Kindred Hydro

Technical Memorandum

Received by Email
2022-01-31

Project: Carrik Court Infiltration Testing
Location: Mukilteo Speedway and 88th Street, SW, Mukilteo, WA
Job#: WES-20-1
Date: September 22, 2020

Westcott Holding, Inc.
1010 Market Street
Kirkland, Washington 98033
Attn: Ryan Appleby

Dear Mr. Appleby:

I am pleased to submit this technical memorandum providing the results of infiltration testing for stormwater infiltration design.

Background

An aerial photograph of the site is shown on Figure 1. The proposed project is located at the corner of Mukilteo Speedway and 88th Street SW in Mukilteo, Washington and covers the following parcels: 00611600013402, 00611600013500, and 00611600013600, with a total area of approximately 10 acres. There are two houses and several small out-buildings on the project site. The northern and southern portions of the site are forested and the central portion of the site is pasture and a gravel parking pad.

Based on the preliminary site plan, the project is expected to include approximately 125 townhomes with 16 live/work units along Mukilteo Speedway.

The purpose of this work was to evaluate the potential for stormwater infiltration and provide preliminary infiltration rates for feasibility assessment.

Topography, Mapped Geology, Slope Hazards, Wetlands

The site is generally sloping to the west with an elevation of approximately 445-450 feet above sea level along the east side and an elevation of approximately 415-420 feet above sea level along the west side.

The geologic map for Mukilteo[1] indicates that the site is mapped as glacial till, a dense mixture of silt sand and gravel that is generally poor for infiltration.

Based on a steep slope assessment conducted for a previous project (not publicly available) there are no slopes steeper than 40 percent on the property and in the immediate vicinity of the property. There are slopes steeper than 40 percent approximately 400 feet west of the site.

A wetland has been identified in the southern portion of the site.

[1] Minard, J.P., 1982, Distribution and Description of Geologic Units in the Mukilteo Quadrangle, Washington, USGS, Miscellaneous Field Studies, MAP MF-1438.

Borings and Testpit Explorations

Earth Solutions NW, LLC conducted borings and test pit explorations on the site. Final results of this work are not yet available but preliminary results were reviewed for this infiltration assessment.

Three borings, ranging in depth from 90 to 135 feet, were completed at the site. All three borings encountered glacial till or other low-permeability soils to the full depth of the explorations. There were no significant permeable soil horizons that were suitable for deep infiltration.

Following the deep explorations, nine test pits were excavated across the site to observe shallow soil and groundwater conditions. Most of these test pits encountered weathered glacial till to a depth of 3-4 feet and unweathered glacial till below the shallow weathered zone. Two test pits excavated just west of the gravel parking area encountered fill soils over glacial till. Some of the test pits were left open for infiltration testing.

Infiltration Testing

Shallow infiltration testing was conducted in six test pits left open during the test pit exploration program. These tests were conducted at locations shown in Figure 1 using the small-scale pilot infiltration test (PIT) method provided in the 2014 Stormwater Management Manual for Western Washington (SMMWW).

Before each infiltration test a soil sample was collected from the bottom of each PIT excavation and delivered to Amtest Laboratory in Redmond, Washington for grainsize analysis. The results are provided in Attachment A and summarized in Table 1. All six samples were well sorted silty sands with 1 to 14 percent gravel and a United States Classification System (USCS) designation of SM.

Table 1: Summary of Grainsize Analyses and Infiltration Testing Results

Location	Depth (ft)	% Gravel	% Sand	% Silt	USCS Class	Coefficient of Uniformity	Moisture Content	Design Infiltration Rate (in./hr)
IT-2	4.0	9	70	21	SM	9.8	12%	0.25
IT-3	4.5	6	69	26	SM	16	10%	0.18
IT-4	4.0	14	61	25	SM	13	10%	0.04
IT-5	4.0	6	63	31	SM	11	11%	0.03
IT-7	4.0	1	73	27	SM	7.0	11%	0.24
IT-9	4.0	5	66	30	SM	11	9%	0.12

The details of the infiltration test procedures and the test data are provided in Attachment B. For very low infiltration tests such as these, it can be difficult to obtain an accurate steady state infiltration rate. Therefore, the falling head infiltration rate is considered more reliable and were used to estimate the design infiltration rates. Note that the falling head infiltration rate declines as the depth of water decreases in the test pit and is always less than the steady state infiltration rate, so using the falling head rate provides an extra factor of safety.

