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May 24, 2007

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Subject: Results from Second Controlled Infiltration Test for High Point Phase I Block-Scale Monitoring Project

Dear Ms. Wertz:

Enclosed is the data report documenting the results from the second of three controlled infiltration tests to be conducted for the High Point Phase I Block-Scale Monitoring program. This test was performed on April 11, 2007 with the assistance of personnel from the Seattle Public Utilities Materials Laboratory. (The first test was conducted on March 7, 2007 and the final test will be performed during the third year of the monitoring project.)

If you have any questions regarding the information presented in this report, please do not hesitate to contact me or John Lenth.

Sincerely,

Herrera Environmental Consultants, Inc.

Niklas Christensen
Water Resource Engineer

Enclosure: Data Report: Second Controlled Infiltration Test for the High Point Phase I Block-Scale Monitoring project

DATA REPORT

Second Controlled Infiltration Test for the High Point Phase I Block-Scale Monitoring Project

Prepared for

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Prepared by

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May 24, 2007

Background

Seattle Public Utilities (SPU) is implementing a large-scale natural drainage system (NDS) project in conjunction with the redevelopment project for the High Point neighborhood in West Seattle (Figure 1). NDS swales are part of what is termed a *low-impact development* approach to managing stormwater runoff. The goal of this approach is to minimize the potential effect of land use changes on the natural hydrograph that can result from urbanization. In contrast to conventional stormwater systems that route runoff directly to storm drains, the NDS swales route runoff first through a vegetated and compost-amended swale, reducing the rate of flow and allowing the runoff to infiltrate into the ground. The excess runoff is then routed to the conventional stormwater system. This approach increases infiltration, decreases the rate and volume of runoff, and improves water quality. The end result is decreased erosion, stabilized water temperatures, and improved downstream habitat.

As part of this NDS project, Seattle Public Utilities is implementing a block-scale monitoring project for NDS swales that have been installed on the High Point redevelopment site. The goal of the monitoring program is to quantify the treatment performance of the NDS swales in order to provide a basis for potential design refinements that might improve performance or reduce installation costs or both. The specific monitoring activities that will be performed to meet this goal are described in a quality assurance project plan (QAPP) that was prepared earlier for the project (Herrera 2006). In general, the QAPP describes hydrologic and water quality monitoring activities to be performed in association with an NDS test swale on the High Point redevelopment site over a 3-year period, beginning in winter 2006 and ending in September 2009.

As described in the QAPP, a specific component of this monitoring project is the implementation of three controlled tests to measure infiltration rates on the surface of the NDS test swale. The first and second tests are to be conducted during the first and second months, respectively, of the monitoring project, and the third test is to be performed during the third and final year of the monitoring project.

This report documents the results of the second controlled infiltration test which was conducted on April 11, 2007. (The first infiltration test was conducted on March 7, 2007.) It describes the study location and the procedures that were used during the test process. It also summarizes the results of the test using graphical representations of the data, as necessary. The raw data from the test are provided in an appendix.

Study Location

The study location was the High Point redevelopment site in West Seattle (Figure 1). The site lies within the Longfellow Creek drainage basin and is generally bordered on the north by SW Juneau Street, on the west by 34th Avenue SW, on the south by SW Myrtle Street, and on the east by a designated steep-sloped greenbelt. The infiltration test was conducted in a representative NDS swale (NDS test swale) that parallels Highpoint Drive SW between SW Graham and SW Bataan Street (Figure 2).

