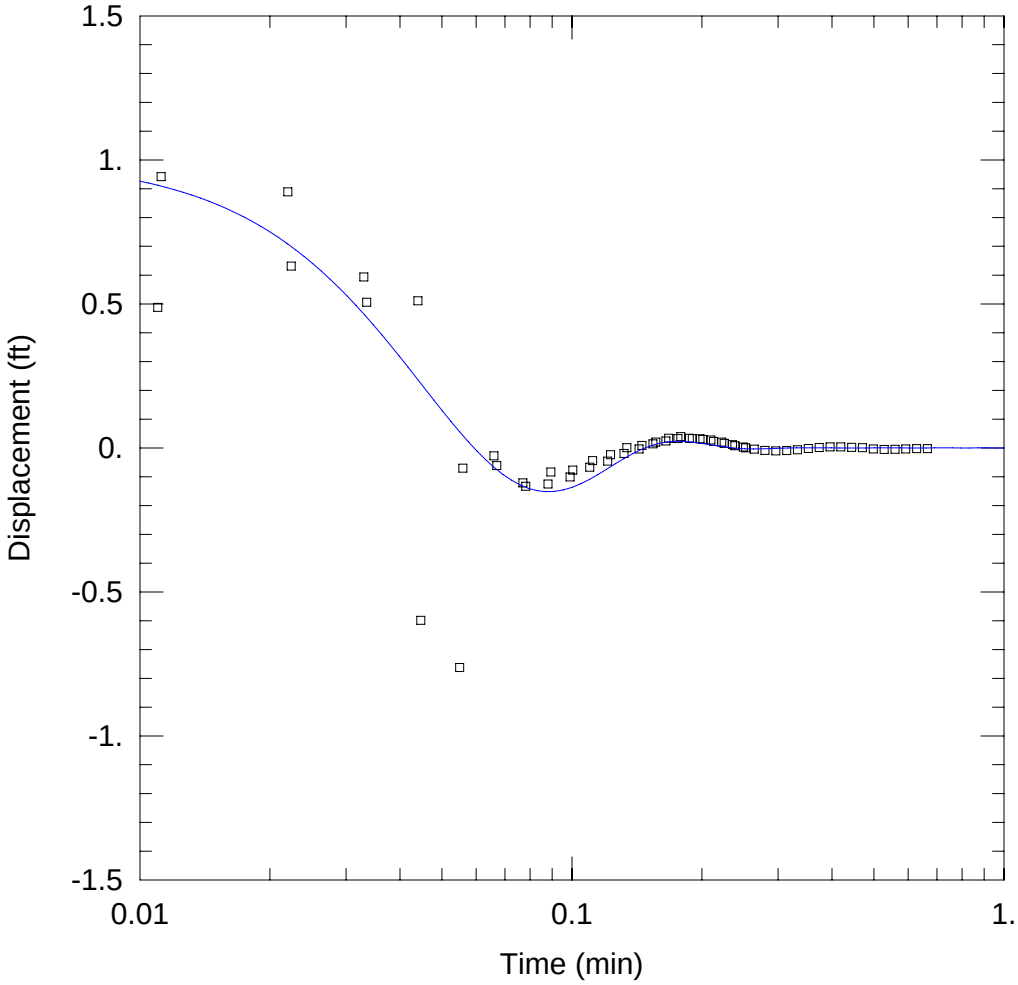
WELL DATA (MW20B)

Initial Displacement: 1. ft
Total Well Penetration Depth: 15. ft
Casing Radius: 0.08 ft
Static Water Column Height: 15. ft
Screen Length: 10. ft
Wellbore Radius: 0.1 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Butler

K = 0.08789 ft/min
C(D) = 0.5242



WELL TEST ANALYSIS

Data Set: R:\...\MW20C_in_Butler.aqt
Date: 08/01/07 Time: 12:05:22

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 335392
Location: RIV
Test Well: MW20C
Test Date: 2006

AQUIFER DATA

Saturated Thickness: 15. ft Anisotropy Ratio (Kz/Kr): 0.1

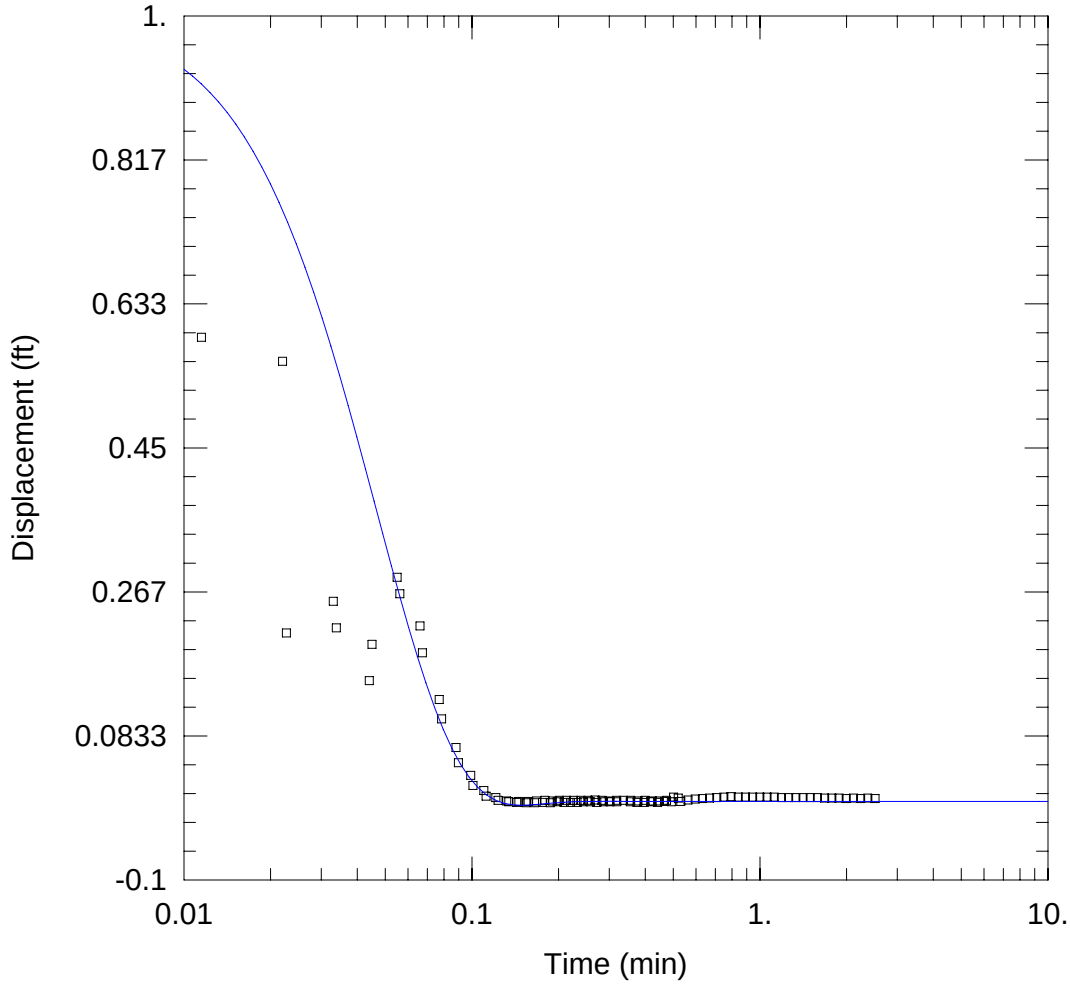
WELL DATA (MW20C)

Initial Displacement: 1. ft Static Water Column Height: 15. ft
Total Well Penetration Depth: 15. ft Screen Length: 10. ft
Casing Radius: 0.08 ft Wellbore Radius: 0.1 ft

SOLUTION

Aquifer Model: Confined Solution Method: Butler

K = 0.08328 ft/min C(D) = 0.5142



WELL TEST ANALYSIS

Data Set: R:\...\MW21_out_Butler.aqt
Date: 08/01/07 Time: 12:10:09

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 335392
Location: RIV
Test Well: MW21
Test Date: 2006

AQUIFER DATA

Saturated Thickness: 24.5 ft Anisotropy Ratio (Kz/Kr): 0.1

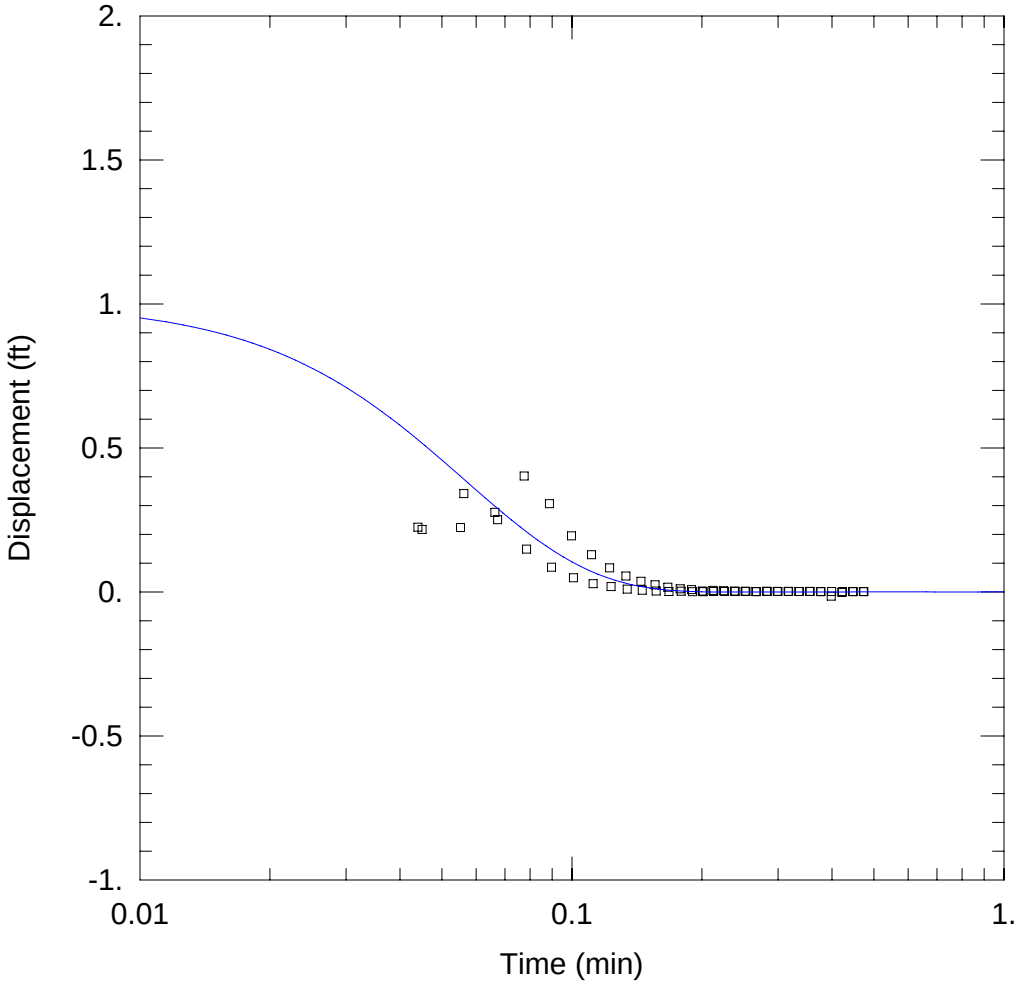
WELL DATA (MW21)

Initial Displacement: 1. ft
Total Well Penetration Depth: 24.5 ft
Casing Radius: 0.08 ft
Static Water Column Height: 24.5 ft
Screen Length: 15. ft
Wellbore Radius: 0.1 ft

SOLUTION

Aquifer Model: Confined Solution Method: Butler

K = 0.03529 ft/min C(D) = 0.861



WELL TEST ANALYSIS

Data Set: R:\...\Best_MW22_out1_Butler.aqt
Date: 08/01/07 Time: 12:55:00

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 335392
Location: RIV
Test Well: MW22
Test Date: 2006

AQUIFER DATA

Saturated Thickness: 28. ft Anisotropy Ratio (Kz/Kr): 0.1

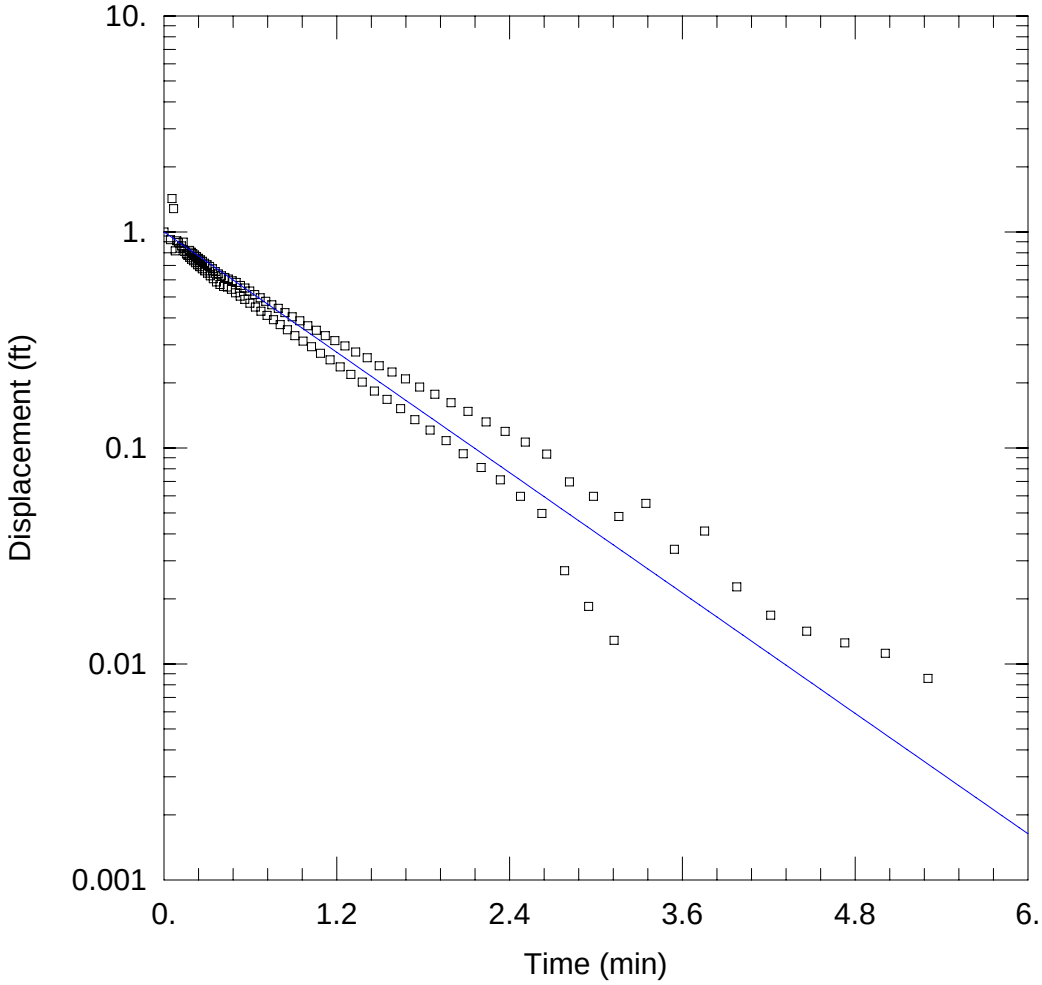
WELL DATA (MW22)

Initial Displacement: 1. ft Static Water Column Height: 28. ft
Total Well Penetration Depth: 28. ft Screen Length: 15. ft
Casing Radius: 0.08 ft Wellbore Radius: 0.1 ft

SOLUTION

Aquifer Model: Confined Solution Method: Butler

K = 0.0275 ft/min C(D) = 0.9226



WELL TEST ANALYSIS

Data Set: R:\...\Best_MW23Ain_B&R.aqt
Date: 08/02/07 Time: 08:47:23

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 335392
Location: RIV
Test Well: MW23A
Test Date: 2007

AQUIFER DATA

Saturated Thickness: 38.2 ft
Anisotropy Ratio (Kz/Kr): 0.1

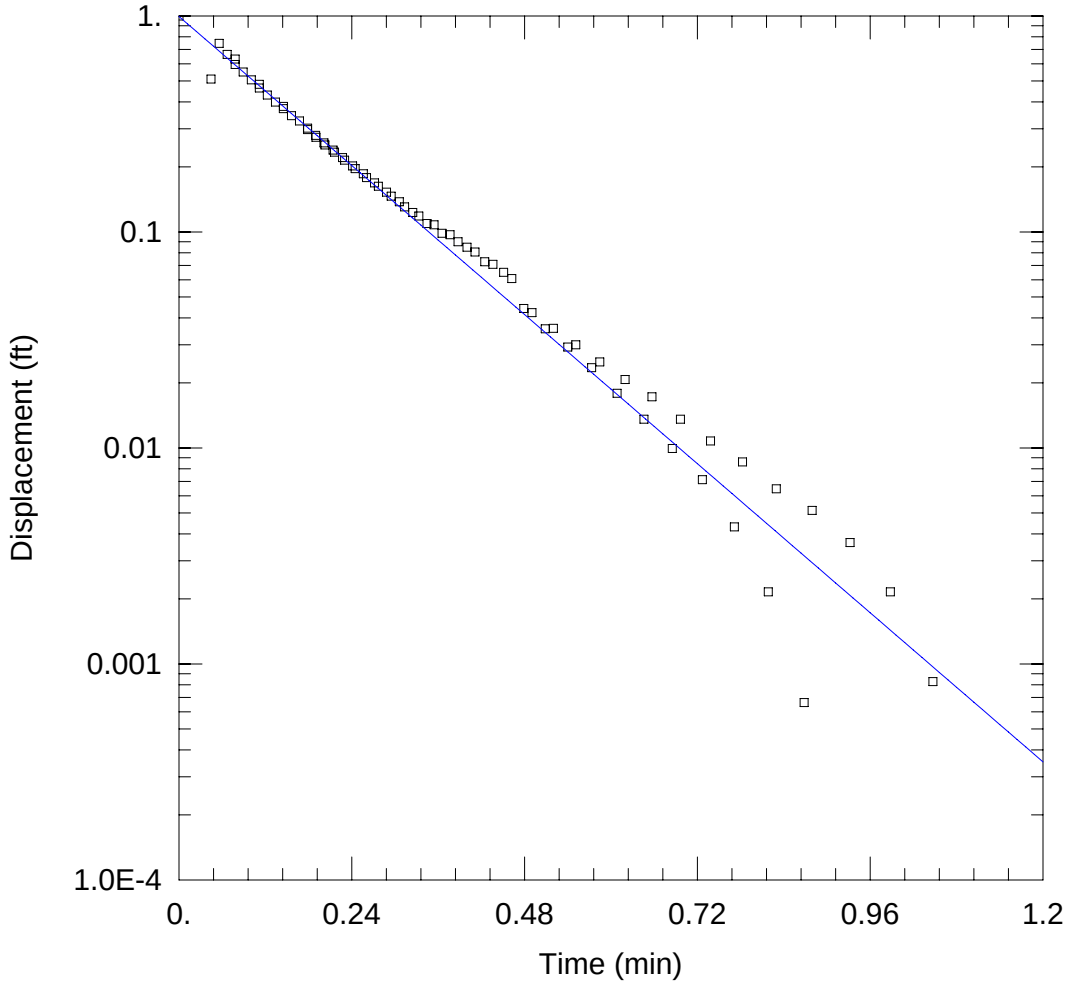
WELL DATA (MW23A)

Initial Displacement: 1. ft
Total Well Penetration Depth: 27.2 ft
Casing Radius: 0.158 ft
Static Water Column Height: 27.2 ft
Screen Length: 20. ft
Wellbore Radius: 0.2 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 0.0029 ft/min
y0 = 1. ft



WELL TEST ANALYSIS

Data Set: R:\...\Best_MW23Aout_B&R.aqt
Date: 08/02/07 Time: 08:49:45

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 335392
Location: RIV
Test Well: MW23A
Test Date: 2007

AQUIFER DATA

Saturated Thickness: 38.2 ft
Anisotropy Ratio (Kz/Kr): 0.1

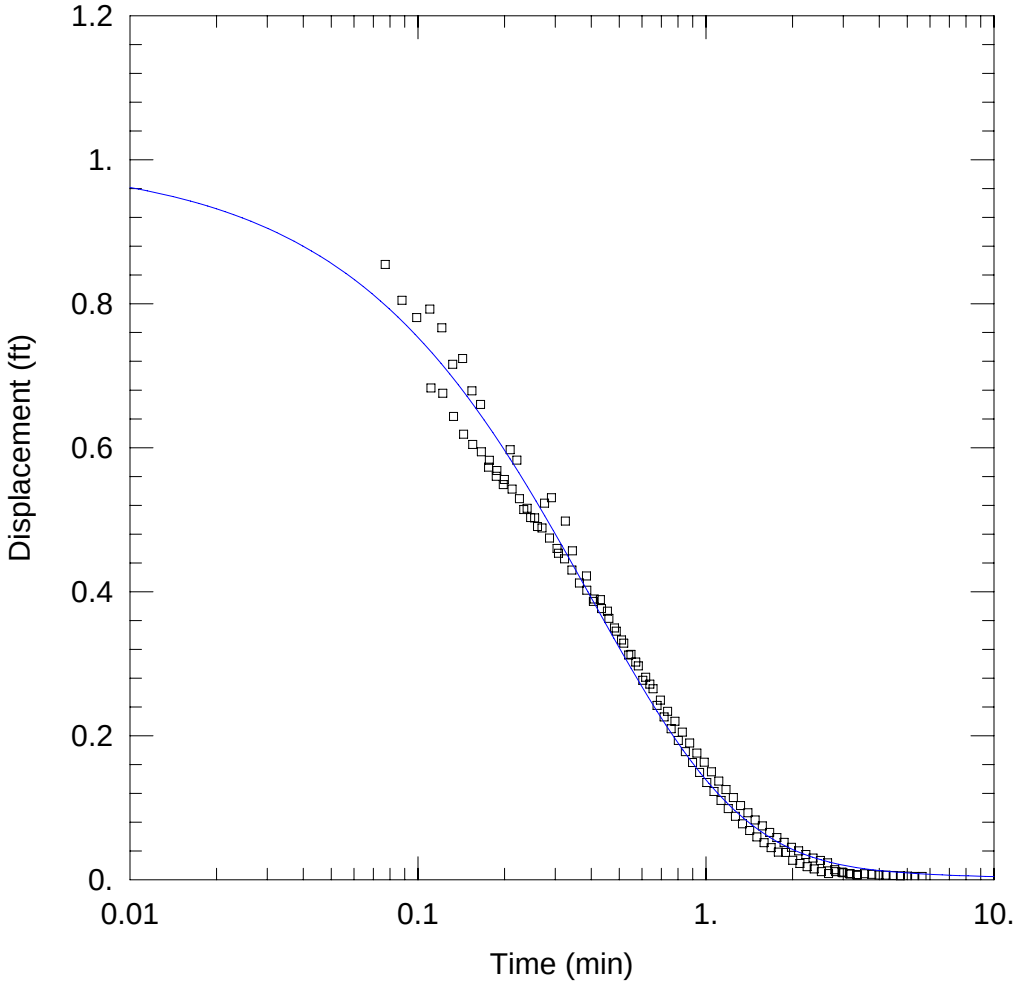
WELL DATA (MW23A)

Initial Displacement: 1. ft
Total Well Penetration Depth: 27.2 ft
Casing Radius: 0.158 ft
Static Water Column Height: 27.2 ft
Screen Length: 20. ft
Wellbore Radius: 0.2 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 0.01796 ft/min
y0 = 0.9941 ft



WELL TEST ANALYSIS

Data Set: R:\...\Best_MW23B_KGS no skin.aqt
Date: 08/02/07 Time: 08:54:58

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 335392
Location: RIV
Test Well: MW23B
Test Date: 2006

AQUIFER DATA

Saturated Thickness: 10. ft

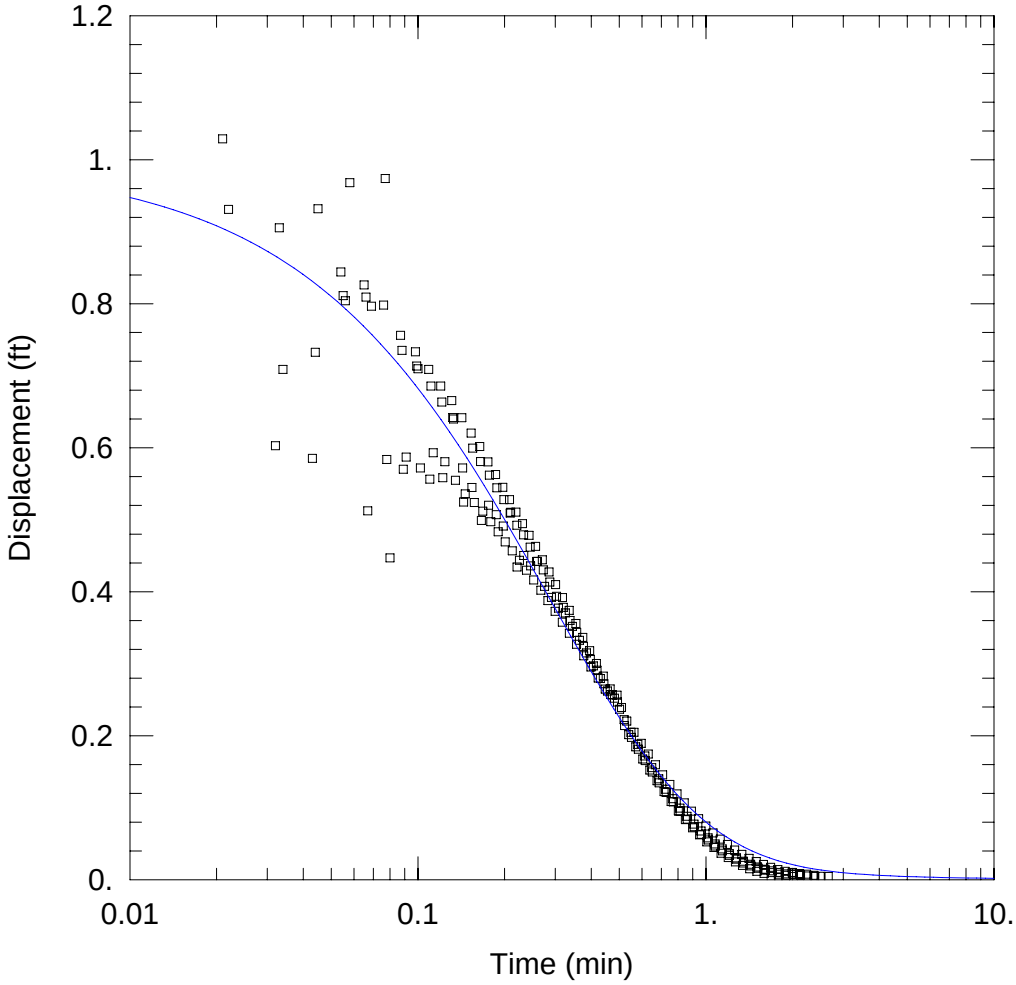
WELL DATA (MW23B)

Initial Displacement: 1. ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.08 ft
Static Water Column Height: 10. ft
Screen Length: 15. ft
Wellbore Radius: 0.1 ft

SOLUTION

Aquifer Model: Confined
Solution Method: KGS Model

Kr = 0.004195 ft/min
Kz/Kr = 0.1
Ss = 1.0E-5 ft^{-1}



WELL TEST ANALYSIS

Data Set: R:\335392OmegaWA275\Field_Sampling\Slug_Testing\analysis\MW23C\MW23C_KGS.aqt
Date: 08/02/07 Time: 08:57:24

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 335392
Location: RIV
Test Well: MW23C
Test Date: 2006

AQUIFER DATA

Saturated Thickness: 28.5 ft

WELL DATA (MW23C)

Initial Displacement: 1. ft
Total Well Penetration Depth: 28.5 ft
Casing Radius: 0.08 ft

Static Water Column Height: 28.5 ft
Screen Length: 15. ft
Wellbore Radius: 0.1 ft

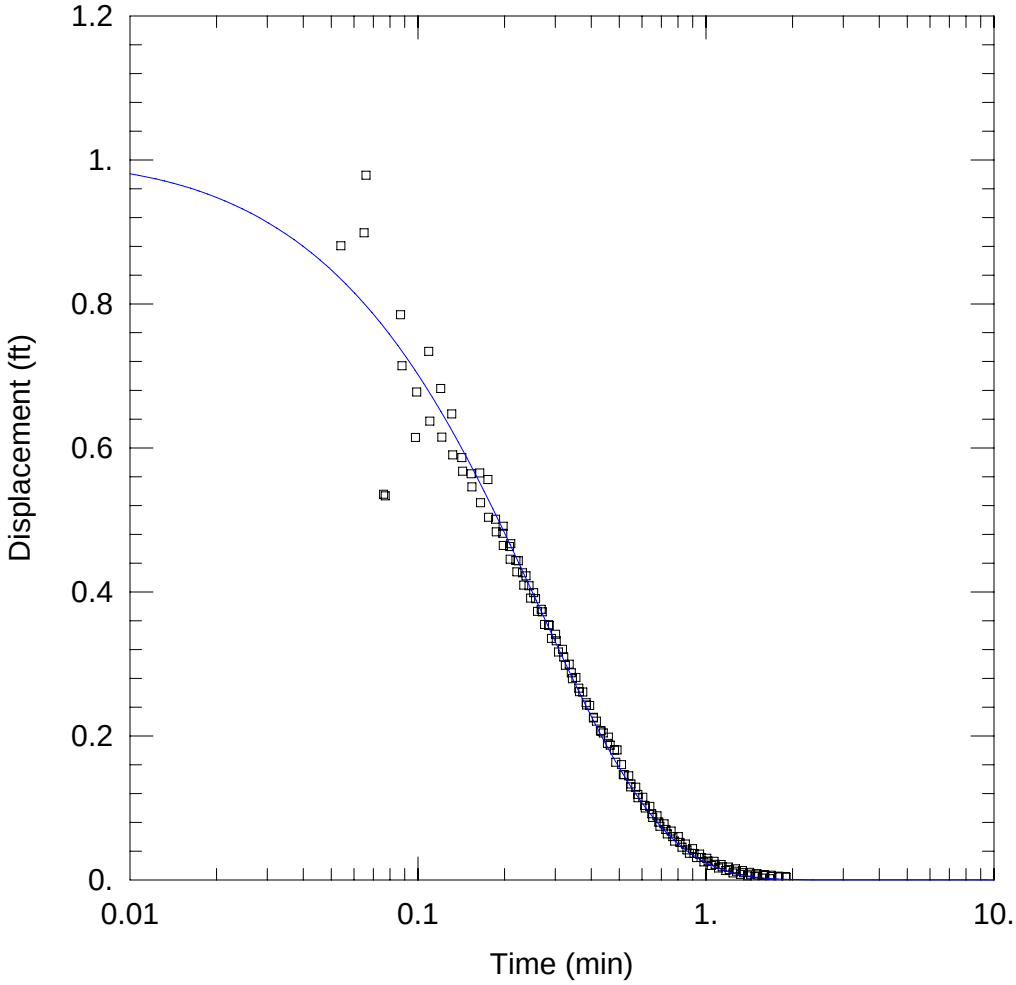
SOLUTION

Aquifer Model: Confined

Solution Method: KGS Model

Kr = 0.003311 ft/min
Kz/Kr = 0.1

Ss = 1.0E-5 ft^{-1}



WELL TEST ANALYSIS

Data Set: R:\...\Best_MW23D_Butler.aqt
Date: 08/02/07 Time: 09:20:05

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 335392
Location: RIV
Test Well: MW23D
Test Date: 2006

AQUIFER DATA

Saturated Thickness: 20. ft
Anisotropy Ratio (Kz/Kr): 0.1

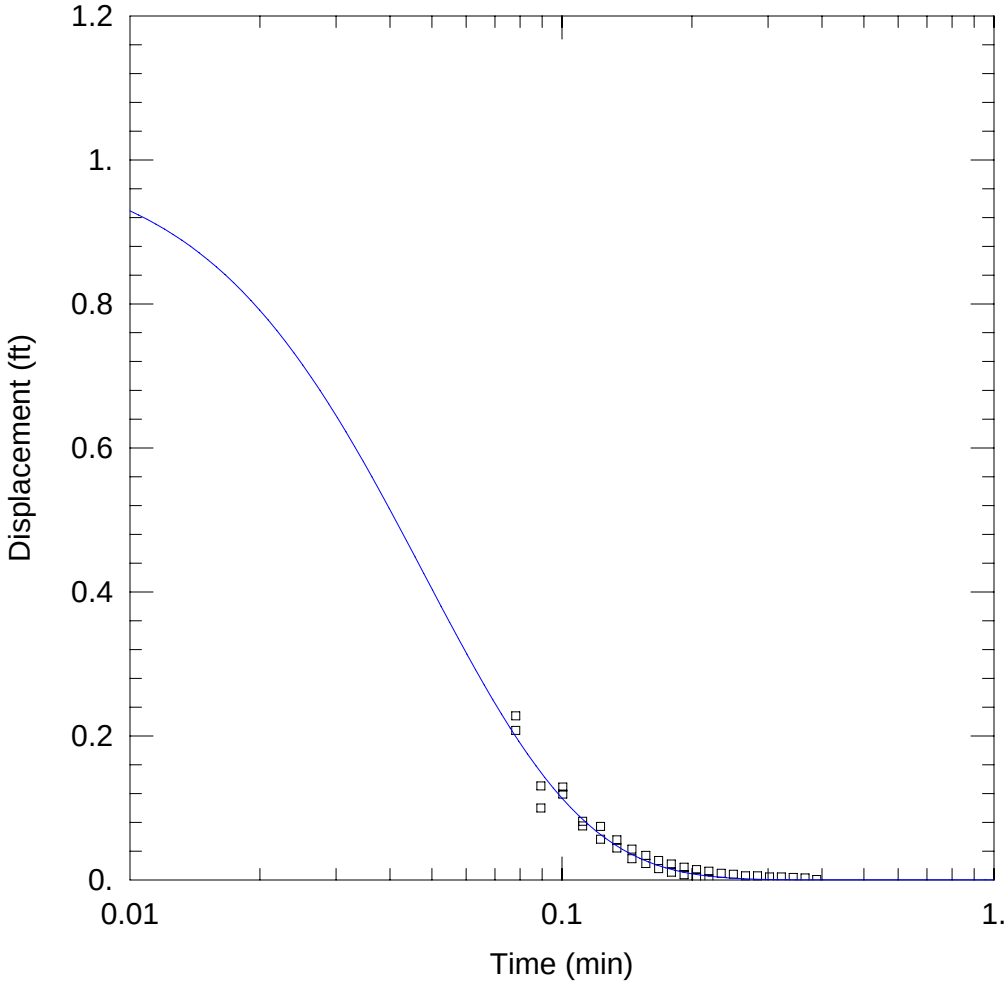
WELL DATA (MW23D)

Initial Displacement: 1. ft
Total Well Penetration Depth: 20. ft
Casing Radius: 0.08 ft
Static Water Column Height: 20. ft
Screen Length: 10. ft
Wellbore Radius: 0.1 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Butler

K = 0.007604 ft/min
C(D) = 3.428



WELL TEST ANALYSIS

Data Set: R:\...\Best_MW24Ain_Butler.aqt
Date: 08/02/07 Time: 09:33:40

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 335392
Location: RIV
Test Well: MW24A
Test Date: 2007

AQUIFER DATA

Saturated Thickness: 37.2 ft Anisotropy Ratio (Kz/Kr): 0.1

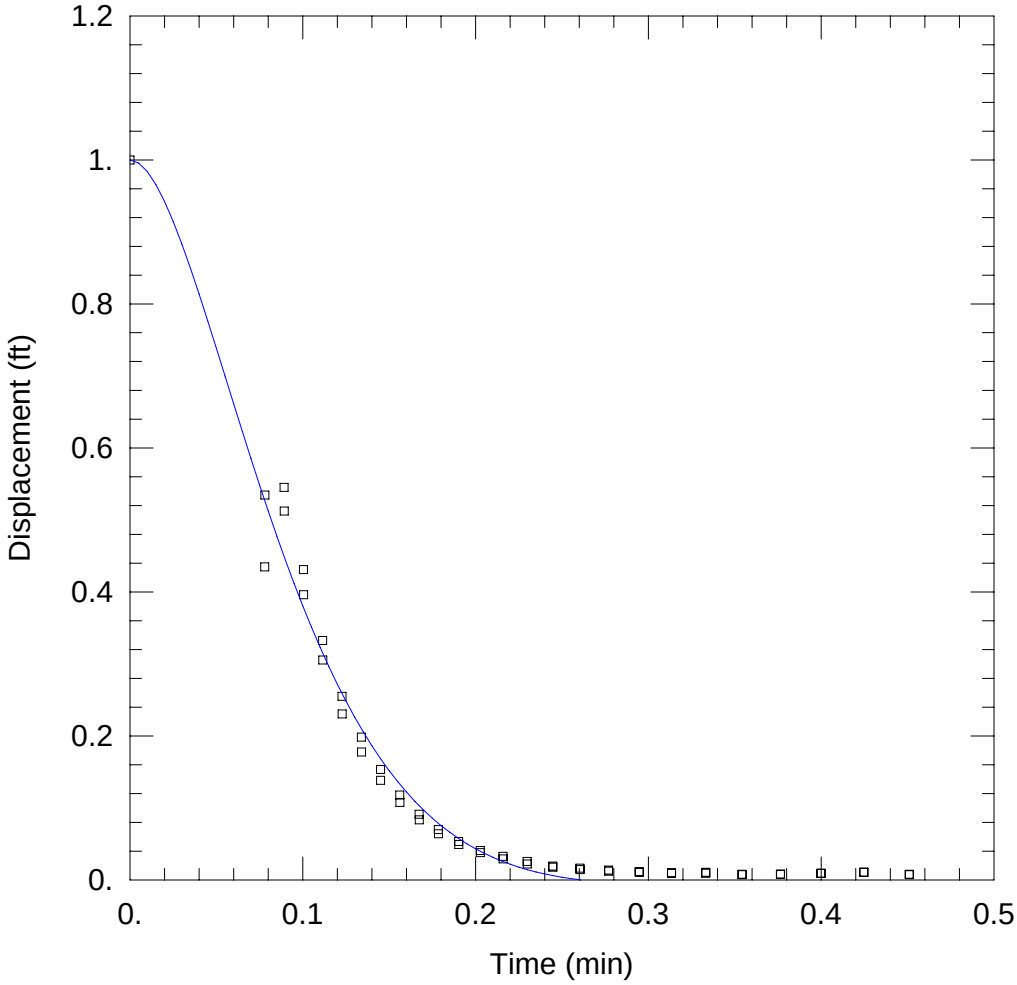
WELL DATA (MW24A)

Initial Displacement: 1. ft Static Water Column Height: 33.2 ft
Total Well Penetration Depth: 33.2 ft Screen Length: 20. ft
Casing Radius: 0.158 ft Wellbore Radius: 0.2 ft

SOLUTION

Aquifer Model: Confined Solution Method: Butler

K = 0.06939 ft/min C(D) = 1.147



WELL TEST ANALYSIS

Data Set: R:\...\Best_MW24Aout_Butler.aqt
Date: 08/02/07 Time: 09:32:52

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 335392
Location: RIV
Test Well: MW24A
Test Date: 2007

AQUIFER DATA

Saturated Thickness: 37.2 ft
Anisotropy Ratio (Kz/Kr): 0.1

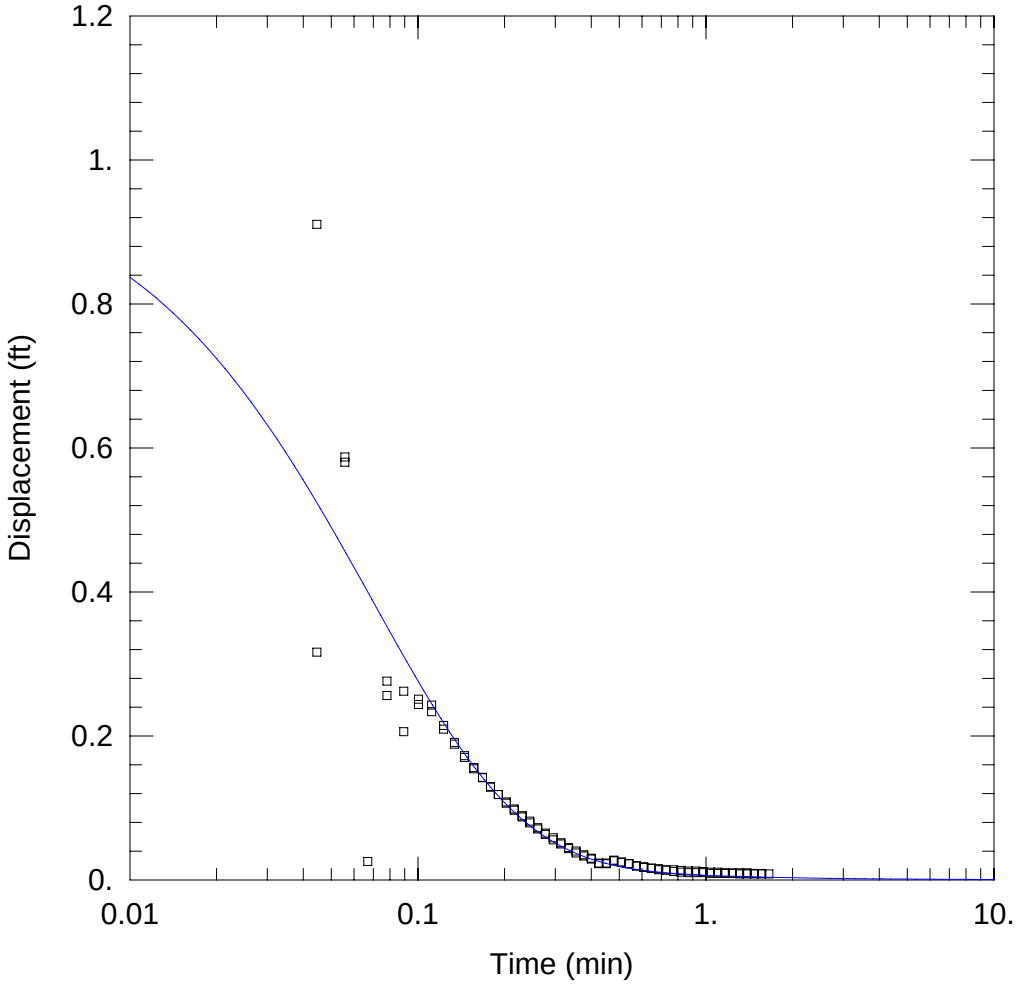
WELL DATA (MW24A)

Initial Displacement: 1. ft
Total Well Penetration Depth: 33.2 ft
Casing Radius: 0.158 ft
Static Water Column Height: 33.2 ft
Screen Length: 20. ft
Wellbore Radius: 0.2 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Butler

K = 0.03992 ft/min
C(D) = 0.8515



WELL TEST ANALYSIS

Data Set: R:\...\Best_MW24Bin_KGS.aqt
Date: 08/02/07 Time: 12:14:35

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 335392
Location: RIV
Test Well: MW24B
Test Date: 2007

AQUIFER DATA

Saturated Thickness: 22. ft

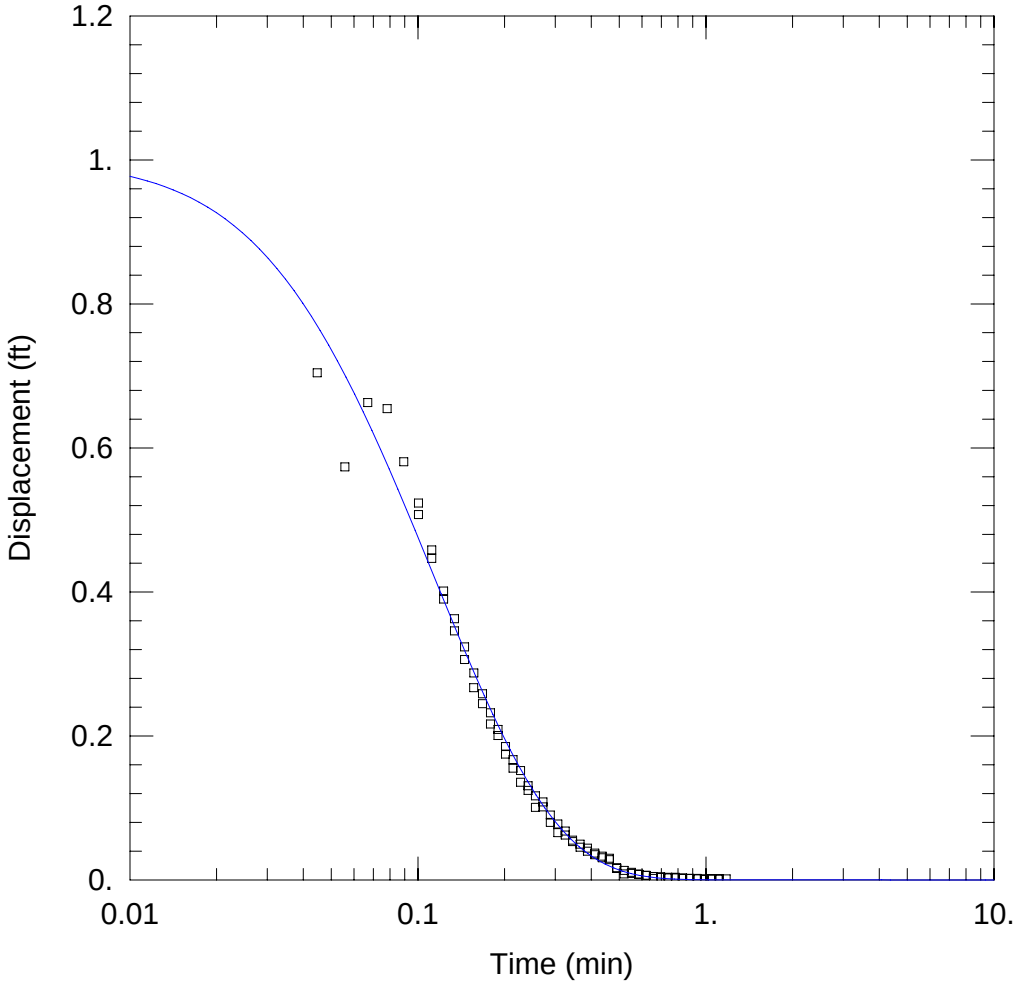
WELL DATA (MW24B)