As specified in the SMMWW, the design infiltration rate is determined by multiplying the measured infiltration rate by the total correction factor. The total correction factor was calculated using the

following correction factors:

- Site variability and number of locations tested (Cf_v) = 0.9 (Ecology recommends 0.33-1.0)
- Test Method (Cf_t) = 0.5 (Small-Scale PIT)
- Degree of influent control to prevent siltation and bio-buildup (Cf_m) = 0.9

The total correction factor (CF_t) = CF_v x CF_t x CF_m = 0.4. The design infiltration rates for each test are summarized in Table 1.

Recommendations

Two of the three infiltration tests in the southern portion of the site (IT-4 and IT-5) provided significantly lower design infiltration rates (0.03 to 0.04 inches/hour) than the remaining test locations, which provided design infiltration rates ranging from 0.12 to 0.25 inches/hour. These lower test results may be associated with the wetland located in the southern portion of the site. Excluding IT-4 and IT-5, the average design infiltration rate is 0.2 inches/hour. For evaluation of dispersed infiltration facilities outside of the southern portion of the site, I recommend using a design rate of 0.2 inches/hour. For the southern portion of the site, I recommend using a design rate of 0.04 inches/hour.

A design rate of 0.2 inches per hour is sufficient for permeable pavement as long as the permeable pavement section is flat or designed with internal check dams to create storage during large storms. This infiltration design rate may be sufficient for infiltration trenches and bioretention swales underlain by a sufficient reservoir of clean crushed drain rock. These facilities should be equipped with overflow pipes to ensure excess water can be conveyed downstream.

Dispersed infiltration in small facilities has been effective at sites underlain by glacial till. During wet periods, when the ground is most saturated, infiltrating stormwater has an opportunity to spread horizontally before infiltrating. Large infiltration facilities provide less opportunity for horizontal spreading and can be less effective in till soils during wet periods. For this reason, we recommend reliance on small dispersed infiltration facilities rather than large centralized infiltration facilities.

Once locations of infiltration facilities have been identified, additional infiltration testing will be necessary to confirm the design infiltration rate. In addition, groundwater mounding analysis may be necessary to evaluate the combined affect of multiple infiltration facilities across the site.

We recommend having Kindred Hydro, Inc. on site during construction to observe the following:

- The base of any excavation for infiltration BMP's: This inspection allows us to confirm that the soils and groundwater conditions are consistent with our expectations and that the bottom of the excavation is free of silt or other contamination that might clog the facility.
- Samples of any aggregate materials used in the construction of the BMPs to confirm that they meet specifications on the plans.
- Placement of materials during construction of the BMP's to ensure that they conform with the design drawings and specifications.

Limitations and Closure

Work for this project was performed and this report prepared in accordance with generally accepted professional practices for the nature and conditions of work completed in the same or similar localities, at the time the work was performed. It is intended for the exclusive use of Westcott Holding, Inc. for specific application to the referenced matter. No other warranty, expressed or implied, is made.

If you have any questions or concerns, please contact the undersigned.