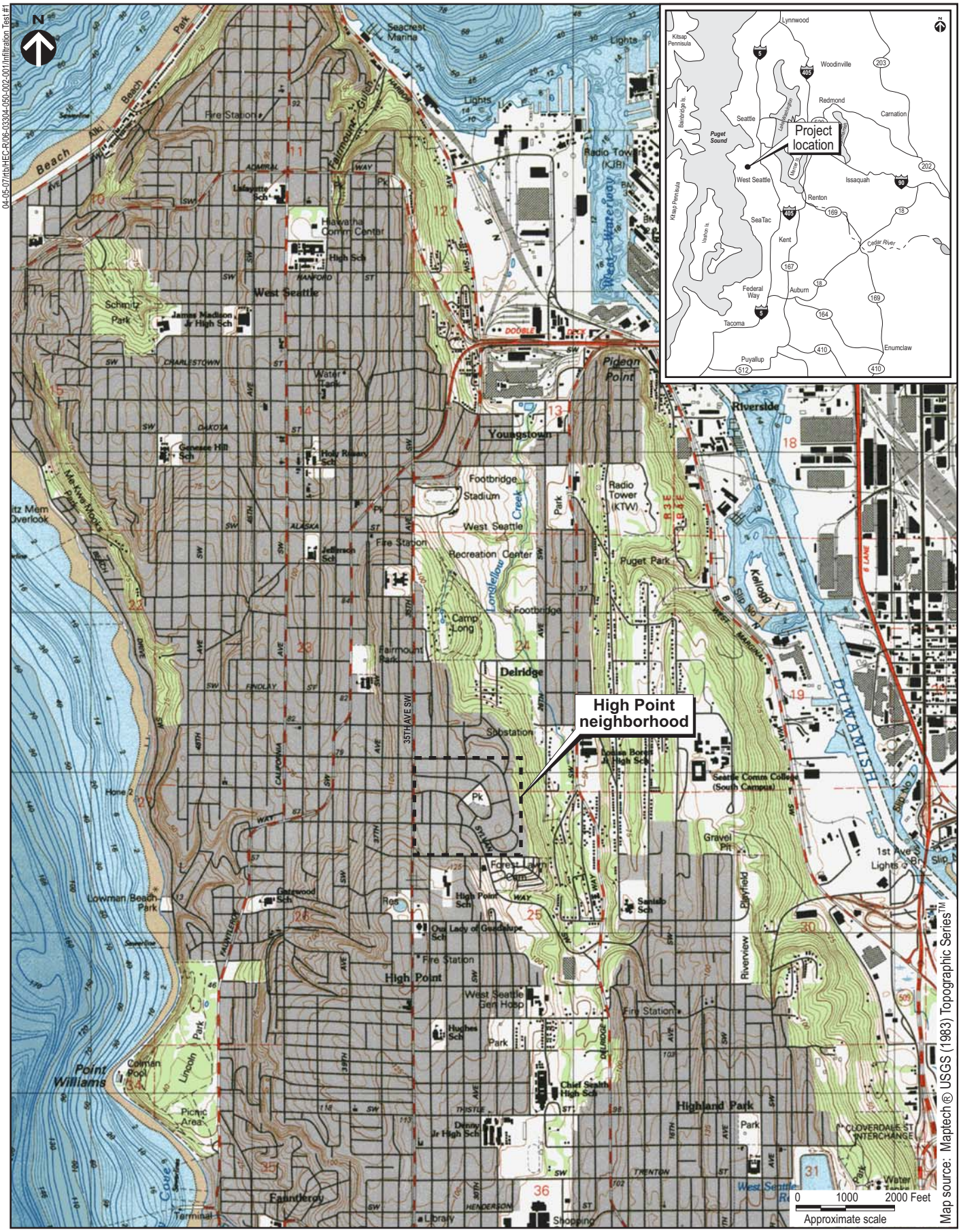

Figure 1. Vicinity map for the High Point redevelopment project site in Seattle, Washington.

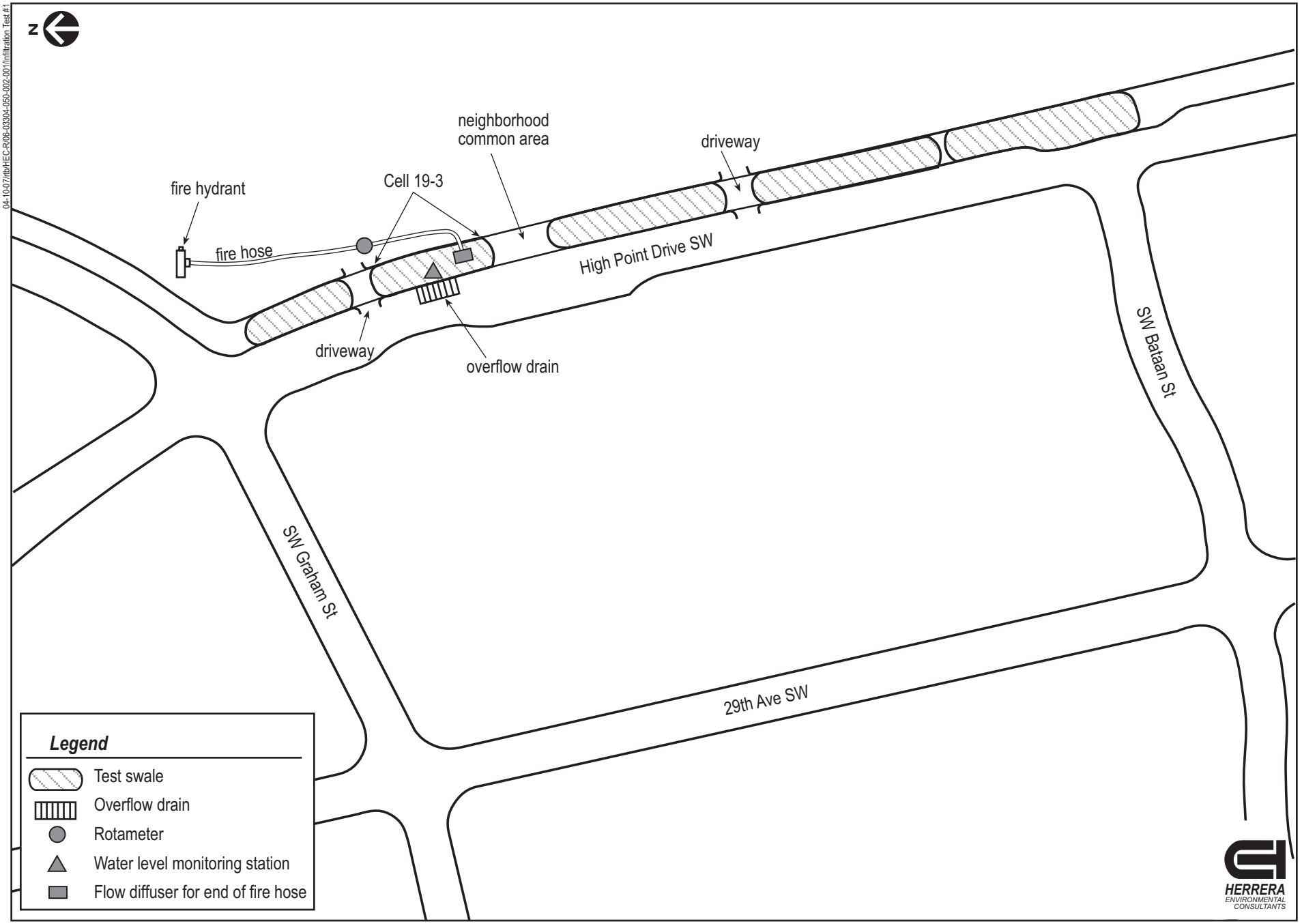

Figure 2. Plan view of natural drainage system test swale and controlled infiltration test monitoring station location for the High Point Phase I Block-scale Monitoring project.

Methods

Surface infiltration rates in the NDS test swale were measured using procedures adopted from the Washington State Department of Ecology's (2005) pilot infiltration test. The pilot infiltration test is a relatively large-scale infiltration test that is typically performed during the design phase of a project to estimate infiltration rates for a proposed stormwater infiltration facility. It specifically involves excavating a test pit to the same depth as that of the proposed infiltration facility. Water is then introduced to the pit at a variable rate to maintain a constant water level in the pit. During this procedure, a rotameter is used to measure the flow rate of the introduced water. After the flow rate has remained stable (i.e., constant) for 60 minutes, the water is turned off and the rate of infiltration (in inches per hour) is recorded until the pit is empty. This method has been shown to provide the most accurate estimates of infiltration rates for large-scale infiltration facilities (Seattle University 2004).

The pilot infiltration test method was modified for use in the NDS test swale as follows:

1. Culverts immediately upgradient and downgradient of the overflow drain for the swale were blocked with inflatable plugs. These culverts convey water beneath a neighborhood common area and driveway that crosses the swale at two locations on High Point Drive SW. This isolated a 72.4-foot section of the swale with an approximate surface area of 391 square feet. This section of the swale (which is identified as Cell 19-3 in the drainage plans for the project) represents approximately 20 percent of the total surface area of the swale. All subsequent activities related to this test were performed on this section of the swale.