Initial Displacement: 1. ft
Total Well Penetration Depth: 17. ft
Casing Radius: 0.08 ft
Static Water Column Height: 17. ft
Screen Length: 15. ft
Wellbore Radius: 0.1 ft

SOLUTION

Aquifer Model: Confined
Solution Method: KGS Model

Kr = 0.01343 ft/min
Kz/Kr = 0.1
Ss = 1.0E-5 ft^{-1}



WELL TEST ANALYSIS

Data Set: R:\...\Best_MW24Bout_Butler.aqt
Date: 08/02/07 Time: 12:16:47

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 335392
Location: RIV
Test Well: MW24B
Test Date: 2007

AQUIFER DATA

Saturated Thickness: 22. ft Anisotropy Ratio (Kz/Kr): 0.1

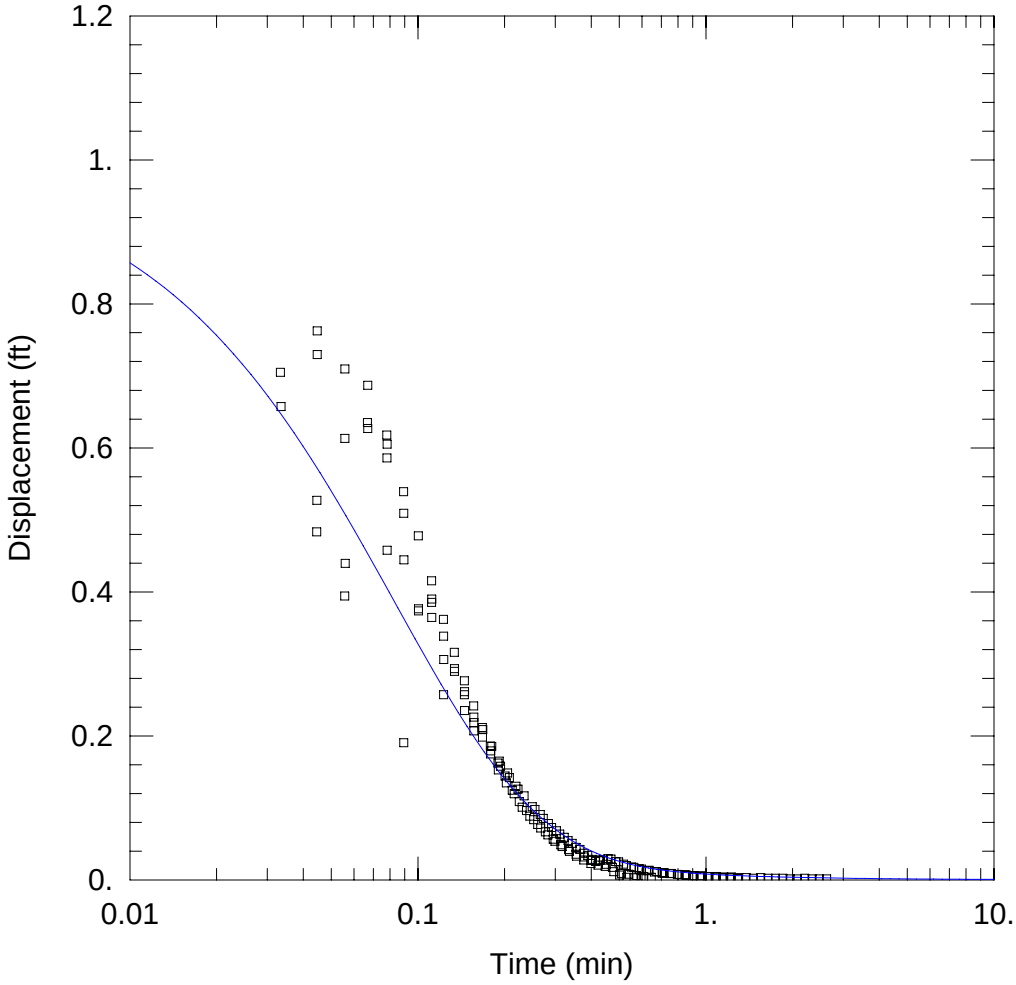
WELL DATA (MW24B)

Initial Displacement: 1. ft Static Water Column Height: 17. ft
Total Well Penetration Depth: 17. ft Screen Length: 15. ft
Casing Radius: 0.08 ft Wellbore Radius: 0.1 ft

SOLUTION

Aquifer Model: Confined Solution Method: Butler

K = 0.01028 ft/min C(D) = 1.539



WELL TEST ANALYSIS

Data Set: R:\...\MW24Call_KGS.aqt
Date: 08/02/07 Time: 12:23:57

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 335392
Location: RIV
Test Well: MW24C
Test Date: 2007

AQUIFER DATA

Saturated Thickness: 30. ft

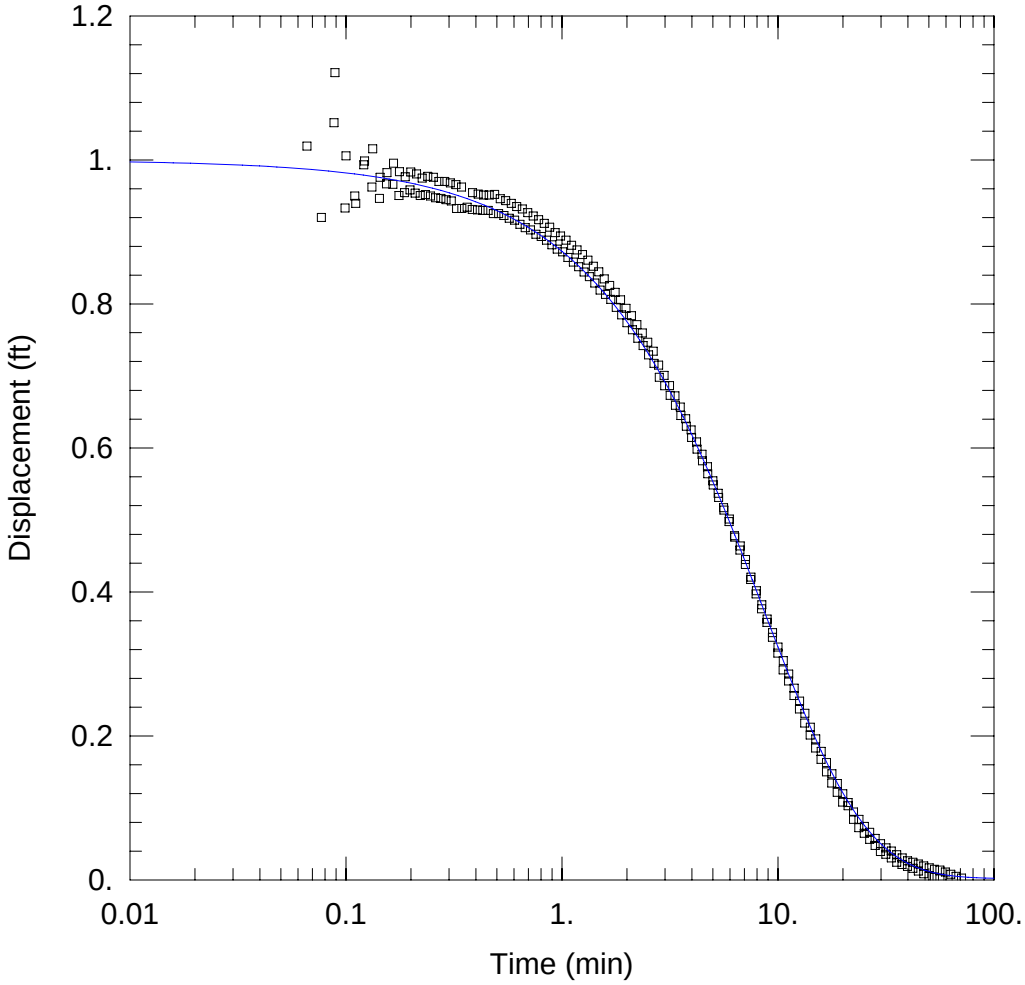
WELL DATA (MW24C)

Initial Displacement: 1. ft
Total Well Penetration Depth: 26. ft
Casing Radius: 0.158 ft
Static Water Column Height: 26. ft
Screen Length: 20. ft
Wellbore Radius: 0.2 ft

SOLUTION

Aquifer Model: Confined
Solution Method: KGS Model

Kr = 0.03151 ft/min
Kz/Kr = 0.1
Ss = 1.0E-5 ft^{-1}



WELL TEST ANALYSIS

Data Set: R:\335392OmegaWA275\Field_Sampling\Slug_Testing\analysis\MW24D\MW24Din_KGS.aqt
Date: 08/02/07 Time: 12:28:29

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 335392
Location: RIV
Test Well: MW24D
Test Date: 2007

AQUIFER DATA

Saturated Thickness: 22. ft

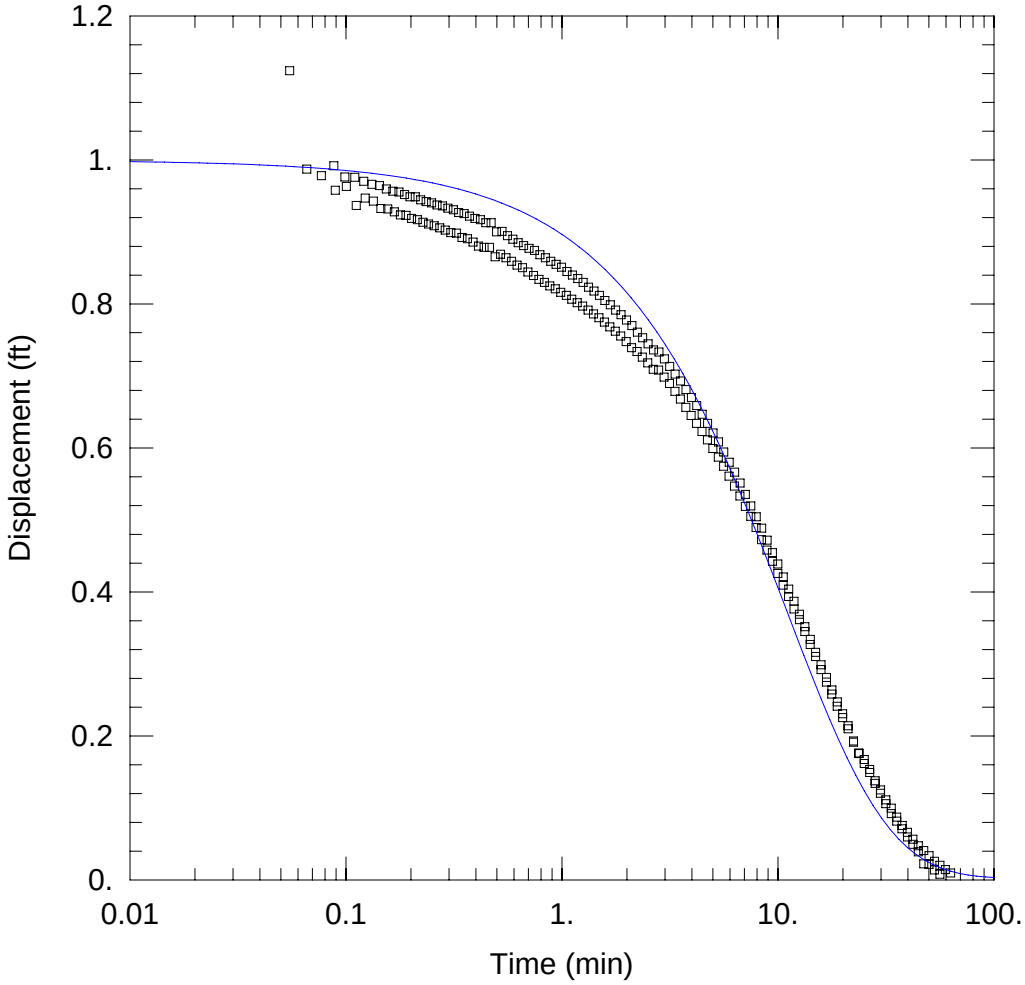
WELL DATA (MW24D)

Initial Displacement: 1. ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.08 ft
Static Water Column Height: 10. ft
Screen Length: 5. ft
Wellbore Radius: 0.1 ft

SOLUTION

Aquifer Model: Confined
Solution Method: KGS Model

Kr = 0.000325 ft/min
Kz/Kr = 0.1
Ss = 1.0E-5 ft^{-1}



WELL TEST ANALYSIS

Data Set: R:\...\MW24Dout_KGS.aqt
Date: 08/02/07 Time: 12:30:33

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 335392
Location: RIV
Test Well: MW24D
Test Date: 2007

AQUIFER DATA

Saturated Thickness: 22. ft

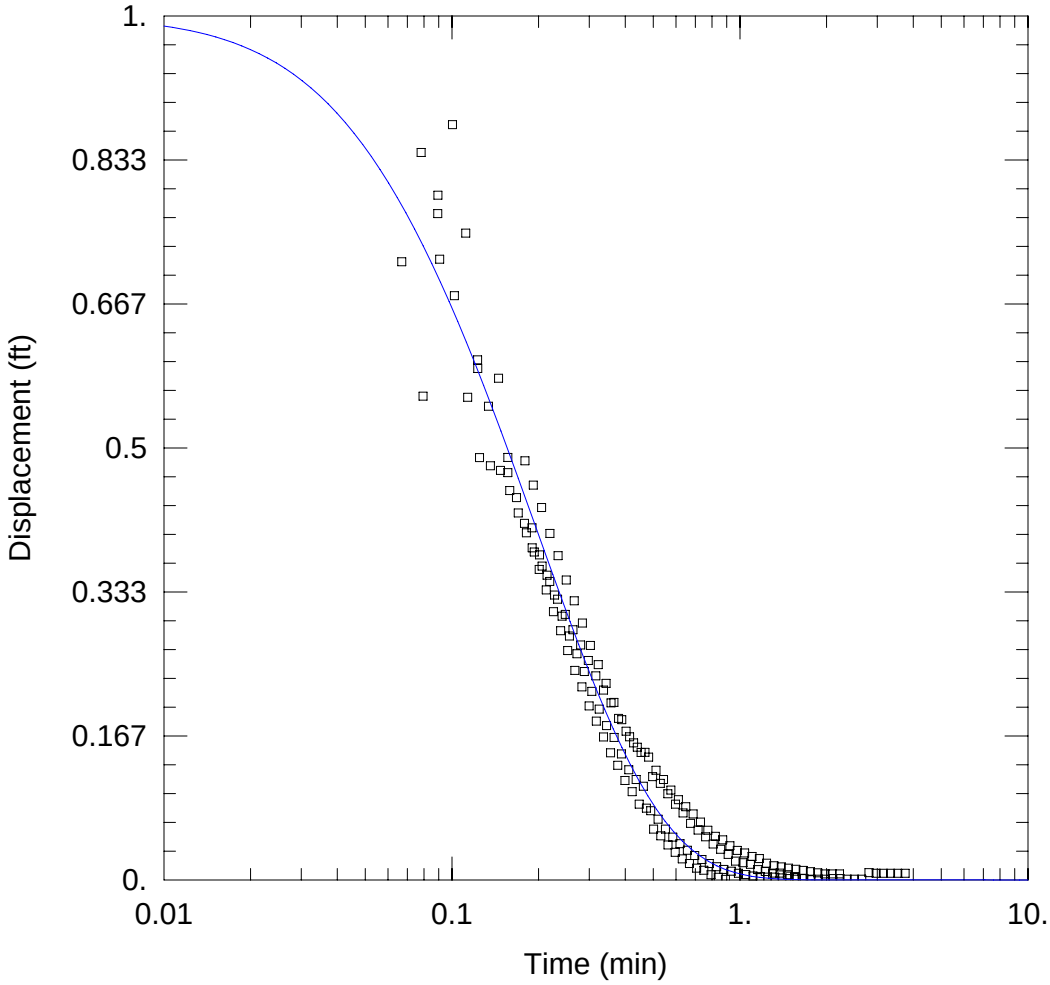
WELL DATA (MW24D)

Initial Displacement: 1. ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.08 ft
Static Water Column Height: 10. ft
Screen Length: 5. ft
Wellbore Radius: 0.1 ft

SOLUTION

Aquifer Model: Confined
Solution Method: KGS Model

Kr = 0.0002552 ft/min
Kz/Kr = 0.1
Ss = 1.0E-5 ft^{-1}



WELL TEST ANALYSIS

Data Set: R:\...\Best_MW25B_Butler.aqt
Date: 08/02/07 Time: 13:46:42

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 335392
Location: RIV
Test Well: MW25B
Test Date: 2007

AQUIFER DATA

Saturated Thickness: 36. ft Anisotropy Ratio (Kz/Kr): 0.1

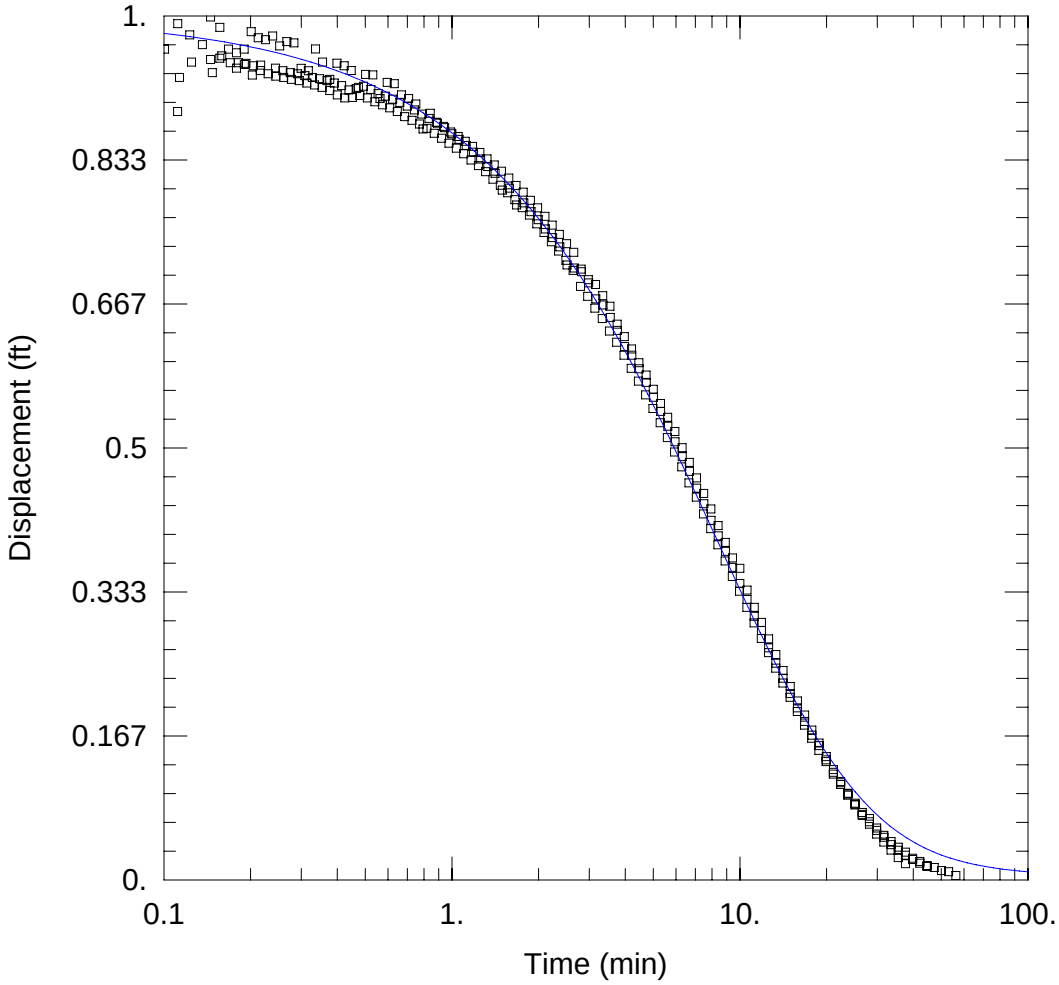
WELL DATA (MW25B)

Initial Displacement: 1. ft
Total Well Penetration Depth: 25. ft
Casing Radius: 0.08 ft
Static Water Column Height: 30. ft
Screen Length: 20. ft
Wellbore Radius: 0.1 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Butler

K = 0.004795 ft/min
C(D) = 1.817



WELL TEST ANALYSIS

Data Set: R:\...\MW25C_KGS_noskin.aqt
Date: 08/02/07 Time: 13:48:28

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 335392
Location: RIV
Test Well: MW25C
Test Date: 2007

AQUIFER DATA

Saturated Thickness: 13. ft

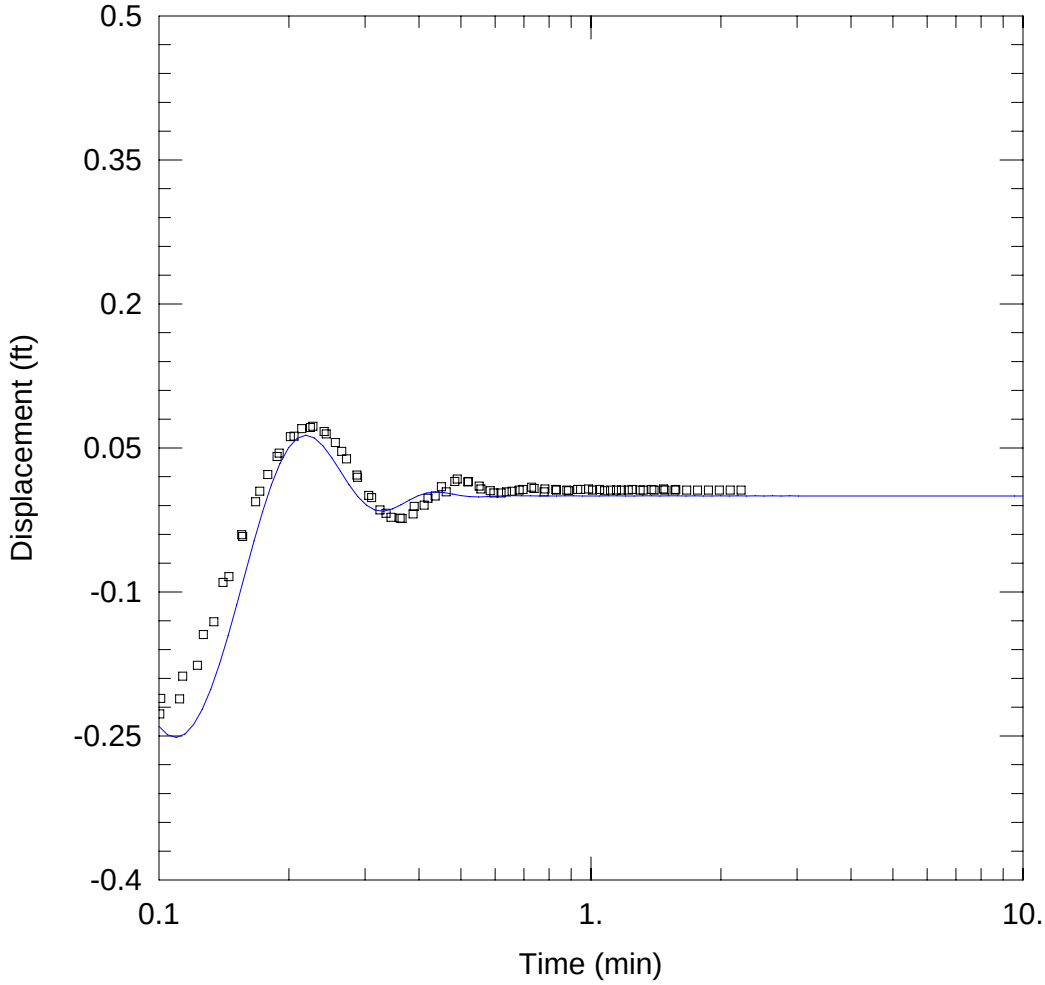
WELL DATA (MW25C)

Initial Displacement: 1. ft
Total Well Penetration Depth: 12. ft
Casing Radius: 0.158 ft
Static Water Column Height: 12. ft
Screen Length: 10. ft
Wellbore Radius: 0.2 ft

SOLUTION

Aquifer Model: Confined
Solution Method: KGS Model

Kr = 0.0006353 ft/min
Kz/Kr = 0.1
Ss = 1.0E-5 ft^{-1}



WELL TEST ANALYSIS

Data Set: R:\...\MW25D_in_Butler.aqt
Date: 08/02/07 Time: 13:49:53

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 335392
Location: RIV
Test Well: MW25D
Test Date: 2007

AQUIFER DATA

Saturated Thickness: 17. ft Anisotropy Ratio (Kz/Kr): 0.1

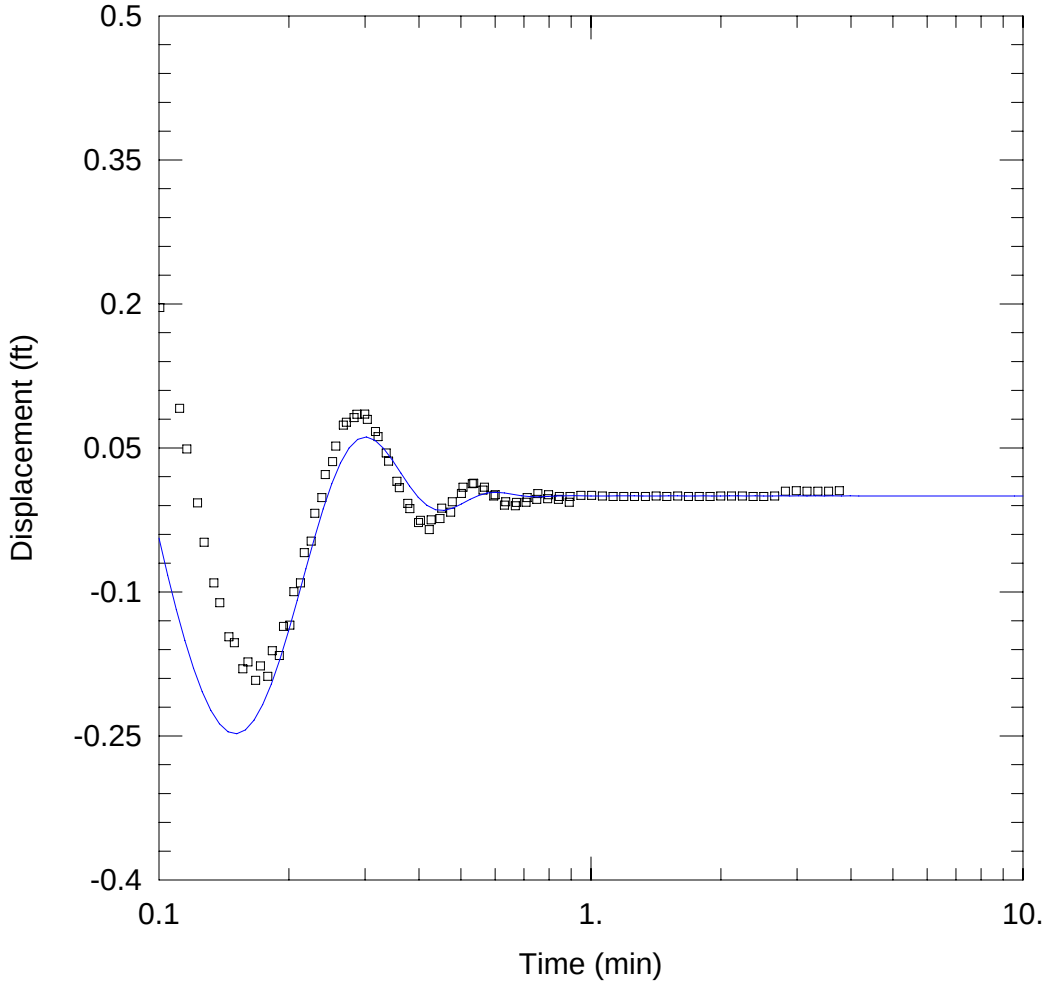
WELL DATA (MW25D)

Initial Displacement: 1. ft
Total Well Penetration Depth: 17. ft
Casing Radius: 0.08 ft
Static Water Column Height: 17. ft
Screen Length: 15. ft
Wellbore Radius: 0.1 ft

SOLUTION

Aquifer Model: Confined Solution Method: Butler

K = 0.05708 ft/min C(D) = 0.4021



WELL TEST ANALYSIS

Data Set: R:\...\MW25D_out_Butler.aqt
Date: 08/02/07 Time: 13:50:49

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 335392
Location: RIV
Test Well: MW25D
Test Date: 2007

AQUIFER DATA

Saturated Thickness: 17. ft Anisotropy Ratio (Kz/Kr): 0.1

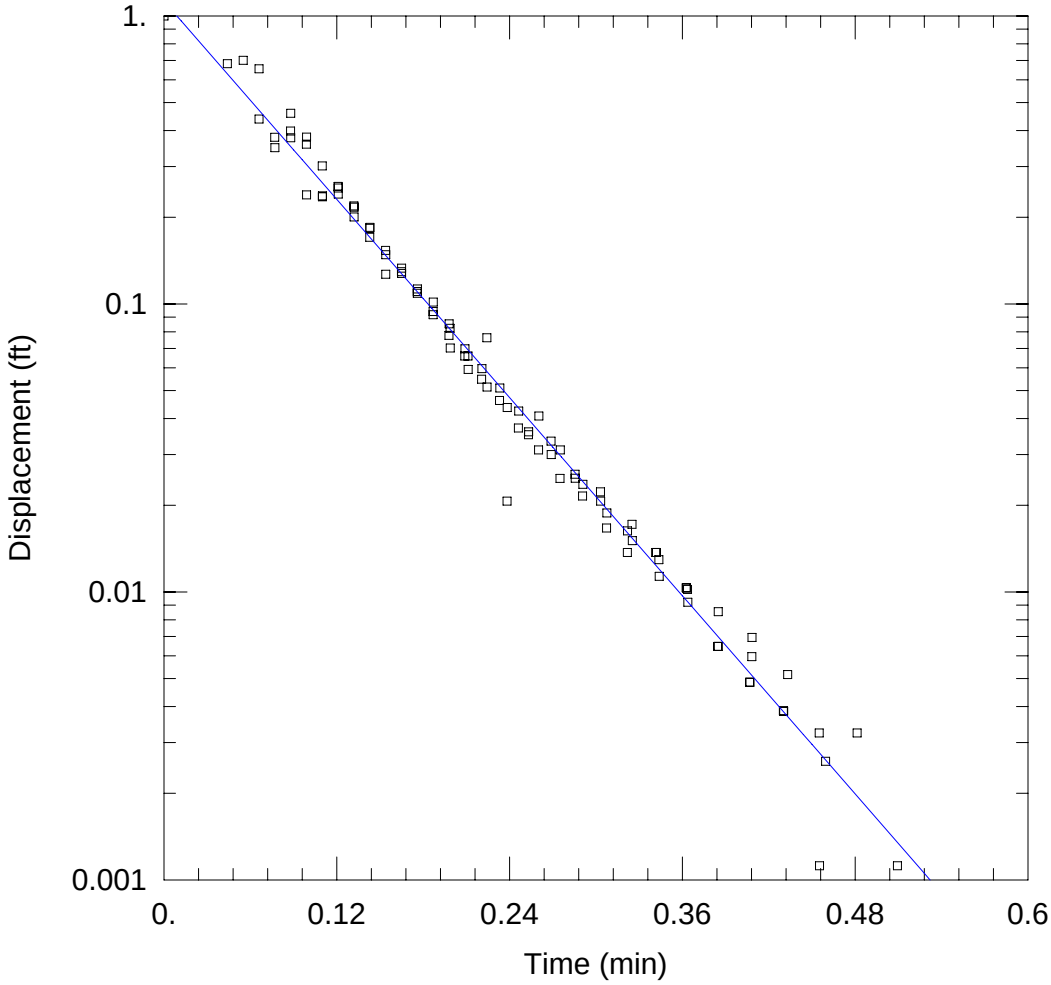
WELL DATA (MW25D)

Initial Displacement: 1. ft Static Water Column Height: 17. ft
Total Well Penetration Depth: 17. ft Screen Length: 15. ft
Casing Radius: 0.08 ft Wellbore Radius: 0.1 ft

SOLUTION

Aquifer Model: Confined Solution Method: Butler

K = 0.04122 ft/min C(D) = 0.4058



WELL TEST ANALYSIS

Data Set: R:\335392OmegaWA275\Field_Sampling\Slug_Testing\analysis\MW26\MW26A_BandR.aqt
Date: 08/02/07 Time: 13:59:51

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 335392
Location: RIV
Test Well: MW26A
Test Date: 2007

AQUIFER DATA

Saturated Thickness: 27.4 ft
Anisotropy Ratio (Kz/Kr): 0.1

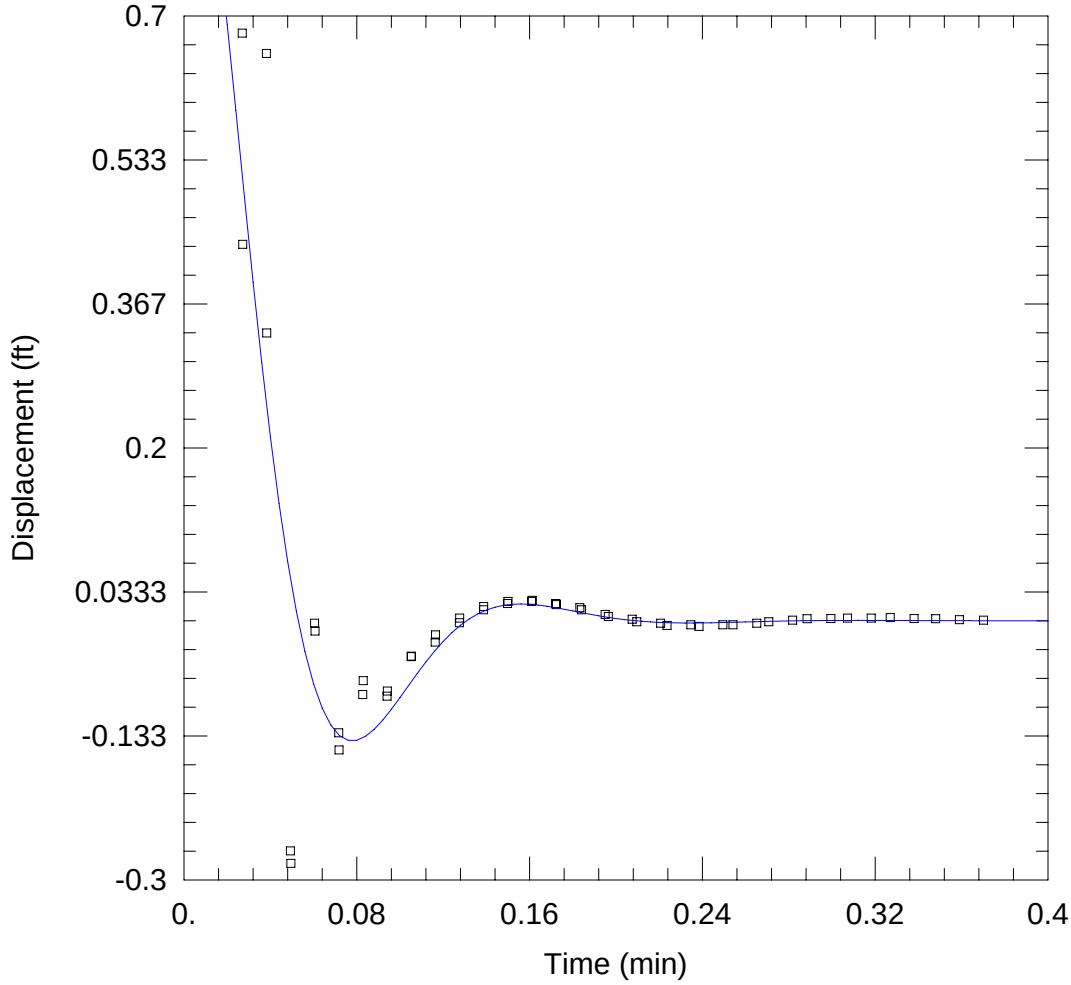
WELL DATA (MW26A)

Initial Displacement: 1. ft
Total Well Penetration Depth: 22.4 ft
Casing Radius: 0.158 ft
Static Water Column Height: 22.4 ft
Screen Length: 20. ft
Wellbore Radius: 0.2 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 0.0355 ft/min
y0 = 1.125 ft



WELL TEST ANALYSIS

Data Set: R:\335392OmegaWA275\Field_Sampling\Slug_Testing\analysis\MW26\MW26Bin_Butler.aqt
Date: 08/02/07 Time: 15:39:53

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 335392
Location: RIV
Test Well: MW26B
Test Date: 2007

AQUIFER DATA

Saturated Thickness: 30. ft
Anisotropy Ratio (Kz/Kr): 0.1

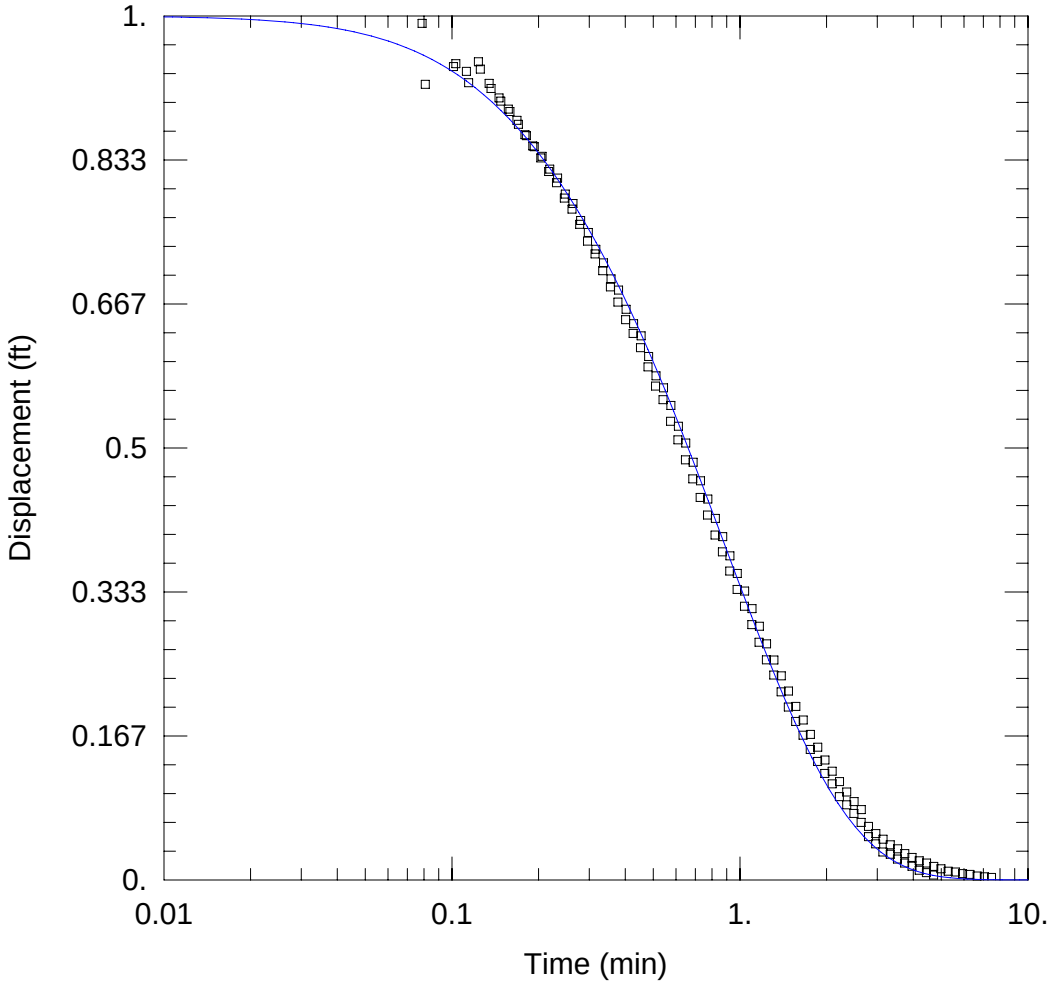
WELL DATA (MW26B)

Initial Displacement: 1. ft
Total Well Penetration Depth: 15. ft
Casing Radius: 0.08 ft
Static Water Column Height: 15. ft
Screen Length: 15. ft
Wellbore Radius: 0.1 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Butler

K = 0.05883 ft/min
C(D) = 0.5318



WELL TEST ANALYSIS

Data Set: R:\...\MW26C_Butler_in.aqt
Date: 08/02/07 Time: 15:52:57

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 335392
Location: RIV
Test Well: MW26C
Test Date: 2007

AQUIFER DATA

Saturated Thickness: 25. ft Anisotropy Ratio (Kz/Kr): 0.1

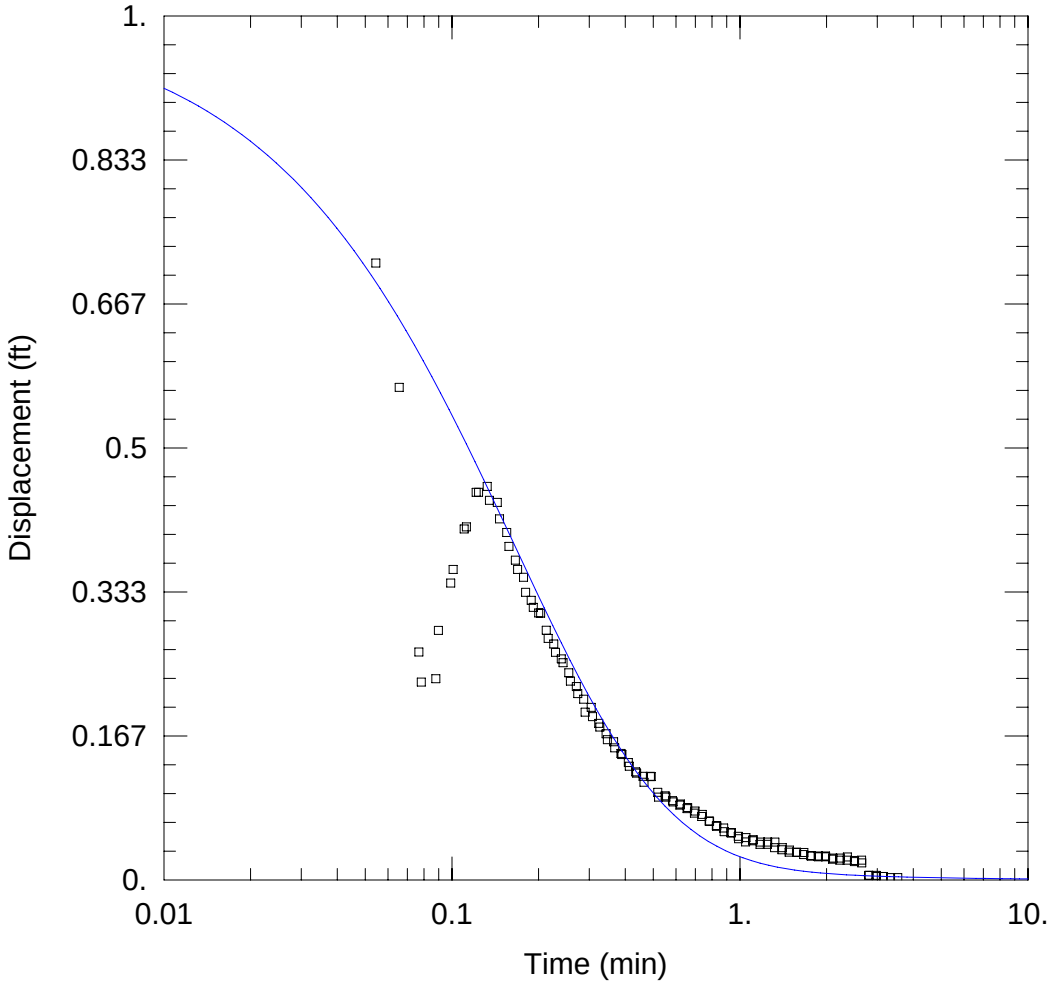
WELL DATA (MW26C)

Initial Displacement: 1. ft Static Water Column Height: 15. ft
Total Well Penetration Depth: 15. ft Screen Length: 15. ft
Casing Radius: 0.08 ft Wellbore Radius: 0.1 ft

SOLUTION

Aquifer Model: Confined Solution Method: Butler

K = 0.001413 ft/min C(D) = 2.296



WELL TEST ANALYSIS

Data Set: R:\...\MW26Din_KGS_noskin.aqt
Date: 08/02/07 Time: 15:59:04

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 335392
Location: RIV
Test Well: MW26D
Test Date: 2007