Sincerely,

J. Scott Kindred, PE
President
Kindred Hydro, Inc.
Date: ___September 22, 2020

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Figure 1: Aerial Photograph of the Site and Infiltration Test Locations

Attachment A:

Grain Size Distribution Results

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Table A-1 (pg. 1 of 2): Grain Size Distributions

Project Name		Carrik Court		Carrik Court		Carrik Court	
Sample Name		IT-2-4.0		IT-3-4.5		IT-4-4.0	
Sample Date		8/24/2020		8/24/2020		8/24/2020	
Solids Content (by weight) %		90%		91%		91%	
Water Content (by weight) %		12%		10%		10%	
Sieve Size	Sieve Size (mm)	% Retained	Cumulative % Passing	% Retained	Cumulative % Retained	% Retained	Cumulative % Retained
1.5"	38.1	0	100	0	100	0	100
1"	25.4	0	100	0	100	0	100
3/4"	19.05	0	100	0	100	4.4	96
1/2"	12.7	2.4	98	2.9	97	4.2	91
3/8"	9.5	1.3	96	0.5	97	0.7	91
#4	4.75	5.4	91	2.2	94	4.4	86
#10	2	6.8	84	4.4	90	5.1	81
#20	0.85	6.7	77	4.3	86	4.9	76
#40	0.425	15.2	62	15.2	71	13.8	63
#60	0.25	17.5	45	19.5	51	17.5	45
#100	0.15	11.8	33	14.3	37	9.5	36
#140	0.105	9.5	23	8.5	28	8.1	27
#200	0.075	2.7	21	2.6	26	2.1	25
#270	0.053	5.7	15	3.5	22	5.5	20
<#270		15		22.1		19.8	
% Gravel		9		6		14	
%Sand		70		69		61	
% Silt		21		26		25	
USCS Class		SM		SM		SM	
% Coarse Gravel		0.0		0.0		32.1	
% Fine Gravel		100.0		100.0		67.9	
% Coarse Sand		9.7		6.4		8.4	
% Medium Sand		31.2		28.3		30.7	
% Fine Sand		59.1		65.3		61.0	
Grain Size at 60% Passing (D60)		0.39		0.31		0.39	
Grain Size at 10% Passing (D10)		0.04		0.02		0.030	
Coefficient of Uniformity (D60/D10)		9.8		16		13	
Description (USCS)		well-graded, slightly gravelly, silty, fine-medium SAND		well-graded, slightly gravelly, silty, fine-medium SAND		well-graded, slightly gravelly, silty, fine-medium SAND	