2. Water from a nearby fire hydrant (Figure 2) was discharged to the swale using approximately 300 feet of 4-inch-diameter fire hose. A rotameter was attached to the hose to measure the water discharge rate. To reduce potential soil erosion at the point of discharge, the end of the fire hose was placed in a makeshift flow diffuser consisting of a plastic 40-gallon garbage can perforated with numerous 1.5-inch holes.

3. The discharge rate from the hose was varied to maintain a water depth of 0.80 feet in the swale. This target depth was identified during the first infiltration test and represents the maximum ponding depth that can be maintained within the swale without loosing water to the overflow drain. Every 15 to 30 minutes, the discharge rate of water entering the swale and the water depth in the swale were manually recorded. A pressure transducer and data logger were also installed in the swale near the overflow drain (Figure 2) and programmed with a 1-minute logging interval to continuously record water depth during the test.

4. After the discharge rate that was required for maintaining the target water depth (0.80 feet) in the swale stabilized and remained constant for 60 minutes, water flow to the swale was turned off. The time required for water remaining in the swale to infiltrate the soil was then measured until there was no longer any standing water.

5. The infiltration rate for the swale was then computed using the following formula:

$$IR = \frac{\Delta L}{\Delta T}$$

where:

IR = infiltration rate (inches/hour)

ΔL = change in water depth (in inches) from the time when water inputs are turned off to the time when no standing water is present

ΔT = change in time (in hours) from the time when water inputs are turned off to the time when no standing water is present

Photographs documenting the implementation of these procedures during the actual test are provided in Appendix A.

Results

A graph of the water depth and discharge data recorded during this test is provided in Figure 3. The field measurements recorded during the test are provided in Appendix B.

After setting up the required equipment, the infiltration test began at 8:36 a.m. with the first discharge of water into the NDS test swale. The prevailing weather at the time (i.e., clear skies) generally persisted through the end of the test. These conditions also persisted over the three days leading up to the test and resulted in a low initial water content in the soils associated with the swale.

At the beginning of the test, the discharge rate for water entering the swale was initially ramped up to approximately 0.19 cubic feet per second (cfs) (Figure 3). After approximately 33 minutes of elapsed time, the ponding depth in the swale reached the target depth of 0.80 feet. The inflow rate was then adjusted (primarily reduced) to maintain a water depth greater than or equal to 0.80 feet until 279 minutes of elapsed time in the test, at which point the discharge rate required to maintain this depth stabilized at 0.065 cfs (Figure 3). This discharge rate was maintained for approximately 60 minutes, or until 339 minutes of elapsed test time, at which point the water input to the swale was turned off. The water depth then dropped steadily over the next 91 minutes (1.52 hours) from the target depth of 0.80 feet until there was no appreciable standing

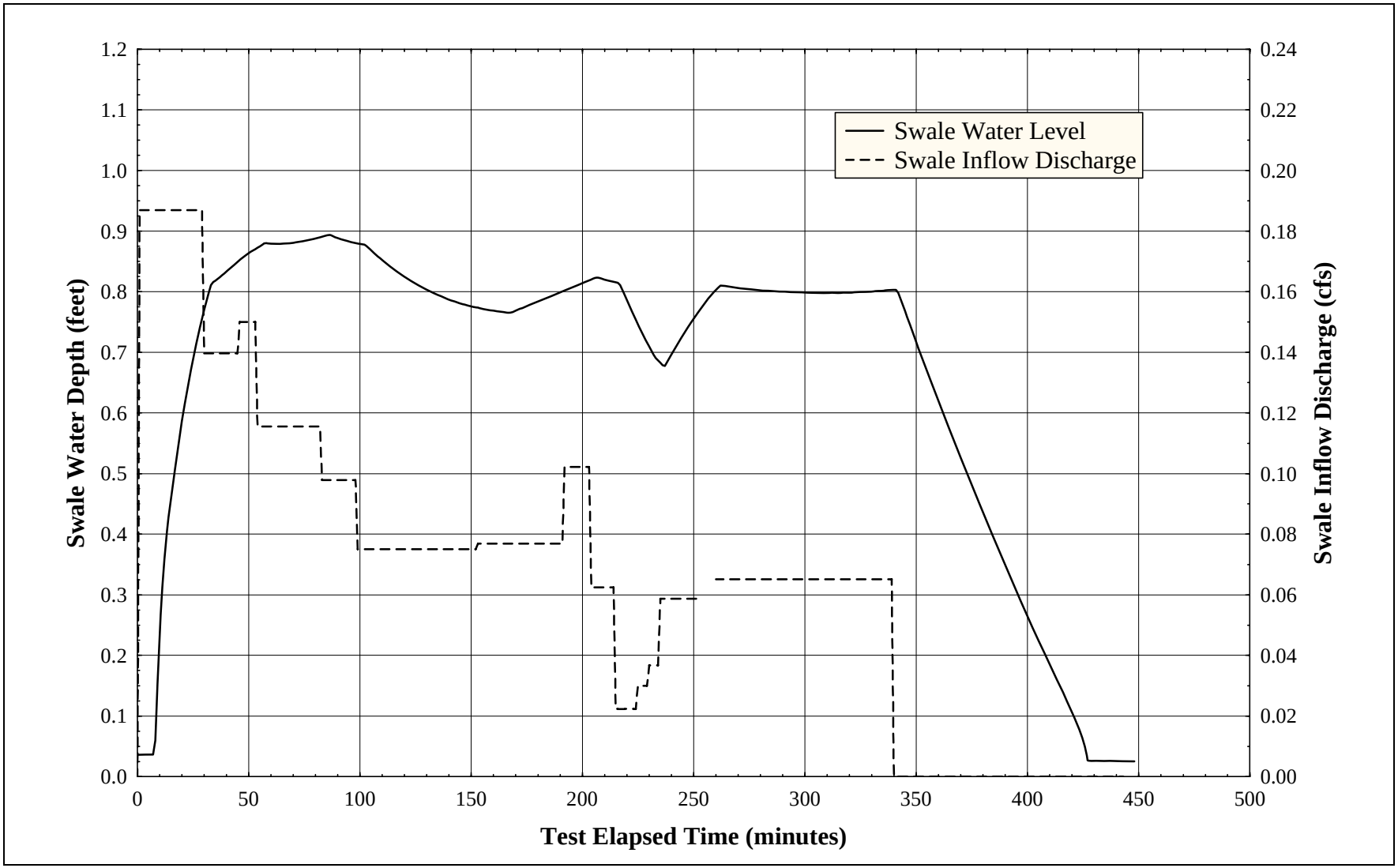

Figure 3. Inflow discharge rates and water depths measured during the controlled infiltration test on April 11, 2007, for the High Point Phase I Block-Scale Monitoring project.