AQUIFER DATA

Saturated Thickness: 36. ft

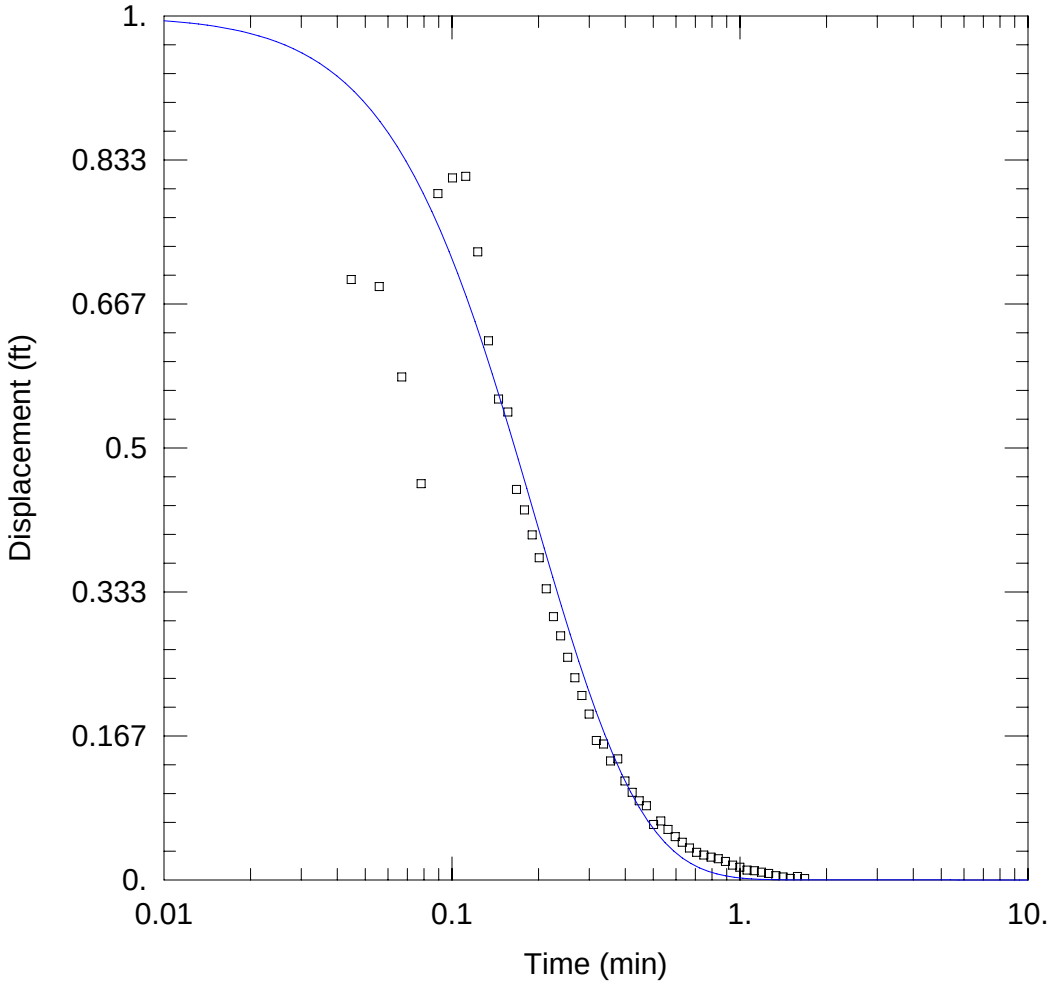
WELL DATA (MW26D)

Initial Displacement: 1. ft
Total Well Penetration Depth: 25. ft
Casing Radius: 0.08 ft
Static Water Column Height: 25. ft
Screen Length: 20. ft
Wellbore Radius: 0.1 ft

SOLUTION

Aquifer Model: Confined
Solution Method: KGS Model

Kr = 0.004178 ft/min
Kz/Kr = 0.1
Ss = 1.0E-5 ft^{-1}



WELL TEST ANALYSIS

Data Set: R:\...\MW26Dout_Butler.aqt
Date: 08/02/07 Time: 15:58:42

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 335392
Location: RIV
Test Well: MW26D
Test Date: 2007

AQUIFER DATA

Saturated Thickness: 36. ft Anisotropy Ratio (Kz/Kr): 0.1

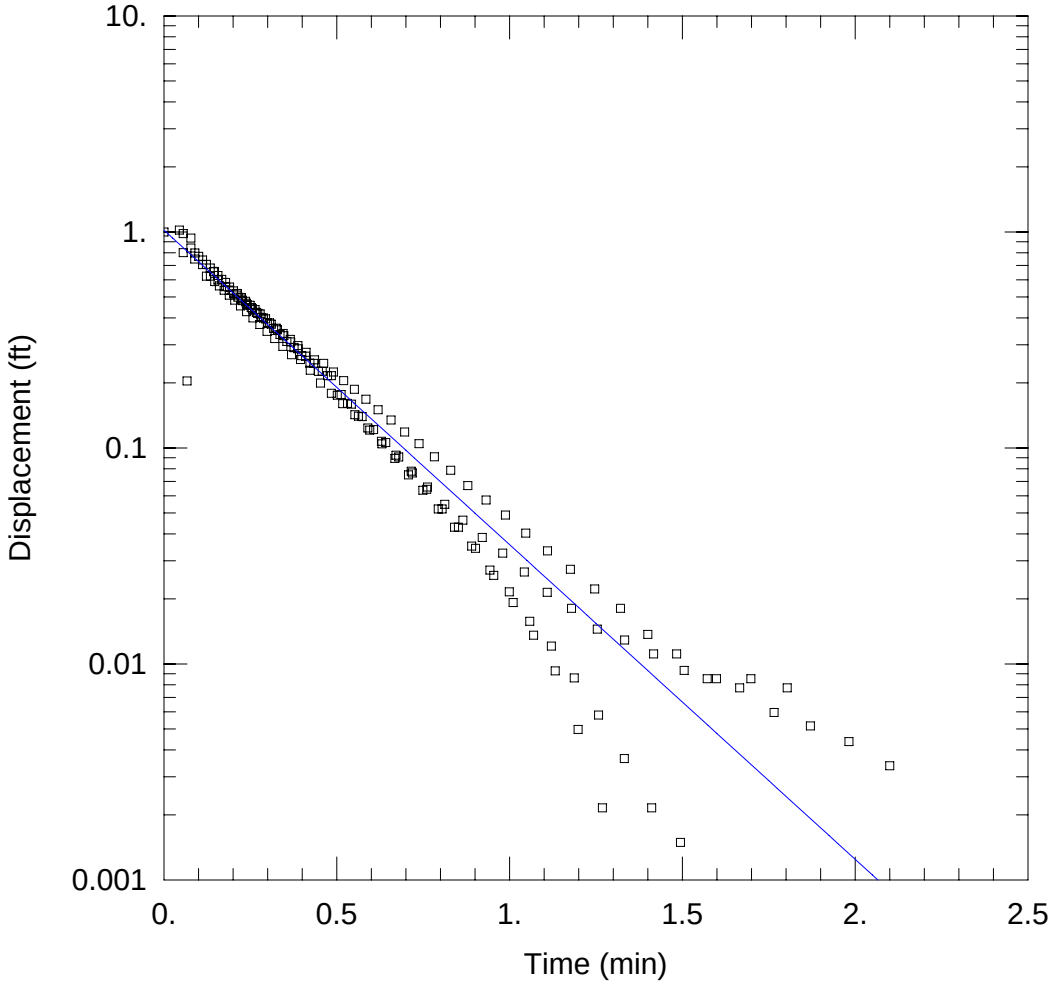
WELL DATA (MW26D)

Initial Displacement: 1. ft
Total Well Penetration Depth: 25. ft
Casing Radius: 0.08 ft
Static Water Column Height: 25. ft
Screen Length: 20. ft
Wellbore Radius: 0.1 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Butler

K = 0.004972 ft/min
C(D) = 1.14



WELL TEST ANALYSIS

Data Set: R:\335392OmegaWA275\Field_Sampling\Slug_Testing\analysis\MW27\MW27A_B&Rall.aqt
Date: 08/02/07 Time: 16:02:21

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 335392
Location: RIV
Test Well: MW27A
Test Date: 2007

AQUIFER DATA

Saturated Thickness: 32.83 ft
Anisotropy Ratio (Kz/Kr): 0.1

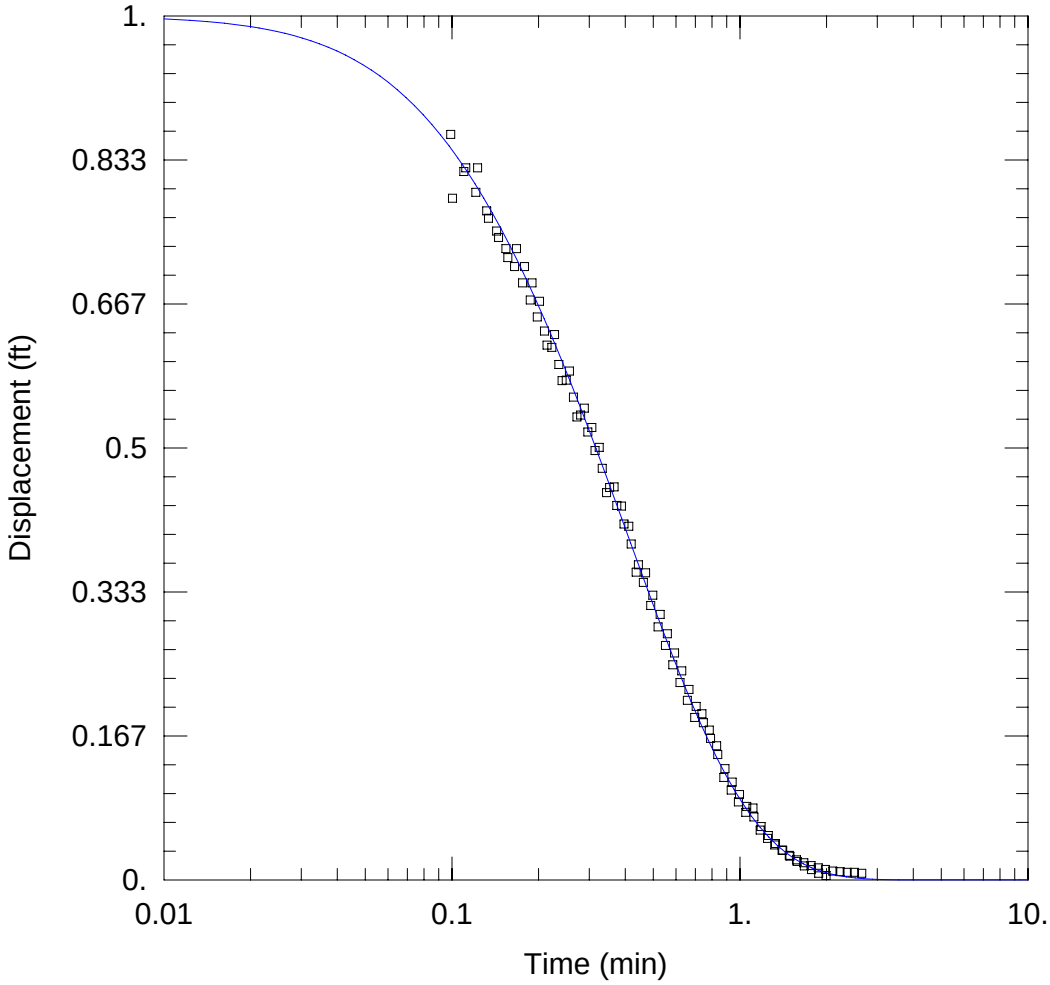
WELL DATA (MW27A)

Initial Displacement: 1. ft
Total Well Penetration Depth: 32.83 ft
Casing Radius: 0.158 ft
Static Water Column Height: 32.83 ft
Screen Length: 20. ft
Wellbore Radius: 0.2 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 0.01026 ft/min
y0 = 1.019 ft



WELL TEST ANALYSIS

Data Set: R:\...\MW27B_Butler_in.aqt
Date: 08/02/07 Time: 16:10:10

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 335392
Location: RIV
Test Well: MW27B
Test Date: 2007

AQUIFER DATA

Saturated Thickness: 20. ft Anisotropy Ratio (Kz/Kr): 0.1

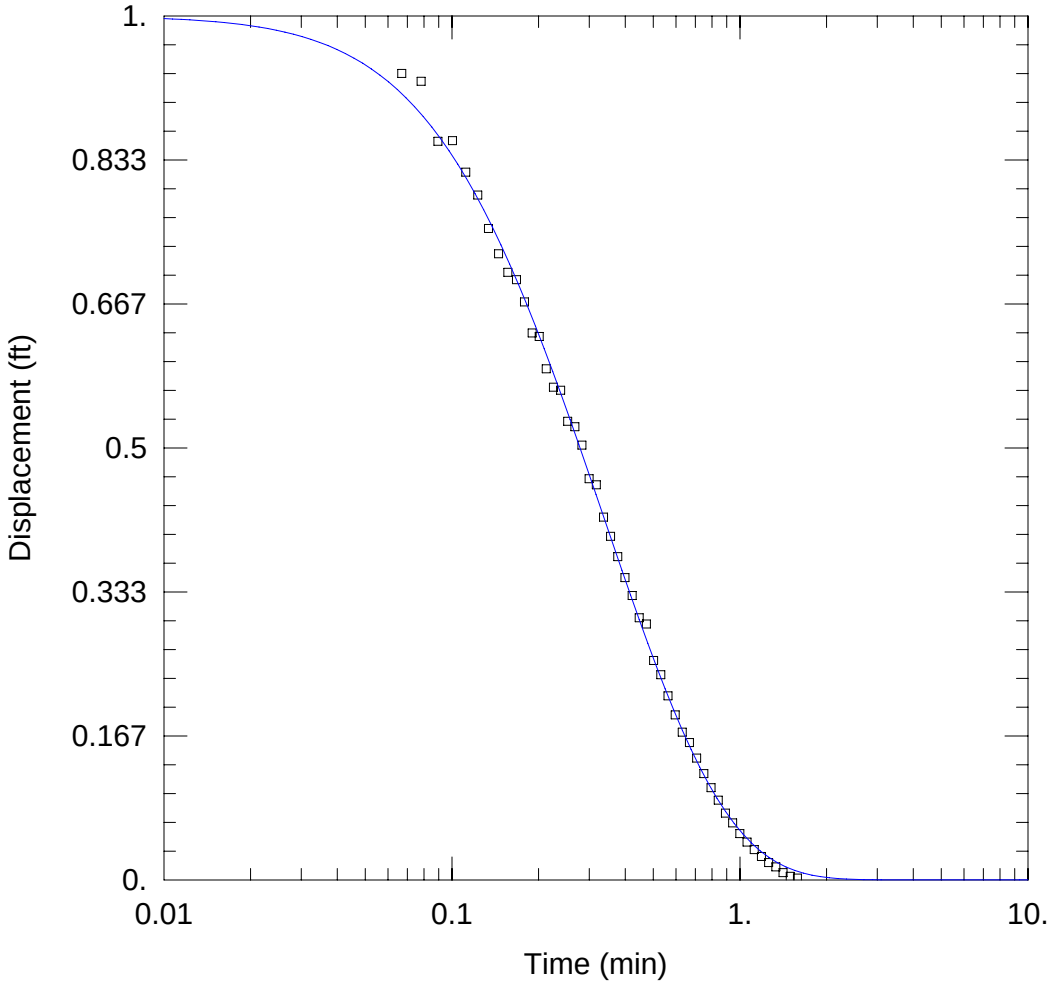
WELL DATA (MW27B)

Initial Displacement: 1. ft Static Water Column Height: 20. ft
Total Well Penetration Depth: 20. ft Screen Length: 20. ft
Casing Radius: 0.158 ft Wellbore Radius: 0.2 ft

SOLUTION

Aquifer Model: Confined Solution Method: Butler

K = 0.007523 ft/min C(D) = 1.931



WELL TEST ANALYSIS

Data Set: R:\...\MW27B_Butler_out.aqt
Date: 08/02/07 Time: 16:11:56

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 335392
Location: RIV
Test Well: MW27B
Test Date: 2007

AQUIFER DATA

Saturated Thickness: 20. ft Anisotropy Ratio (Kz/Kr): 0.1

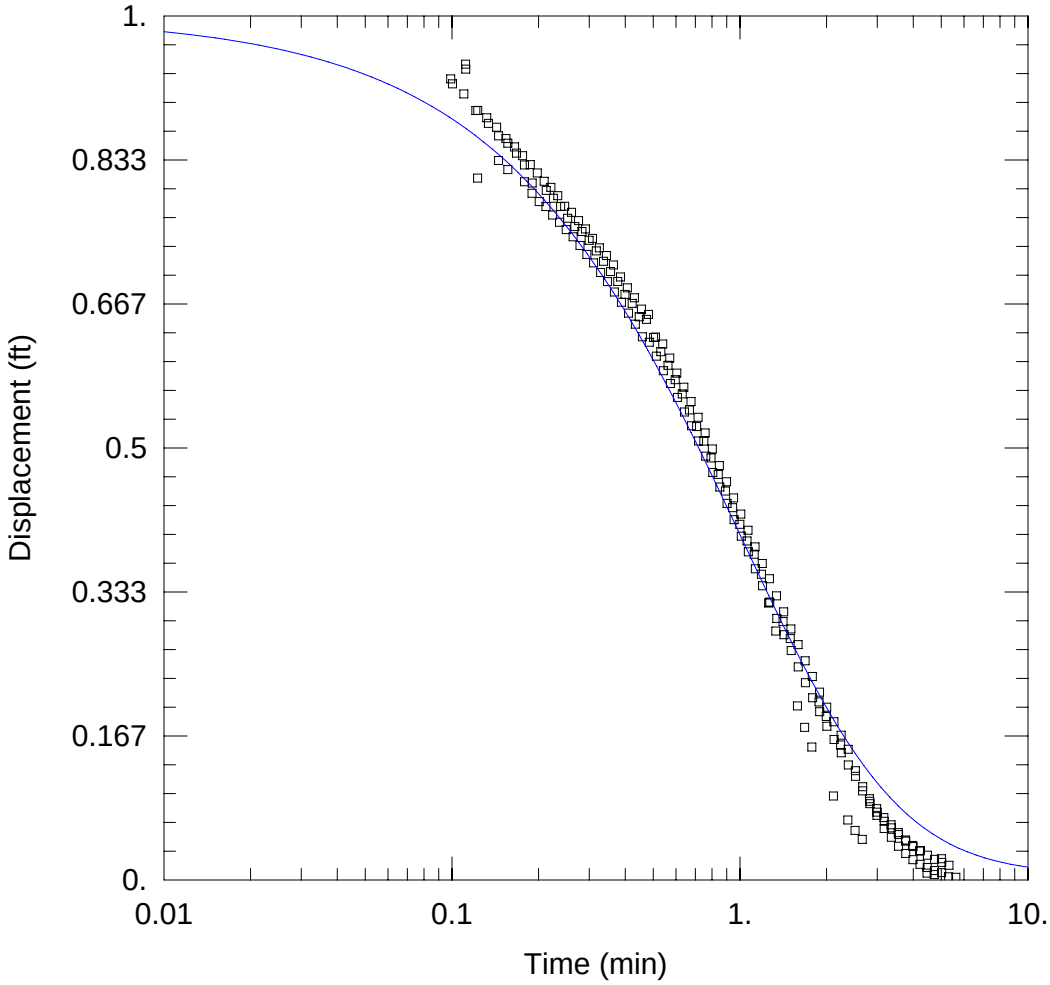
WELL DATA (MW27B)

Initial Displacement: 1. ft Static Water Column Height: 20. ft
Total Well Penetration Depth: 20. ft Screen Length: 20. ft
Casing Radius: 0.158 ft Wellbore Radius: 0.2 ft

SOLUTION

Aquifer Model: Confined Solution Method: Butler

K = 0.008768 ft/min C(D) = 1.546



WELL TEST ANALYSIS

Data Set: R:\...\MW27C_KGS_noskin.aqt
Date: 08/02/07 Time: 16:21:02

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 335392
Location: RIV
Test Well: MW27C
Test Date: 2007

AQUIFER DATA

Saturated Thickness: 10. ft

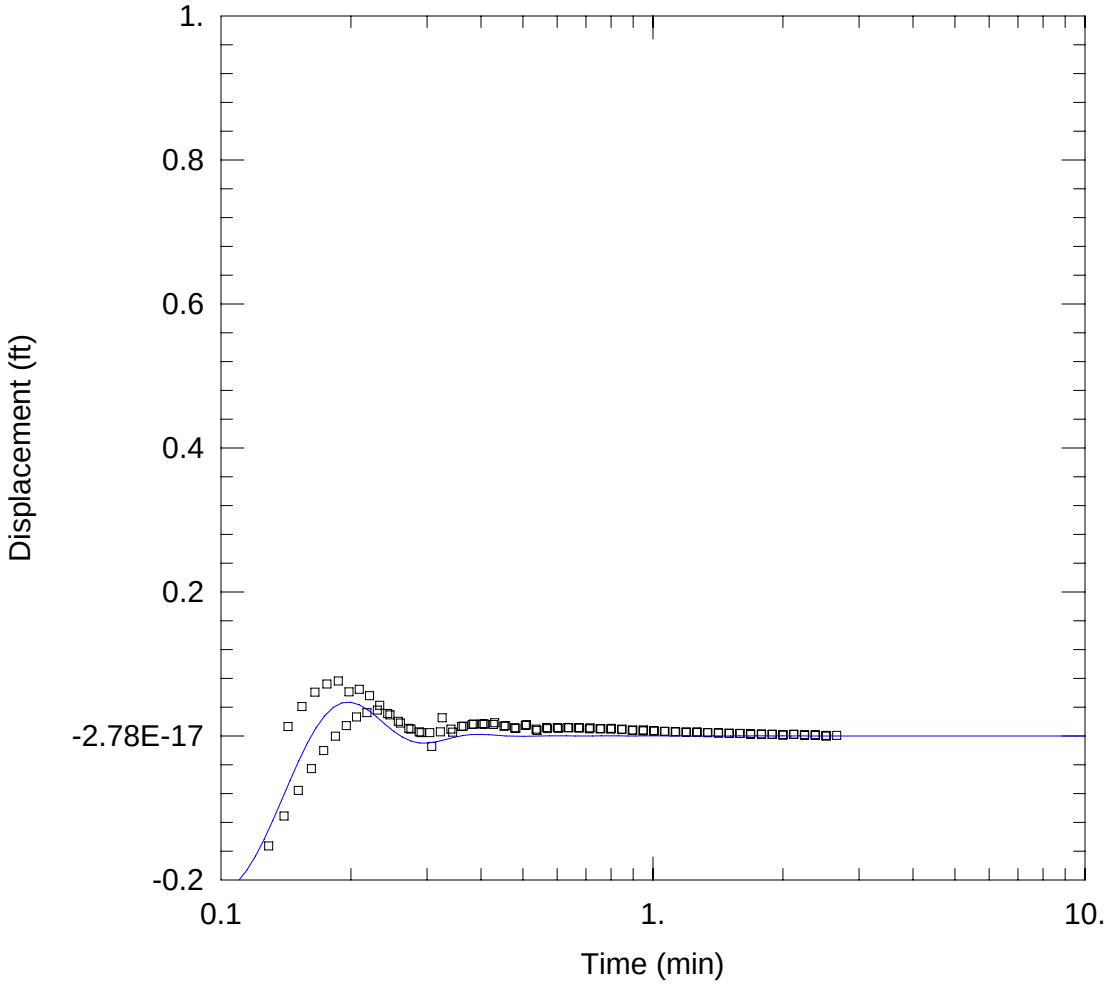
WELL DATA (MW27C)

Initial Displacement: 1. ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.08 ft
Static Water Column Height: 10. ft
Screen Length: 10. ft
Wellbore Radius: 0.1 ft

SOLUTION

Aquifer Model: Confined
Solution Method: KGS Model

Kr = 0.00148 ft/min
Kz/Kr = 0.1
Ss = 1.0E-5 ft^{-1}



WELL TEST ANALYSIS

Data Set: R:\...\MW27D_in_Butler.aqt
Date: 08/03/07 Time: 08:17:53

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 335392
Location: RIV
Test Well: MW27D
Test Date: 2007

AQUIFER DATA

Saturated Thickness: 10. ft Anisotropy Ratio (Kz/Kr): 0.1

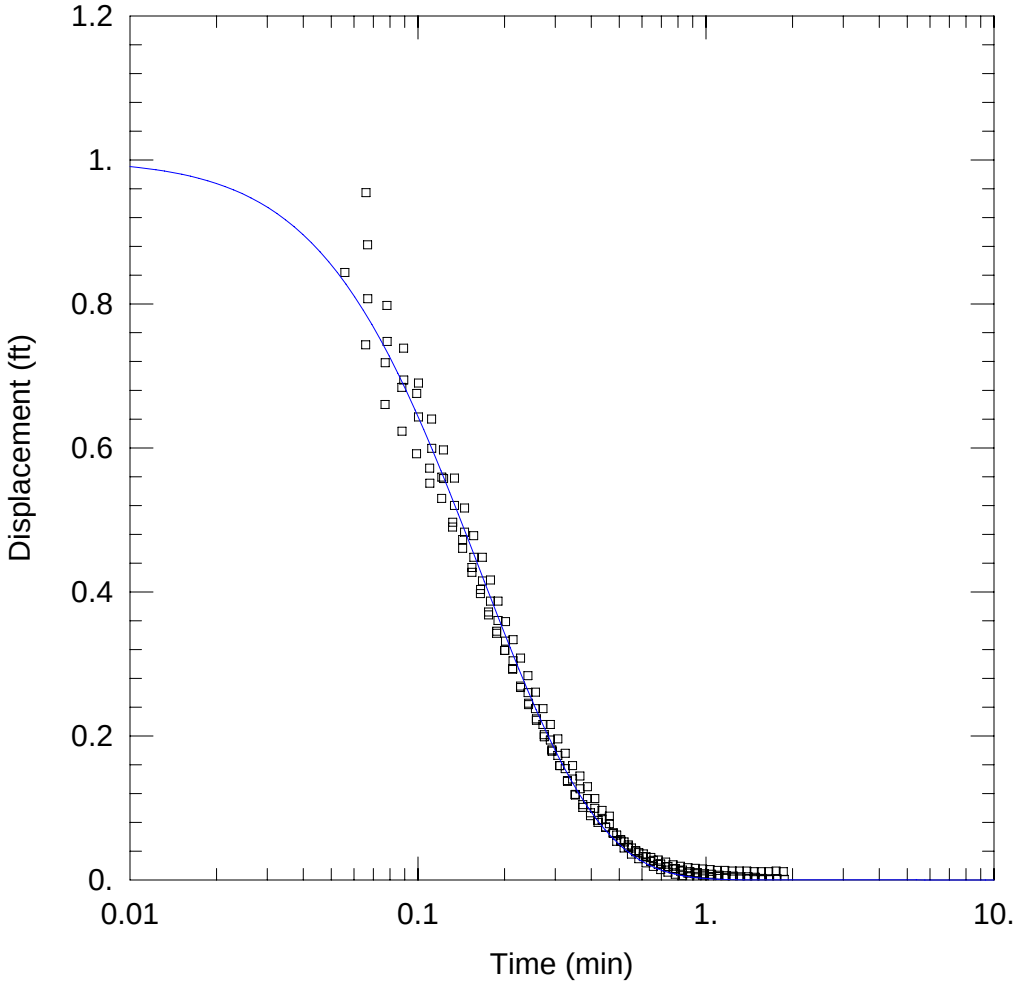
WELL DATA (MW27D)

Initial Displacement: 1. ft Static Water Column Height: 10. ft
Total Well Penetration Depth: 10. ft Screen Length: 10. ft
Casing Radius: 0.08 ft Wellbore Radius: 0.1 ft

SOLUTION

Aquifer Model: Confined Solution Method: Butler

K = 0.0688 ft/min C(D) = 0.4375



WELL TEST ANALYSIS

Data Set: R:\...\Best_MW28_Butler.aqt
Date: 08/03/07 Time: 08:19:11

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 335392
Location: RIV
Test Well: MW28
Test Date: 2007

AQUIFER DATA

Saturated Thickness: 36.06 ft Anisotropy Ratio (Kz/Kr): 0.1

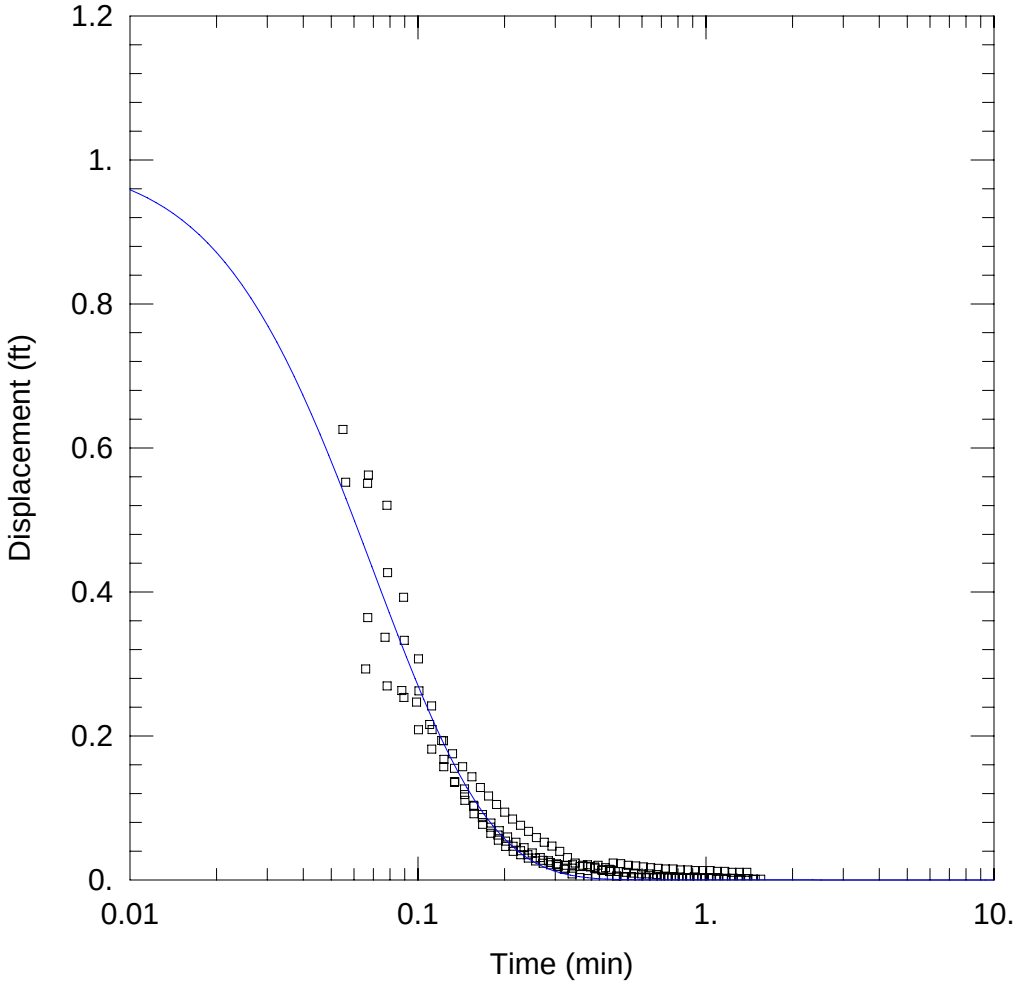
WELL DATA (MW28)

Initial Displacement: 1. ft
Total Well Penetration Depth: 31.06 ft
Casing Radius: 0.158 ft
Static Water Column Height: 31.06 ft
Screen Length: 20. ft
Wellbore Radius: 0.2 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Butler

K = 0.01939 ft/min
C(D) = 1.347



WELL TEST ANALYSIS

Data Set: R:\...\Best_MW29_Butler.aqt
Date: 08/03/07 Time: 08:22:17

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 335392
Location: RIV
Test Well: MW29
Test Date: 2007

AQUIFER DATA

Saturated Thickness: 26. ft Anisotropy Ratio (Kz/Kr): 0.1

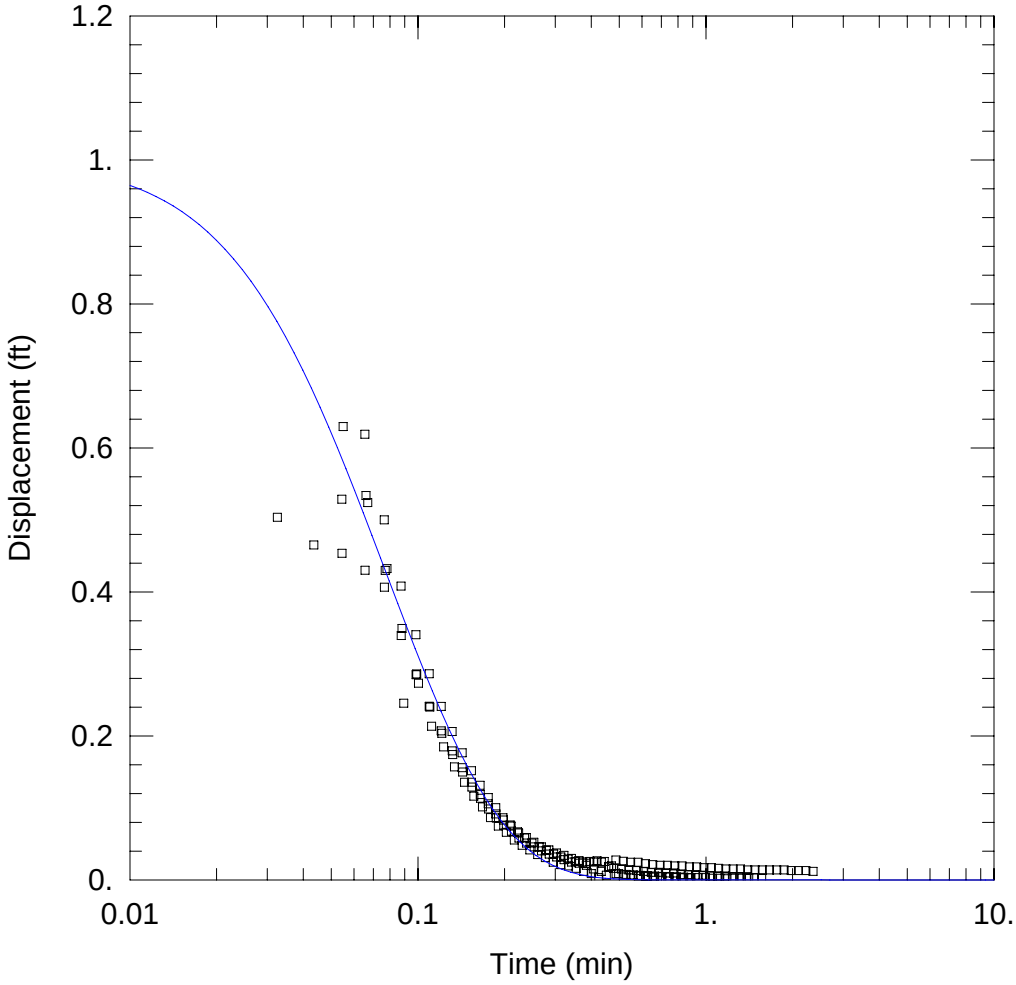
WELL DATA (MW29)

Initial Displacement: 1. ft Static Water Column Height: 23. ft
Total Well Penetration Depth: 23. ft Screen Length: 20. ft
Casing Radius: 0.158 ft Wellbore Radius: 0.2 ft

SOLUTION

Aquifer Model: Confined Solution Method: Butler

K = 0.04585 ft/min C(D) = 1.295



WELL TEST ANALYSIS

Data Set: R:\335392OmegaWA275\Field_Sampling\Slug_Testing\analysis\MW30\MW30_Butler.aqt
Date: 08/03/07 Time: 08:26:06

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 335392
Location: RIV
Test Well: MW30
Test Date: 2007

AQUIFER DATA

Saturated Thickness: 28.12 ft
Anisotropy Ratio (Kz/Kr): 0.1

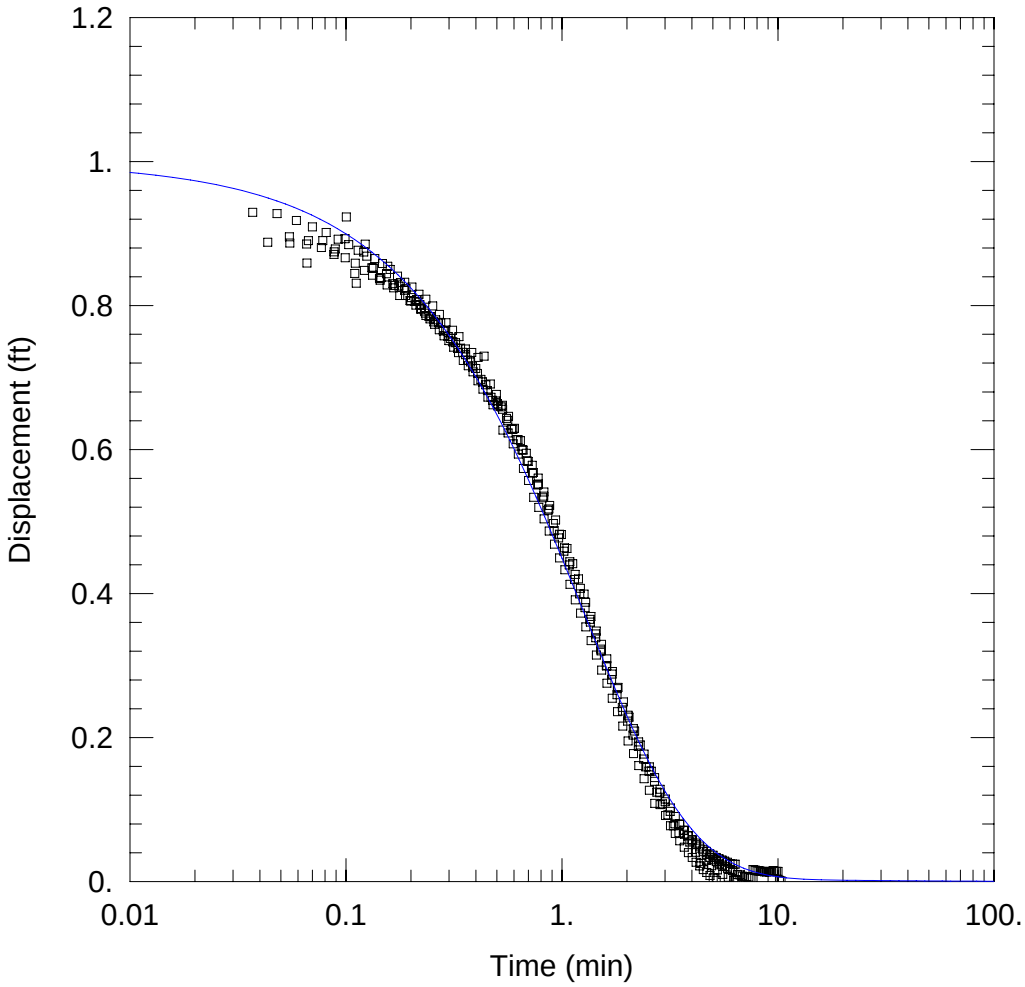
WELL DATA (MW30)

Initial Displacement: 1. ft
Static Water Column Height: 23.12 ft
Total Well Penetration Depth: 23.12 ft
Screen Length: 20. ft
Casing Radius: 0.158 ft
Wellbore Radius: 0.2 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Butler

K = 0.04163 ft/min
C(D) = 1.303



WELL TEST ANALYSIS

Data Set: R:\...\OW3B_10ft_15ft_Butler.aqt
Date: 08/03/07 Time: 15:43:55

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 335392
Location: RIV
Test Well: OW3B
Test Date: 2006

AQUIFER DATA

Saturated Thickness: 41. ft

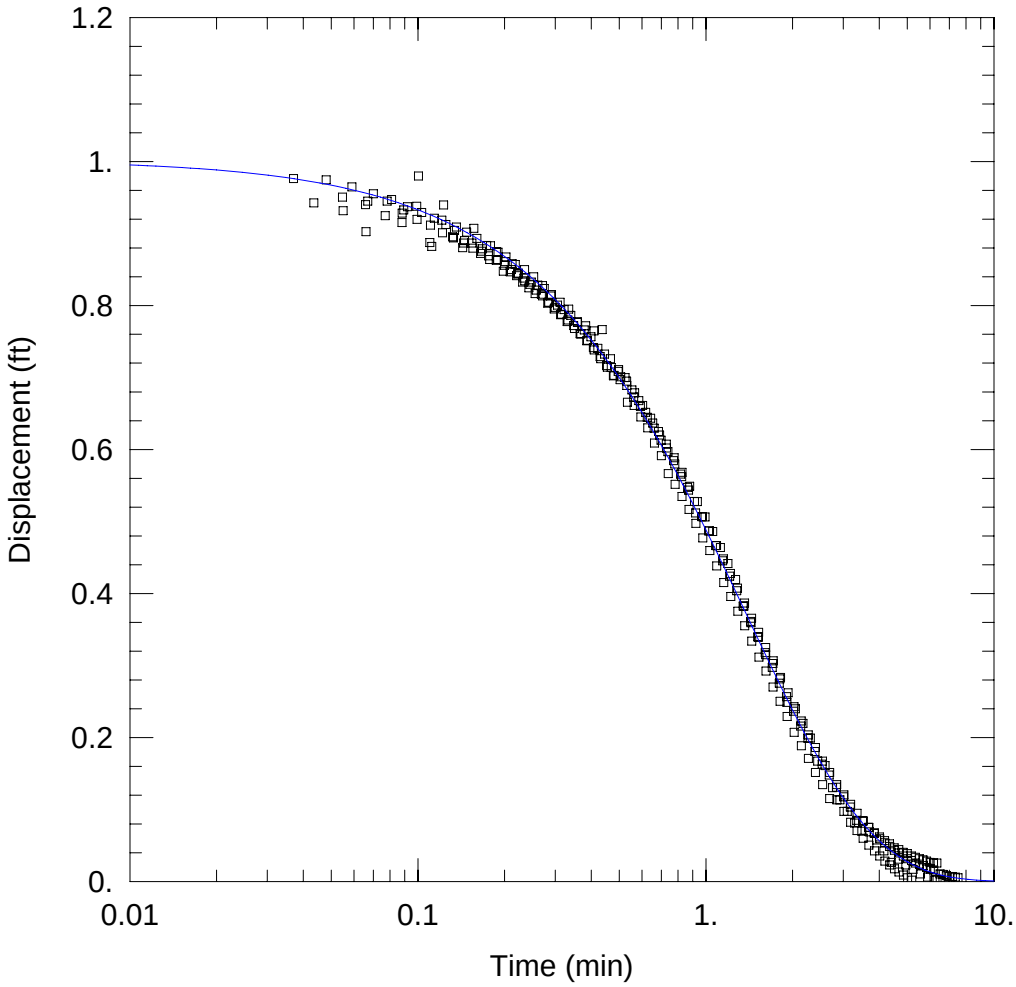
WELL DATA (OW3B)

Initial Displacement: 1. ft
Total Well Penetration Depth: 41. ft
Casing Radius: 0.167 ft
Static Water Column Height: 41. ft
Screen Length: 10. ft
Wellbore Radius: 0.209 ft

SOLUTION

Aquifer Model: Confined
Solution Method: KGS Model

Kr = 0.005063 ft/min
Kz/Kr = 0.1
Ss = 1.0E-5 ft^{-1}



WELL TEST ANALYSIS

Data Set: R:\...\Best_OW3B_Butler.aqt
Date: 08/03/07 Time: 08:35:19

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 335392
Location: RIV
Test Well: OW3B
Test Date: 2006

AQUIFER DATA

Saturated Thickness: 41. ft
Anisotropy Ratio (Kz/Kr): 0.1

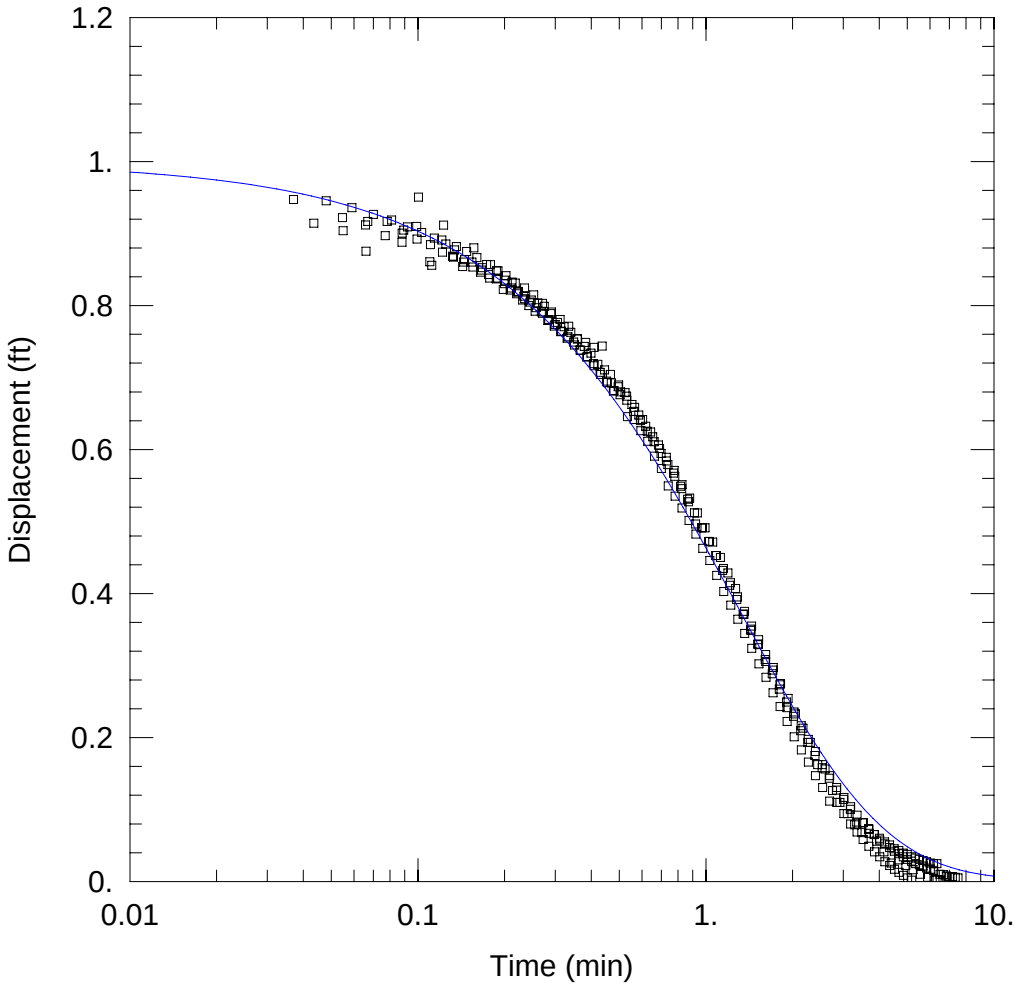
WELL DATA (OW3B)

Initial Displacement: 1. ft
Total Well Penetration Depth: 41. ft
Casing Radius: 0.167 ft
Static Water Column Height: 41. ft
Screen Length: 10. ft
Wellbore Radius: 0.209 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Butler

K = 0.005716 ft/min
C(D) = 10.