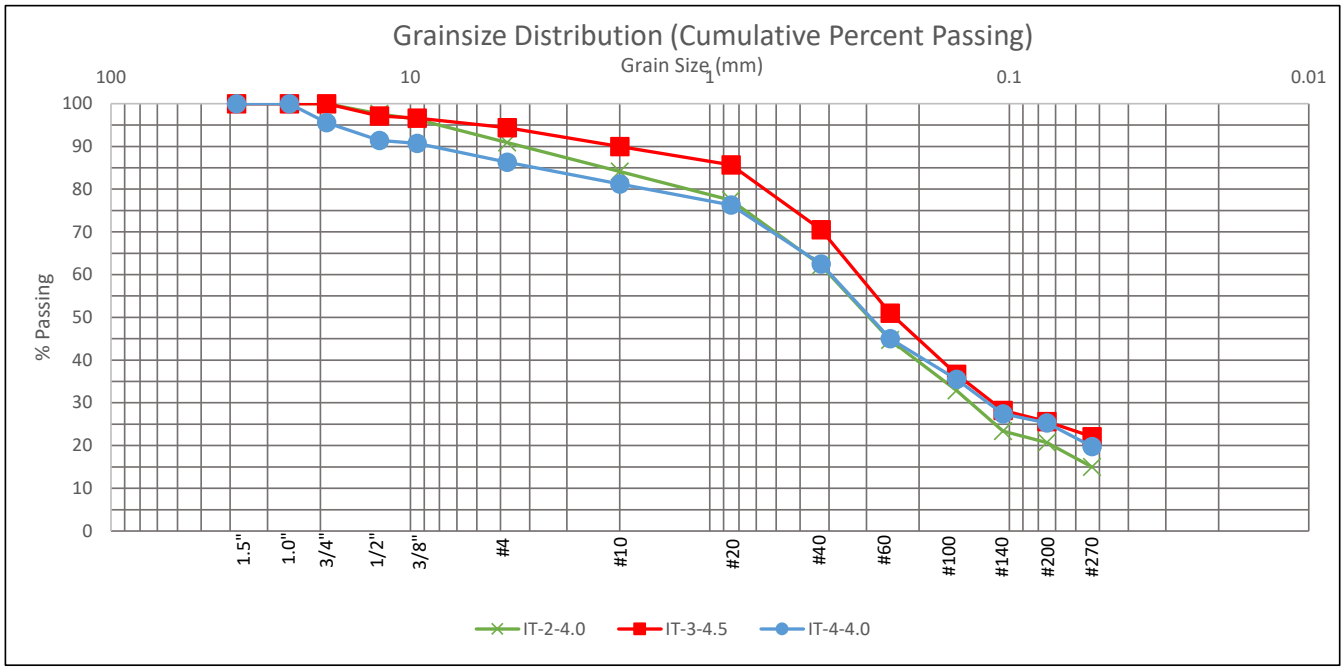

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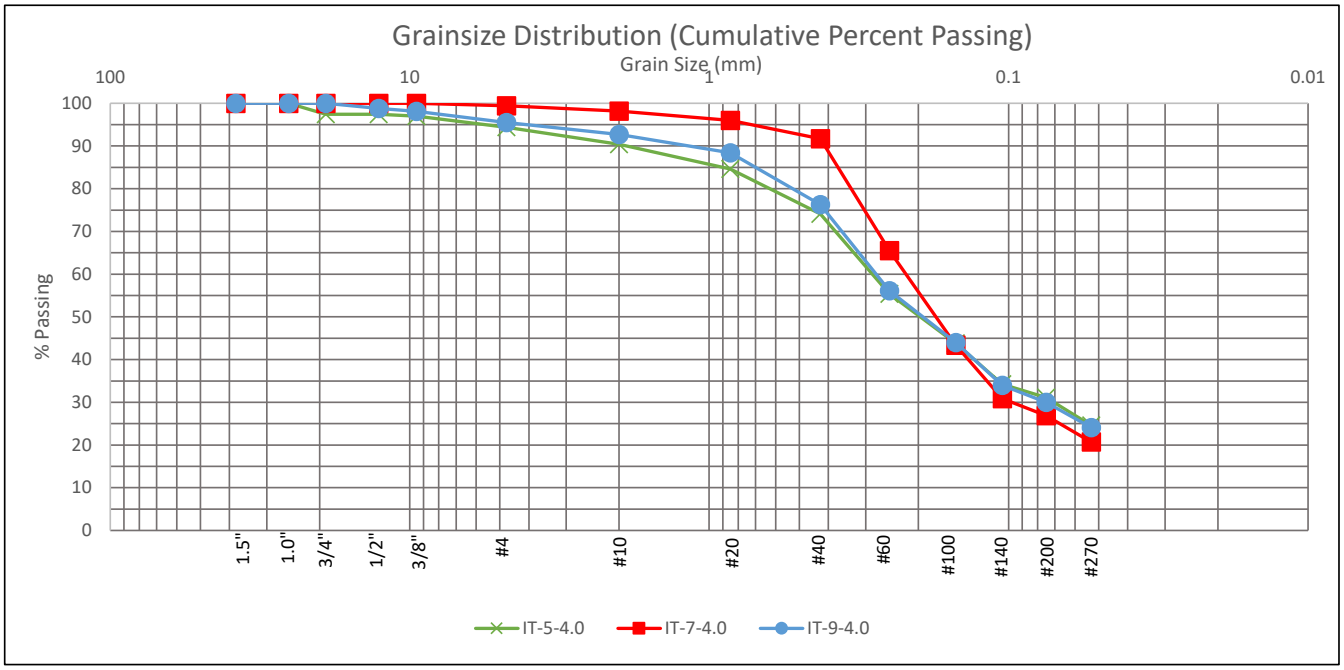
Table A-1 (pg. 2 of 2): Grain Size Distributions