water remaining in the swale (Figure 3). The total elapsed time for the test at this point was 430 minutes. At the end of the test, the final water depth in the swale was 0.026 feet, which corresponds to a 0.774-foot (9.228-inch) change in water depth from the time when the flow to the swale was turned off. Based on these data, the calculated infiltration rate for the swale is 9.228 inches/1.52 hours or 6.111 inches/hour.

To provide some perspective for interpreting these results, an infiltration rate of 2 inches/hour was assumed for the surface of the High Point NDS swales during the design phase of the project (Herrera and R.W. Beck 2004). Furthermore, the rate measured during the first infiltration test that was performed in connection with this project was 4.216 inches/hour. The difference in the measured infiltration rates between the first and second infiltration tests (i.e., 1.895 inches/hour) may be attributed to differences in the soil moisture content of the test swale leading up to the tests (it rained prior to the first infiltration test); however, maintaining a steady state discharge rate for 60 minutes prior to measuring the infiltration rate is meant to ensure saturated soil conditions persist in the test swale regardless of antecedent conditions. Therefore, differences in the initial soil moisture content should not be a significant factor contributing to the differences in infiltration rates between the first and second tests.

References

Ecology. 2005. Stormwater Management in Western Washington. Volume III, Hydrologic Analysis and Flow Control Design/BMPs. Publication 05-10-31 (a revision of Publication 99-13). Washington State Department of Ecology, Water Quality Program, Olympia, Washington. February 2005.

Herrera. 2006. Quality Assurance Project Plan: High Point Phase I Block Scale Monitoring. Draft. Prepared for Seattle Public Utilities by Herrera Environmental Consultants, Seattle, Washington. September 13, 2006.

Herrera and R.W. Beck. 2004. Hydrologic Modeling for High Point Revitalization, Seattle, Washington. Appendix C to High Point Drainage Plan Report by SvR Design Company. Prepared for Seattle Public Utilities by Herrera Environmental Consultants, Inc., and R.W. Beck, Seattle, Washington. May 5, 2004.

Seattle University. 2004. Soil Stormwater Detention Monitoring Method. Prepared for Seattle Public Utilities by Seattle University, School of Science and Engineering, Seattle, Washington. May 25, 2004.

APPENDIX A

Photographic Documentation of Field Measurement Procedures for April 11, 2007 Controlled Infiltration Test

Controlled Infiltration Test on April 11, 2007
High Point Block-Scale Monitoring Program
Photographic Log

Photo Number	Photo Description
1	Rotameter used to measure inflow discharge rates to the natural drainage system test swale
2	Pressure transducer used to measure water level in the natural drainage system test swale
3	Upgradient inflatable plug used to isolate Cell 19-3 of the natural drainage system test swale
4	Downgradient inflatable plug used to isolate Cell 19-3 of the natural drainage system test swale
5	Flow diffuser used for water entering the natural drainage system test swale
6	Ponding in natural drainage system test swale during infiltration test
7	Ponding in natural drainage system test swale during infiltration test
8	Fire hydrant and 4” hose used to deliver water to the natural drainage system test swale
9	Field book and datalogger near natural drainage system test swale overflow drain

1

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APPENDIX B

Field Measurements from Controlled Infiltration Test on April 11, 2007

Table B1. Field measurements from controlled infiltration test on April 11, 2007.

Date	Time	Elapsed Time (minutes)	Water Level (feet)	Inflow Discharge Rate (cubic feet per second)
4/11/2007	8:36:00	0	0.036	0.000
4/11/2007	8:37:00	1	0.036	0.187
4/11/2007	8:38:00	2	0.036	0.187
4/11/2007	8:39:00	3	0.036	0.187
4/11/2007	8:40:00	4	0.036	0.187
4/11/2007	8:41:00	5	0.036	0.187
4/11/2007	8:42:00	6	0.036	0.187
4/11/2007	8:43:00	7	0.036	0.187
4/11/2007	8:44:00	8	0.060	0.187
4/11/2007	8:45:00	9	0.152	0.187
4/11/2007	8:46:00	10	0.236	0.187
4/11/2007	8:47:00	11	0.306	0.187
4/11/2007	8:48:00	12	0.351	0.187
4/11/2007	8:49:00	13	0.393	0.187
4/11/2007	8:50:00	14	0.428	0.187
4/11/2007	8:51:00	15	0.457	0.187
4/11/2007	8:52:00	16	0.483	0.187
4/11/2007	8:53:00	17	0.510	0.187
4/11/2007	8:54:00	18	0.537	0.187
4/11/2007	8:55:00	19	0.563	0.187
4/11/2007	8:56:00	20	0.587	0.187
4/11/2007	8:57:00	21	0.610	0.187
4/11/2007	8:58:00	22	0.631	0.187
4/11/2007	8:59:00	23	0.651	0.187
4/11/2007	9:00:00	24	0.670	0.187
4/11/2007	9:01:00	25	0.689	0.187
4/11/2007	9:02:00	26	0.707	0.187
4/11/2007	9:03:00	27	0.724	0.187
4/11/2007	9:04:00	28	0.740	0.187
4/11/2007	9:05:00	29	0.755	0.187
4/11/2007	9:06:00	30	0.770	0.140
4/11/2007	9:07:00	31	0.784	0.140
4/11/2007	9:08:00	32	0.798	0.140
4/11/2007	9:09:00	33	0.811	0.140
4/11/2007	9:10:00	34	0.816	0.140
4/11/2007	9:11:00	35	0.818	0.140
4/11/2007	9:12:00	36	0.821	0.140
4/11/2007	9:13:00	37	0.824	0.140
4/11/2007	9:14:00	38	0.827	0.140
4/11/2007	9:15:00	39	0.830	0.140
4/11/2007	9:16:00	40	0.833	0.140
4/11/2007	9:17:00	41	0.837	0.140
4/11/2007	9:18:00	42	0.839	0.140