WELL TEST ANALYSIS

Data Set: R:\335392OmegaWA275\Field_Sampling\Slug_Testing\analysis\OW3B\OW3B_KGS.aqt
Date: 08/03/07 Time: 15:44:33

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 335392
Location: RIV
Test Well: OW3B
Test Date: 2006

AQUIFER DATA

Saturated Thickness: 41. ft

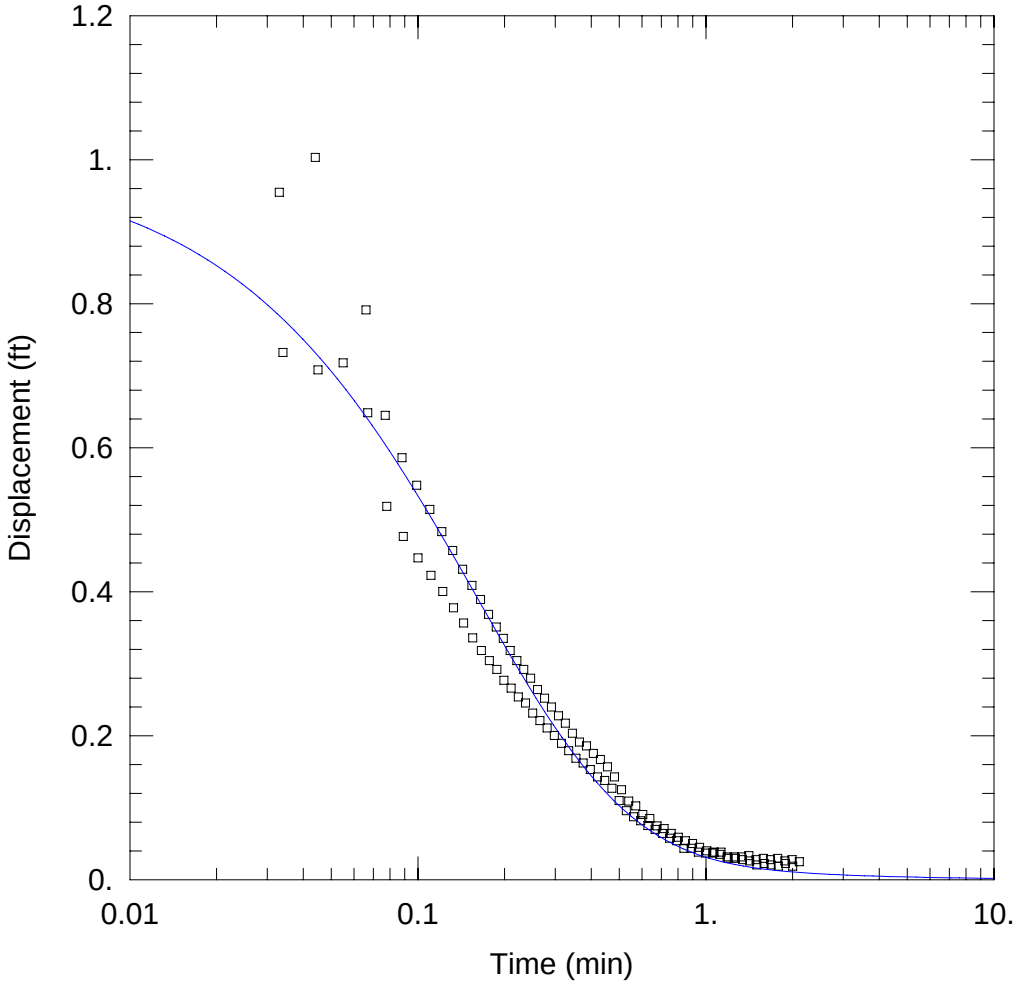
WELL DATA (OW3B)

Initial Displacement: 1. ft
Total Well Penetration Depth: 41. ft
Casing Radius: 0.167 ft
Static Water Column Height: 41. ft
Screen Length: 10. ft
Wellbore Radius: 0.209 ft

SOLUTION

Aquifer Model: Confined
Solution Method: KGS Model

Kr = 0.004842 ft/min
Kz/Kr = 0.1
Ss = 1.0E-5 ft^{-1}



WELL TEST ANALYSIS

Data Set: R:\335392OmegaWA275\Field_Sampling\Slug_Testing\analysis\OW4A\OW4A_in_KGS.aqt
Date: 08/03/07 Time: 10:45:24

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 335392
Location: RIV
Test Well: OW4A
Test Date: 2006

AQUIFER DATA

Saturated Thickness: 21.63 ft

WELL DATA (OW4A)

Initial Displacement: 1. ft
Total Well Penetration Depth: 21.63 ft
Casing Radius: 0.168 ft

Static Water Column Height: 21.63 ft
Screen Length: 20. ft
Wellbore Radius: 0.209 ft

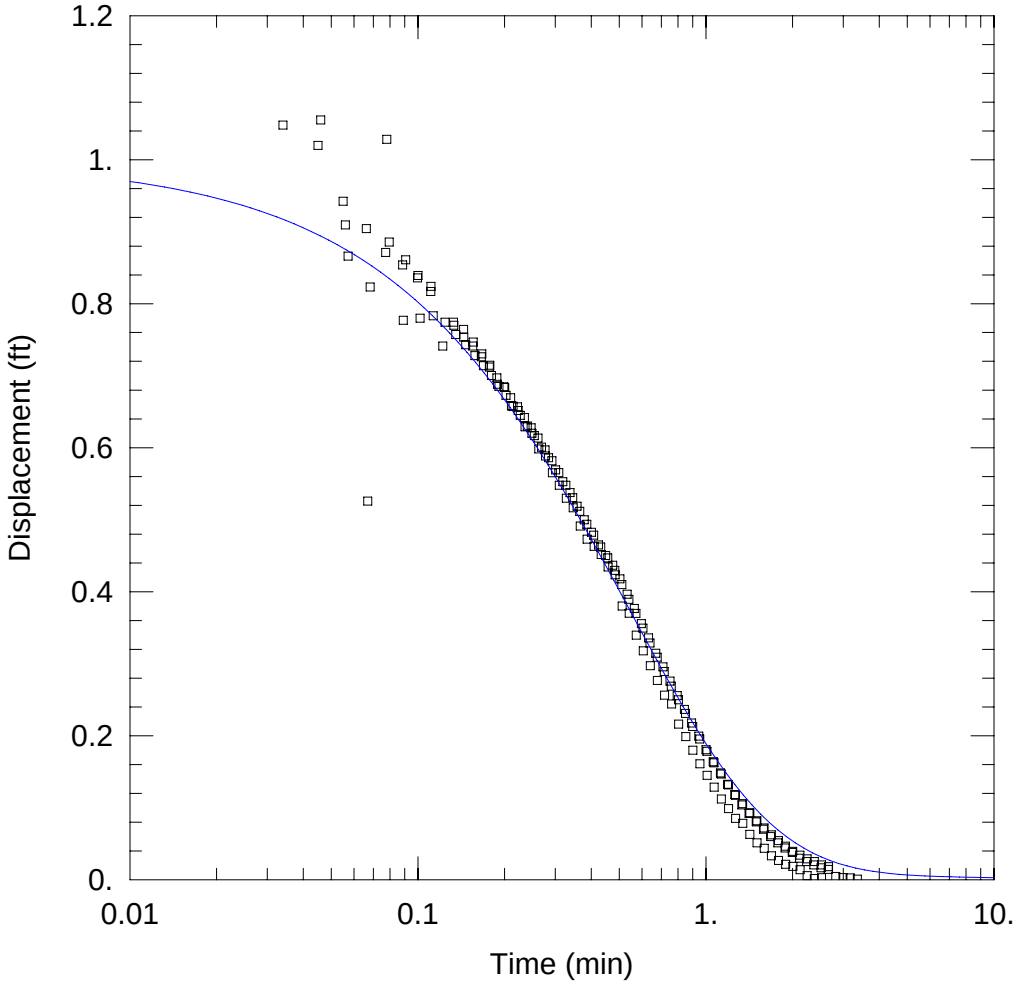
SOLUTION

Aquifer Model: Confined

Kr = 0.01883 ft/min
Kz/Kr = 0.1

Solution Method: KGS Model

Ss = 1.0E-5 ft^{-1}



WELL TEST ANALYSIS

Data Set: R:\335392OmegaWA275\Field_Sampling\Slug_Testing\analysis\OW4B\OW4B_KGS_2.aqt
Date: 08/03/07 Time: 10:53:52

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 335392
Location: RIV
Test Well: OW4B
Test Date: 2006

AQUIFER DATA

Saturated Thickness: 24. ft

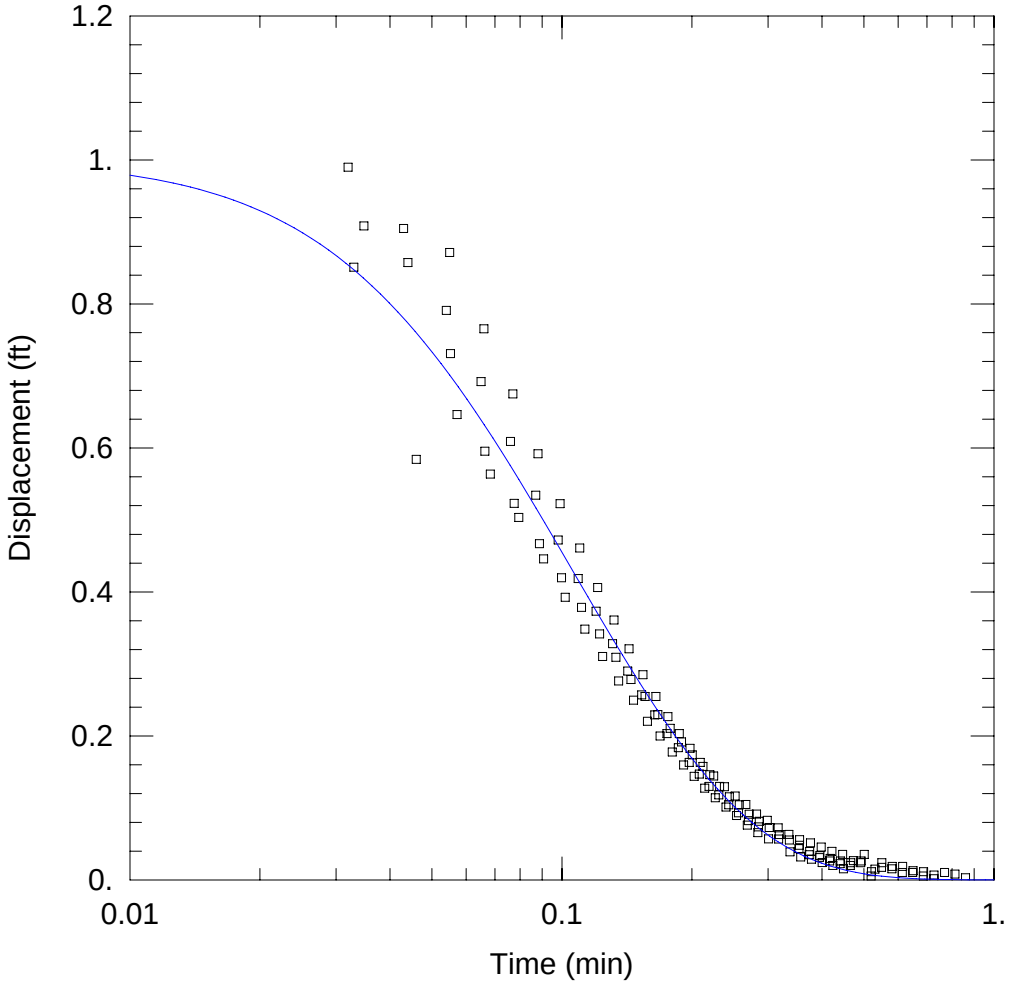
WELL DATA (OW4B)

Initial Displacement: 1. ft
Total Well Penetration Depth: 24. ft
Casing Radius: 0.168 ft
Static Water Column Height: 24. ft
Screen Length: 10.3 ft
Wellbore Radius: 0.209 ft

SOLUTION

Aquifer Model: Confined
Solution Method: KGS Model

Kr = 0.01155 ft/min
Kz/Kr = 0.1
Ss = 1.0E-5 ft^{-1}



WELL TEST ANALYSIS

Data Set: R:\335392OmegaWA275\Field_Sampling\Slug_Testing\analysis\OW5\Best_OW5_Butler.aqt
Date: 08/03/07 Time: 10:59:17

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 335392
Location: RIV
Test Well: OW5
Test Date: 2006

AQUIFER DATA

Saturated Thickness: 13. ft
Anisotropy Ratio (Kz/Kr): 0.1

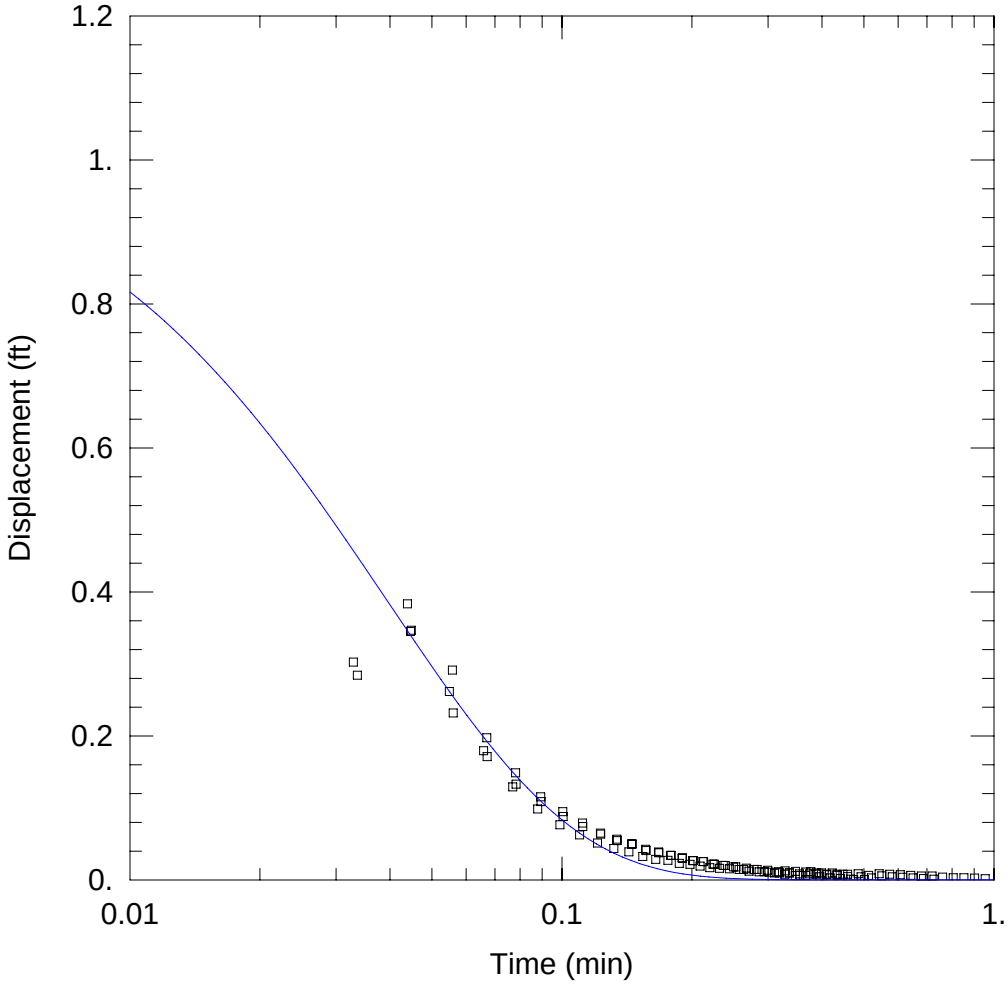
WELL DATA (OW5)

Initial Displacement: 1. ft
Total Well Penetration Depth: 13. ft
Casing Radius: 0.167 ft
Static Water Column Height: 13. ft
Screen Length: 13. ft
Wellbore Radius: 0.209 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Confined
Solution Method: Butler

K = 0.04328 ft/min
C(D) = 1.365



WELL TEST ANALYSIS

Data Set: R:\335392OmegaWA275\Field_Sampling\Slug_Testing\analysis\OW6\OW6_Butler.aqt
Date: 08/03/07 Time: 15:22:03

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 335392
Location: RIV
Test Well: OW6
Test Date: 2006

AQUIFER DATA

Saturated Thickness: 15.35 ft
Anisotropy Ratio (Kz/Kr): 0.1

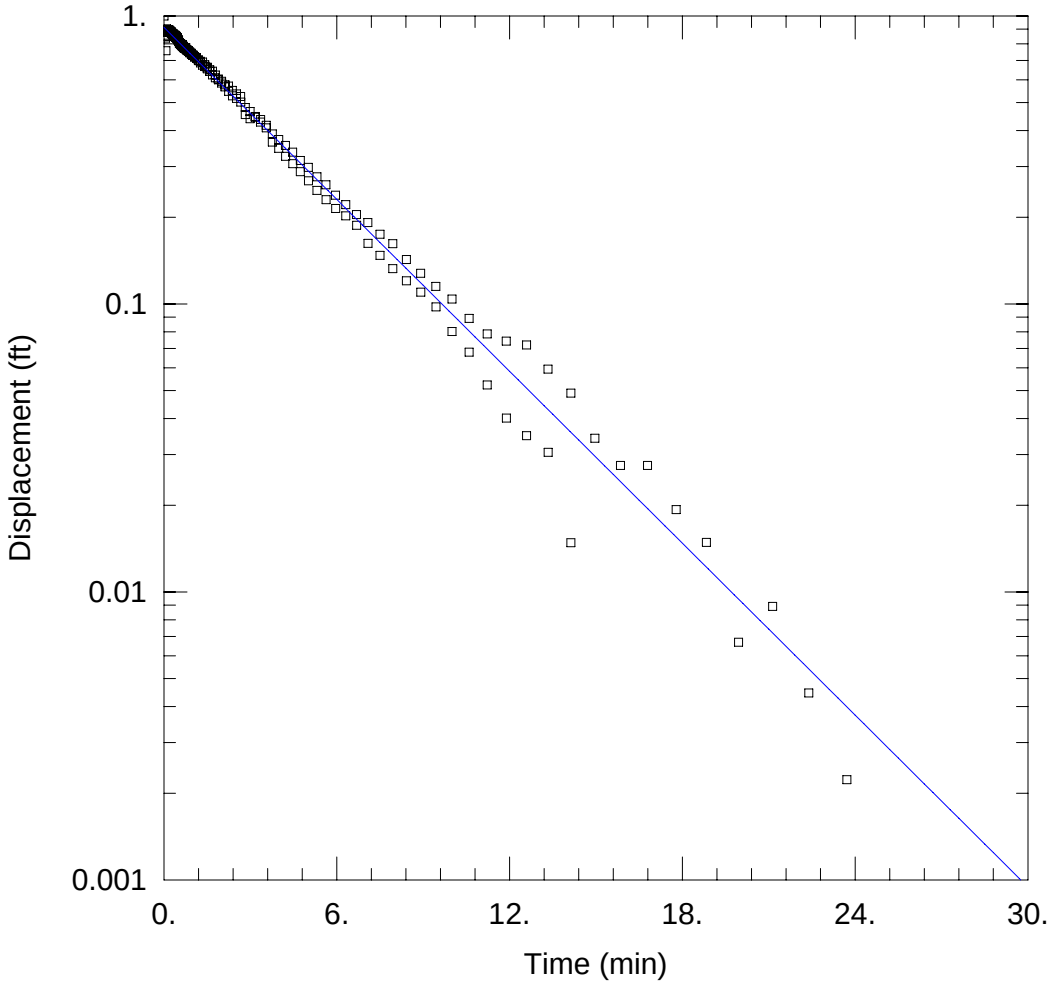
WELL DATA (OW6)

Initial Displacement: 1. ft
Total Well Penetration Depth: 15.35 ft
Casing Radius: 0.168 ft
Static Water Column Height: 15.35 ft
Screen Length: 20. ft
Wellbore Radius: 0.209 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Confined
Solution Method: Butler

K = 0.08953 ft/min
C(D) = 2.344



WELL TEST ANALYSIS

Data Set: R:\335392OmegaWA275\Field_Sampling\Slug_Testing\analysis\OW7\OW7_in_B&R.aqt
Date: 08/03/07 Time: 11:22:27

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 335392
Location: RIV
Test Well: OW7
Test Date: 2006

AQUIFER DATA

Saturated Thickness: 15.8 ft
Anisotropy Ratio (Kz/Kr): 0.1

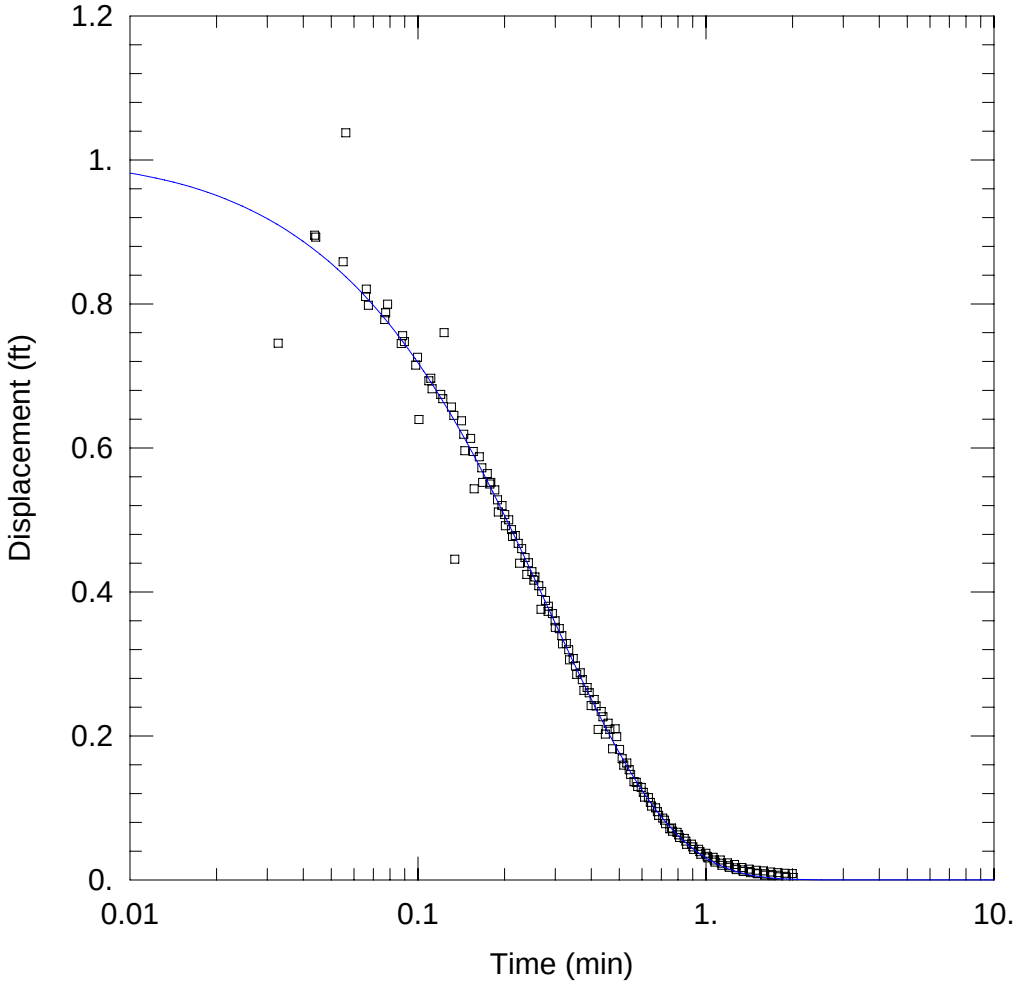
WELL DATA (OW7)

Initial Displacement: 1. ft
Total Well Penetration Depth: 15.8 ft
Casing Radius: 0.168 ft
Static Water Column Height: 15.8 ft
Screen Length: 15.8 ft
Wellbore Radius: 0.209 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 0.0006799 ft/min
y0 = 0.912 ft



WELL TEST ANALYSIS

Data Set: R:\...\Best_OW8B_Butler.aqt
Date: 08/03/07 Time: 11:23:55

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 335392
Location: RIV
Test Well: OW8B
Test Date: 2006

AQUIFER DATA

Saturated Thickness: 16. ft Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (OW8B)

Initial Displacement: 1. ft Static Water Column Height: 16. ft
Total Well Penetration Depth: 16. ft Screen Length: 10. ft
Casing Radius: 0.167 ft Wellbore Radius: 0.209 ft

SOLUTION

Aquifer Model: Confined Solution Method: Butler

K = 0.02741 ft/min C(D) = 3.617

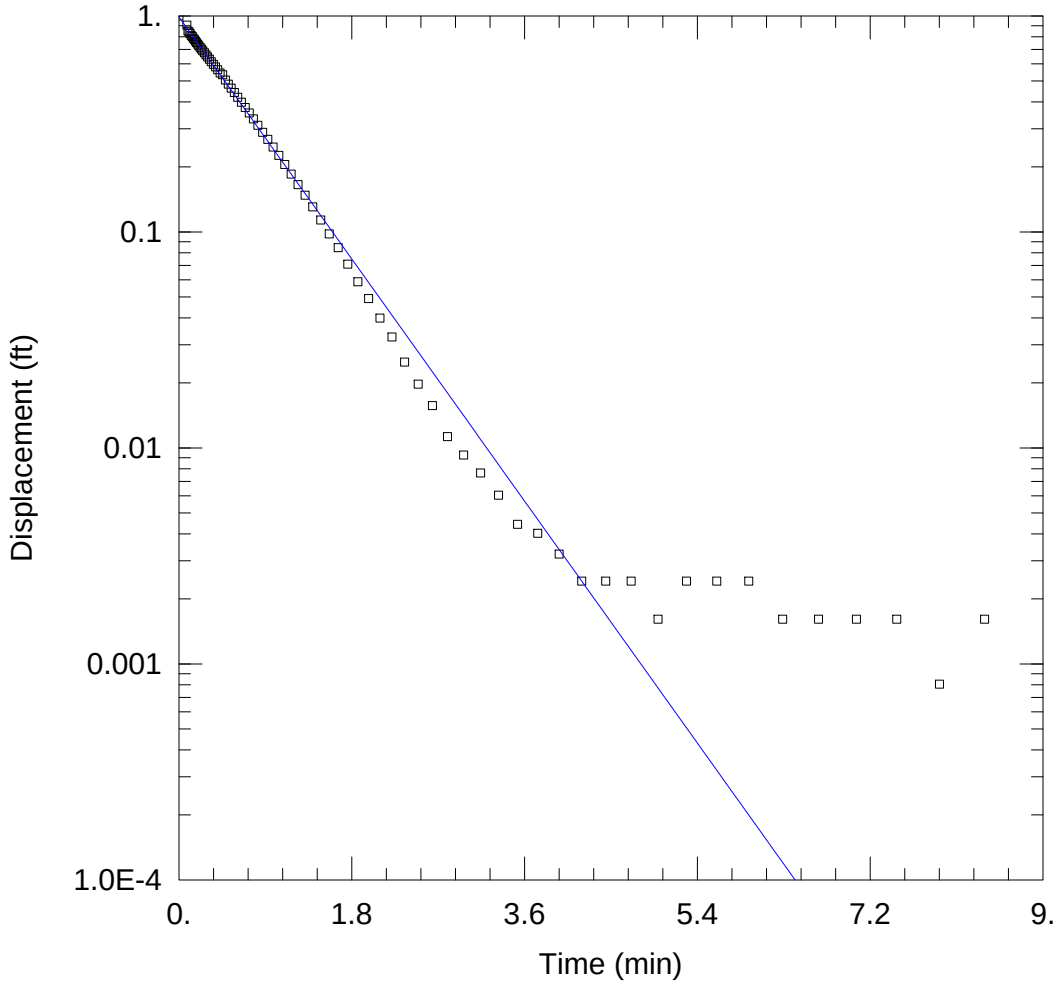
MW31 Slug Test Summary

Analysis by the Hyder et al. 1994 (aka "KGS") model

Test	K [ft/min]	Ss [ft^{-1}]	K [ft/d]
in1	0.001771	1.00E-06	2.6
in2	0.00112	1.00E-06	1.6
in3	0.000803	8.99E-06	1.2
out1	0.002325	2.68E-06	3.3
out2	0.001292	4.38E-05	1.9
out3	0.001079	7.08E-05	1.6
mean	0.001398	2.14E-05	2.0

Analysis by the Bouwer and Rice, 1976 method

Test	K [ft/min]	K [ft/d]
in1	0.001563	2.3
in2	0.000936	1.3
in3	0.000723	1.0
out1	0.001907	2.7
out2	0.00116	1.7
out3	0.001061	1.5
mean	0.001225	1.8
Total Average	0.001312	1.9



WELL TEST ANALYSIS

Data Set: R:\...\MW31in1_B&R.aqt
Date: 03/16/10 Time: 17:54:47

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 386743
Location: Omega
Test Well: MW31
Test Date: 10/23/09

AQUIFER DATA

Saturated Thickness: 30. ft Anisotropy Ratio (Kz/Kr): 0.1

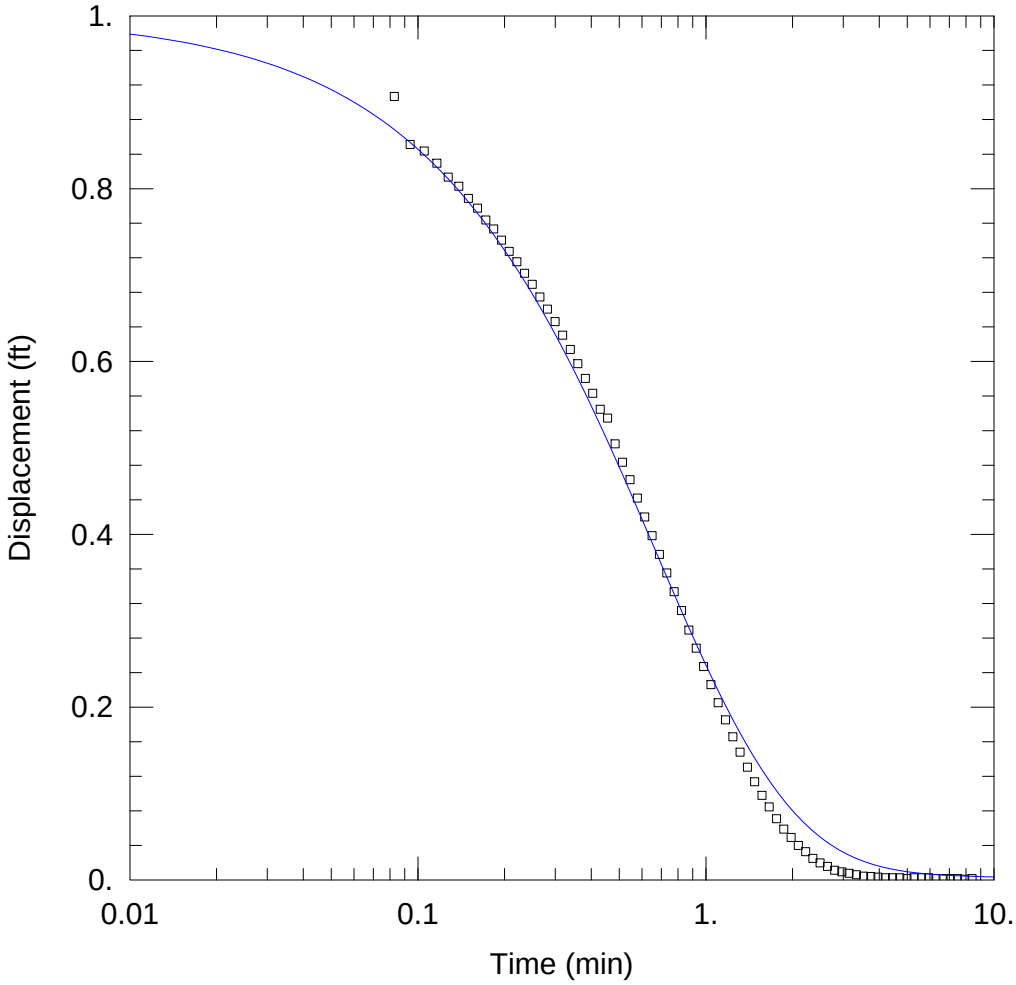
WELL DATA (MW31)

Initial Displacement: 1. ft Static Water Column Height: 22. ft
Total Well Penetration Depth: 22. ft Screen Length: 15. ft
Casing Radius: 0.0808 ft Wellbore Radius: 0.0808 ft

SOLUTION

Aquifer Model: Confined Solution Method: Bouwer-Rice

K = 0.001563 ft/min y0 = 0.9886 ft



WELL TEST ANALYSIS

Data Set: R:\...\MW31in1_KGS_2.aqt
Date: 03/16/10 Time: 17:55:40

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 386743
Location: Omega
Test Well: MW31
Test Date: 10/23/09

AQUIFER DATA

Saturated Thickness: 30. ft

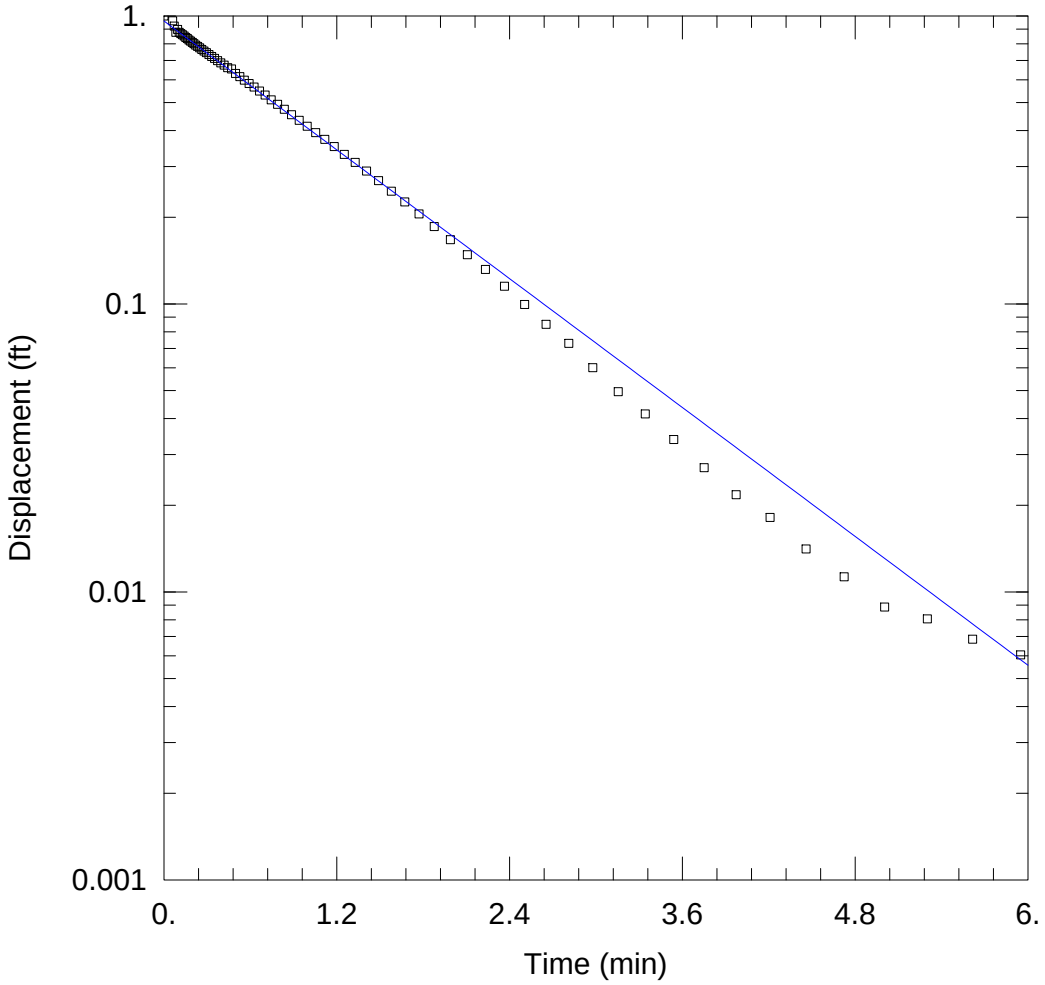
WELL DATA (MW31)

Initial Displacement: 1. ft
Total Well Penetration Depth: 22. ft
Casing Radius: 0.0808 ft
Static Water Column Height: 22. ft
Screen Length: 15. ft
Wellbore Radius: 0.0808 ft

SOLUTION

Aquifer Model: Confined
Solution Method: KGS Model

Kr = 0.001771 ft/min
Kz/Kr = 0.1
Ss = 1.0E-6 ft^{-1}



WELL TEST ANALYSIS

Data Set: R:\...\MW31in2_B&R.aqt
Date: 03/16/10 Time: 17:54:01

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 386743
Location: Omega
Test Well: MW31
Test Date: 10/23/09

AQUIFER DATA

Saturated Thickness: 30. ft Anisotropy Ratio (Kz/Kr): 0.1

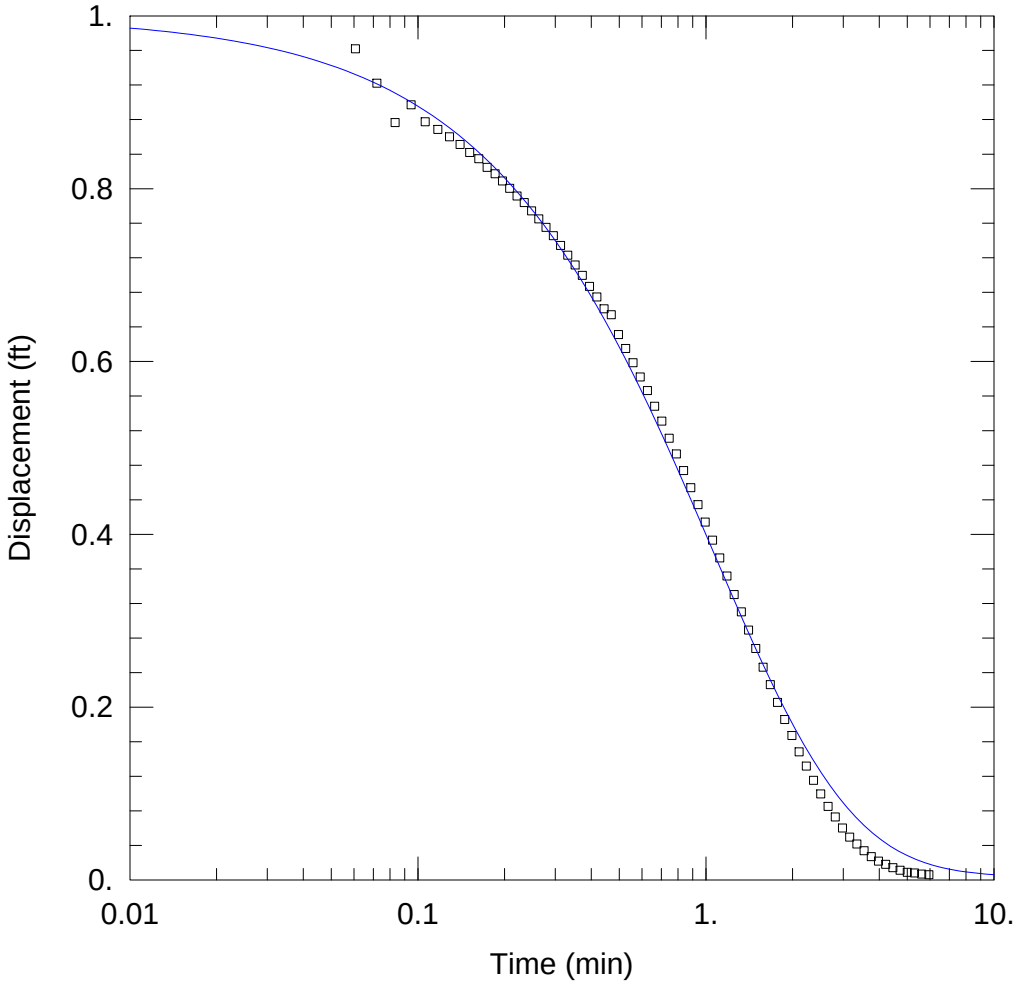
WELL DATA (MW31)

Initial Displacement: 1. ft Static Water Column Height: 22. ft
Total Well Penetration Depth: 22. ft Screen Length: 15. ft
Casing Radius: 0.0808 ft Wellbore Radius: 0.0808 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 0.0009363 ft/min y0 = 0.96 ft



WELL TEST ANALYSIS

Data Set: R:\...\MW31in2_KGS_2.aqt
Date: 03/16/10 Time: 17:56:19

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 386743
Location: Omega
Test Well: MW31
Test Date: 10/23/09

AQUIFER DATA

Saturated Thickness: 30. ft

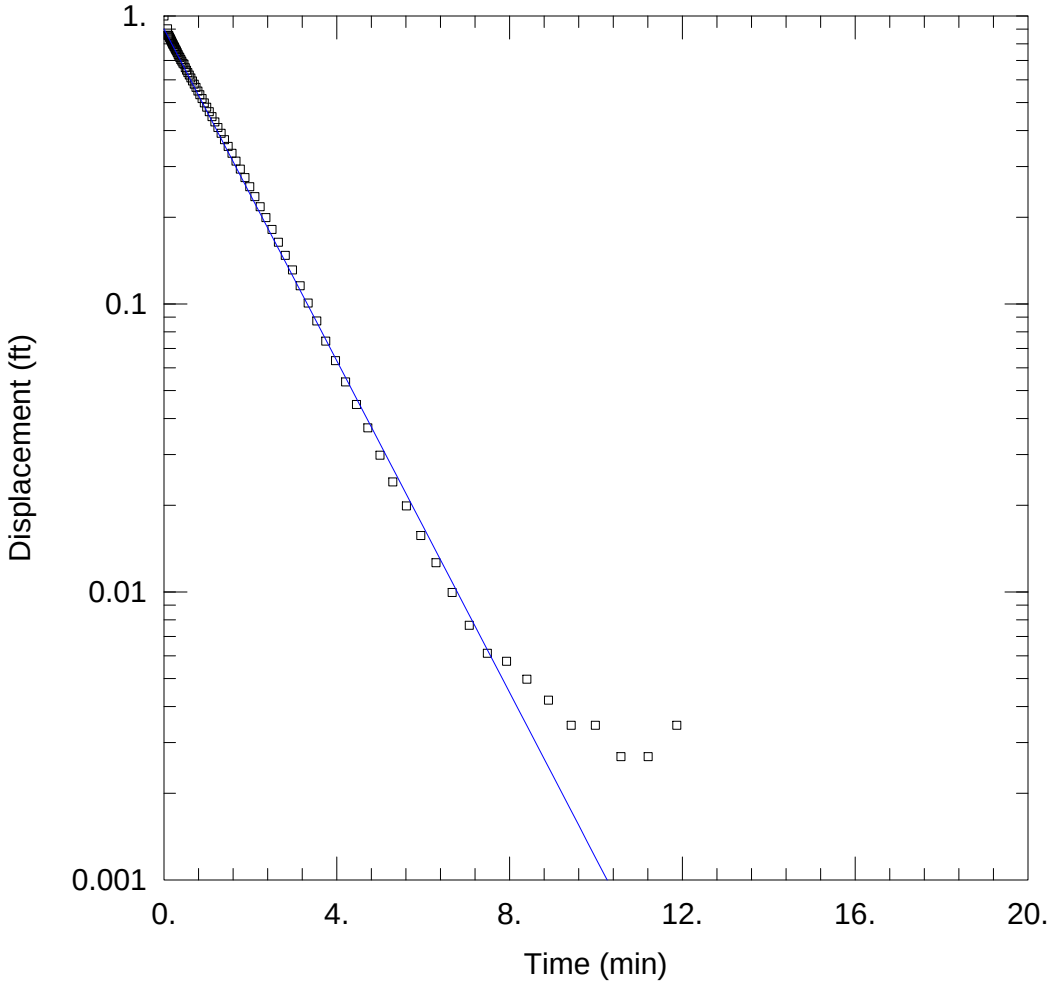
WELL DATA (MW31)

Initial Displacement: 1. ft
Total Well Penetration Depth: 22. ft
Casing Radius: 0.0808 ft
Static Water Column Height: 22. ft
Screen Length: 15. ft
Wellbore Radius: 0.0808 ft

SOLUTION

Aquifer Model: Confined
Solution Method: KGS Model

Kr = 0.00112 ft/min
Kz/Kr = 0.1
Ss = 1.0E-6 ft^{-1}



WELL TEST ANALYSIS

Data Set: R:\...\MW31in3_B&R.aqt
Date: 03/16/10 Time: 17:53:07

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 386743
Location: Omega
Test Well: MW31
Test Date: 10/23/09