Project Name		Carrik Court		Carrik Court		Carrik Court	
Sample Name		IT-5-4.0		IT-7-4.0		IT-9-4.0	
Sample Date		8/24/2020		8/24/2020		8/24/2020	
Solids Content (by weight) %		90%		90%		92%	
Water Content (by weight) %		11%		11%		9%	
Sieve Size	Sieve Size (mm)	% Retained	Cumulative % Retained	% Retained	Cumulative % Retained	% Retained	Cumulative % Retained
1.5"	38.1	0	100	0	100	0	100
1"	25.4	0	100	0	100	0	100
3/4"	19.05	2.6	97	0	100	0	100
1/2"	12.7	0	97	0	100	1.2	99
3/8"	9.5	0.4	97	0	100	0.7	98
#4	4.75	2.6	94	0.6	99	2.6	96
#10	2	4	90	1.2	98	2.8	93
#20	0.85	5.8	85	2.2	96	4.3	88
#40	0.425	10.5	74	4.3	92	12.1	76
#60	0.25	18.7	55	26.2	66	20.2	56
#100	0.15	11.6	44	22.1	43	12.1	44
#140	0.105	9.6	34	12.5	31	10	34
#200	0.075	3.1	31	4	27	4	30
#270	0.053	6.5	25	6.2	21	5.9	24
<#270		24.6		20.7		24.1	
% Gravel		6		1		5	
%Sand		63		73		66	
% Silt		31		27		30	
USCS Class		SM		SM		SM	
% Coarse Gravel		46.4		0.0		0.0	
% Fine Gravel		53.6		100.0		100.0	
% Coarse Sand		6.3		1.7		4.3	
% Medium Sand		25.8		9.0		25.0	
% Fine Sand		67.9		89.4		70.7	
Grain Size at 60% Passing (D60)		0.28		0.21		0.28	
Grain Size at 10% Passing (D10)		0.025		0.030		0.025	
Uniformity Coefficient (D60/D10)		11		7.0		11	
Description (USCS)		well-graded, slightly gravelly, very silty, fine-medium SAND		well graded, silty, fine SAND, trace gravel		well-graded, very silty, slightly gravelly, fine-medium SAND	



Attachment B:

Infiltration Testing Procedures and Results

Small-Scale Pilot Infiltration Test Procedure

Infiltration testing was conducted in general accordance with the small-scale pilot infiltration test (PIT) method provided in the 2014 Stormwater Management Manual for Western Washington (SMMWW). Key elements of the PIT methodology, along with any significant deviations from the SWWMM procedures, are provided below:

1) The test pits were excavated to a depth of 4.0 to 4.5 feet. This depth was through the weathered glacial till zone and into the unweathered glacial till, which is expected to provide a conservative estimate of infiltration across the site.

2) The horizontal surface area of the bottom of the test pits ranged from 13.5 to 16.2 square feet.

3) The depth of water in the pit was measured using both a vertical measuring rod marked in inches and tenths of an inch and a pressure transducer. The data shown on the data sheets is based on the transducer data.

4) Water was conveyed into the pits using slotted PVC pipe to reduce erosion and disturbance of the bottom soils.

5) Due to the very low infiltration rates, it was not possible to measure the flow rate that would maintain a constant water level in the pits (usually less than 0.1 gallons/minute). Instead, the water level was maintained between a depth of approximately 12 and 14 inches by adding water periodically during the pre-soak period. The pre-soak period lasted at least 6 hours.

6) Once the pre-soak period was ended, the water level was allowed to fall below 12 inches. The steady-state infiltration rate was assumed to equal the falling head rate approximately one hour after the pre-soak period was complete. Using the falling head rate at the end of the hour was more accurate than adding water at a fixed rate to maintain a constant head for an hour.