Table B1 (continued). Field measurements from controlled infiltration test on April 11, 2007

Date	Time	Elapsed Time (minutes)	Water Level (feet)	Inflow Discharge Rate (cubic feet per second)
4/11/2007	9:19:00	43	0.843	0.140
4/11/2007	9:20:00	44	0.846	0.140
4/11/2007	9:21:00	45	0.849	0.140
4/11/2007	9:22:00	46	0.852	0.150
4/11/2007	9:23:00	47	0.855	0.150
4/11/2007	9:24:00	48	0.858	0.150
4/11/2007	9:25:00	49	0.861	0.150
4/11/2007	9:26:00	50	0.863	0.150
4/11/2007	9:27:00	51	0.866	0.150
4/11/2007	9:28:00	52	0.868	0.150
4/11/2007	9:29:00	53	0.870	0.150
4/11/2007	9:30:00	54	0.872	0.116
4/11/2007	9:31:00	55	0.875	0.116
4/11/2007	9:32:00	56	0.877	0.116
4/11/2007	9:33:00	57	0.880	0.116
4/11/2007	9:34:00	58	0.880	0.116
4/11/2007	9:35:00	59	0.879	0.116
4/11/2007	9:36:00	60	0.879	0.116
4/11/2007	9:37:00	61	0.879	0.116
4/11/2007	9:38:00	62	0.879	0.116
4/11/2007	9:39:00	63	0.879	0.116
4/11/2007	9:40:00	64	0.879	0.116
4/11/2007	9:41:00	65	0.879	0.116
4/11/2007	9:42:00	66	0.879	0.116
4/11/2007	9:43:00	67	0.879	0.116
4/11/2007	9:44:00	68	0.880	0.116
4/11/2007	9:45:00	69	0.880	0.116
4/11/2007	9:46:00	70	0.881	0.116
4/11/2007	9:47:00	71	0.881	0.116
4/11/2007	9:48:00	72	0.882	0.116
4/11/2007	9:49:00	73	0.882	0.116
4/11/2007	9:50:00	74	0.883	0.116
4/11/2007	9:51:00	75	0.884	0.116
4/11/2007	9:52:00	76	0.884	0.116
4/11/2007	9:53:00	77	0.885	0.116
4/11/2007	9:54:00	78	0.886	0.116
4/11/2007	9:55:00	79	0.887	0.116
4/11/2007	9:56:00	80	0.888	0.116
4/11/2007	9:57:00	81	0.889	0.116
4/11/2007	9:58:00	82	0.890	0.116
4/11/2007	9:59:00	83	0.890	0.098
4/11/2007	10:00:00	84	0.892	0.098
4/11/2007	10:01:00	85	0.893	0.098
4/11/2007	10:02:00	86	0.894	0.098

Table B1 (continued). Field measurements from controlled infiltration test on April 11, 2007

Date	Time	Elapsed Time (minutes)	Water Level (feet)	Inflow Discharge Rate (cubic feet per second)
4/11/2007	10:03:00	87	0.893	0.098
4/11/2007	10:04:00	88	0.891	0.098
4/11/2007	10:05:00	89	0.890	0.098
4/11/2007	10:06:00	90	0.889	0.098
4/11/2007	10:07:00	91	0.887	0.098
4/11/2007	10:08:00	92	0.886	0.098
4/11/2007	10:09:00	93	0.885	0.098
4/11/2007	10:10:00	94	0.884	0.098
4/11/2007	10:11:00	95	0.883	0.098
4/11/2007	10:12:00	96	0.882	0.098
4/11/2007	10:13:00	97	0.881	0.098
4/11/2007	10:14:00	98	0.880	0.098
4/11/2007	10:15:00	99	0.880	0.075
4/11/2007	10:16:00	100	0.879	0.075
4/11/2007	10:17:00	101	0.878	0.075
4/11/2007	10:18:00	102	0.878	0.075
4/11/2007	10:19:00	103	0.875	0.075
4/11/2007	10:20:00	104	0.872	0.075
4/11/2007	10:21:00	105	0.868	0.075
4/11/2007	10:22:00	106	0.865	0.075
4/11/2007	10:23:00	107	0.862	0.075
4/11/2007	10:24:00	108	0.858	0.075
4/11/2007	10:25:00	109	0.855	0.075
4/11/2007	10:26:00	110	0.852	0.075
4/11/2007	10:27:00	111	0.849	0.075
4/11/2007	10:28:00	112	0.846	0.075
4/11/2007	10:29:00	113	0.843	0.075
4/11/2007	10:30:00	114	0.840	0.075
4/11/2007	10:31:00	115	0.838	0.075
4/11/2007	10:32:00	116	0.835	0.075
4/11/2007	10:33:00	117	0.832	0.075
4/11/2007	10:34:00	118	0.830	0.075
4/11/2007	10:35:00	119	0.827	0.075
4/11/2007	10:36:00	120	0.825	0.075
4/11/2007	10:37:00	121	0.822	0.075
4/11/2007	10:38:00	122	0.820	0.075
4/11/2007	10:39:00	123	0.818	0.075
4/11/2007	10:40:00	124	0.816	0.075
4/11/2007	10:41:00	125	0.814	0.075
4/11/2007	10:42:00	126	0.811	0.075
4/11/2007	10:43:00	127	0.809	0.075
4/11/2007	10:44:00	128	0.807	0.075
4/11/2007	10:45:00	129	0.805	0.075
4/11/2007	10:46:00	130	0.803	0.075

Table B1 (continued). Field measurements from controlled infiltration test on April 11, 2007