AQUIFER DATA

Saturated Thickness: 30. ft Anisotropy Ratio (Kz/Kr): 0.1

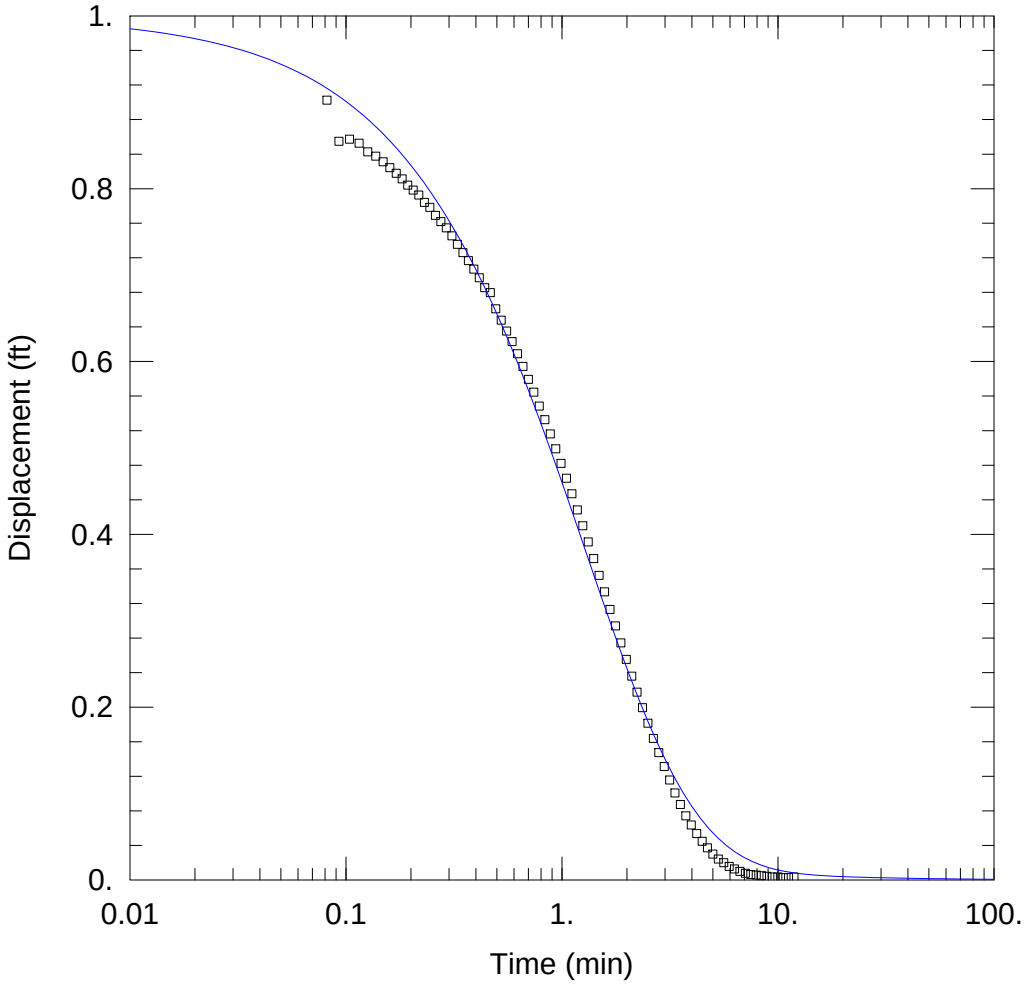
WELL DATA (MW31)

Initial Displacement: 1. ft Static Water Column Height: 22. ft
Total Well Penetration Depth: 22. ft Screen Length: 15. ft
Casing Radius: 0.0808 ft Wellbore Radius: 0.0808 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 0.0007234 ft/min y0 = 0.901 ft



WELL TEST ANALYSIS

Data Set: R:\...\MW31in3_KGS.aqt
Date: 03/16/10 Time: 17:52:55

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 386743
Location: Omega
Test Well: MW31
Test Date: 10/23/09

AQUIFER DATA

Saturated Thickness: 30. ft

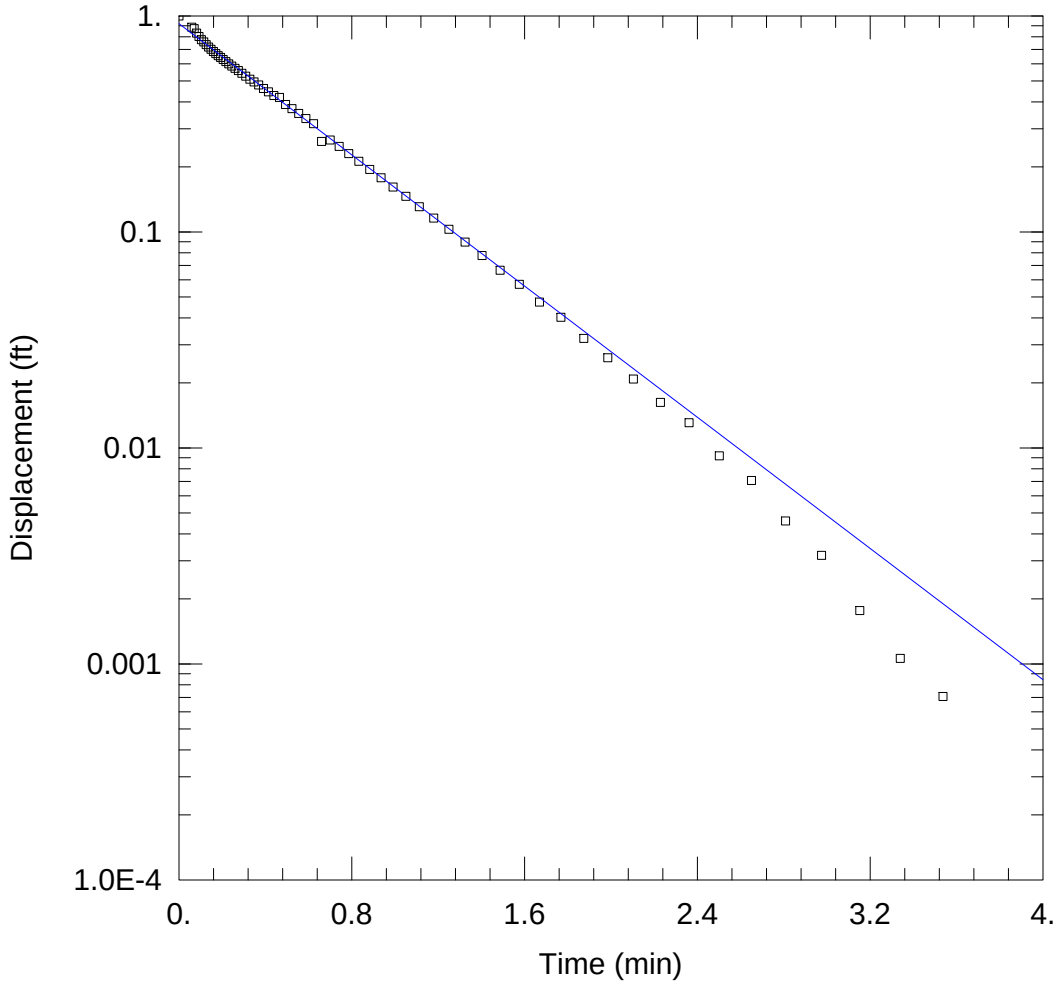
WELL DATA (MW31)

Initial Displacement: 1. ft
Total Well Penetration Depth: 22. ft
Casing Radius: 0.0808 ft
Static Water Column Height: 22. ft
Screen Length: 15. ft
Wellbore Radius: 0.0808 ft

SOLUTION

Aquifer Model: Confined
Solution Method: KGS Model

Kr = 0.0008032 ft/min
Kz/Kr = 0.1
Ss = 8.993E-6 ft^{-1}



WELL TEST ANALYSIS

Data Set: R:\...\MW31out1_B&R.aqt
Date: 03/16/10 Time: 17:52:41

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 386743
Location: Omega
Test Well: MW31
Test Date: 10/23/09

AQUIFER DATA

Saturated Thickness: 30. ft Anisotropy Ratio (Kz/Kr): 0.1

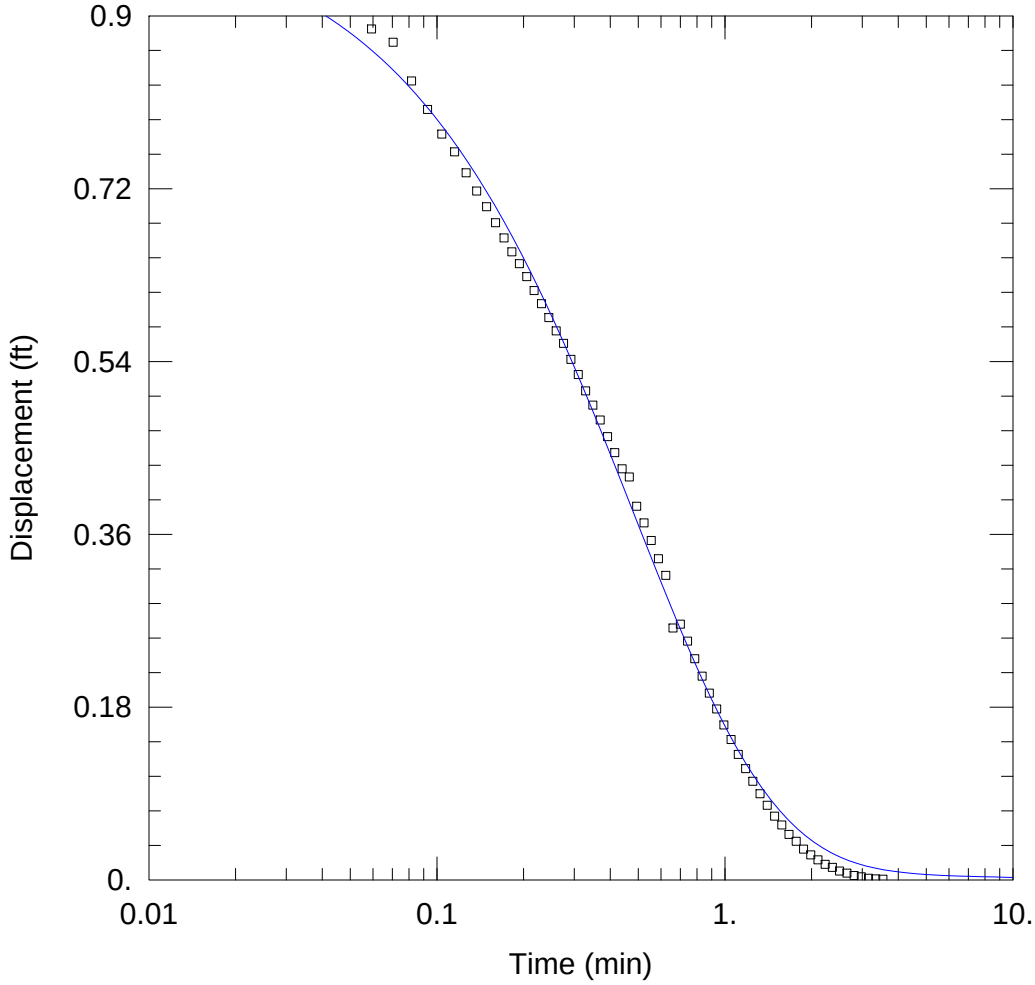
WELL DATA (MW31)

Initial Displacement: 1. ft Static Water Column Height: 22. ft
Total Well Penetration Depth: 22. ft Screen Length: 15. ft
Casing Radius: 0.0808 ft Wellbore Radius: 0.0808 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 0.001907 ft/min y0 = 0.9202 ft



WELL TEST ANALYSIS

Data Set: R:\...\MW31out1_KGS.aqt
Date: 03/16/10 Time: 17:52:30

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 386743
Location: Omega
Test Well: MW31
Test Date: 10/23/09

AQUIFER DATA

Saturated Thickness: 30. ft

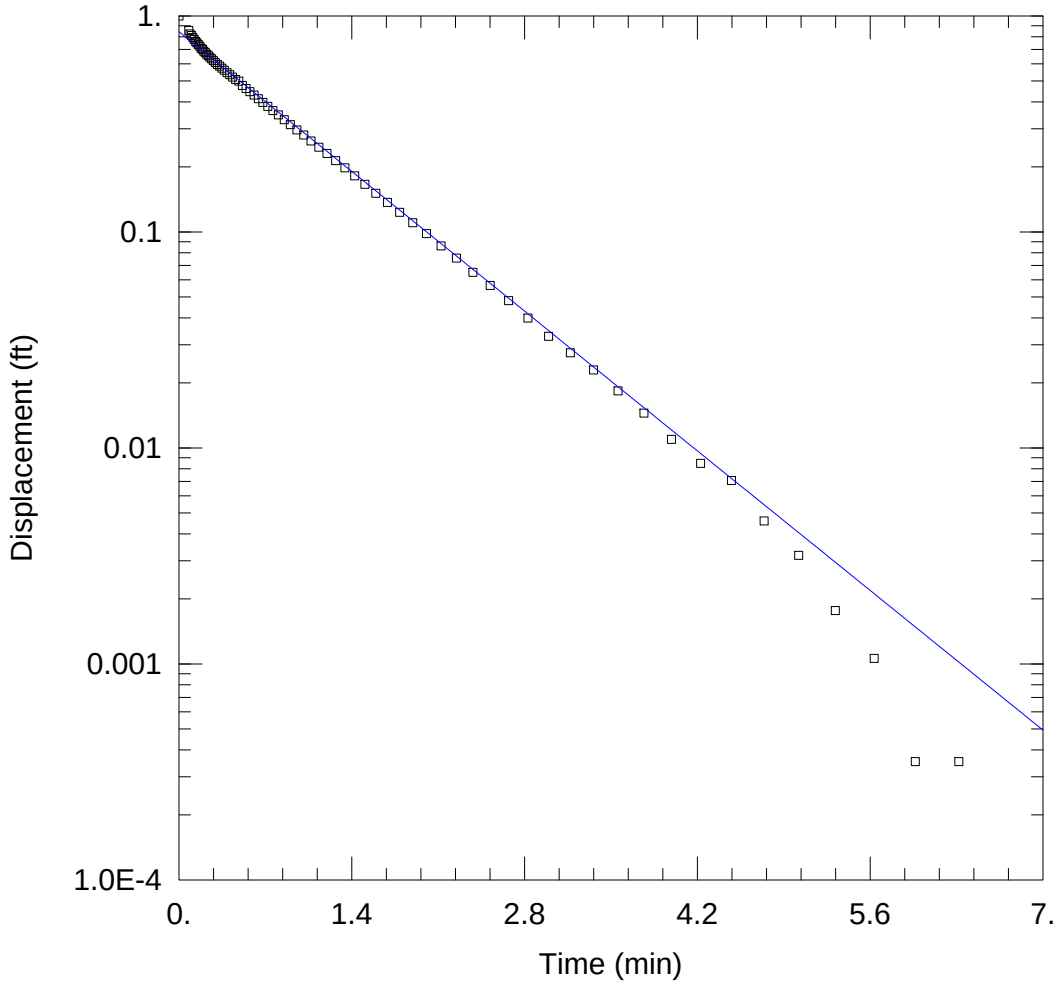
WELL DATA (MW31)

Initial Displacement: 1. ft
Total Well Penetration Depth: 22. ft
Casing Radius: 0.0808 ft
Static Water Column Height: 22. ft
Screen Length: 15. ft
Wellbore Radius: 0.0808 ft

SOLUTION

Aquifer Model: Confined
Solution Method: KGS Model

Kr = 0.002325 ft/min
Kz/Kr = 0.1
Ss = 2.683E-6 ft^{-1}



WELL TEST ANALYSIS

Data Set: R:\...\MW31out2_B&R.aqt
Date: 03/16/10 Time: 17:52:17

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 386743
Location: Omega
Test Well: MW31
Test Date: 10/23/09

AQUIFER DATA

Saturated Thickness: 30. ft Anisotropy Ratio (Kz/Kr): 0.1

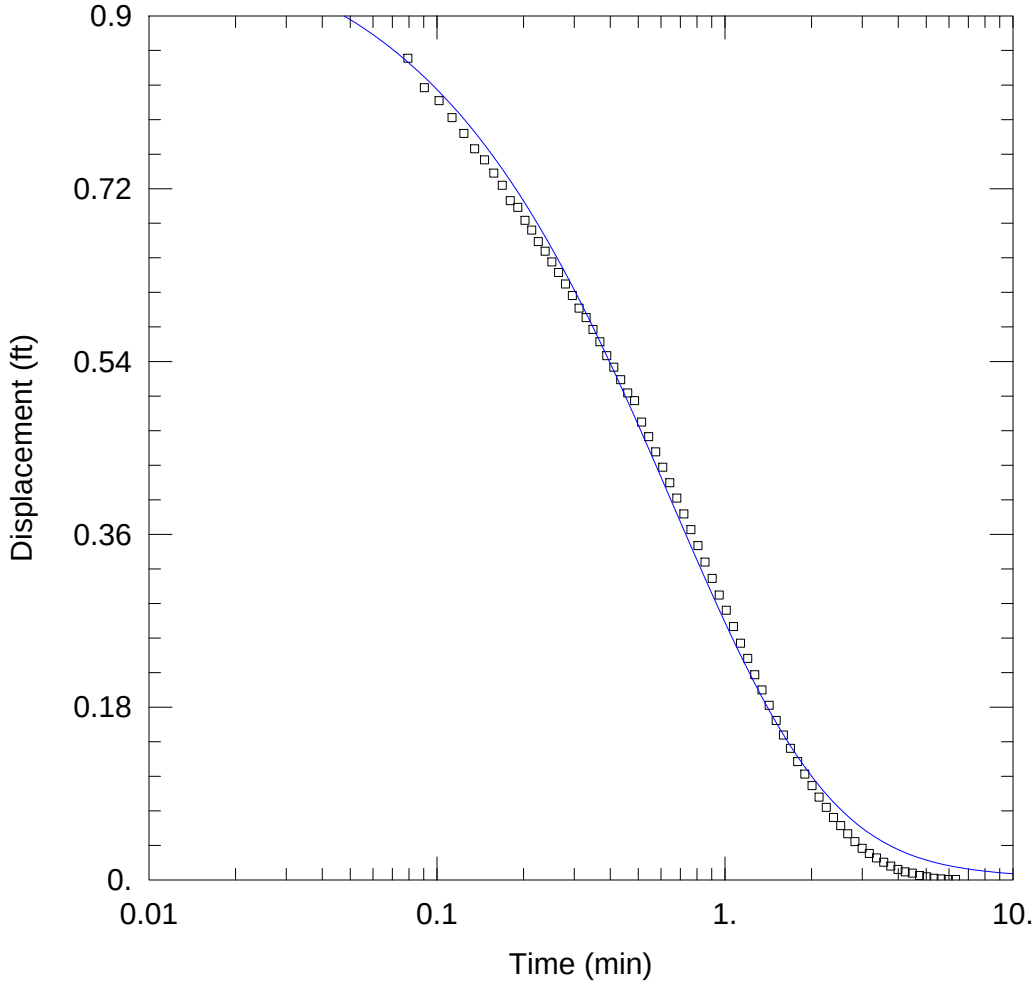
WELL DATA (MW31)

Initial Displacement: 1. ft Static Water Column Height: 22. ft
Total Well Penetration Depth: 22. ft Screen Length: 15. ft
Casing Radius: 0.0808 ft Wellbore Radius: 0.0808 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 0.00116 ft/min y0 = 0.8447 ft



WELL TEST ANALYSIS

Data Set: R:\...\MW31out2_KGS.aqt
Date: 03/16/10 Time: 17:51:57

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 386743
Location: Omega
Test Well: MW31
Test Date: 10/23/09

AQUIFER DATA

Saturated Thickness: 30. ft

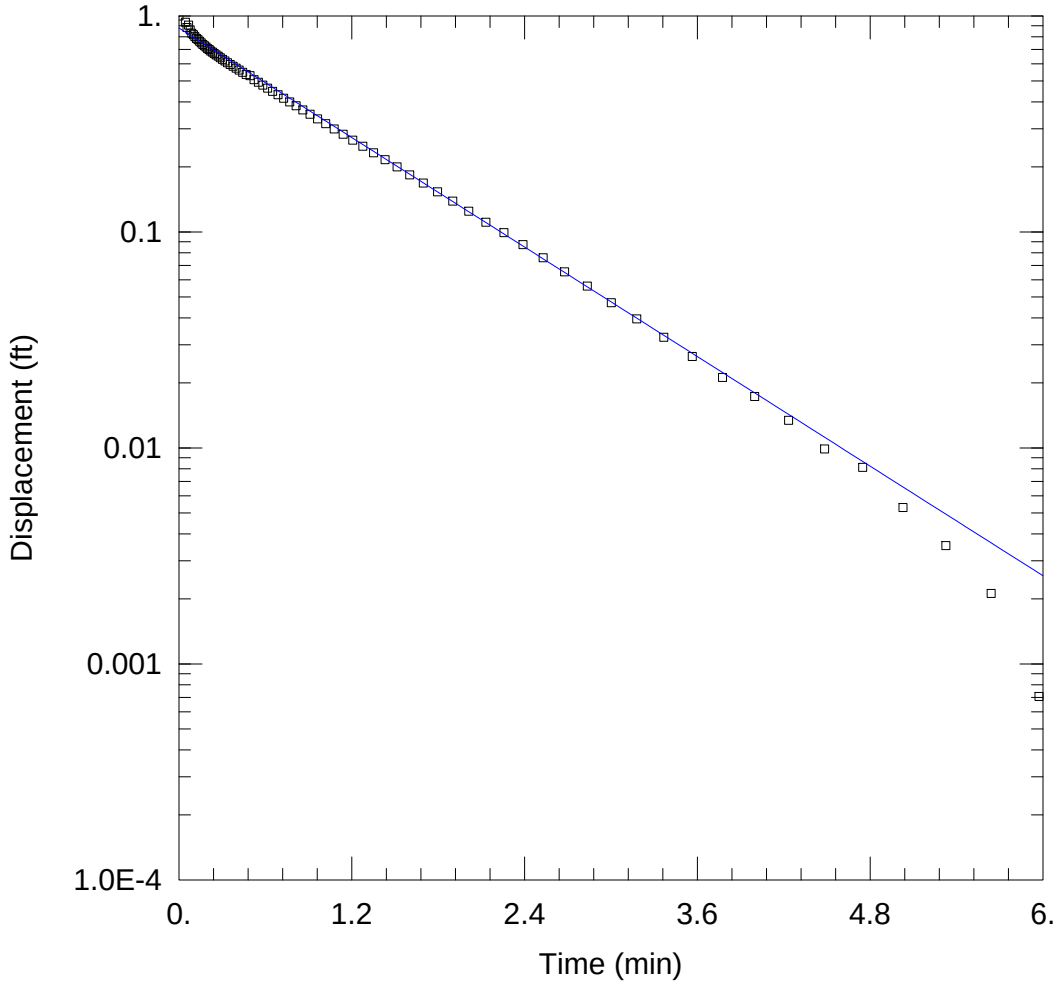
WELL DATA (MW31)

Initial Displacement: 1. ft
Total Well Penetration Depth: 22. ft
Casing Radius: 0.0808 ft
Static Water Column Height: 22. ft
Screen Length: 15. ft
Wellbore Radius: 0.0808 ft

SOLUTION

Aquifer Model: Confined
Solution Method: KGS Model

Kr = 0.001292 ft/min
Kz/Kr = 0.1
Ss = 4.38E-5 ft^{-1}



WELL TEST ANALYSIS

Data Set: R:\...\MW31out3_B&R.aqt
Date: 03/16/10 Time: 17:51:43

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 386743
Location: Omega
Test Well: MW31
Test Date: 10/23/09

AQUIFER DATA

Saturated Thickness: 30. ft Anisotropy Ratio (Kz/Kr): 0.1

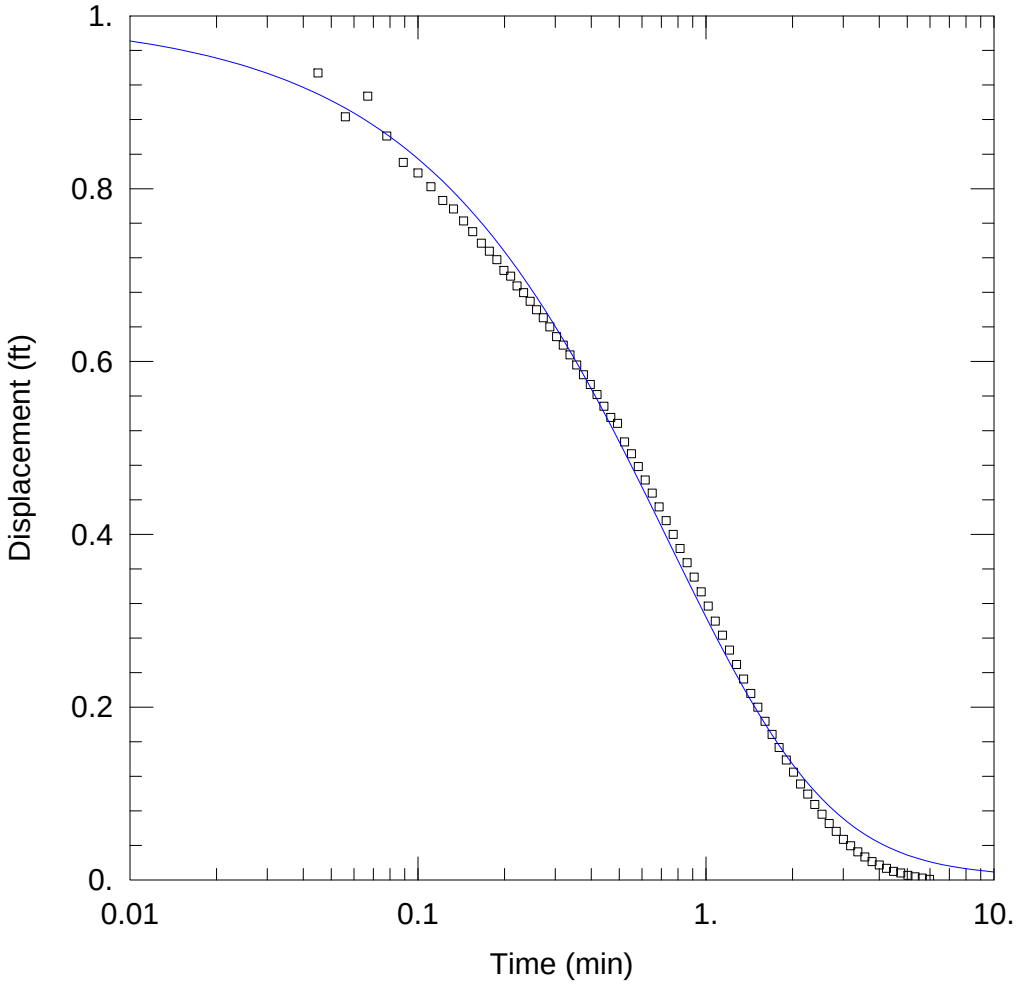
WELL DATA (MW31)

Initial Displacement: 1. ft Static Water Column Height: 22. ft
Total Well Penetration Depth: 22. ft Screen Length: 15. ft
Casing Radius: 0.0808 ft Wellbore Radius: 0.0808 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 0.001061 ft/min y0 = 0.879 ft



WELL TEST ANALYSIS

Data Set: R:\...\MW31out3_KGS.aqt
Date: 03/16/10 Time: 17:51:16

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 386743
Location: Omega
Test Well: MW31
Test Date: 10/23/09

AQUIFER DATA

Saturated Thickness: 30. ft

WELL DATA (MW31)

Initial Displacement: 1. ft
Total Well Penetration Depth: 22. ft
Casing Radius: 0.0808 ft
Static Water Column Height: 22. ft
Screen Length: 15. ft
Wellbore Radius: 0.0808 ft

SOLUTION

Aquifer Model: Confined
Solution Method: KGS Model

Kr = 0.001079 ft/min
Kz/Kr = 0.1
Ss = 7.075E-5 ft^{-1}

Appendix H2 - Analysis of Pumping Tests

Following the field pumping tests, data from the 30-PSI rated pressure transducers (In-Situ Level TROLL® 700 Series) were downloaded and processed using WinSitu 5 software (In-Situ, Inc., 2007). The depth-to-water measurements were converted to drawdown in a spreadsheet. The plots of the drawdown and pumping rates versus time are included in this appendix.

Initial Assessment of the Test Results

The drawdown response to pumping in the extraction wells stabilized quickly at all the tested locations, indicating that the wells are installed in permeable aquifer material. The pumping test wells were selected along the main contaminant transport pathway from the former Omega property, at locations where future remedial pumping may be considered. These wells were screened in sand units that likely represent the most permeable aquifer material at OU2. The well screens were not installed in fine grained materials that comprise a significant portion of the sediments at OU2. Therefore, the aquifer properties estimated from the pumping tests are characteristic of the material within the main contaminant transport pathway, but not of the bulk aquifer properties in the basin.

The tests at nested wells and well clusters allowed the evaluation of hydraulic continuity of the aquifer near the tested wells. During the EW-1 pumping tests, all four well screens at MW8 were monitored. Wells MW-8A, MW-8B, and MW-8C responded to the pumping while well MW-8D did not. The drawdown responses and the model fitting discussed below indicated that the units screened by the upper three screens at MW8 (A-C) responded hydraulically as one aquifer. The aquifer zone screened by MW8D is separated by fine-grained sediments from the overlying unit. This conclusion is further supported by the difference in heads and contaminant concentrations measured in MW8D and those measured in the three shallower wells (MW8A-C).

During the pumping tests at nested wells (MW23A, MW24A, MW24C, MW26A, MW26B, MW27A, MW27B, and MW30), water levels in adjacent screen intervals (above and below, as applicable) were monitored with pressure transducers. Drawdown response was recorded at MW24B during pumping from MW24C, indicating hydraulic communication between the two screened zones. No other observation wells responded to pumping. These results indicate that the fine grained unit separating MW24B and MW24C is not an effective barrier to groundwater flow and contaminant migration. The fine grained unit between MW24A and MW24B likely is a barrier to groundwater flow, as evidenced by the lack of hydraulic response and also by the difference in head and contaminant concentrations. MW24C and MW24D are likely separated by a low permeability unit because no response to pumping from MW24C was recorded in MW24D.

Plots of drawdown (stabilized at the end of each pumping step) versus pumping rates can be found in this appendix. A linear trend implies no well loss due to friction at the well screen. This was observed at MW26B and MW30; therefore, the well loss coefficient C (e.g., Kawecki, 1995) was not included in the model fitting to the data from these two wells. For most tested wells the trend is non-linear (approximately quadratic), indicating the effect of frictional well loss; C was estimated via model fitting for these tests. The specific capacities

of the wells, shown in Table H2-1 were calculated as the pumping rate divided by the drawdown of the last step in the tests. The specific capacity, along with the drawdown versus pumping rate charts, will be used to predict the pumping rates for remedial alternatives evaluated as part of the future Feasibility Study.

Background water levels were monitored prior to the EW1 test. Monitoring of water levels during the tests at the nested wells provided additional background data. No significant trends in water levels were recorded during the test; consequently, no trend corrections of the time-drawdown data were necessary. The background monitoring showed diurnal, atmospheric pressure induced fluctuations of the water levels inside the wells with amplitude of up to 0.05 feet. These fluctuations constitute "noise" in the test data; because of their small magnitude, no correction was required.

Methods of Analysis

The pumping tests were performed at wells installed at highly permeable aquifer material and at locations of potential remedial pumping. The drawdown response was generally very fast and the water level in the pumped well stabilized early into the pumping. Such pumping response makes traditional methods for pumping test analysis (e.g., Kruseman and deRidder, 1992) difficult to use. Conducting the tests in steps provided further information on the well properties (well loss) as well as sufficient information content on aquifer properties, but required fitting with a model that also accounts for frictional well loss. Widely used commercial software (e.g., Aqtesolv, AquiferWin, etc.) includes methods for analyzing tests on partially penetrating wells with finite casing diameter, or fully penetrating wells experiencing well loss, but not both. Analysis with these methods resulted in systematic misfit between the model and field data (examples from MW23A and MW24A are shown in this appendix). The processed data were therefore analyzed using the General Well Function (GWF; Perina and Lee, 2006) for pumping from partially-penetrating wells installed in confined, unconfined, or leaky aquifers. GWF accounts for well skin properties; the well loss is included as an additional drawdown component (e.g., Kawecki, 1995). The fitting of the model to the observed time-drawdown data was using the non-linear least squares technique based on the modified Marquardt method. The plots of observed and computed time-drawdown data are included in this appendix.

Estimated Aquifer Properties

The main objective was to estimate the horizontal hydraulic conductivity of the aquifer zones screened by the tested wells. The specific storage (S_s) and the hydraulic conductivity in the vertical direction (K_z) could not be reliably estimated from the test data; this is a known limitation of single-well pumping tests (e.g., Kruseman and deRidder, 1994).

However, S_s can be constrained within a fairly narrow range for unconsolidated sandy soils using published values of soil compressibility and porosity (Domenico and Schwartz, 1992); the range of plausible S_s values is shown in Table H1-2 (in Appendix H-1). The lowest estimated S_s value of 1.0×10^{-6} ft^{-1} is lower than the reasonable range of S_s values from 9.9×10^{-6} ft^{-1} to 2.69×10^{-4} ft^{-1} for sands and gravels (Domenico and Schwartz, 1990). Therefore, for most tests, S_s was held fixed (not estimated) at a value of 4.0×10^{-5} ft^{-1}. This S_s value was chosen to be more representative of the 9 wells on which pumping tests were performed. Because K_z is generally expected to be lower than the horizontal (in the radial direction

relative to the pumped well) hydraulic conductivity (e.g., Domenico and Schwartz, 1992), the ratio K_z/K_r was held fixed at 0.1 for the single-well test analysis. The hydraulic conductivity of well skin (K_{rs}) was only estimated when the fitting improved and the estimated K_r was reasonable.

Results of Analysis

The best-fit estimates chosen as the representative results are summarized in Table H2-1. Some results for multiple fitting cases are shown in Table H2-2 as an example of the sensitivity of the estimated aquifer properties to the parameters held fixed. The results for six fittings to EW1 test data are shown: two that estimated all parameters based on data from EW1 plus the observation wells simultaneously, two that used data from the observation wells only, and two that used data from all wells but with some parameters held fixed. The representative K_r is 404 ft/day based on the best fit; this high conductivity of the aquifer explains the flat time-drawdown curves (i.e., reflecting steady flow condition) recorded during the test. The other parameter estimates are also reasonable (Table H2-2). The drawdown response during the test (flat time-drawdown curve) and the estimated K_r are in agreement. The test analysis results supersede the visual description of the lithology of the screened interval at EW1; the pumping test results are representative of coarse sands but the lithologic description for EW1 includes silt, fine to medium sand, and clay within the screen interval. The visual lithologic description for EW1 is likely biased toward fine grained soils, because the downhole resistivity log and boring log for nearby MW8 indicates predominantly sands. The estimated K_z/K_r values were low, representative of the layering in the aquifer with alternating coarse and fine-grained soils (i.e., sands and silts/clays). Such low K_z explains head differences between shallow and deep-screened wells (e.g., at MW8A-D) and is expected to limit downward migration of contaminants.

The overall range of K_r values estimated from the MW26B test is 316 ft/day to 383 ft/day. The results of the sensitivity simulations for the MW26B test show that whether S_s or hydraulic conductivity from well skin (K_{rs}) were estimated or fixed, or whether K_{rs} was omitted (no skin) has little effect on the estimated K_r. These results increase the confidence in the K_r estimate.

The model fit to the test data was good. Slight systematic misfit for some wells could be explained by pumping rate measurement errors in some test steps, leaking pump valve during recovery, and non-ideal response of the aquifer (e.g., heterogeneous aquifer properties, etc.).

The representative K_r results range from a minimum value of 45 ft/day at MW27B to 404 ft/day for EW1. The K_r values are higher than those estimated from slug tests on the same wells. This is a common test outcome; because the hydraulic disturbance caused by pumping affected much larger volume of the tested aquifer than the disturbance from the slug tests, more flow pathways (i.e., zones of relatively high K_r) were active during the pumping than during the slug tests. K_{rs} was calculated for five of the nine test wells; the skin effect was insignificant for the remaining wells. The average specific capacity is 62.2 gpm/ft and the average well loss coefficient (C) is 0.3 min^2/ft^5.

References:

Kawecki, M.W. 1995. Meaningful Interpretation of Step-Drawdown Tests. Ground Water, vol. 33, no. 1, pp. 23-32.

Kruseman, G. P., and N. A. deRidder. 1994. Analysis and Evaluation of Pumping Test Data. International Institute for Land Reclamation and Improvement, Wageningen, Netherlands, 377 pp.

Perina, T., and T.C. Lee. 2006. General well function for pumping from a confined, leaky, or unconfined aquifer. Journal of Hydrology, vol. 317, no. 3, pp. 239-260.

Table H2-1
Pumping Test Results using GWF Method of Analysis
Omega Chemical Superfund Site

Well	K_r (ft/min)	K_{rs} (ft/min)	C (min^2/ft^5)	S_s	R^2	specific capacity (gpm/ft drawdown)	K_r (ft/d)
MW23A	0.148181	0.00702882	0.13423	4.00E-05	0.997687	5.0	213
MW24A	0.23749	N/A	0.0395194	4.00E-05	0.983168	139.2	342
MW24C	0.177324	0.00624687	0.0636532	4.00E-05	0.998679	52.9	255
MW26A	0.12908	N/A	0.0629765	4.00E-05	0.988662	104.4	186
MW26B	0.219279	N/A	N/A	4.00E-05	0.921618	85.6	316
MW27A	0.037196	0.0071075	0.685561	4.00E-05	0.992678	15.8	54
MW27B	0.031515	N/A	0.796796	4.00E-05	0.985161	14.3	45
MW30	0.200749	0.0122843	N/A	4.00E-05	0.999379	80.6	289

Well	K_z/K_r	K_r (ft/min)	S_s	K_{rs} (ft/min)	C	R^2	K_r (ft/d)
EW1	0.009198	0.280757	2.0700E-05	3.03E-03	1.88E-01	0.99958	404

Notes:

K_r = Hydraulic Conductivity of the aquifer

K_{rs} = Hydraulic Conductivity of well skin

C = well loss coefficient

S_s = Specific Storage

K_z/K_r = anisotropy ratio where z is vertical and r is horizontal

N/A = Not considered in the model.

gpm = gallons per minute

S_s was fixed for monitoring well pumping test analyses at 4.0E-05

K_z/K_r was fixed for monitoring well pumping test analyses at 0.1

Table H2-2
Pumping Test Results for MW26B and EW1 using GWF Method of Analysis
Omega Chemical Superfund Site

Well	K_r (ft/min)	K_{rs} (ft/min)	C (min^2/ft^5)	S_s	R^2	specific capacity (gpm/ft drawdown)	K_r (ft/d)	
MW26B	0.219279	N/A	N/A	4.00E-05	0.921618	85.6	316	
MW26B	0.266092	4.00E-02	N/A	3.90E-04	0.927354	85.6	383	
Well	K_z/K_r	K_r (ft/min)	S_s	K_{rs} (ft/min)	C	R^2	K_r (ft/d)	comments
EW1	0.009198	0.280757	2.07E-05	3.03E-03	1.88E-01	0.99958	404	used all data
EW1	0.006863	0.316942	1.00E-06	3.03E-03	1.88E-01	0.999628	456	used all data
EW1	0.024621	0.181944	1.74E-05	2.00E-03	N/A	0.960375	262	used observation wells only
EW1	0.019255	0.187472	3.85E-05	6.96E-03	N/A	0.984698	270	used observation wells only
EW1	0.1	0.137665	9.74E-05	3.58E-03	1.89E-01	0.999443	198	used all data, fixed K_z/K_r
EW1	0.018632	0.174987	4.00E-05	3.40E-03	1.89E-01	0.999546	252	used all data, fixed S_s

Notes:

K_r = Hydraulic Conductivity of the aquifer

K_{rs} = Hydraulic Conductivity of well skin

C = well loss coefficient

S_s = Specific Storage

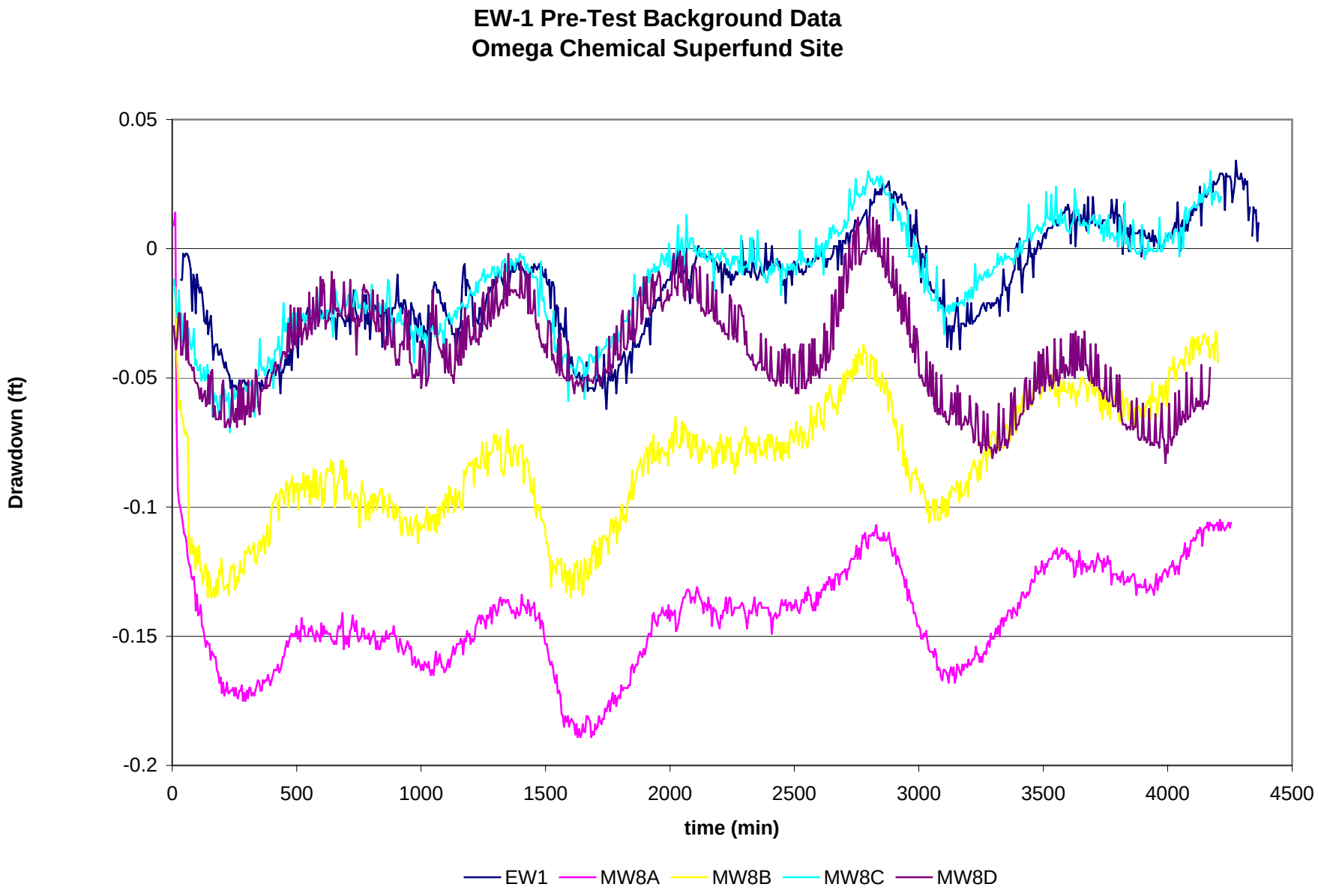
K_z/K_r = anisotropy ratio where z is vertical and r is horizontal

N/A = Not considered in the model.

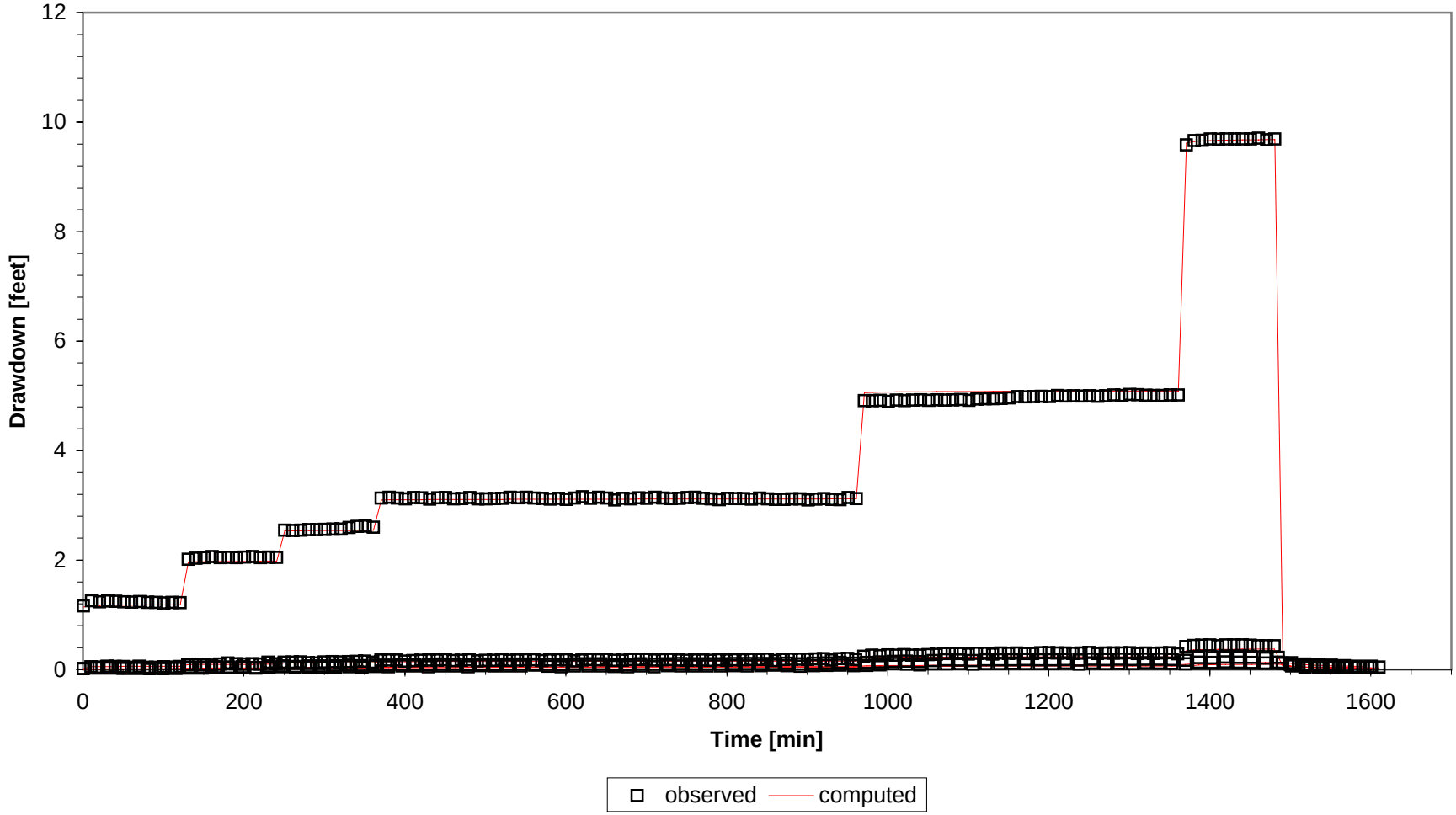
gpm = gallons per minute

S_s was fixed for monitoring well pumping test analyses at 4.0E-05

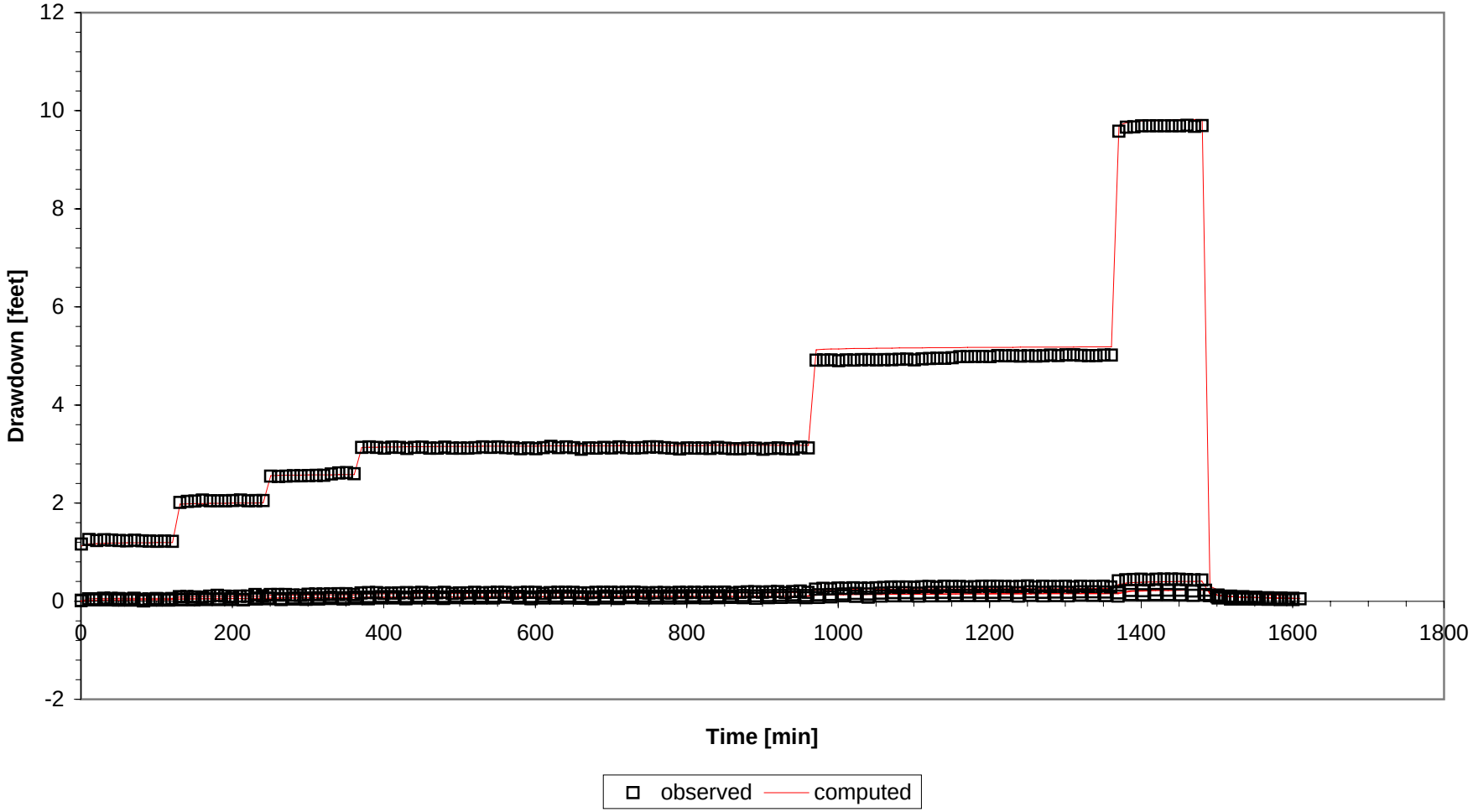
K_z/K_r was fixed for monitoring well pumping test analyses at 0.1


EW-1 Pre-Test Background Data
Omega Chemical Superfund Site
Drawdown (ft)
0.05
0
-0.05
-0.1
-0.15
-0.2
0
500
1000
1500
2000
2500
3000
3500
4000
4500
time (min)
EW1
MW8A
MW8B
MW8C
MW8D

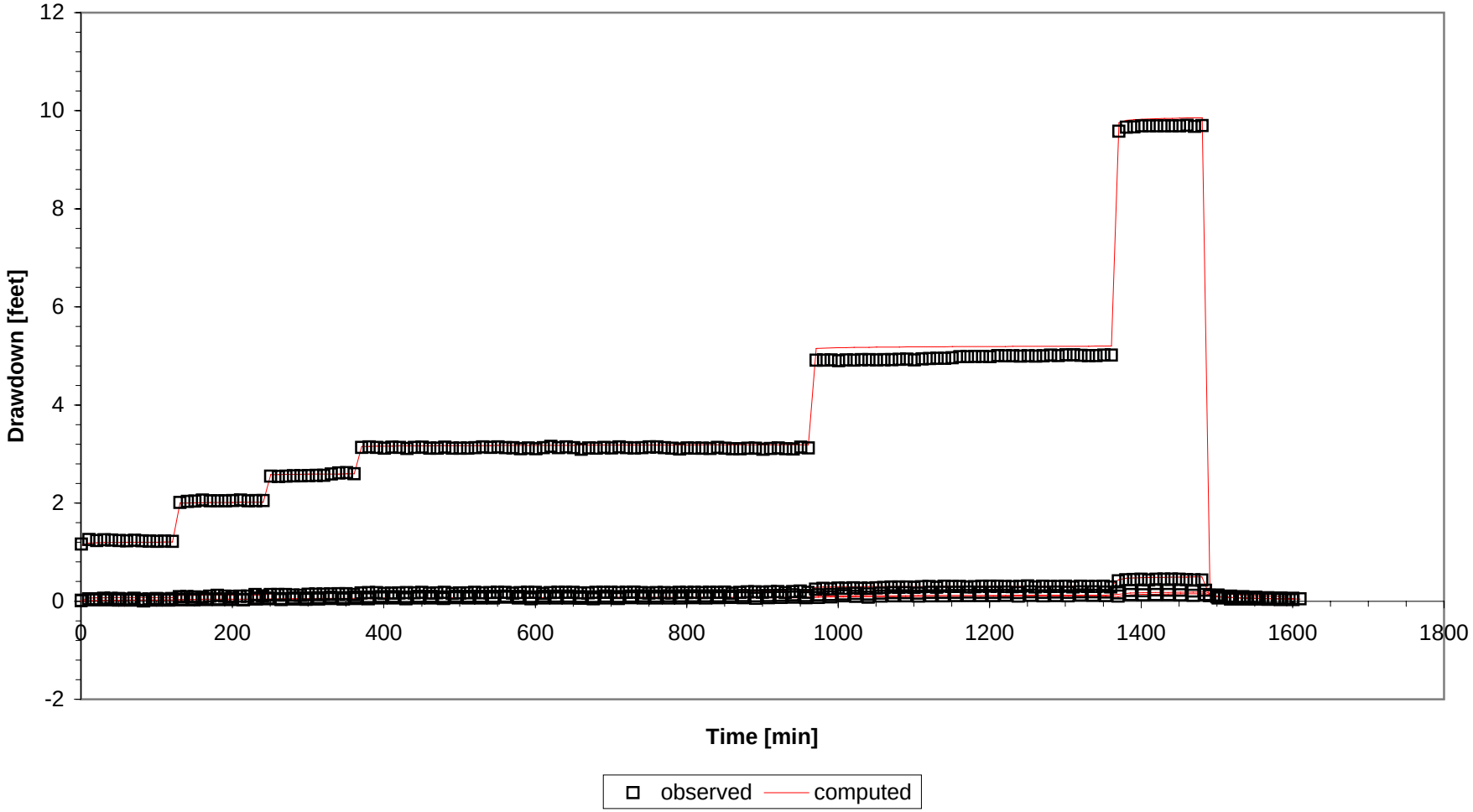
EW1 Pumping Test - Results from GWF
Omega Chemical Superfund Site
11-20-06 to 11-21-06
Kr=404 ft/day



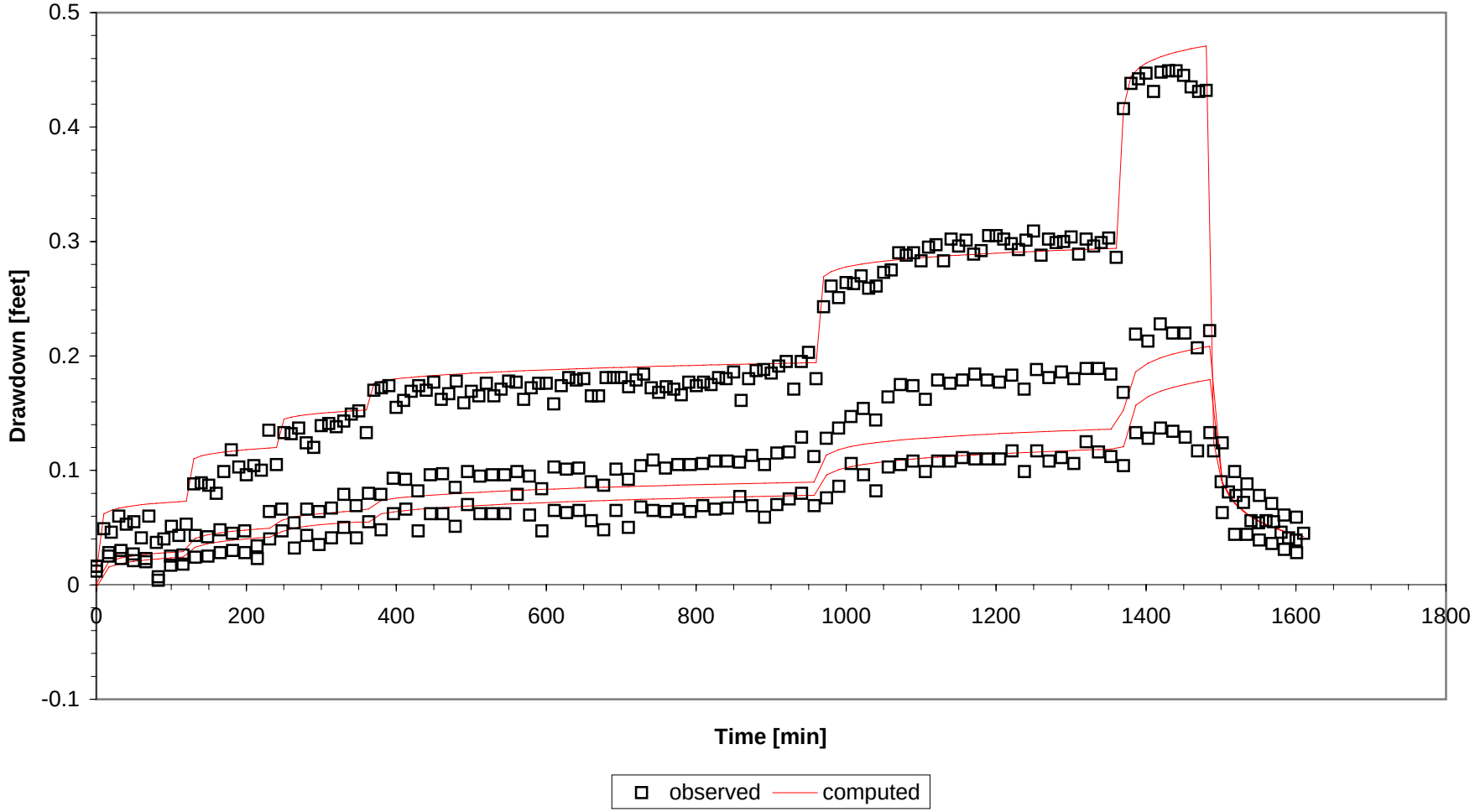
EW1 Pumping Test - Results from GWF
Omega Chemical Superfund Site
11-20-06 to 11-21-06
Kr=198 ft/day



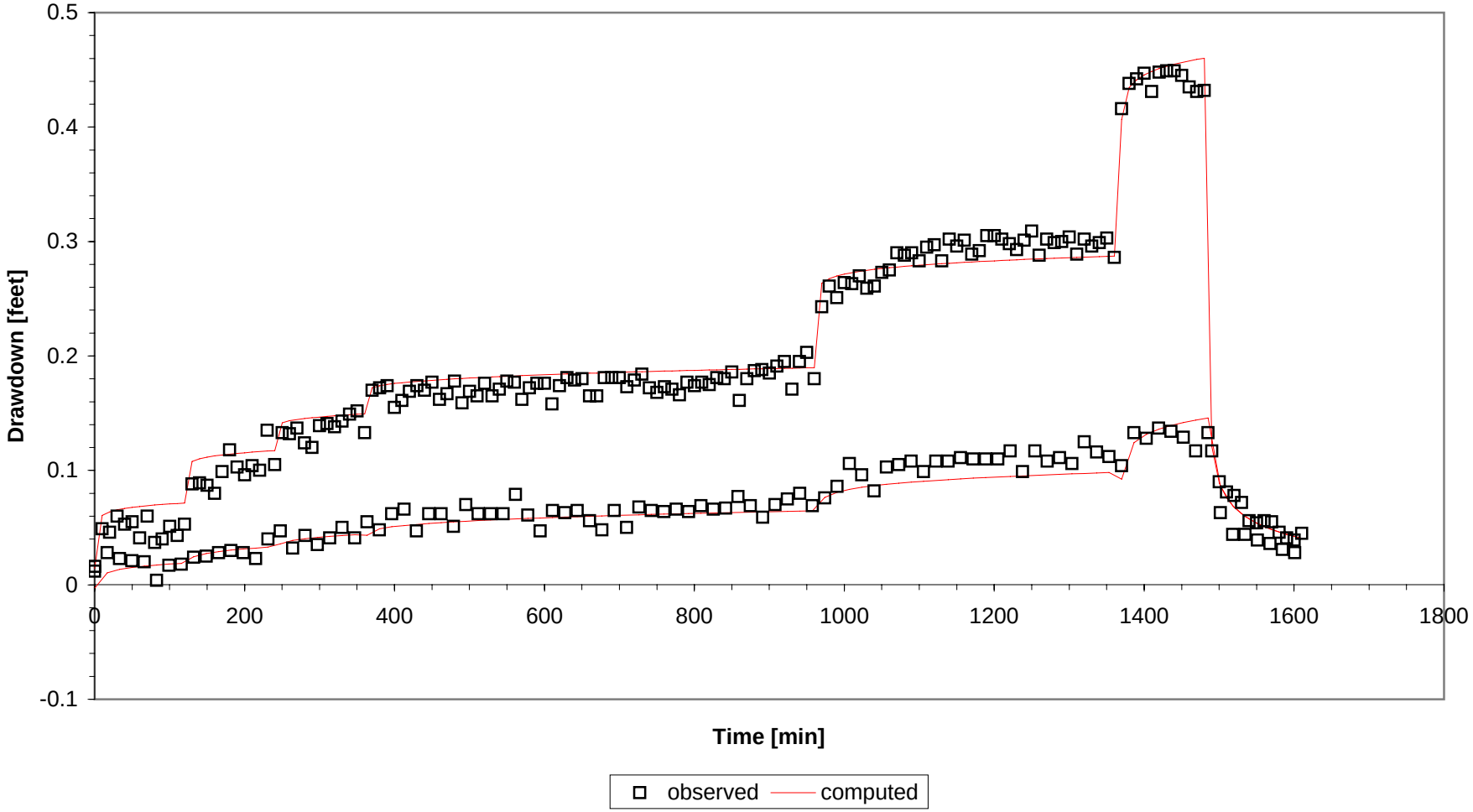
EW1 Pumping Test - Results from GWF
Omega Chemical Superfund Site
11-20-06 to 11-21-06
Kr=252 ft/day



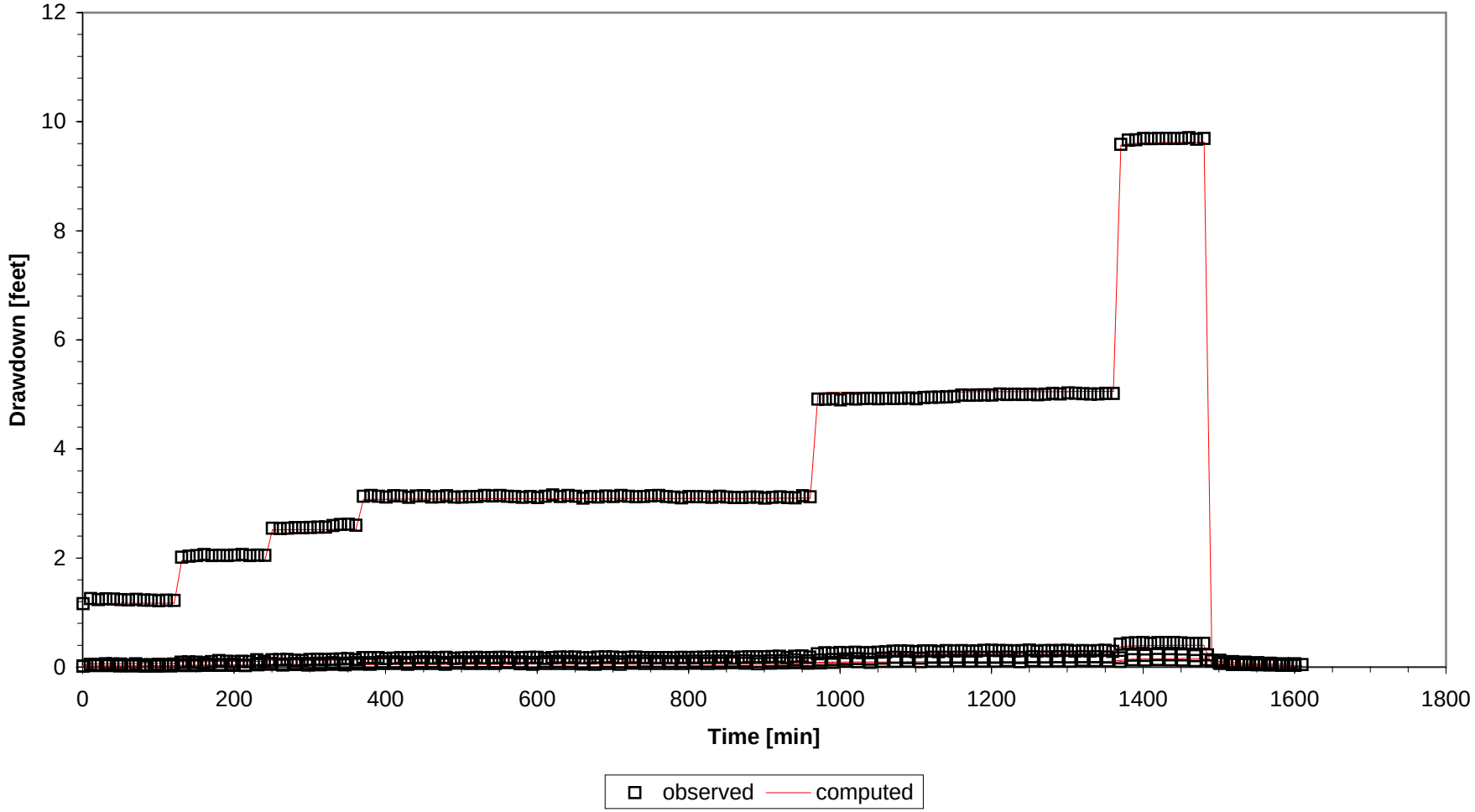
EW1 Pumping Test - Results from GWF
Omega Chemical Superfund Site
11-20-06 to 11-21-06
Kr=262 ft/day

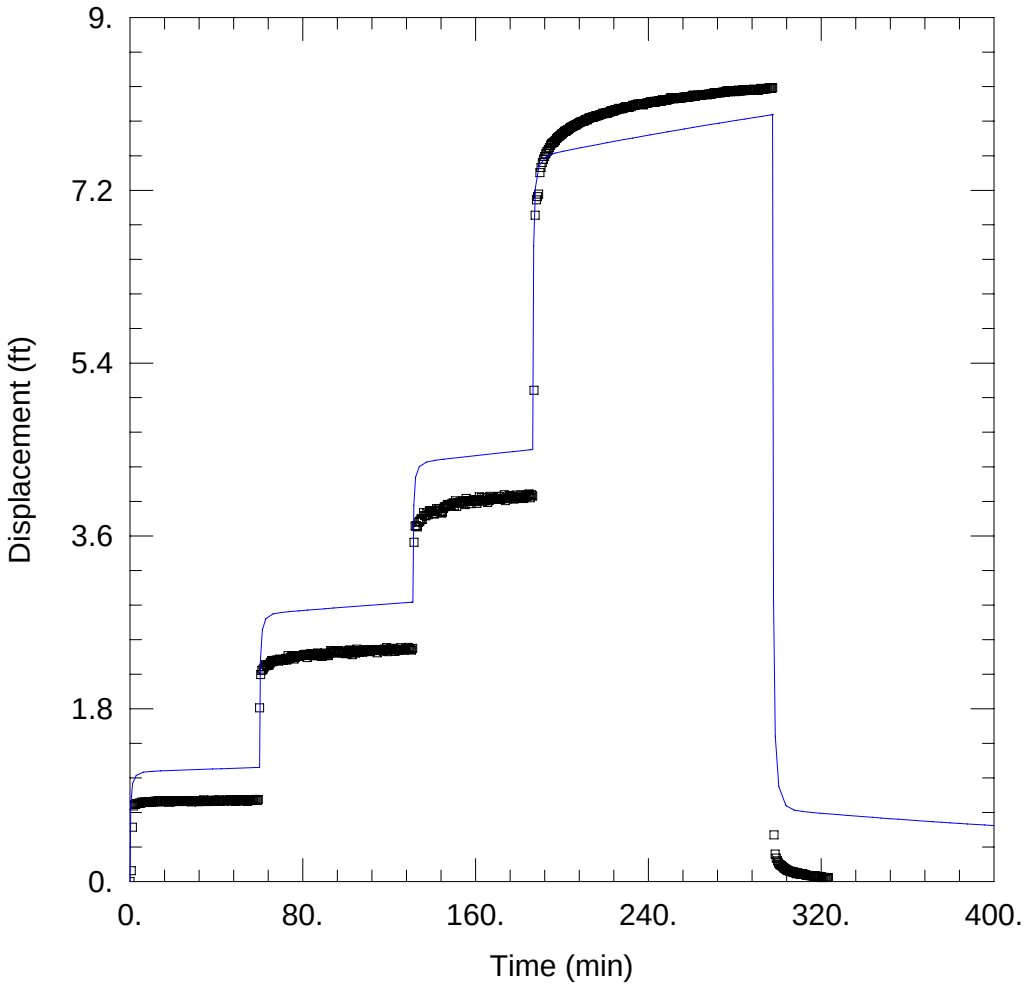


EW1 Pumping Test - Results from GWF
Omega Chemical Superfund Site
11-20-06 to 11-21-06
Kr=270 ft/day



EW1 Pumping Test - Results from GWF
Omega Chemical Superfund Site
11-20-06 to 11-21-06
Kr=456 ft/day





WELL TEST ANALYSIS

Data Set: R:\...\MW23Apump.aqt
Date: 09/28/07 Time: 10:06:44

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 335392
Location: Omega
Test Well: MW23A
Test Date: 6/29/07

AQUIFER DATA

Saturated Thickness: 38.2 ft Anisotropy Ratio (Kz/Kr): 0.06238

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
MW23A	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
▫ MW23A	0	0

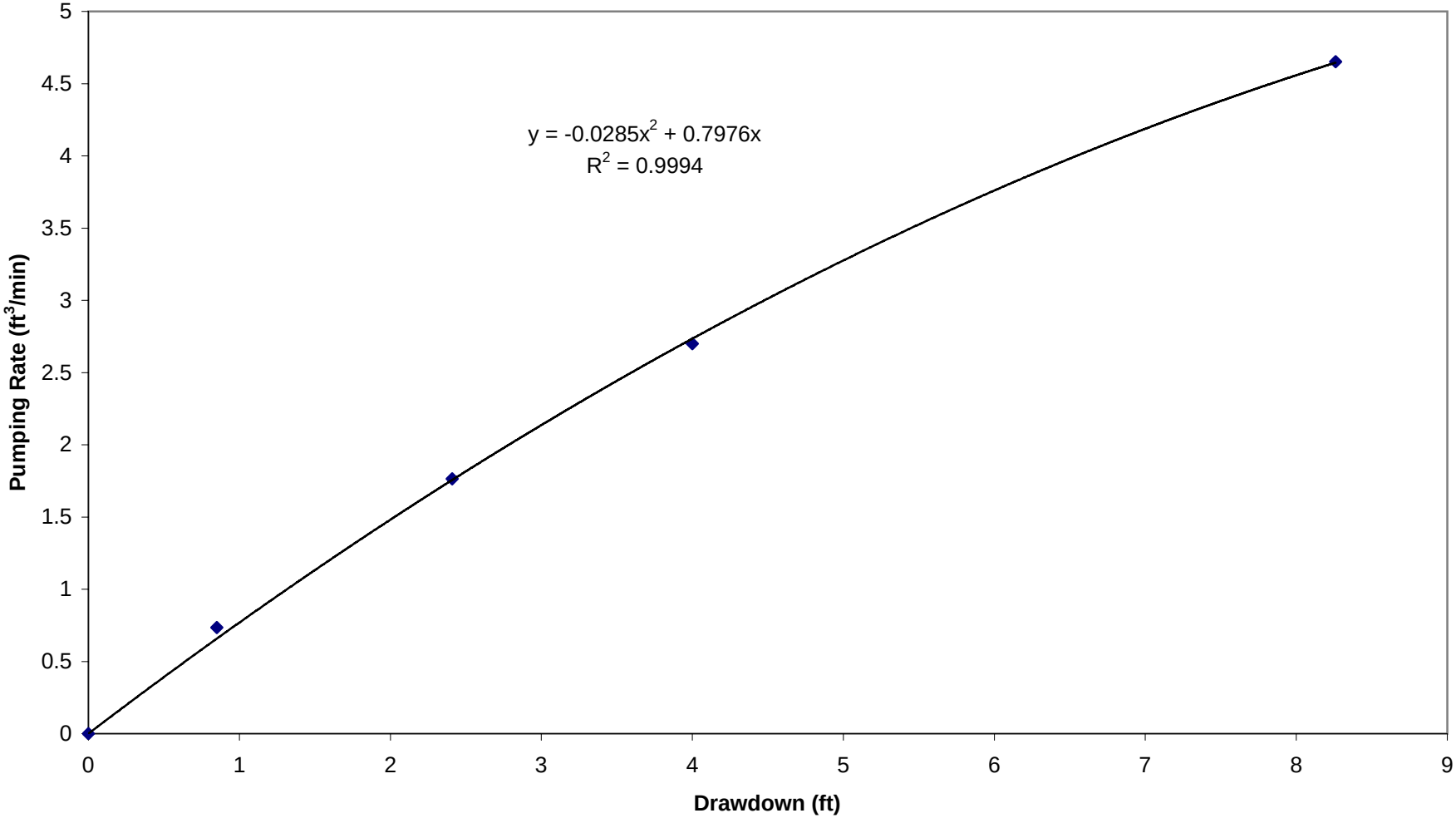
SOLUTION

Aquifer Model: Unconfined Solution Method: Moench

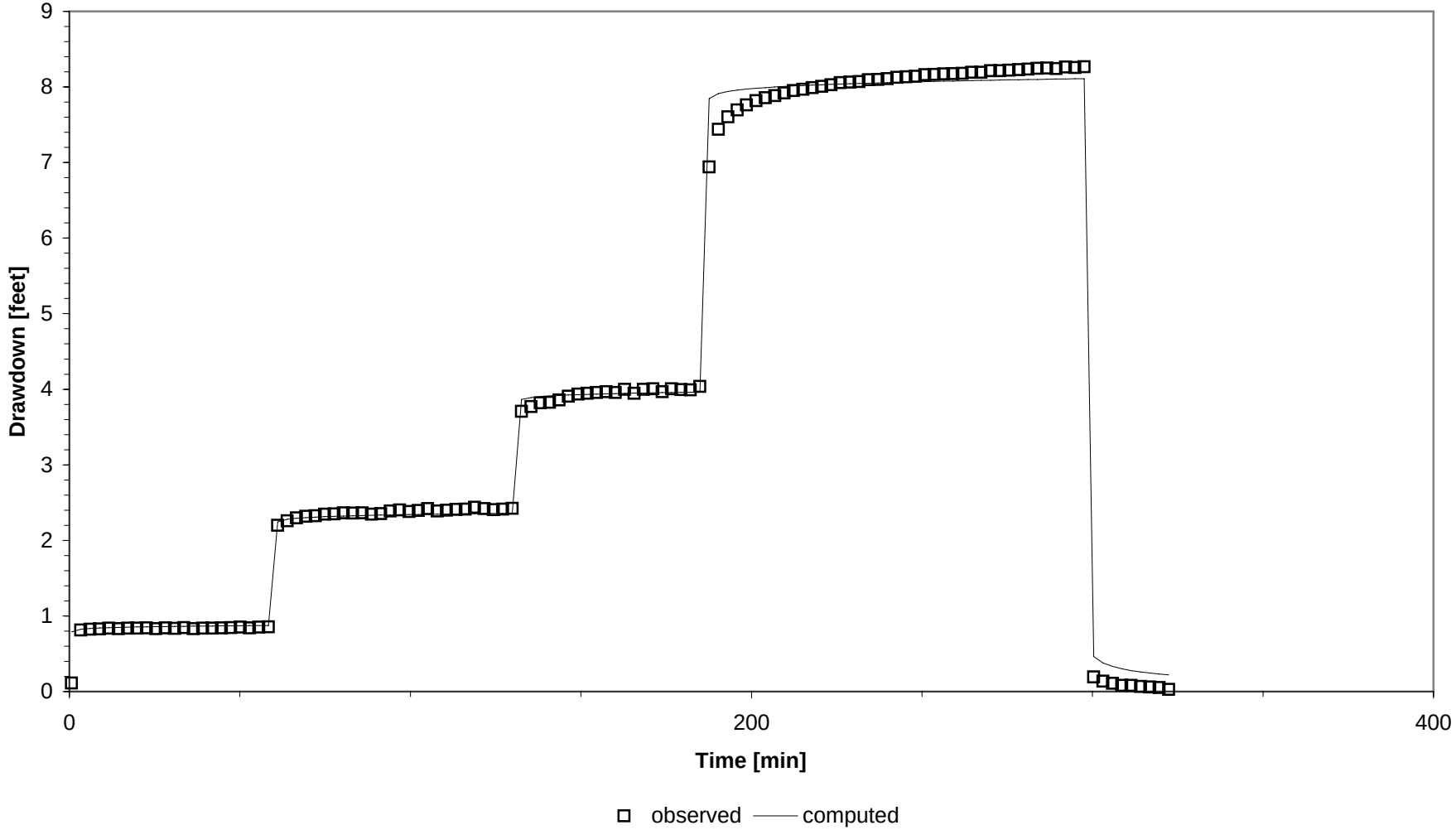
T = 0.3309 ft^2/min
Sy = 0.01
Sw = -3.992
alpha = 1.0E+30 min^{-1}

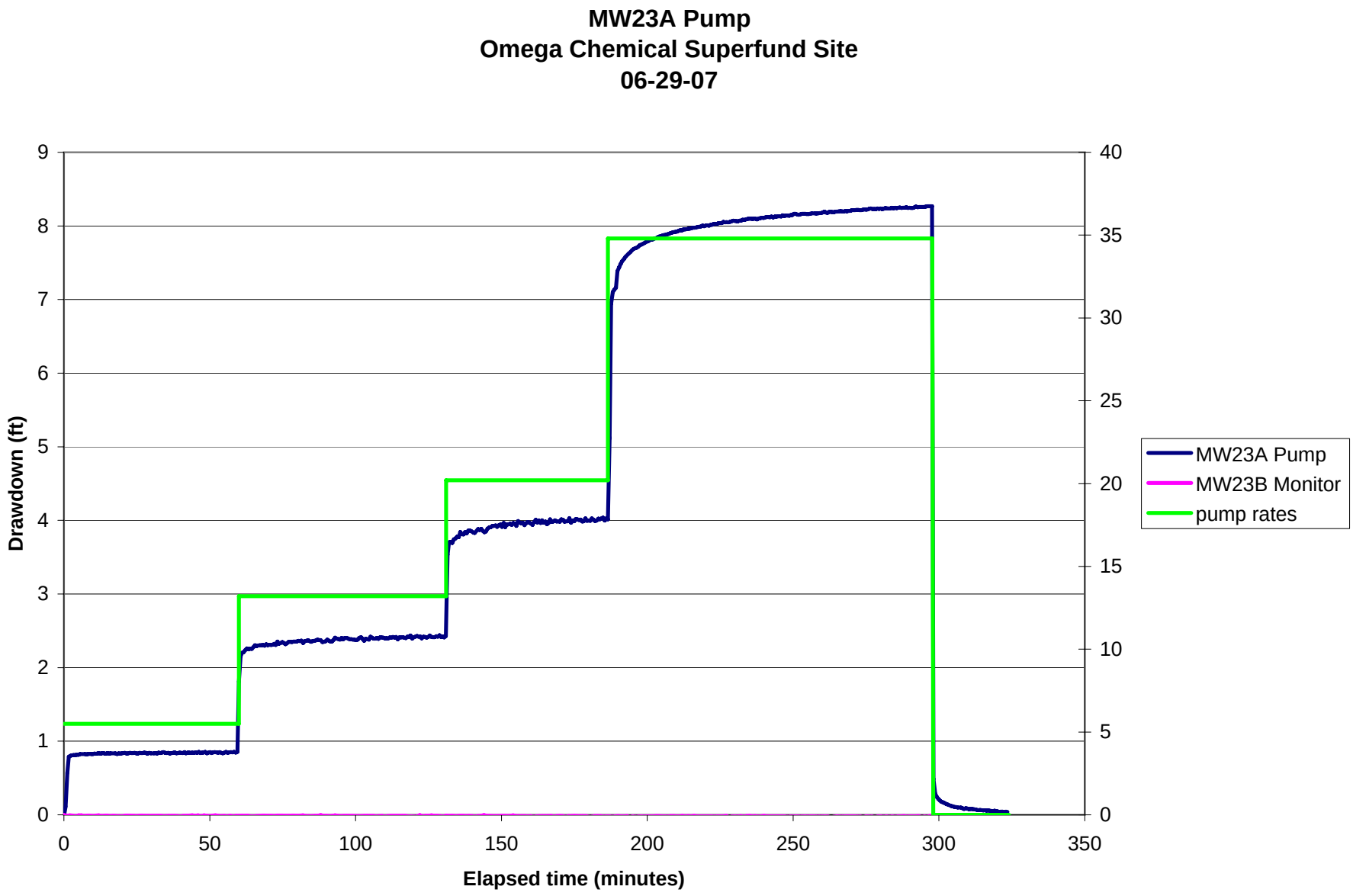
S = 0.0001054
ß = 1.71E-6
r(w) = 0.158 ft

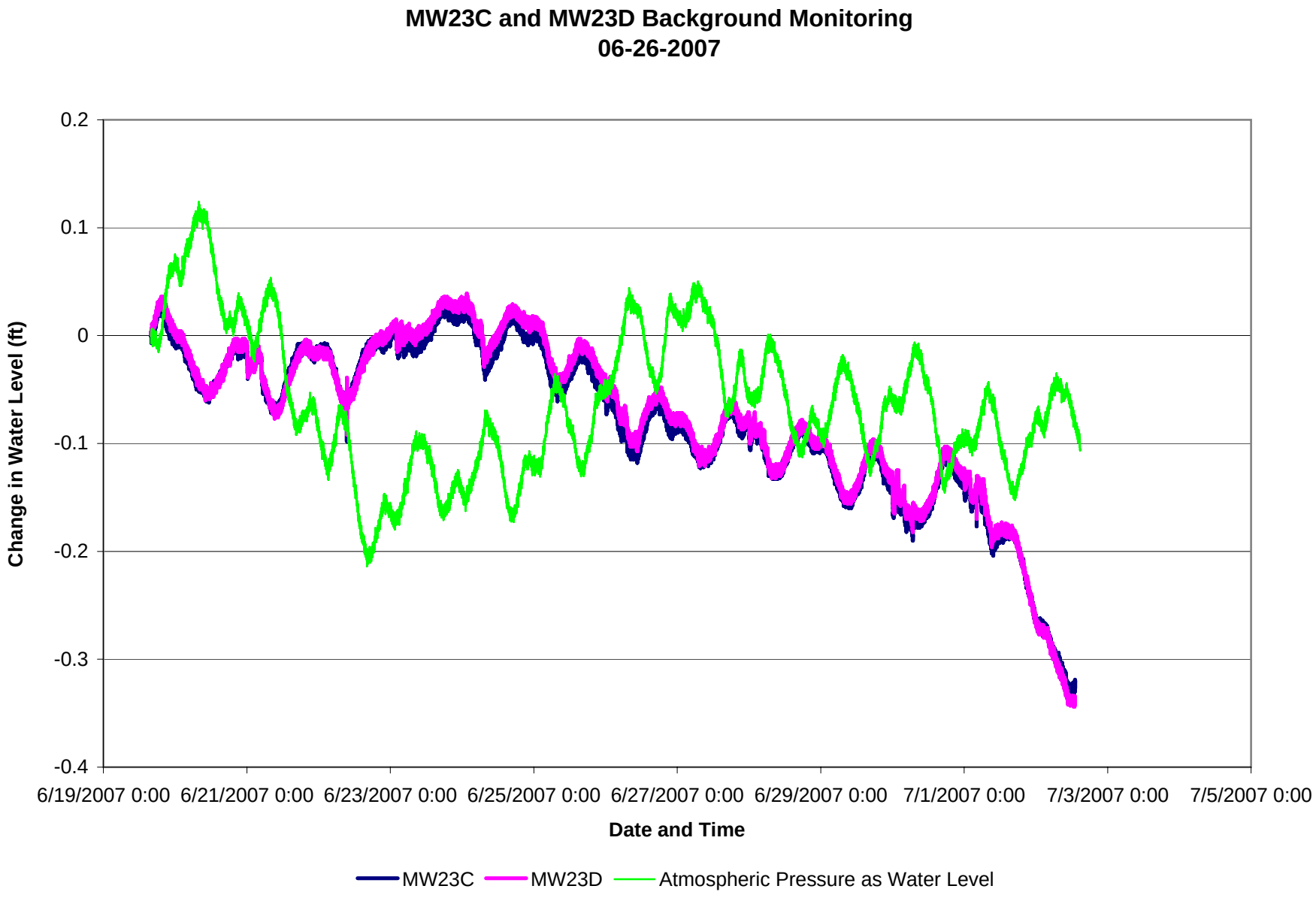
MW23A
Omega Chemical Superfund Site
06-29-07

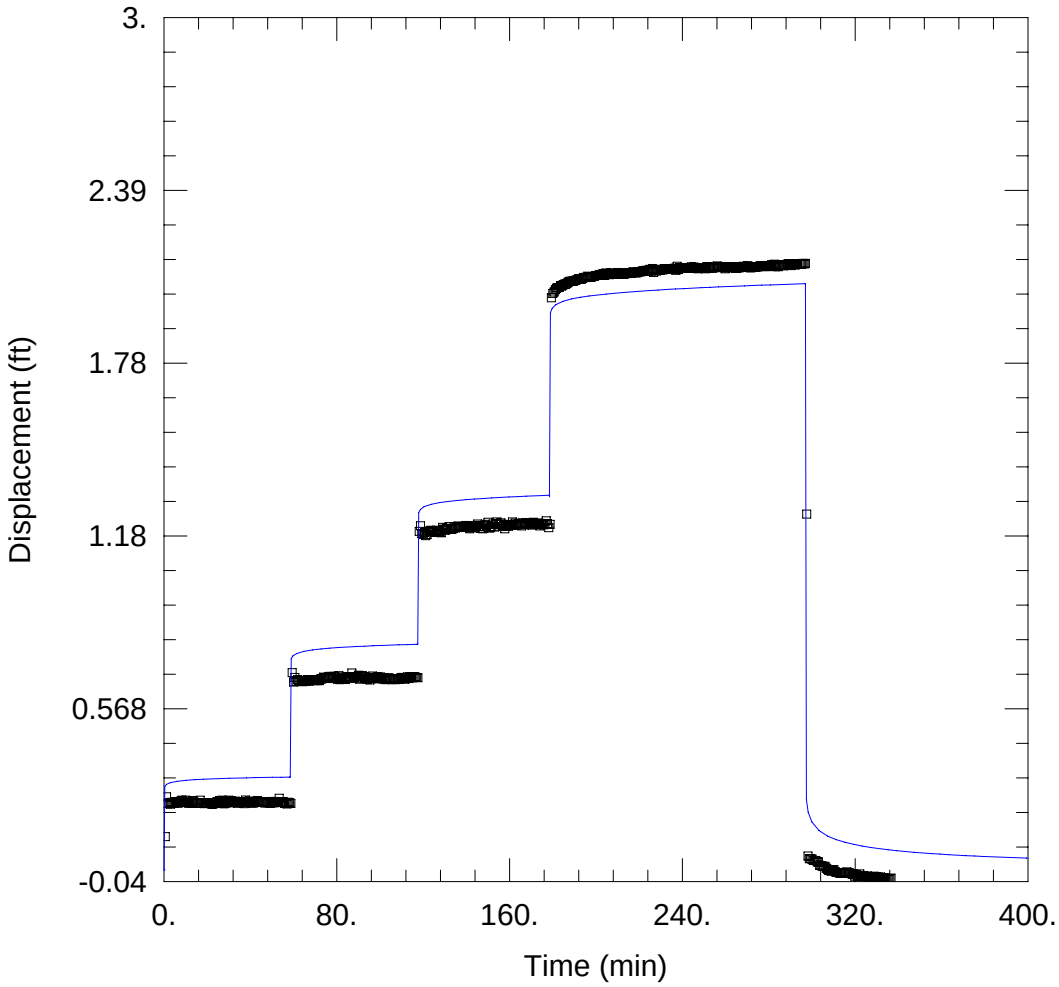


MW23A Step Pumping Test - Results from GWF
Omega Chemical Superfund Site
06-29-07




MW23A Pump
Omega Chemical Superfund Site
06-29-07
Drawdown (ft)
Elapsed time (minutes)
0
1
2
3
4
5
6
7
8
9
0
5
10
15
20
25
30
35
40
0
50
100
150
200
250
300
350
MW23A Pump
MW23B Monitor
pump rates


MW23C and MW23D Background Monitoring
06-26-2007
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
Change in Water Level (ft)
6/19/2007 0:00
6/21/2007 0:00
6/23/2007 0:00
6/25/2007 0:00
6/27/2007 0:00
6/29/2007 0:00
7/1/2007 0:00
7/3/2007 0:00
7/5/2007 0:00
Date and Time
MW23C
MW23D
Atmospheric Pressure as Water Level



WELL TEST ANALYSIS

Data Set: R:\...\MW24Apump.aqt
Date: 09/28/07 Time: 10:07:57

PROJECT INFORMATION

Company: CH2M HILL
Client: EPA
Project: 335392
Location: Omega
Test Well: MW24A
Test Date: 6/28/07

AQUIFER DATA

Saturated Thickness: 37.2 ft Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
MW24A	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
▫ MW24A	0	0

SOLUTION

Aquifer Model: Confined Solution Method: Theis (Step Test)

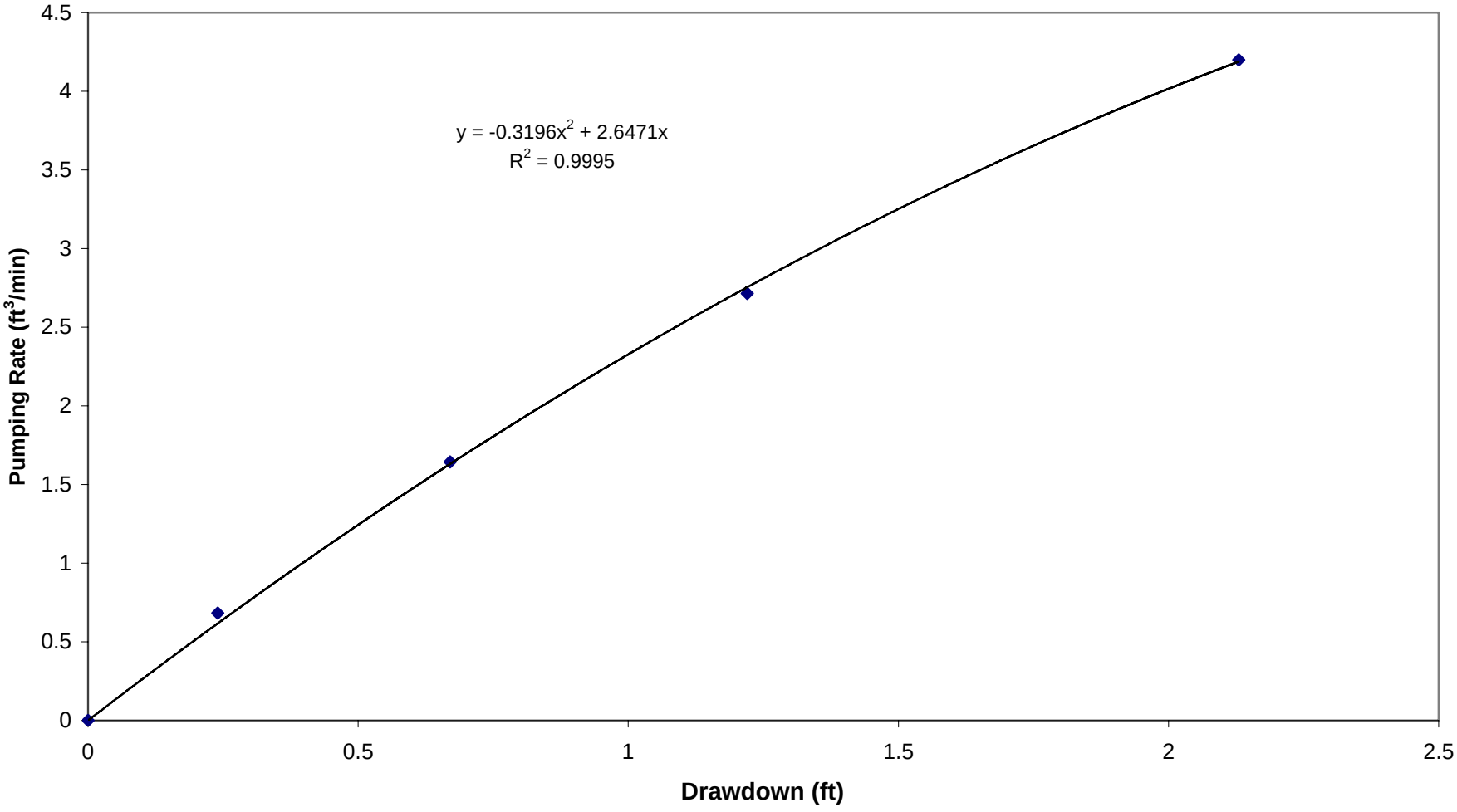
T = 8.173 ft^2/min
Sw = 10.
P = 2.