Date	Time	Elapsed Time (minutes)	Water Level (feet)	Inflow Discharge Rate (cubic feet per second)
4/11/2007	10:47:00	131	0.801	0.075
4/11/2007	10:48:00	132	0.800	0.075
4/11/2007	10:49:00	133	0.798	0.075
4/11/2007	10:50:00	134	0.797	0.075
4/11/2007	10:51:00	135	0.795	0.075
4/11/2007	10:52:00	136	0.793	0.075
4/11/2007	10:53:00	137	0.792	0.075
4/11/2007	10:54:00	138	0.790	0.075
4/11/2007	10:55:00	139	0.788	0.075
4/11/2007	10:56:00	140	0.787	0.075
4/11/2007	10:57:00	141	0.786	0.075
4/11/2007	10:58:00	142	0.784	0.075
4/11/2007	10:59:00	143	0.783	0.075
4/11/2007	11:00:00	144	0.782	0.075
4/11/2007	11:01:00	145	0.781	0.075
4/11/2007	11:02:00	146	0.780	0.075
4/11/2007	11:03:00	147	0.779	0.075
4/11/2007	11:04:00	148	0.778	0.075
4/11/2007	11:05:00	149	0.777	0.075
4/11/2007	11:06:00	150	0.776	0.075
4/11/2007	11:07:00	151	0.775	0.075
4/11/2007	11:08:00	152	0.774	0.075
4/11/2007	11:09:00	153	0.774	0.077
4/11/2007	11:10:00	154	0.773	0.077
4/11/2007	11:11:00	155	0.772	0.077
4/11/2007	11:12:00	156	0.771	0.077
4/11/2007	11:13:00	157	0.770	0.077
4/11/2007	11:14:00	158	0.770	0.077
4/11/2007	11:15:00	159	0.769	0.077
4/11/2007	11:16:00	160	0.769	0.077
4/11/2007	11:17:00	161	0.768	0.077
4/11/2007	11:18:00	162	0.768	0.077
4/11/2007	11:19:00	163	0.767	0.077
4/11/2007	11:20:00	164	0.767	0.077
4/11/2007	11:21:00	165	0.766	0.077
4/11/2007	11:22:00	166	0.766	0.077
4/11/2007	11:23:00	167	0.765	0.077
4/11/2007	11:24:00	168	0.766	0.077
4/11/2007	11:25:00	169	0.767	0.077
4/11/2007	11:26:00	170	0.769	0.077
4/11/2007	11:27:00	171	0.771	0.077
4/11/2007	11:28:00	172	0.772	0.077
4/11/2007	11:29:00	173	0.773	0.077
4/11/2007	11:30:00	174	0.775	0.077

Table B1 (continued). Field measurements from controlled infiltration test on April 11, 2007

Date	Time	Elapsed Time (minutes)	Water Level (feet)	Inflow Discharge Rate (cubic feet per second)
4/11/2007	11:31:00	175	0.777	0.077
4/11/2007	11:32:00	176	0.778	0.077
4/11/2007	11:33:00	177	0.779	0.077
4/11/2007	11:34:00	178	0.781	0.077
4/11/2007	11:35:00	179	0.783	0.077
4/11/2007	11:36:00	180	0.784	0.077
4/11/2007	11:37:00	181	0.785	0.077
4/11/2007	11:38:00	182	0.787	0.077
4/11/2007	11:39:00	183	0.788	0.077
4/11/2007	11:40:00	184	0.790	0.077
4/11/2007	11:41:00	185	0.791	0.077
4/11/2007	11:42:00	186	0.793	0.077
4/11/2007	11:43:00	187	0.794	0.077
4/11/2007	11:44:00	188	0.796	0.077
4/11/2007	11:45:00	189	0.797	0.077
4/11/2007	11:46:00	190	0.799	0.077
4/11/2007	11:47:00	191	0.800	0.077
4/11/2007	11:48:00	192	0.802	0.102
4/11/2007	11:49:00	193	0.803	0.102
4/11/2007	11:50:00	194	0.805	0.102
4/11/2007	11:51:00	195	0.806	0.102
4/11/2007	11:52:00	196	0.808	0.102
4/11/2007	11:53:00	197	0.810	0.102
4/11/2007	11:54:00	198	0.811	0.102
4/11/2007	11:55:00	199	0.813	0.102
4/11/2007	11:56:00	200	0.814	0.102
4/11/2007	11:57:00	201	0.816	0.102
4/11/2007	11:58:00	202	0.817	0.102
4/11/2007	11:59:00	203	0.819	0.102
4/11/2007	12:00:00	204	0.820	0.062
4/11/2007	12:01:00	205	0.822	0.062
4/11/2007	12:02:00	206	0.823	0.062
4/11/2007	12:03:00	207	0.823	0.062
4/11/2007	12:04:00	208	0.822	0.062
4/11/2007	12:05:00	209	0.821	0.062
4/11/2007	12:06:00	210	0.820	0.062
4/11/2007	12:07:00	211	0.819	0.062
4/11/2007	12:08:00	212	0.818	0.062
4/11/2007	12:09:00	213	0.817	0.062
4/11/2007	12:10:00	214	0.816	0.062
4/11/2007	12:11:00	215	0.815	0.022
4/11/2007	12:12:00	216	0.815	0.022
4/11/2007	12:13:00	217	0.811	0.022
4/11/2007	12:14:00	218	0.803	0.022

Table B1 (continued). Field measurements from controlled infiltration test on April 11, 2007

Date	Time	Elapsed Time (minutes)	Water Level (feet)	Inflow Discharge Rate (cubic feet per second)
4/11/2007	12:15:00	219	0.794	0.022
4/11/2007	12:16:00	220	0.786	0.022
4/11/2007	12:17:00	221	0.778	0.022
4/11/2007	12:18:00	222	0.770	0.022
4/11/2007	12:19:00	223	0.762	0.022
4/11/2007	12:20:00	224	0.754	0.022
4/11/2007	12:21:00	225	0.746	0.030
4/11/2007	12:22:00	226	0.738	0.030
4/11/2007	12:23:00	227	0.730	0.030
4/11/2007	12:24:00	228	0.724	0.030
4/11/2007	12:25:00	229	0.717	0.030
4/11/2007	12:26:00	230	0.710	0.037
4/11/2007	12:27:00	231	0.703	0.037
4/11/2007	12:28:00	232	0.696	0.037
4/11/2007	12:29:00	233	0.691	0.037
4/11/2007	12:30:00	234	0.687	0.037
4/11/2007	12:31:00	235	0.683	0.059
4/11/2007	12:32:00	236	0.679	0.059
4/11/2007	12:33:00	237	0.678	0.059
4/11/2007	12:34:00	238	0.684	0.059
4/11/2007	12:35:00	239	0.690	0.059
4/11/2007	12:36:00	240	0.697	0.059
4/11/2007	12:37:00	241	0.703	0.059
4/11/2007	12:38:00	242	0.709	0.059
4/11/2007	12:39:00	243	0.715	0.059
4/11/2007	12:40:00	244	0.721	0.059
4/11/2007	12:41:00	245	0.727	0.059
4/11/2007	12:42:00	246	0.733	0.059
4/11/2007	12:43:00	247	0.739	0.059
4/11/2007	12:44:00	248	0.744	0.059
4/11/2007	12:45:00	249	0.750	0.059
4/11/2007	12:46:00	250	0.755	0.059
4/11/2007	12:47:00	251	0.761	0.059
4/11/2007	12:48:00	252	0.766	0.059
4/11/2007	12:49:00	253	0.771	0.059
4/11/2007	12:50:00	254	0.776	0.059
4/11/2007	12:51:00	255	0.781	0.262
4/11/2007	12:52:00	256	0.786	0.262
4/11/2007	12:53:00	257	0.791	0.262
4/11/2007	12:54:00	258	0.795	0.262
4/11/2007	12:55:00	259	0.799	0.262
4/11/2007	12:56:00	260	0.803	0.065
4/11/2007	12:57:00	261	0.807	0.065
4/11/2007	12:58:00	262	0.810	0.065