S = 1.0E-5
C = 2.424E-5 min^2/ft^5

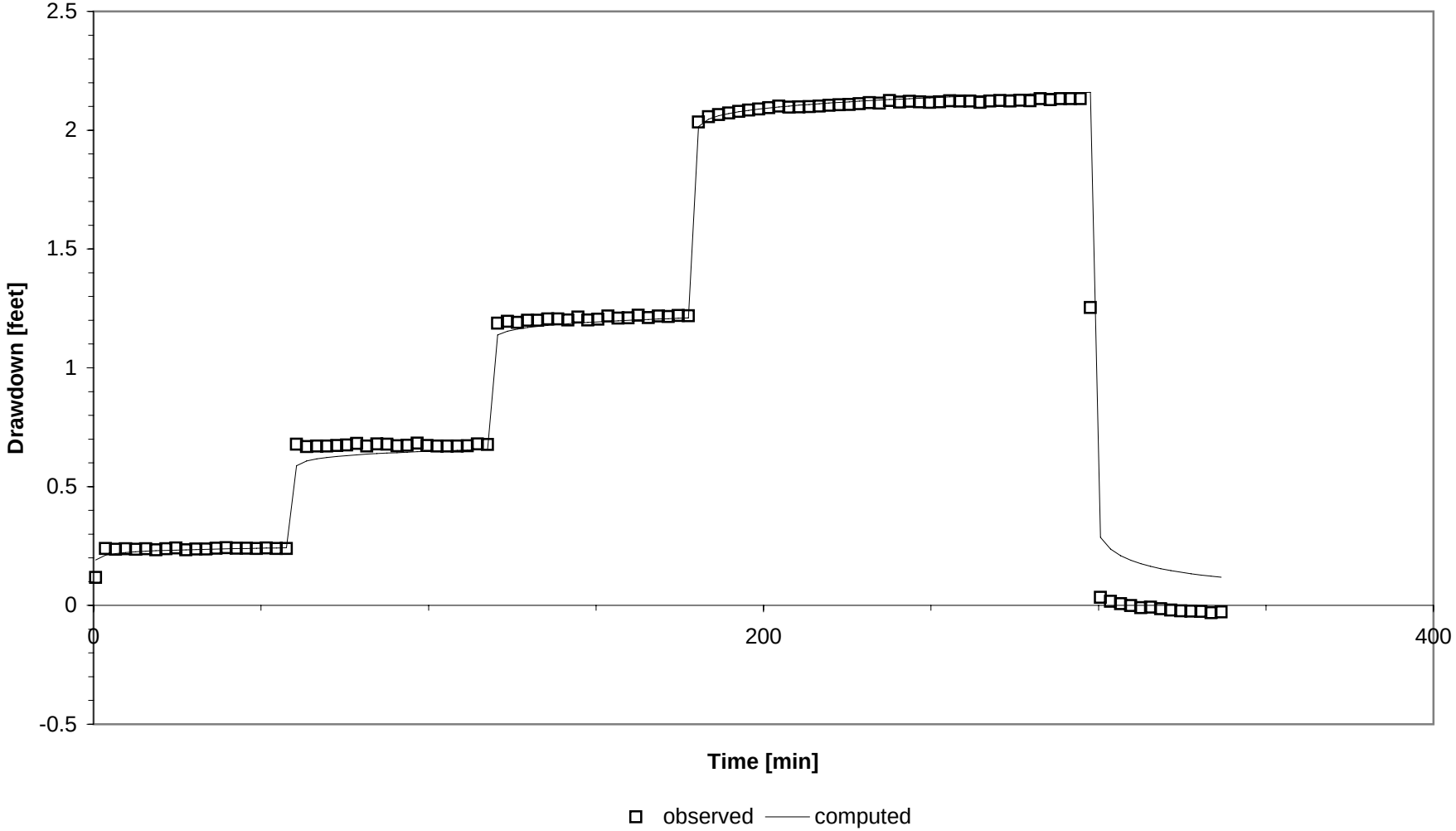
Step Test Model: Jacob-Rorabaugh

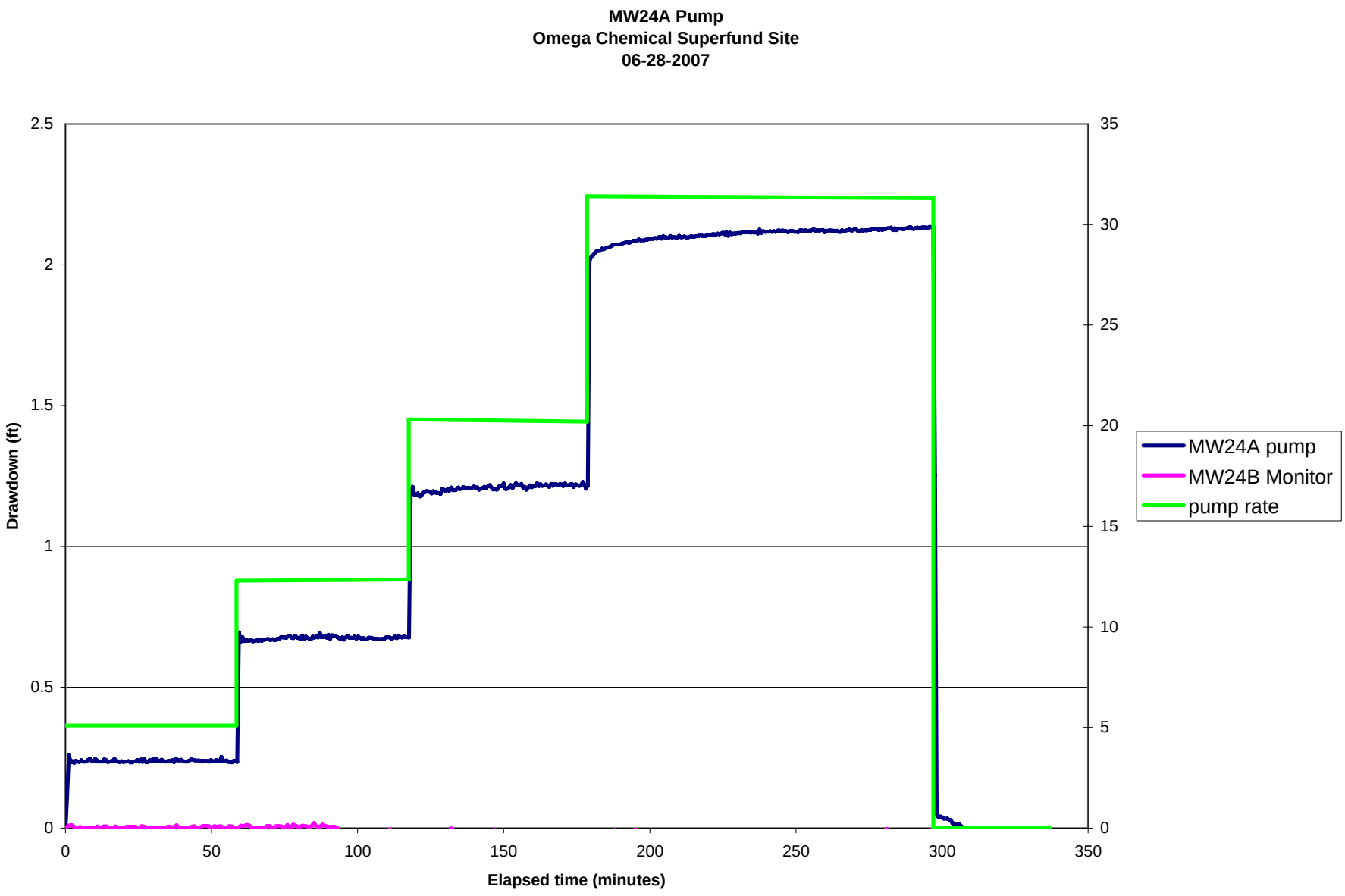
$s(t) = 0.4408Q + 2.424E\text{-}5Q^{2.}$

MW24A
Omega Chemical Superfund Site
06-28-07

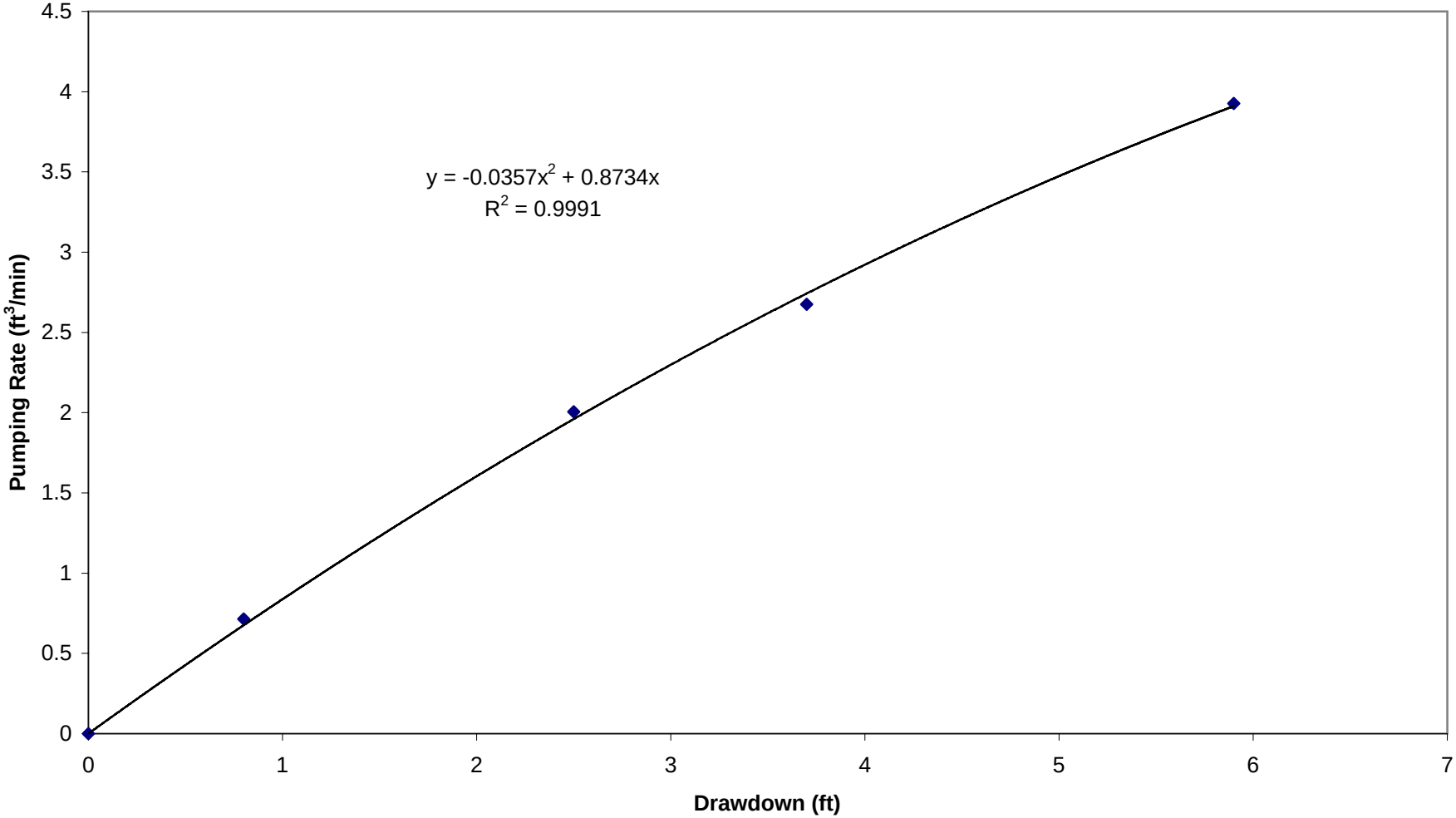


MW24A Step Pumping Test - Results from GWF
Omega Chemical Superfund Site
06-28-07

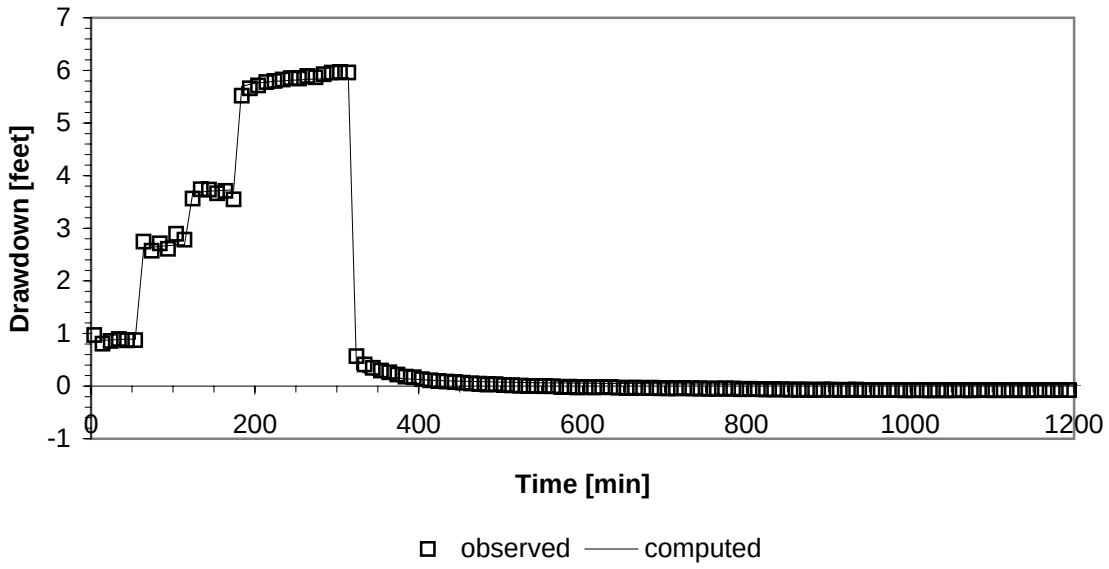



MW24A Pump
Omega Chemical Superfund Site
06-28-2007
Drawdown (ft)
2.5
2
1.5
1
0.5
0
35
30
25
20
15
10
5
0
0
50
100
150
200
250
300
350
Elapsed time (minutes)
MW24A pump
MW24B Monitor
pump rate

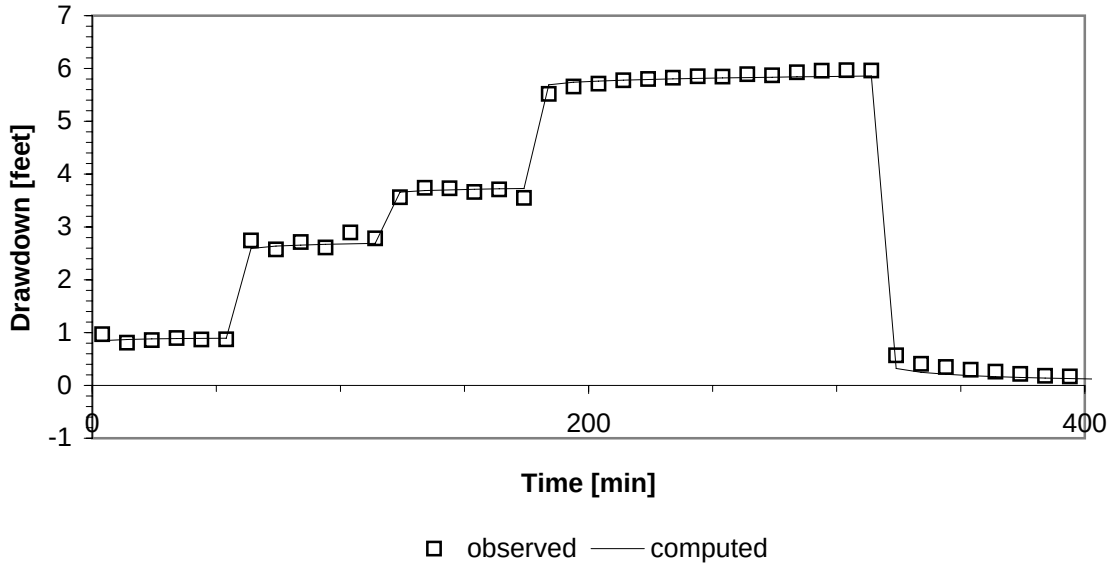
MW24C
Omega Chemical Superfund Site
06-26-07



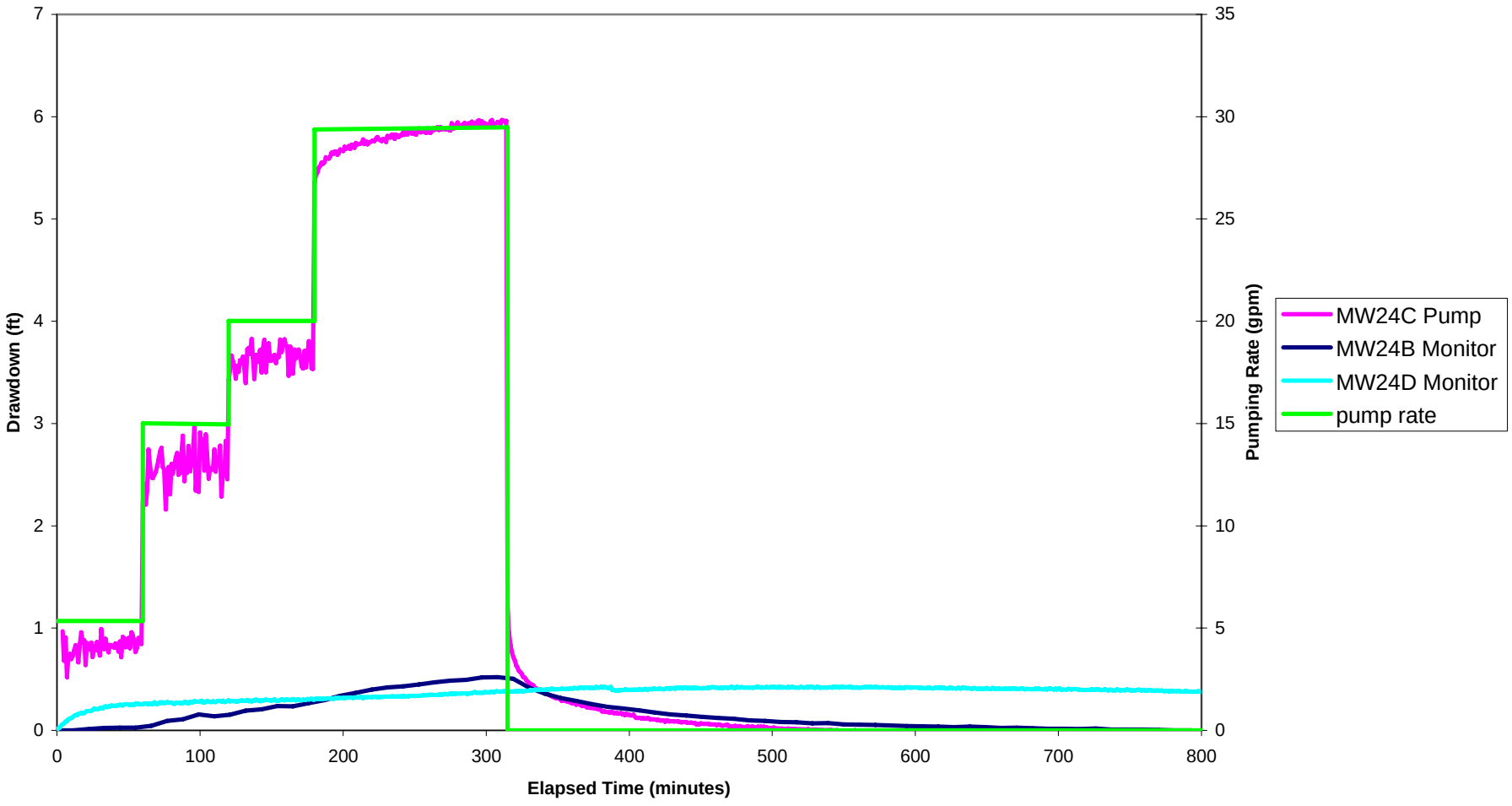
MW24C Step Pumping Test - Results from GWF
Omega Chemical Superfund Site
06-26-07



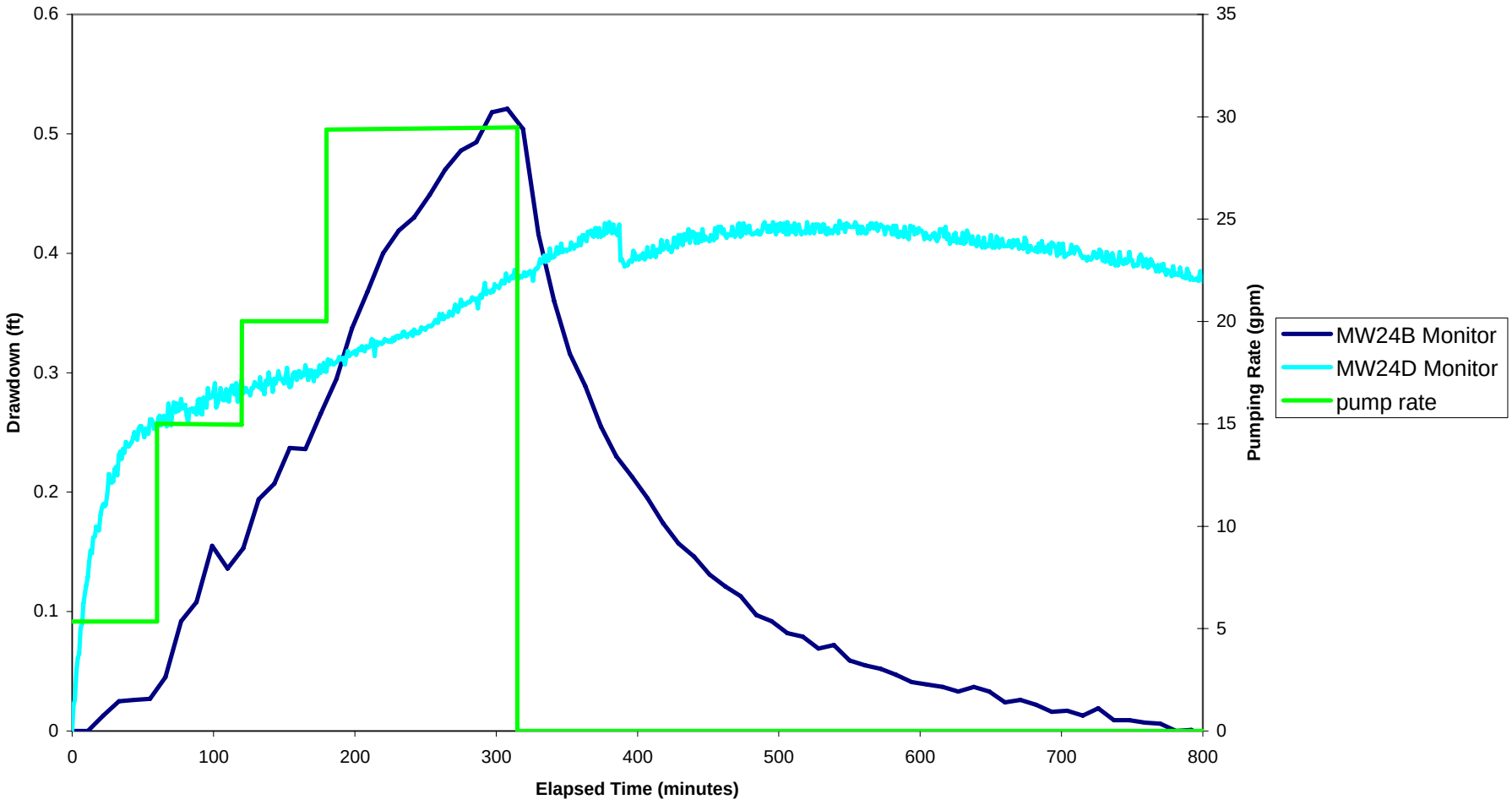
MW24C Step Pumping Test - Results from GWF
Omega Chemical Superfund Site
06-26-07



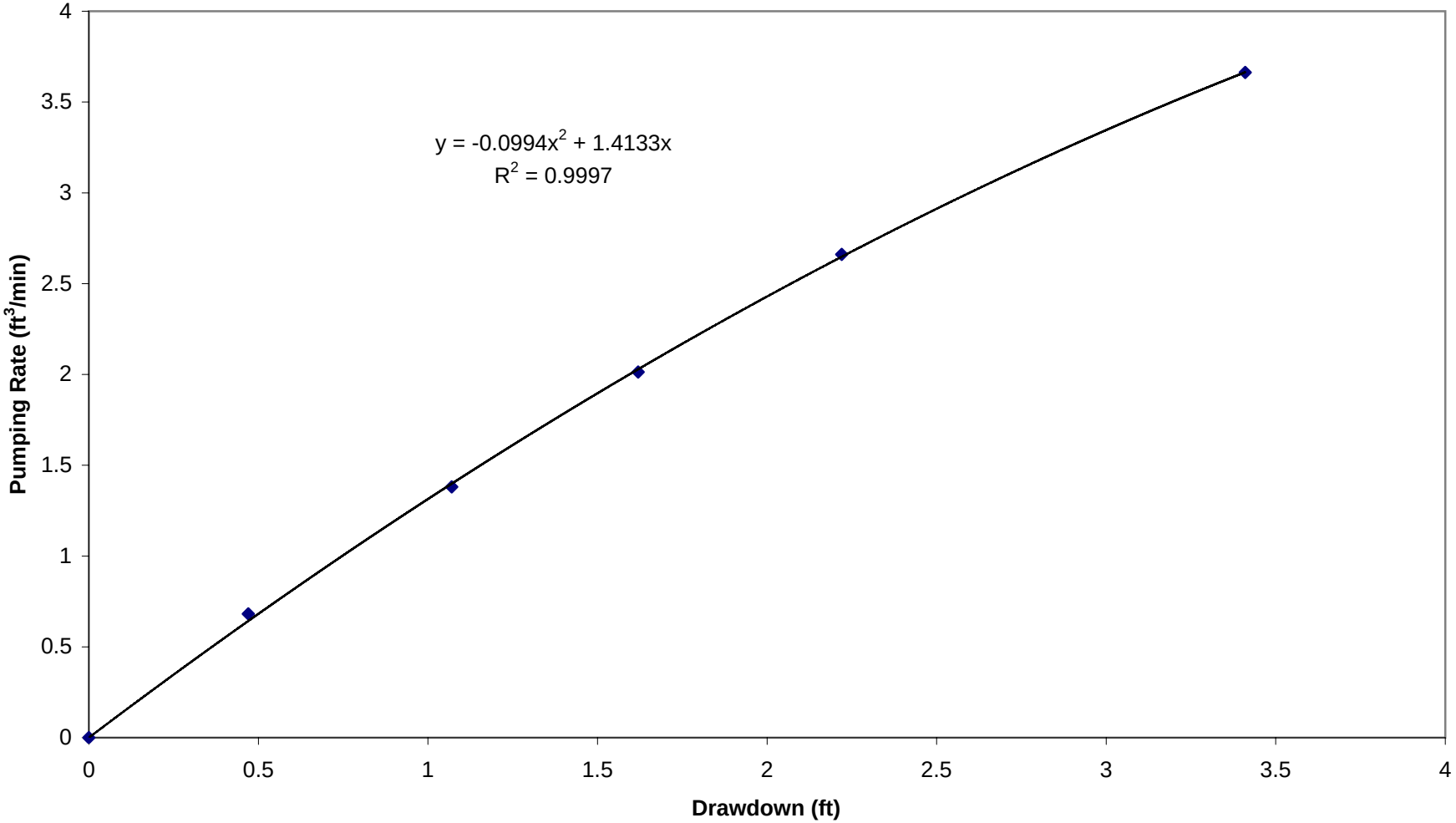
MW24C Pump
Omega Chemical Superfund Site
06-26-2007



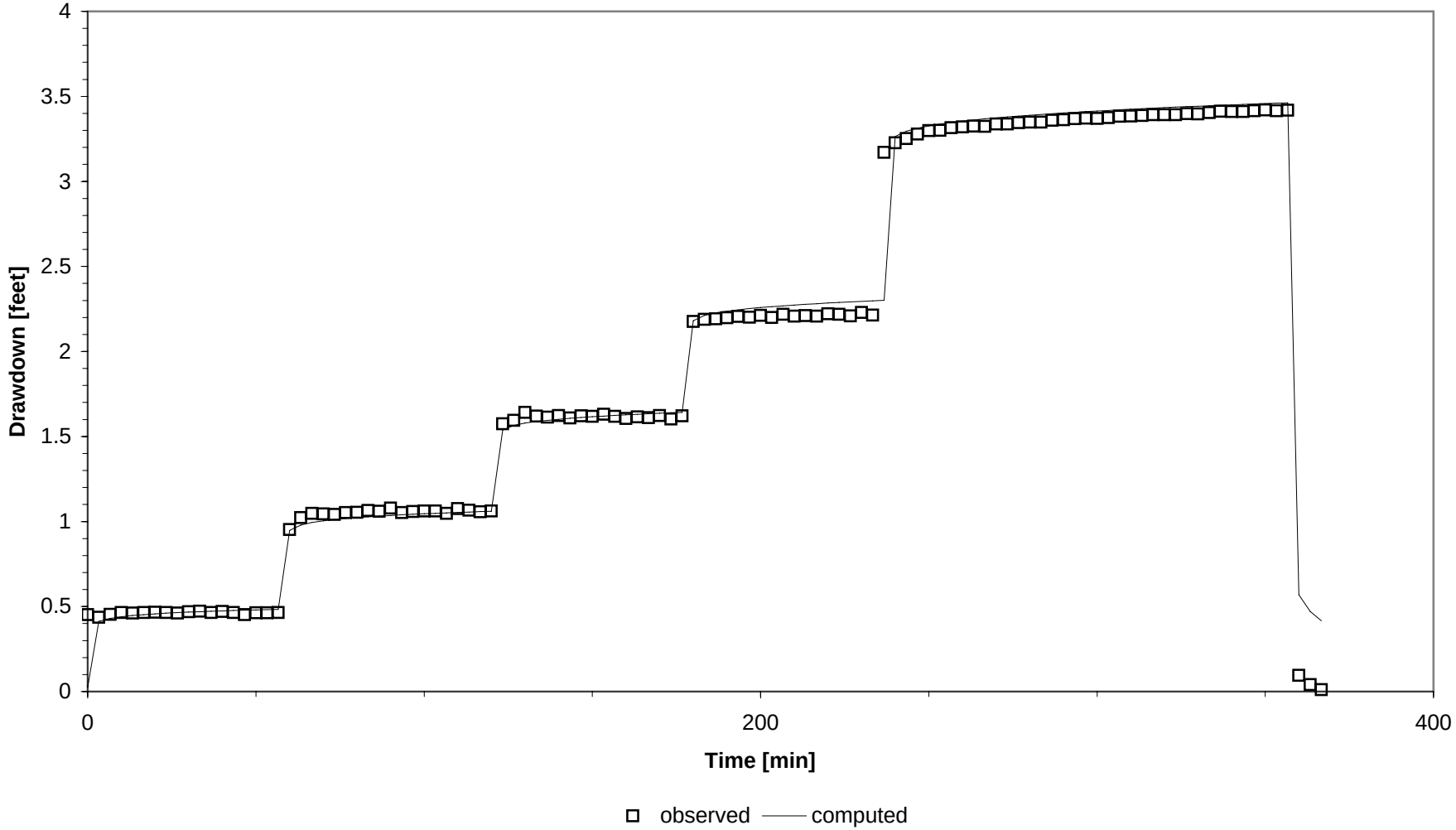
MW24C Pump
Omega Chemical Superfund Site
06-26-2007

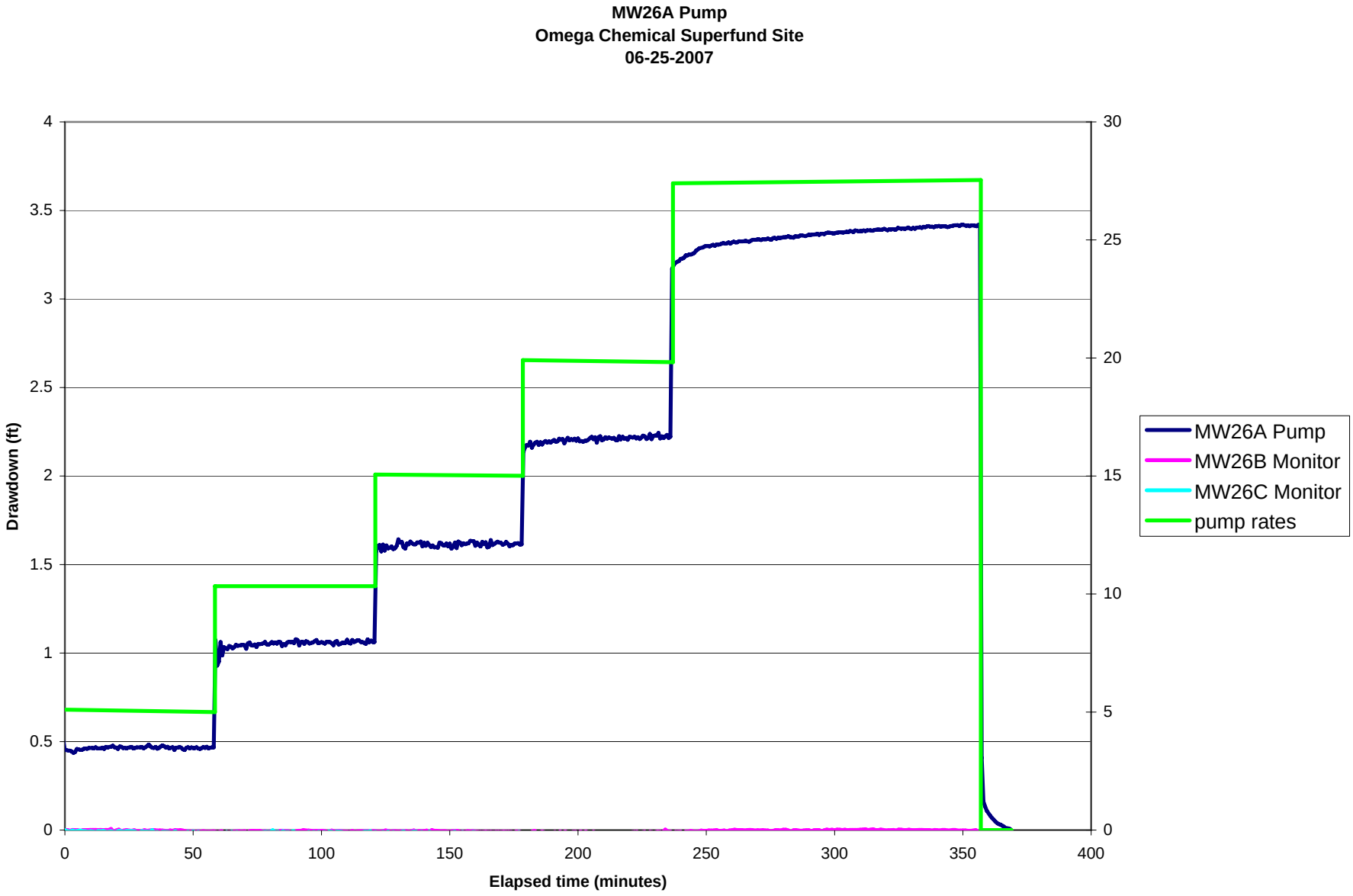


MW26A
Omega Chemical Superfund Site
6-25-07

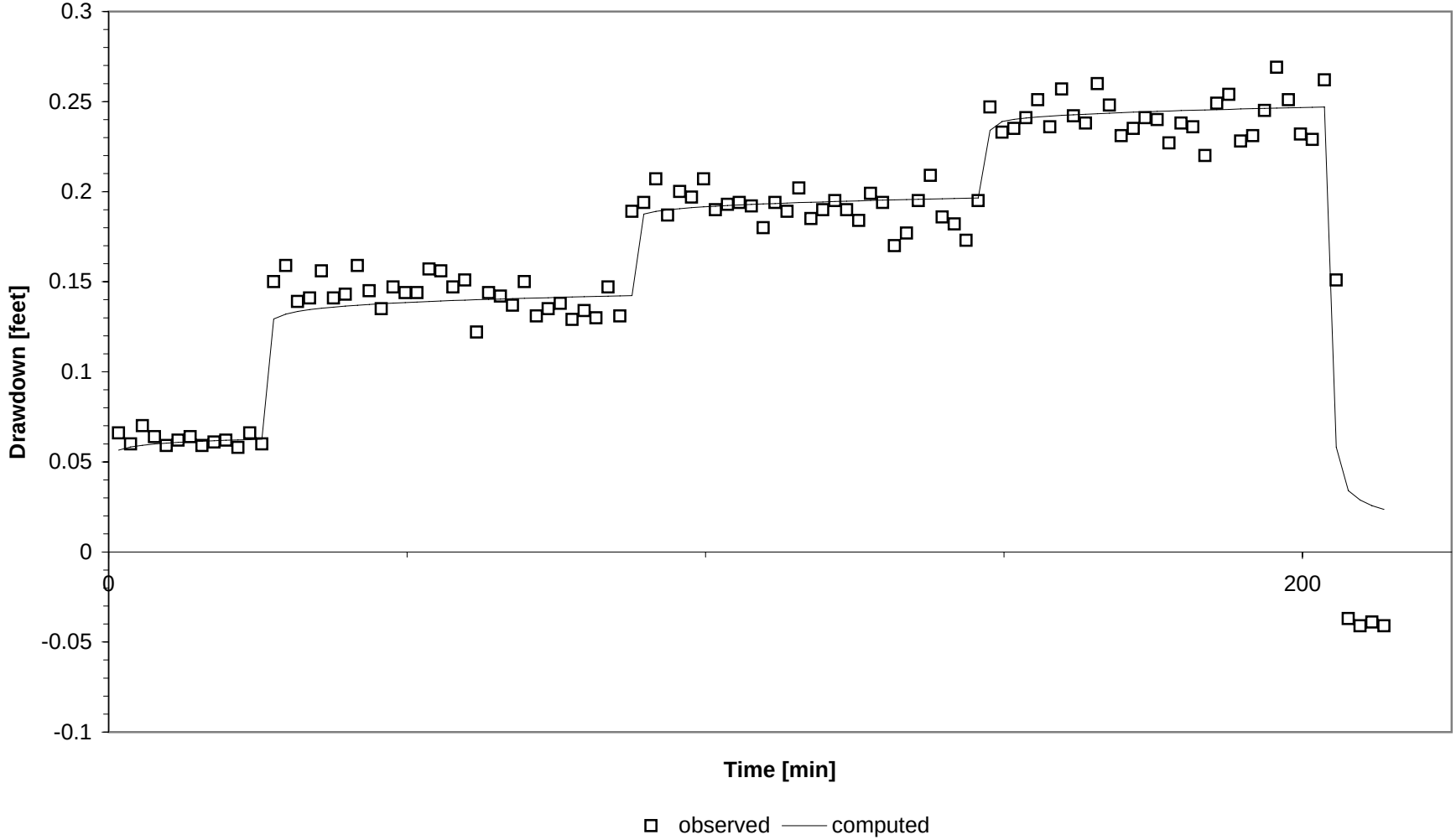


MW26A Step Pumping Test - Results from GWF
Omega Chemical Superfund Site
06-25-07

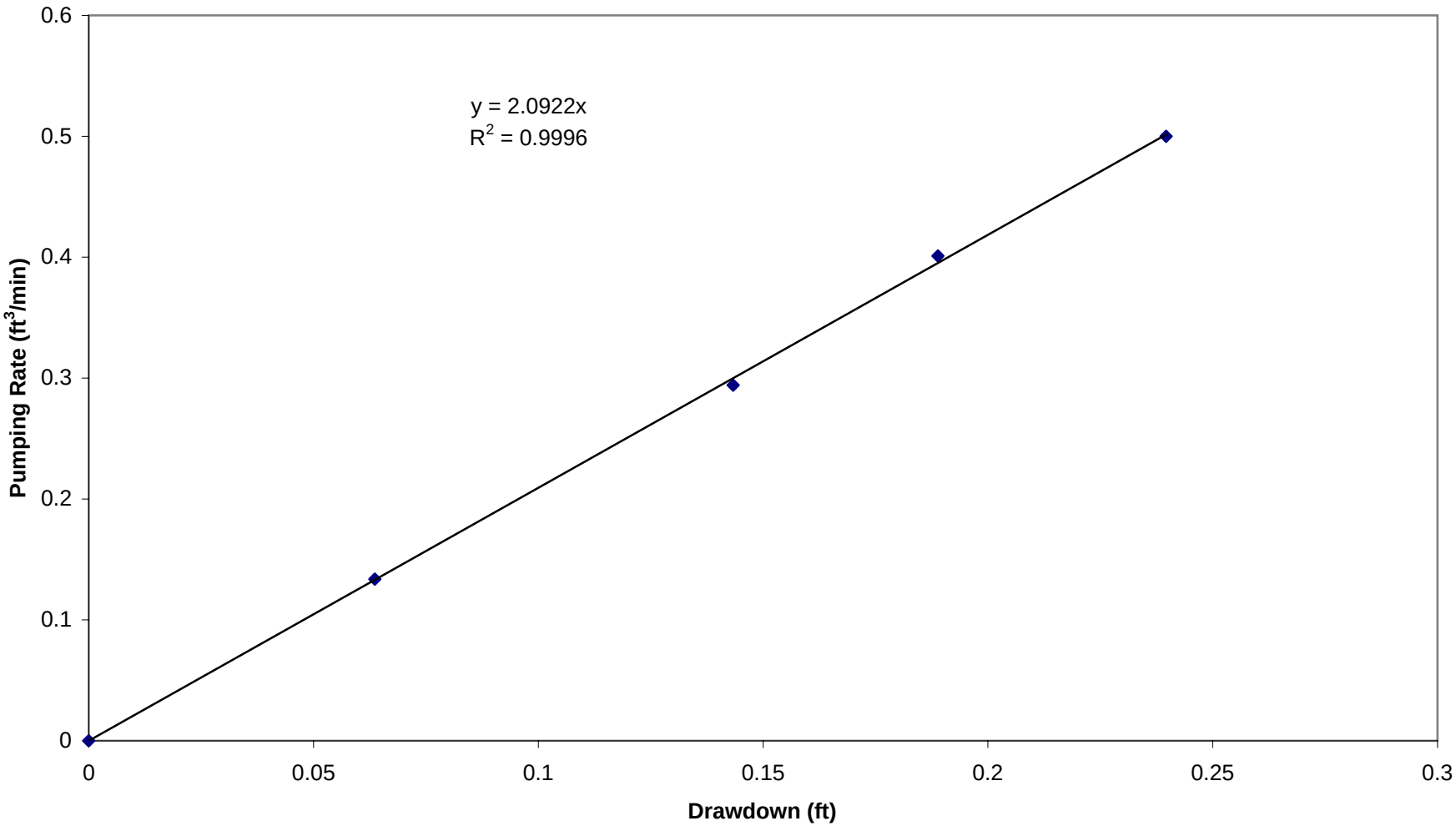



MW26A Pump
Omega Chemical Superfund Site
06-25-2007
Drawdown (ft)
Elapsed time (minutes)
0
0.5
1
1.5
2
2.5
3
3.5
4
0
5
10
15
20
25
30
0
50
100
150
200
250
300
350
400
MW26A Pump
MW26B Monitor
MW26C Monitor
pump rates