Table B1 (continued). Field measurements from controlled infiltration test on April 11, 2007

Date	Time	Elapsed Time (minutes)	Water Level (feet)	Inflow Discharge Rate (cubic feet per second)
4/11/2007	12:59:00	263	0.810	0.065
4/11/2007	13:00:00	264	0.810	0.065
4/11/2007	13:01:00	265	0.809	0.065
4/11/2007	13:02:00	266	0.808	0.065
4/11/2007	13:03:00	267	0.808	0.065
4/11/2007	13:04:00	268	0.807	0.065
4/11/2007	13:05:00	269	0.807	0.065
4/11/2007	13:06:00	270	0.806	0.065
4/11/2007	13:07:00	271	0.806	0.065
4/11/2007	13:08:00	272	0.806	0.065
4/11/2007	13:09:00	273	0.805	0.065
4/11/2007	13:10:00	274	0.804	0.065
4/11/2007	13:11:00	275	0.804	0.065
4/11/2007	13:12:00	276	0.804	0.065
4/11/2007	13:13:00	277	0.803	0.065
4/11/2007	13:14:00	278	0.803	0.065
4/11/2007	13:15:00	279	0.803	0.065
4/11/2007	13:16:00	280	0.802	0.065
4/11/2007	13:17:00	281	0.802	0.065
4/11/2007	13:18:00	282	0.802	0.065
4/11/2007	13:19:00	283	0.801	0.065
4/11/2007	13:20:00	284	0.801	0.065
4/11/2007	13:21:00	285	0.801	0.065
4/11/2007	13:22:00	286	0.801	0.065
4/11/2007	13:23:00	287	0.801	0.065
4/11/2007	13:24:00	288	0.800	0.065
4/11/2007	13:25:00	289	0.800	0.065
4/11/2007	13:26:00	290	0.800	0.065
4/11/2007	13:27:00	291	0.800	0.065
4/11/2007	13:28:00	292	0.800	0.065
4/11/2007	13:29:00	293	0.799	0.065
4/11/2007	13:30:00	294	0.800	0.065
4/11/2007	13:31:00	295	0.799	0.065
4/11/2007	13:32:00	296	0.799	0.065
4/11/2007	13:33:00	297	0.799	0.065
4/11/2007	13:34:00	298	0.799	0.065
4/11/2007	13:35:00	299	0.799	0.065
4/11/2007	13:36:00	300	0.799	0.065
4/11/2007	13:37:00	301	0.798	0.065
4/11/2007	13:38:00	302	0.798	0.065
4/11/2007	13:39:00	303	0.799	0.065
4/11/2007	13:40:00	304	0.798	0.065
4/11/2007	13:41:00	305	0.798	0.065
4/11/2007	13:42:00	306	0.798	0.065

Table B1 (continued). Field measurements from controlled infiltration test on April 11, 2007

Date	Time	Elapsed Time (minutes)	Water Level (feet)	Inflow Discharge Rate (cubic feet per second)
4/11/2007	13:43:00	307	0.798	0.065
4/11/2007	13:44:00	308	0.798	0.065
4/11/2007	13:45:00	309	0.798	0.065
4/11/2007	13:46:00	310	0.798	0.065
4/11/2007	13:47:00	311	0.798	0.065
4/11/2007	13:48:00	312	0.798	0.065
4/11/2007	13:49:00	313	0.798	0.065
4/11/2007	13:50:00	314	0.798	0.065
4/11/2007	13:51:00	315	0.798	0.065
4/11/2007	13:52:00	316	0.798	0.065
4/11/2007	13:53:00	317	0.798	0.065
4/11/2007	13:54:00	318	0.798	0.065
4/11/2007	13:55:00	319	0.799	0.065
4/11/2007	13:56:00	320	0.799	0.065
4/11/2007	13:57:00	321	0.799	0.065
4/11/2007	13:58:00	322	0.799	0.065
4/11/2007	13:59:00	323	0.799	0.065
4/11/2007	14:00:00	324	0.799	0.065
4/11/2007	14:01:00	325	0.800	0.065
4/11/2007	14:02:00	326	0.800	0.065
4/11/2007	14:03:00	327	0.800	0.065
4/11/2007	14:04:00	328	0.800	0.065
4/11/2007	14:05:00	329	0.800	0.065
4/11/2007	14:06:00	330	0.800	0.065
4/11/2007	14:07:00	331	0.801	0.065
4/11/2007	14:08:00	332	0.801	0.065
4/11/2007	14:09:00	333	0.801	0.065
4/11/2007	14:10:00	334	0.802	0.065
4/11/2007	14:11:00	335	0.802	0.065
4/11/2007	14:12:00	336	0.802	0.065
4/11/2007	14:13:00	337	0.803	0.065
4/11/2007	14:14:00	338	0.803	0.065
4/11/2007	14:15:00	339	0.803	0.065
4/11/2007	14:16:00	340	0.803	0.000
4/11/2007	14:17:00	341	0.803	0.000
4/11/2007	14:18:00	342	0.798	0.000
4/11/2007	14:19:00	343	0.788	0.000
4/11/2007	14:20:00	344	0.778	0.000
4/11/2007	14:21:00	345	0.768	0.000
4/11/2007	14:22:00	346	0.758	0.000
4/11/2007	14:23:00	347	0.748	0.000
4/11/2007	14:24:00	348	0.739	0.000
4/11/2007	14:25:00	349	0.727	0.000
4/11/2007	14:26:00	350	0.717	0.000