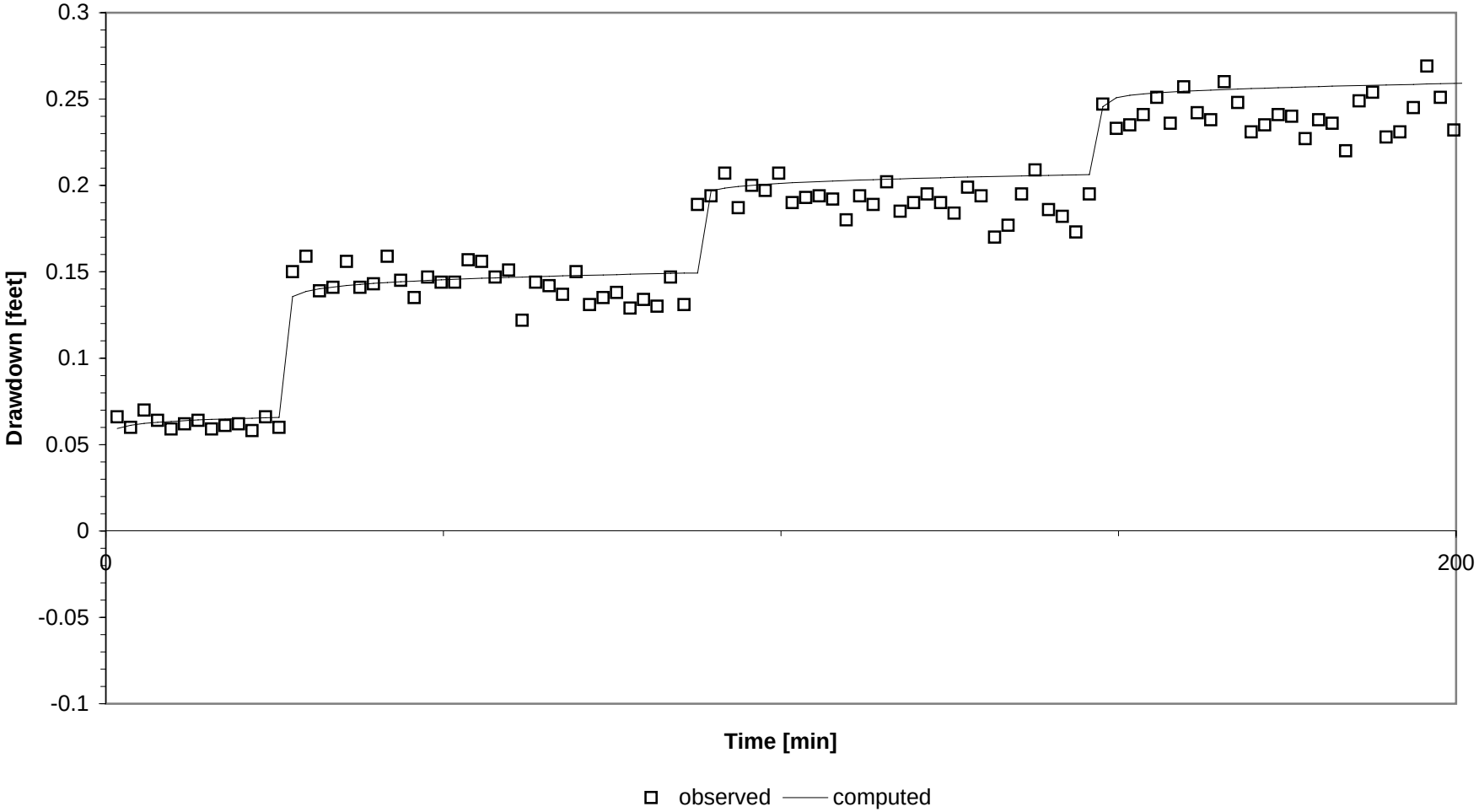
MW26B Step Pumping Test - Results from GWF
Omega Chemical Superfund Site
06-22-07



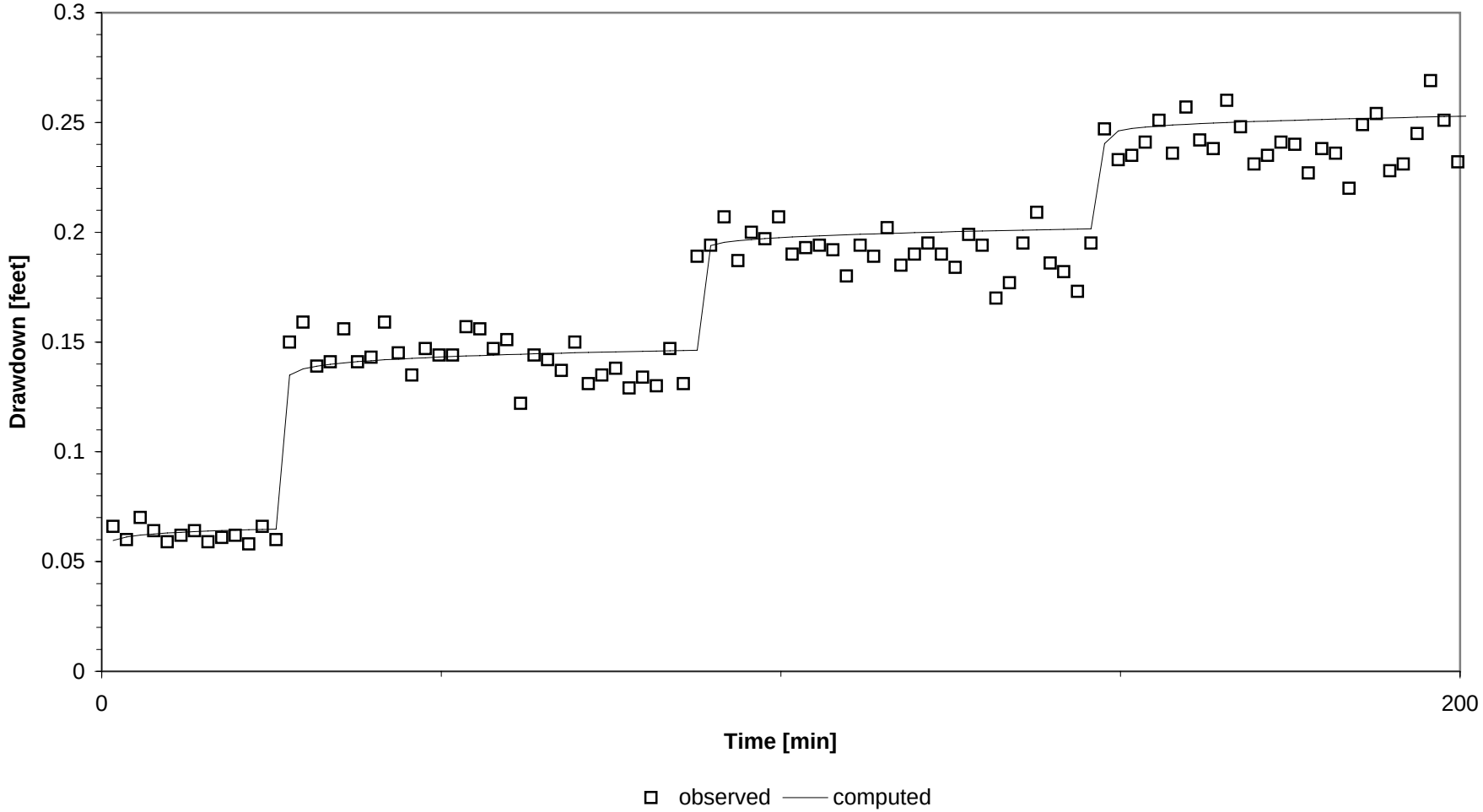
MW26B
Omega Chemical Superfund Site
06-22-07

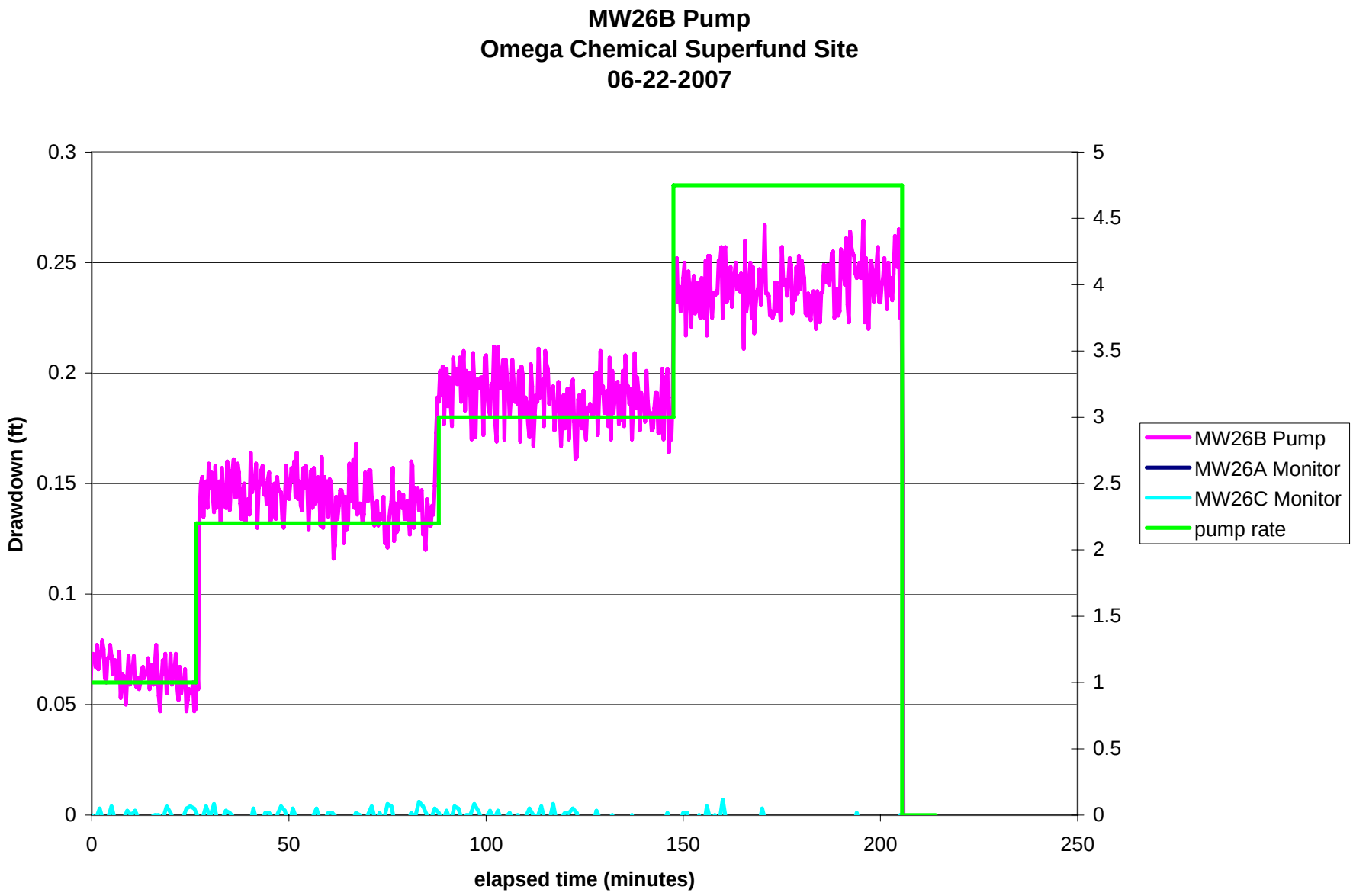


MW26B Step Pumping Test - Results from GWF
Omega Chemical Superfund Site
06-22-07
Kr=303 ft/day

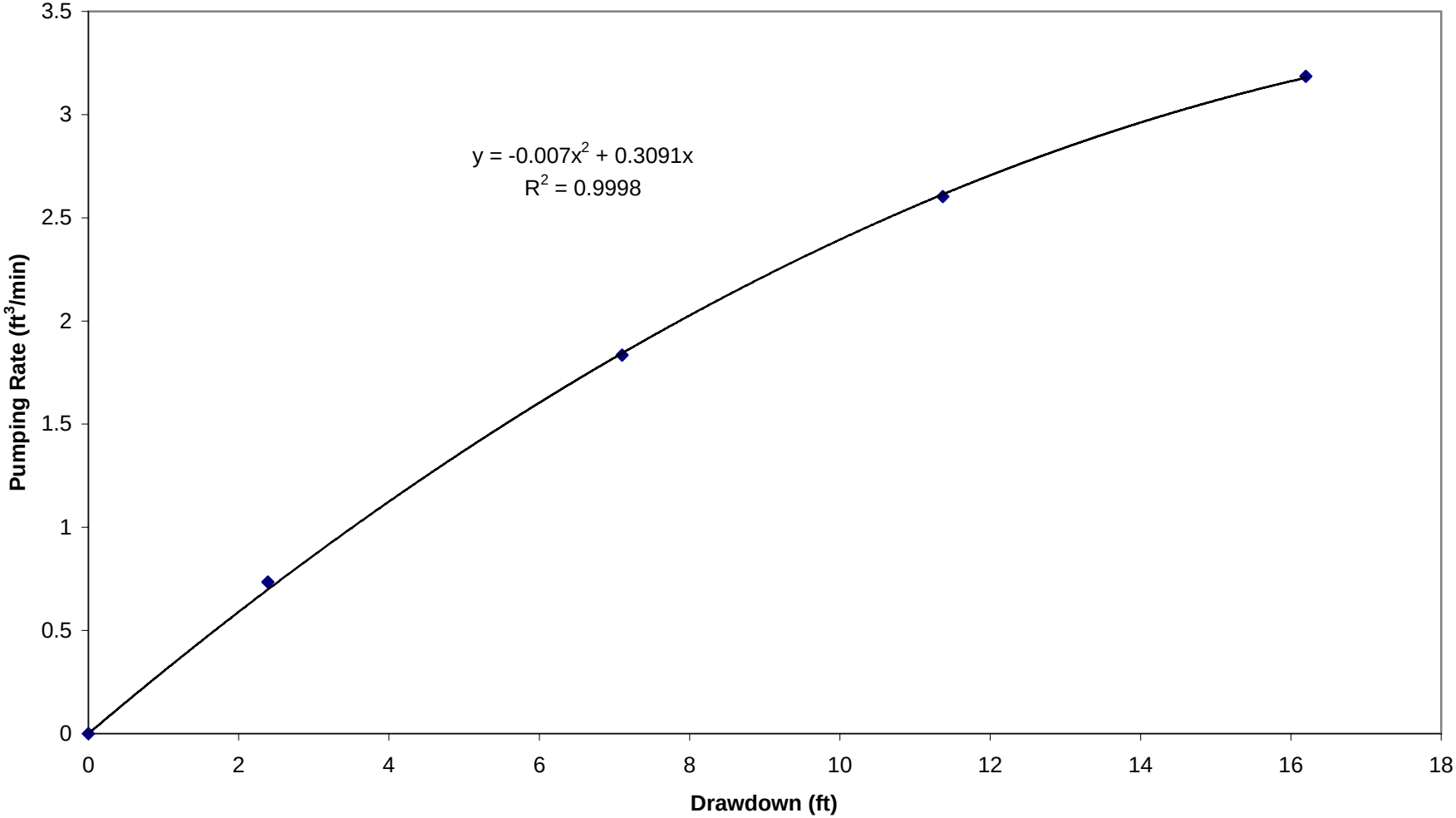


MW26B Step Pumping Test - Results from GWF
Omega Chemical Superfund Site
06-22-07
Kr=383 ft/day; no C

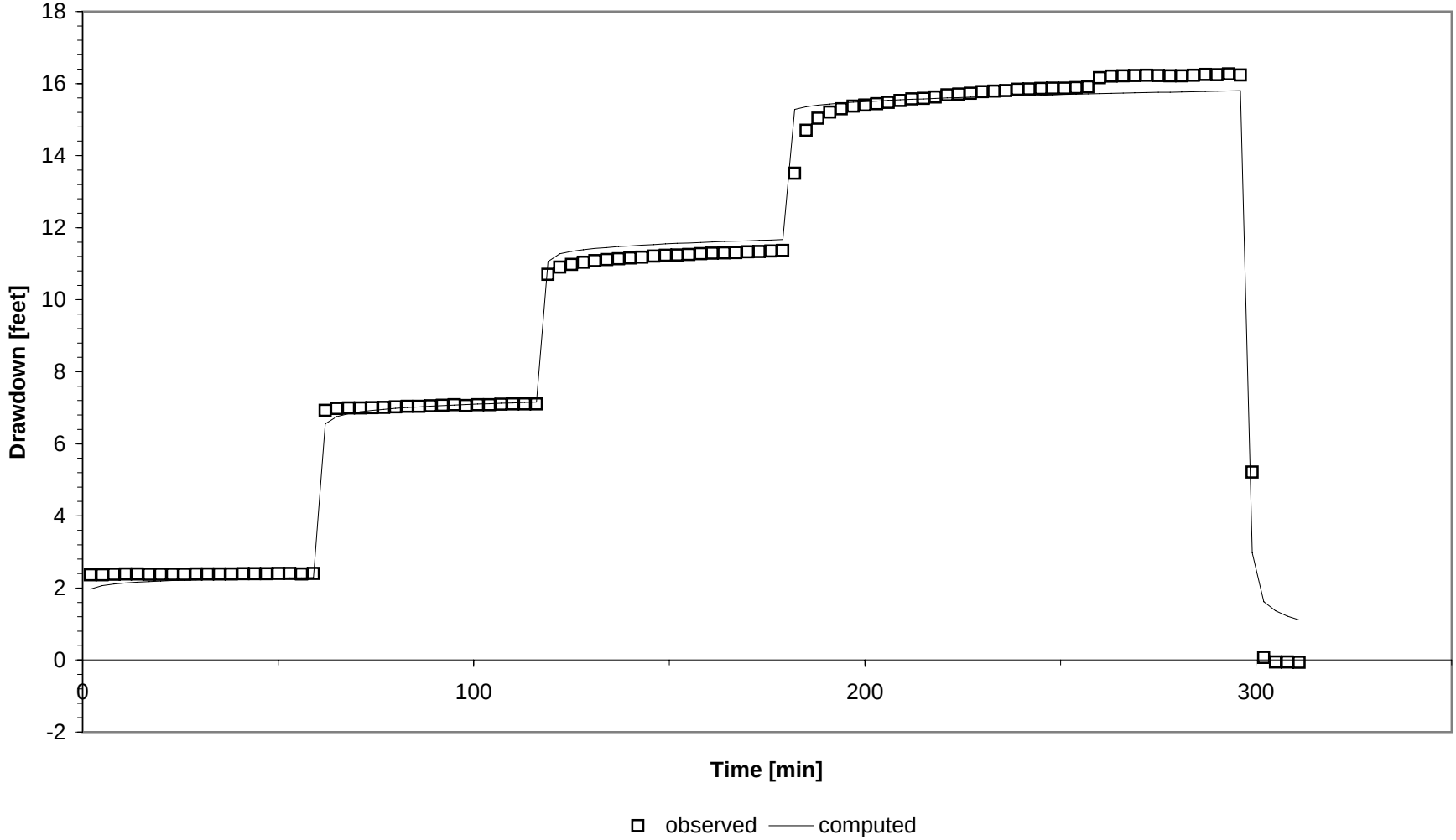


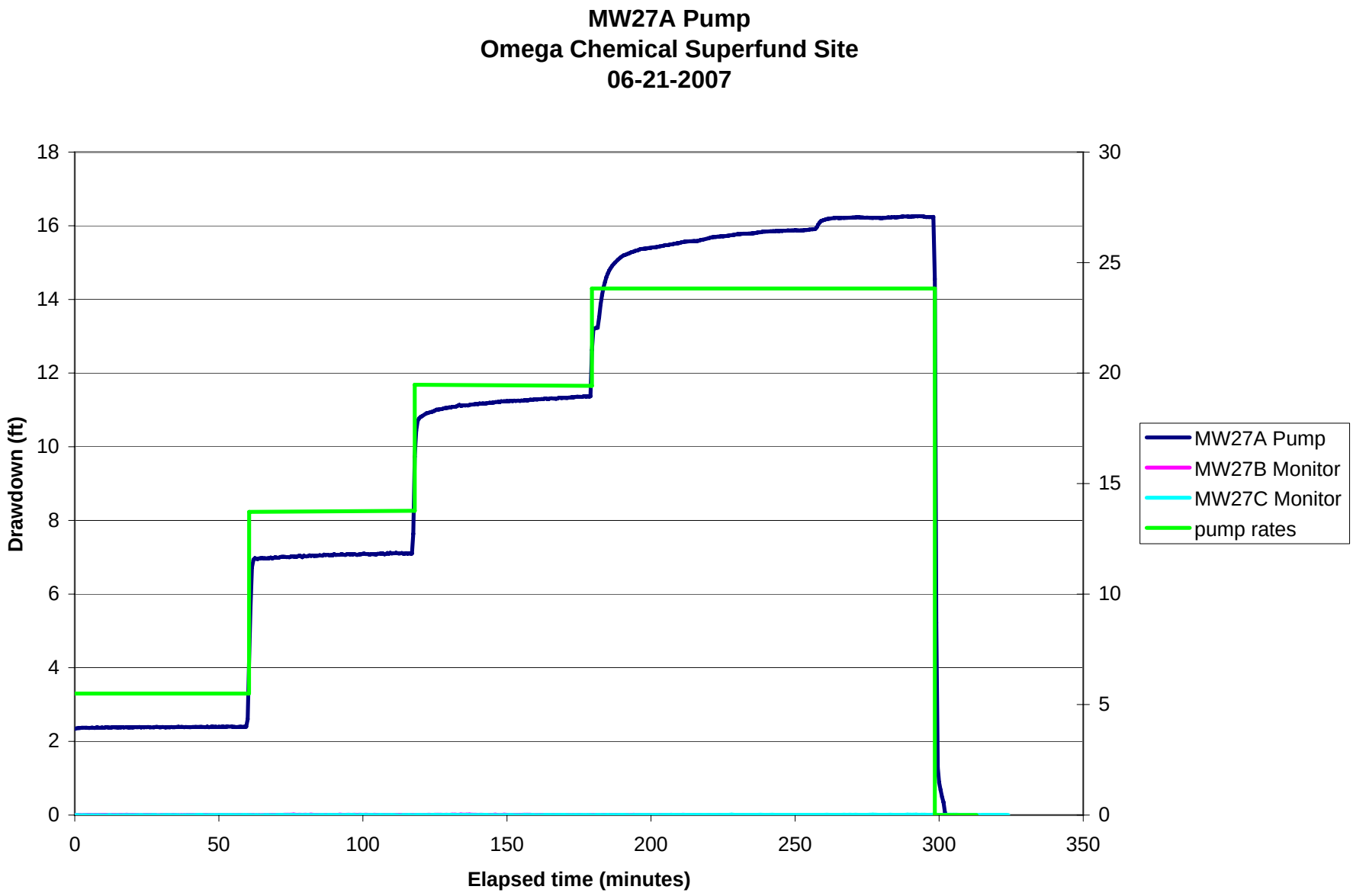

MW26B Pump
Omega Chemical Superfund Site
06-22-2007
Drawdown (ft)
0.3
0.25
0.2
0.15
0.1
0.05
0
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
0
50
100
150
200
250
elapsed time (minutes)
MW26B Pump
MW26A Monitor
MW26C Monitor
pump rate

MW27A
Omega Chemical Superfund Site
06-21-07

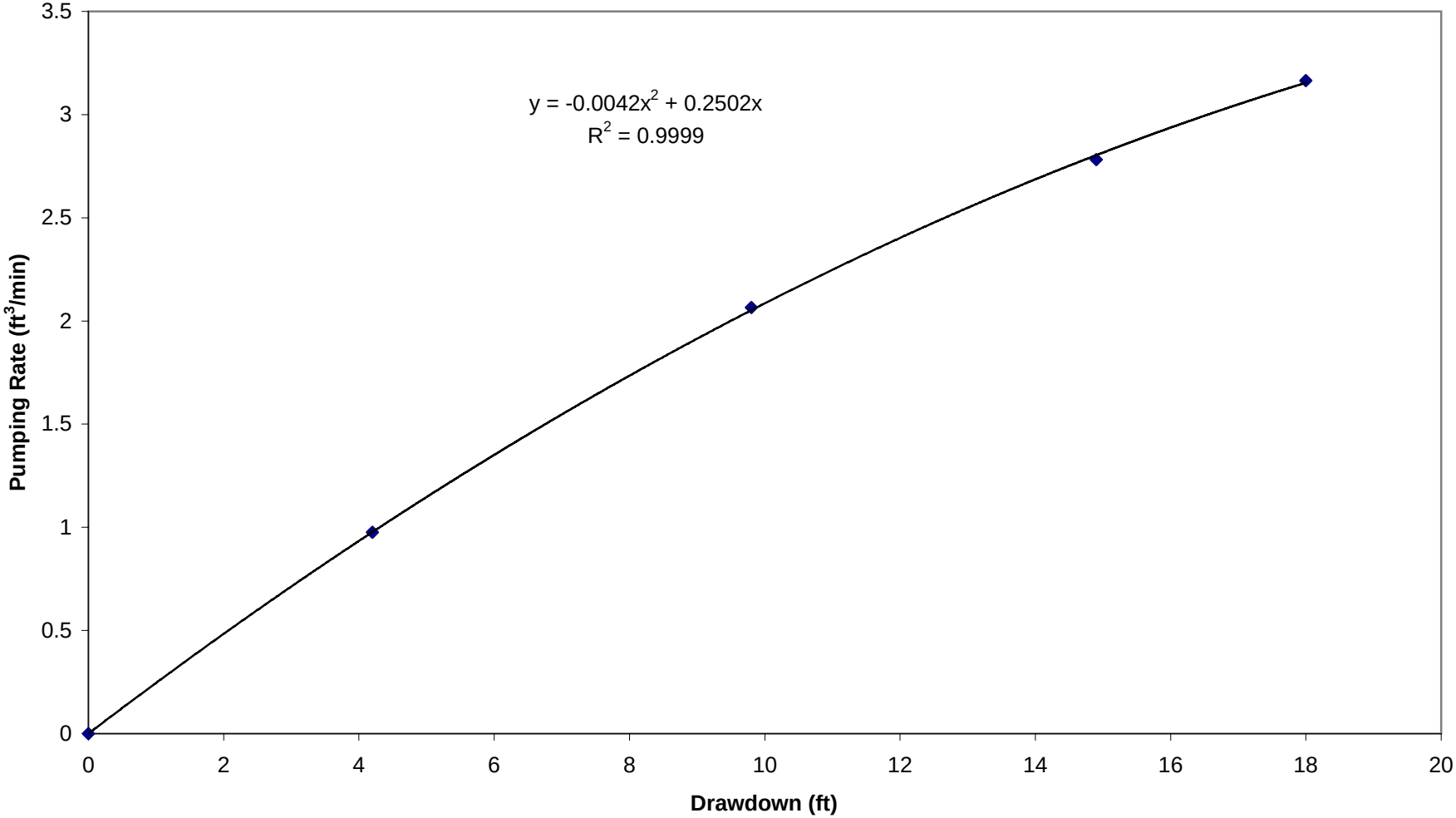


MW27A Step Pumping Test - Results from GWF
Omega Chemical Superfund Site
06-21-07

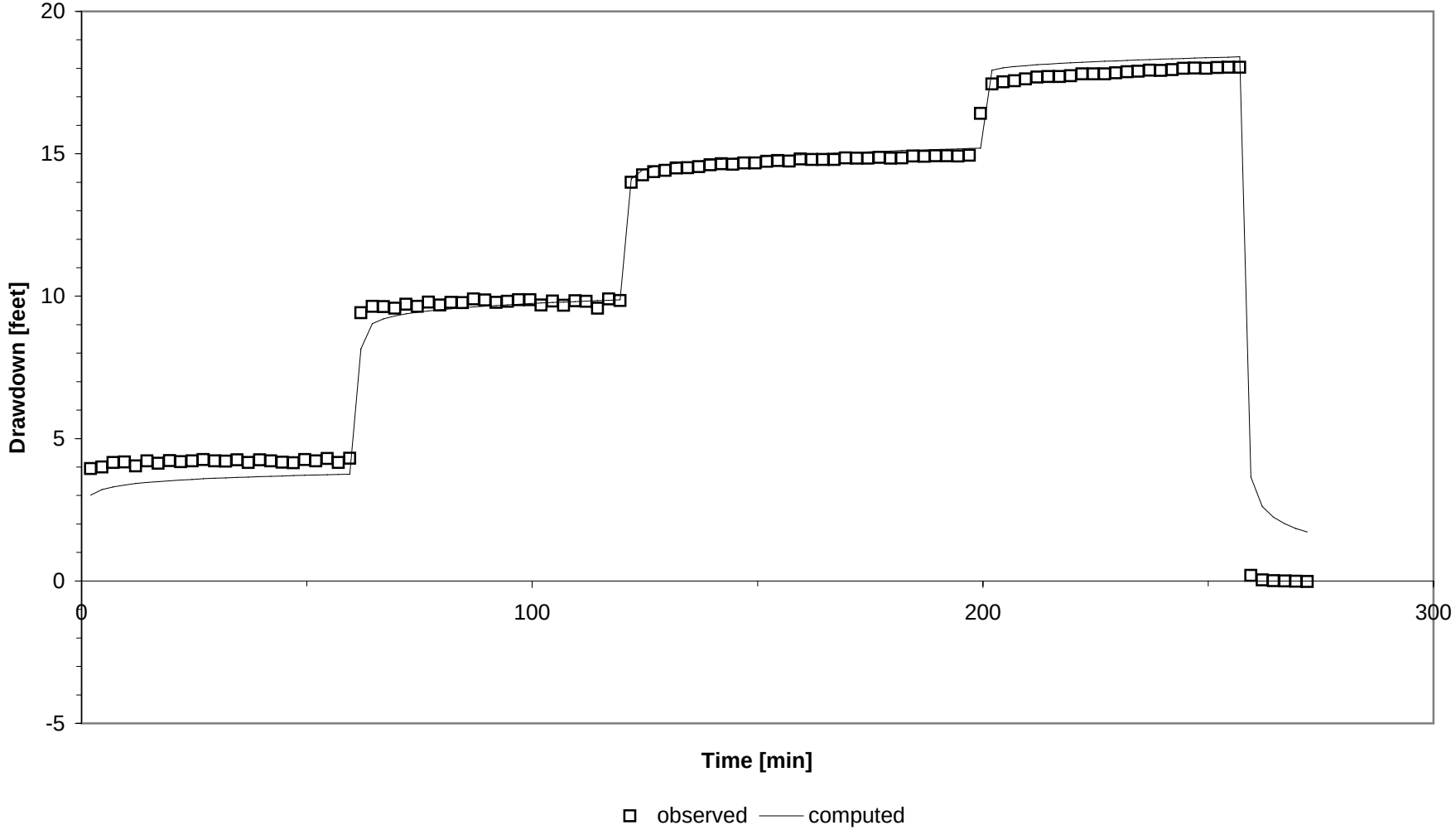


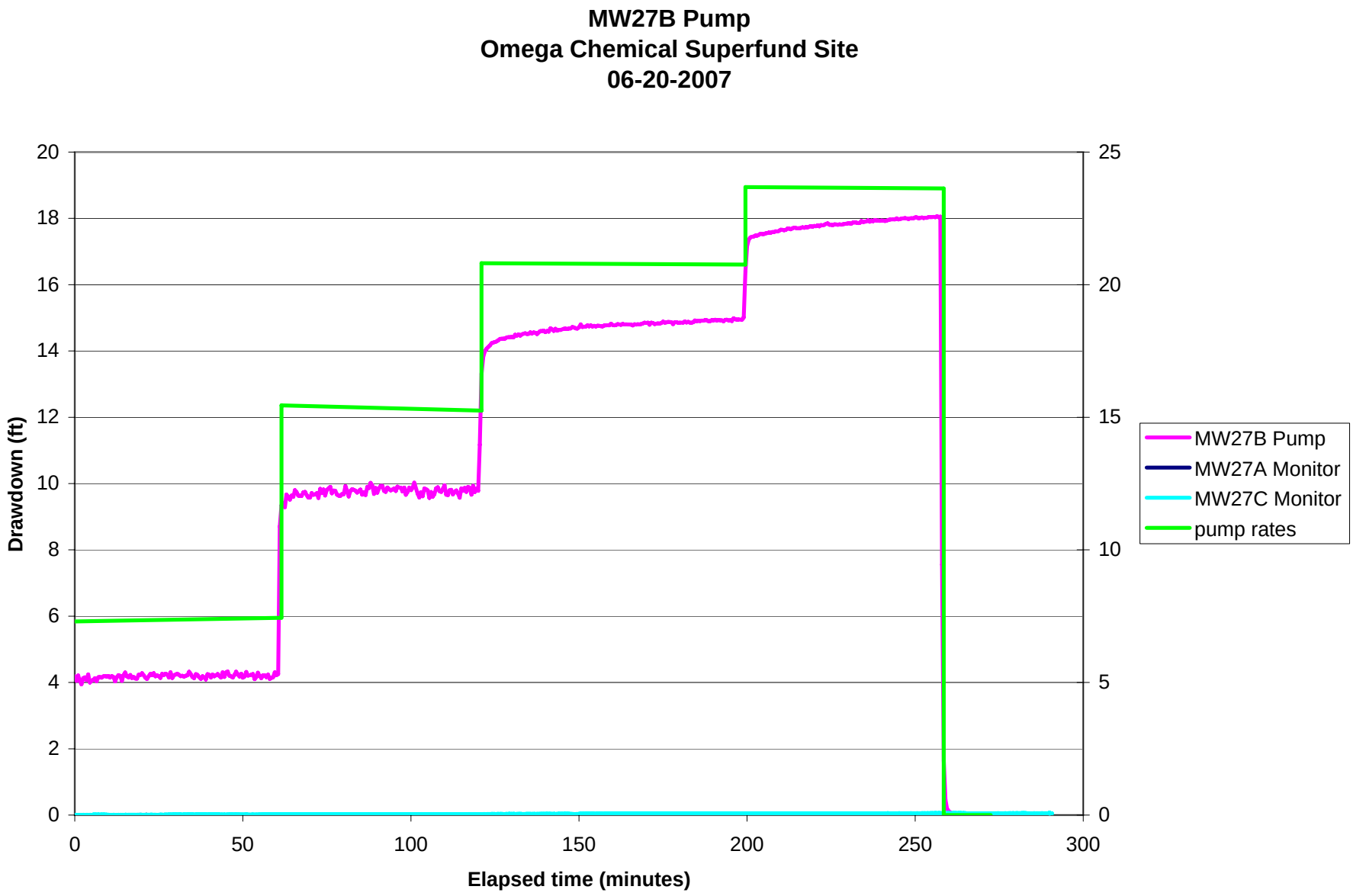

MW27A Pump
Omega Chemical Superfund Site
06-21-2007
Drawdown (ft)
Elapsed time (minutes)
0
2
4
6
8
10
12
14
16
18
0
5
10
15
20
25
30
0
50
100
150
200
250
300
350
MW27A Pump
MW27B Monitor
MW27C Monitor
pump rates

MW27B
Omega Chemical Superfund Site
06-20-07

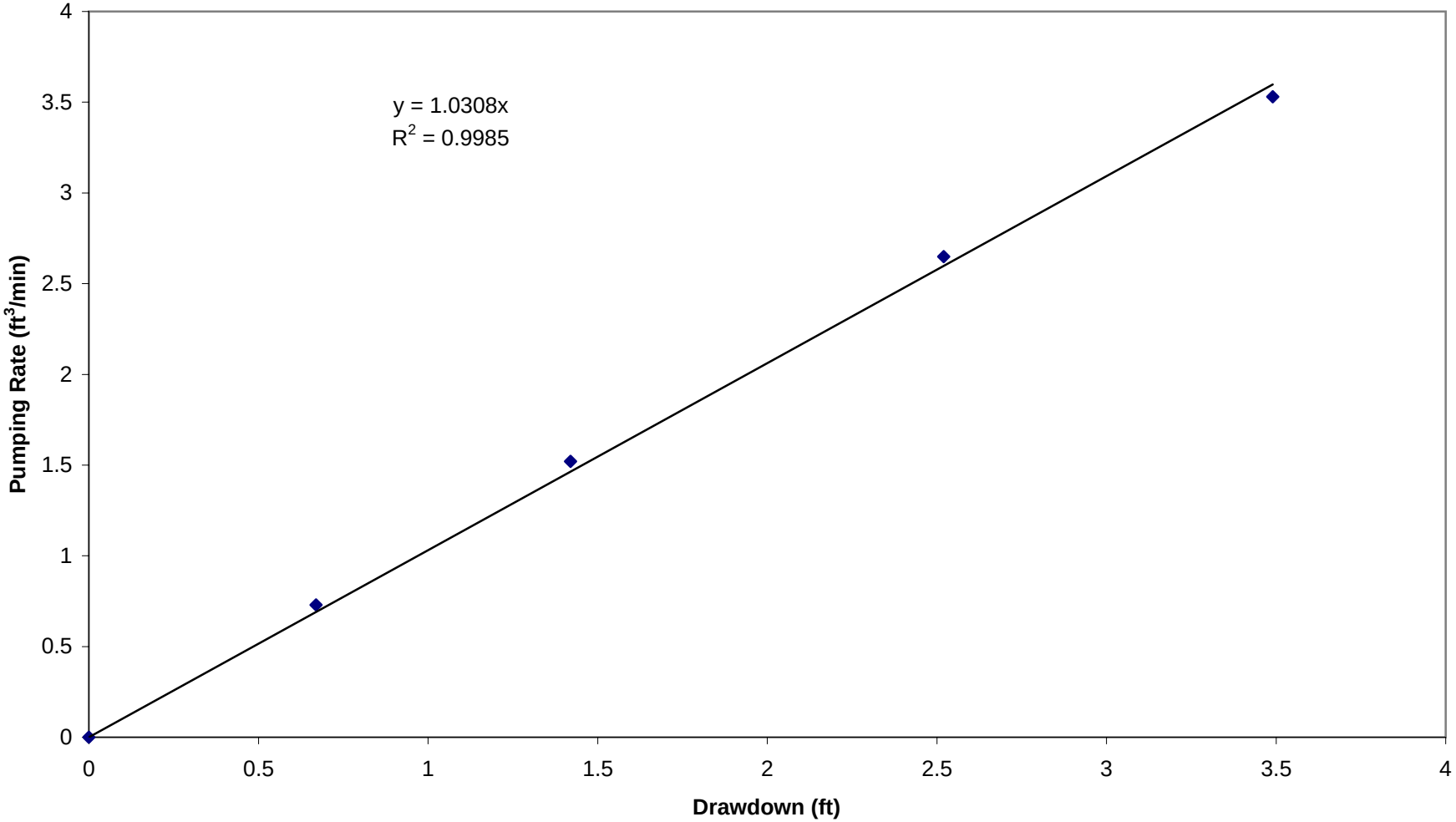


MW27B Step Pumping Test - Results from GWF
Omega Chemical Superfund Site
06-20-07

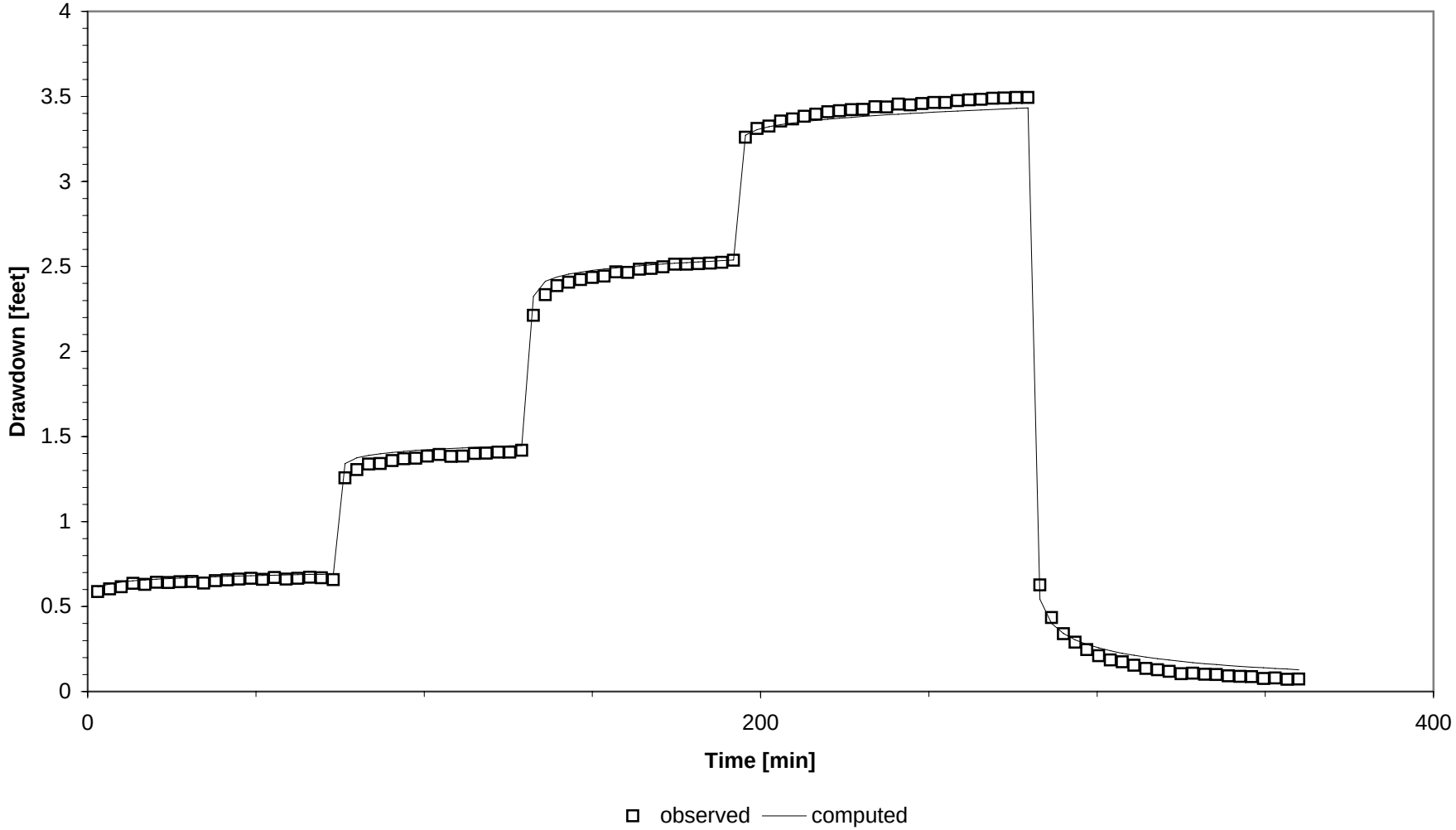


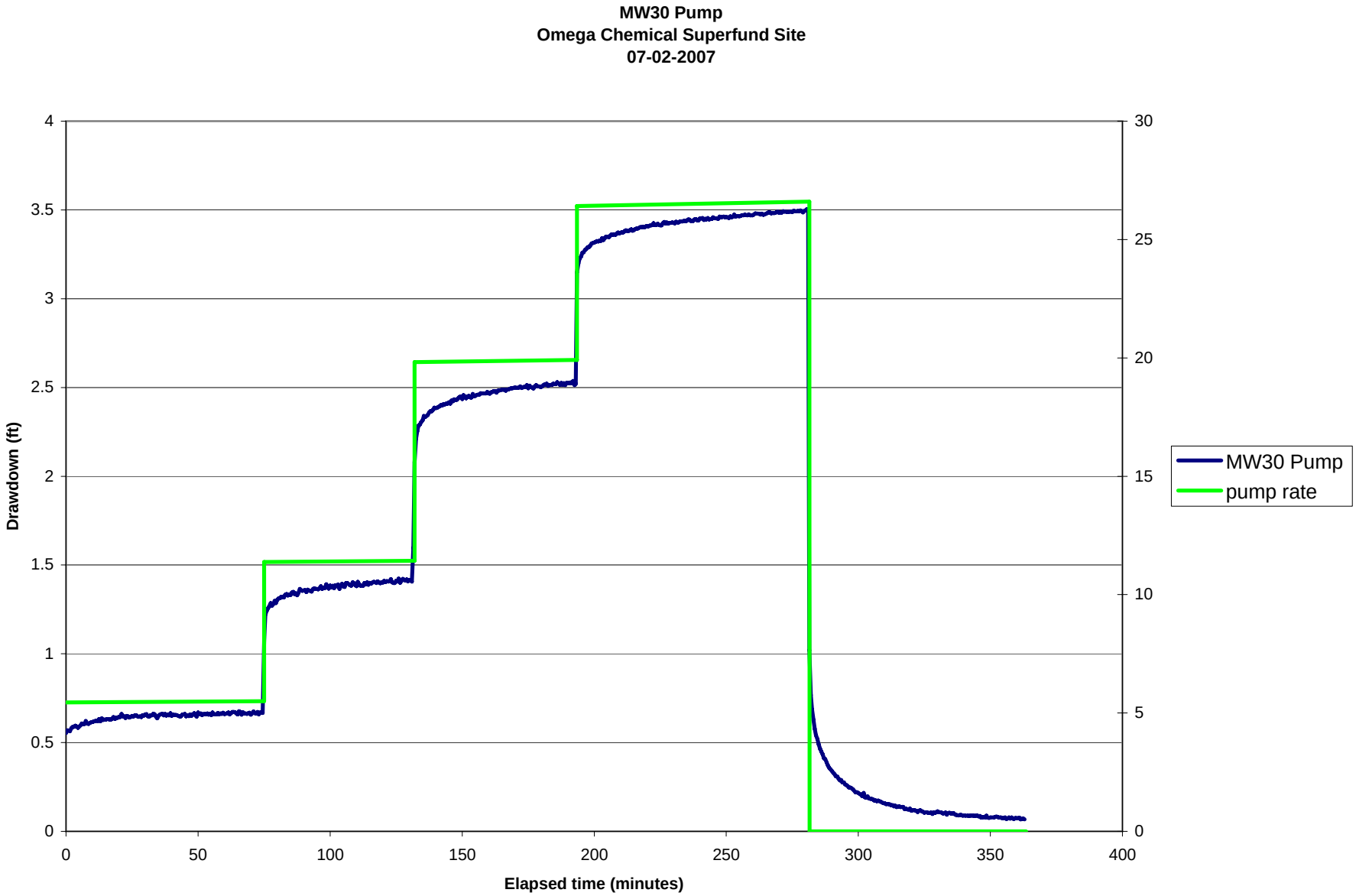

MW27B Pump
Omega Chemical Superfund Site
06-20-2007
Drawdown (ft)
Elapsed time (minutes)
0
2
4
6
8
10
12
14
16
18
20
0
5
10
15
20
25
0
50
100
150
200
250
300
MW27B Pump
MW27A Monitor
MW27C Monitor
pump rates

MW30
Omega Chemical Superfund Site
07-02-07



MW30 Step Pumping Test - Results from GWF
Omega Chemical Superfund Site
07-02-07




MW30 Pump
Omega Chemical Superfund Site
07-02-2007
Drawdown (ft)
Elapsed time (minutes)
0
0.5
1
1.5
2
2.5
3
3.5
4
0
5
10
15
20
25
30
0
50
100
150
200
250
300
350
400
MW30 Pump
pump rate