Table B1 (continued). Field measurements from controlled infiltration test on April 11, 2007

Date	Time	Elapsed Time (minutes)	Water Level (feet)	Inflow Discharge Rate (cubic feet per second)
4/11/2007	14:27:00	351	0.707	0.000
4/11/2007	14:28:00	352	0.697	0.000
4/11/2007	14:29:00	353	0.688	0.000
4/11/2007	14:30:00	354	0.678	0.000
4/11/2007	14:31:00	355	0.668	0.000
4/11/2007	14:32:00	356	0.658	0.000
4/11/2007	14:33:00	357	0.649	0.000
4/11/2007	14:34:00	358	0.639	0.000
4/11/2007	14:35:00	359	0.630	0.000
4/11/2007	14:36:00	360	0.620	0.000
4/11/2007	14:37:00	361	0.611	0.000
4/11/2007	14:38:00	362	0.601	0.000
4/11/2007	14:39:00	363	0.591	0.000
4/11/2007	14:40:00	364	0.582	0.000
4/11/2007	14:41:00	365	0.573	0.000
4/11/2007	14:42:00	366	0.563	0.000
4/11/2007	14:43:00	367	0.554	0.000
4/11/2007	14:44:00	368	0.545	0.000
4/11/2007	14:45:00	369	0.536	0.000
4/11/2007	14:46:00	370	0.527	0.000
4/11/2007	14:47:00	371	0.518	0.000
4/11/2007	14:48:00	372	0.508	0.000
4/11/2007	14:49:00	373	0.499	0.000
4/11/2007	14:50:00	374	0.490	0.000
4/11/2007	14:51:00	375	0.481	0.000
4/11/2007	14:52:00	376	0.472	0.000
4/11/2007	14:53:00	377	0.463	0.000
4/11/2007	14:54:00	378	0.454	0.000
4/11/2007	14:55:00	379	0.445	0.000
4/11/2007	14:56:00	380	0.436	0.000
4/11/2007	14:57:00	381	0.428	0.000
4/11/2007	14:58:00	382	0.419	0.000
4/11/2007	14:59:00	383	0.410	0.000
4/11/2007	15:00:00	384	0.401	0.000
4/11/2007	15:01:00	385	0.392	0.000
4/11/2007	15:02:00	386	0.384	0.000
4/11/2007	15:03:00	387	0.375	0.000
4/11/2007	15:04:00	388	0.367	0.000
4/11/2007	15:05:00	389	0.358	0.000
4/11/2007	15:06:00	390	0.349	0.000
4/11/2007	15:07:00	391	0.341	0.000
4/11/2007	15:08:00	392	0.332	0.000
4/11/2007	15:09:00	393	0.324	0.000
4/11/2007	15:10:00	394	0.315	0.000

Table B1 (continued). Field measurements from controlled infiltration test on April 11, 2007

Date	Time	Elapsed Time (minutes)	Water Level (feet)	Inflow Discharge Rate (cubic feet per second)
4/11/2007	15:11:00	395	0.307	0.000
4/11/2007	15:12:00	396	0.298	0.000
4/11/2007	15:13:00	397	0.290	0.000
4/11/2007	15:14:00	398	0.281	0.000
4/11/2007	15:15:00	399	0.273	0.000
4/11/2007	15:16:00	400	0.265	0.000
4/11/2007	15:17:00	401	0.256	0.000
4/11/2007	15:18:00	402	0.248	0.000
4/11/2007	15:19:00	403	0.240	0.000
4/11/2007	15:20:00	404	0.232	0.000
4/11/2007	15:21:00	405	0.224	0.000
4/11/2007	15:22:00	406	0.216	0.000
4/11/2007	15:23:00	407	0.209	0.000
4/11/2007	15:24:00	408	0.201	0.000
4/11/2007	15:25:00	409	0.193	0.000
4/11/2007	15:26:00	410	0.185	0.000
4/11/2007	15:27:00	411	0.177	0.000
4/11/2007	15:28:00	412	0.170	0.000
4/11/2007	15:29:00	413	0.162	0.000
4/11/2007	15:30:00	414	0.154	0.000
4/11/2007	15:31:00	415	0.146	0.000
4/11/2007	15:32:00	416	0.139	0.000
4/11/2007	15:33:00	417	0.131	0.000
4/11/2007	15:34:00	418	0.123	0.000
4/11/2007	15:35:00	419	0.114	0.000
4/11/2007	15:36:00	420	0.106	0.000
4/11/2007	15:37:00	421	0.098	0.000
4/11/2007	15:38:00	422	0.089	0.000
4/11/2007	15:39:00	423	0.081	0.000
4/11/2007	15:40:00	424	0.071	0.000
4/11/2007	15:41:00	425	0.060	0.000
4/11/2007	15:42:00	426	0.046	0.000
4/11/2007	15:43:00	427	0.027	0.000
4/11/2007	15:44:00	428	0.026	0.000
4/11/2007	15:45:00	429	0.026	0.000
4/11/2007	15:46:00	430	0.026	0.000
4/11/2007	15:47:00	431	0.026	0.000
4/11/2007	15:48:00	432	0.026	0.000
4/11/2007	15:49:00	433	0.026	0.000
4/11/2007	15:50:00	434	0.026	0.000
4/11/2007	15:51:00	435	0.026	0.000
4/11/2007	15:52:00	436	0.026	0.000
4/11/2007	15:53:00	437	0.026	0.000
4/11/2007	15:54:00	438	0.026	0.000

Table B1 (continued). Field measurements from controlled infiltration test on April 11, 2007

Date	Time	Elapsed Time (minutes)	Water Level (feet)	Inflow Discharge Rate (cubic feet per second)
4/11/2007	15:55:00	439	0.026	0.000
4/11/2007	15:56:00	440	0.026	0.000
4/11/2007	15:57:00	441	0.026	0.000
4/11/2007	15:58:00	442	0.026	0.000
4/11/2007	15:59:00	443	0.026	0.000