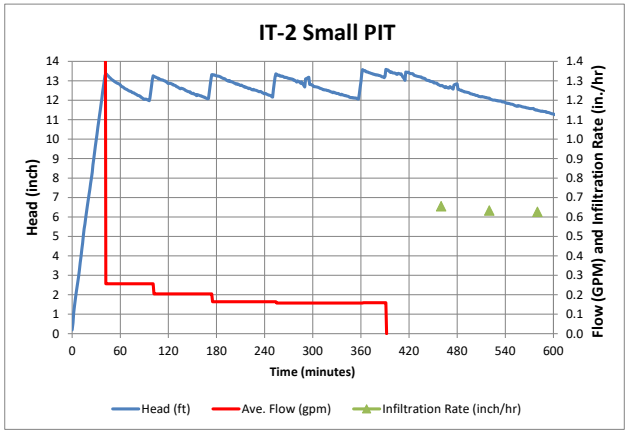
7) The falling head rate was assumed to equal the falling head rate approximately 60 to 160 minutes after the steady state portion of the test was complete.

8) Due to the slow infiltration rates none of the pits were dry when we returned the next day. Therefore, it was not necessary to over-excavate the pits to see if the test water was mounded on a shallow restrictive layer.

The results of each test are provided on the attached datasheets.

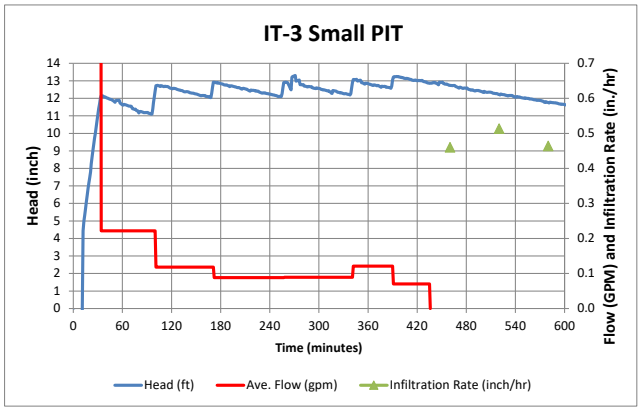
Location:	Carrik Ct.	IT-2	Corr:	0.060		
Date and Time	Time (min.)	Ave. Flow (gpm)	Head (ft)	Corr. Head (inch)	Cumulative Volume (gal)	Infiltration Rate (inch/hr)
8/25/20 9:14	0.0	3.444	0.076	0.192		
8/25/20 9:15	1.0	3.444	0.106	0.557		
8/25/20 9:16	2.0	3.444	0.149	1.064		
8/25/20 9:17	3.0	3.444	0.179	1.424		
8/25/20 9:18	4.0	3.444	0.207	1.763		
8/25/20 9:19	5.0	3.444	0.233	2.076		
8/25/20 9:20	6.0	3.444	0.257	2.365		
8/25/20 9:21	7.0	3.444	0.280	2.642		
8/25/20 9:22	8.0	3.444	0.304	2.929		
8/25/20 9:23	9.0	3.444	0.332	3.258	31.00	
8/25/20 9:24	10.0	2.857	0.364	3.649		
8/25/20 9:25	11.0	2.857	0.390	3.958		
8/25/20 9:26	12.0	2.857	0.421	4.333		
8/25/20 9:27	13.0	2.857	0.449	4.664		
8/25/20 9:28	14.0	2.857	0.478	5.018		
8/25/20 9:29	15.0	2.857	0.509	5.384		
8/25/20 9:30	16.0	2.857	0.530	5.638		
8/25/20 9:31	17.0	2.857	0.558	5.970		
8/25/20 9:32	18.0	2.857	0.583	6.277		
8/25/20 9:33	19.0	2.857	0.608	6.577		
8/25/20 9:34	20.0	2.857	0.632	6.859		
8/25/20 9:35	21.0	2.857	0.656	7.147		
8/25/20 9:36	22.0	2.857	0.678	7.421		
8/25/20 9:37	23.0	2.857	0.705	7.734		
8/25/20 9:38	24.0	2.857	0.727	8.008		
8/25/20 9:39	25.0	2.857	0.752	8.304		
8/25/20 9:40	26.0	2.857	0.783	8.677		
8/25/20 9:41	27.0	2.857	0.808	8.981		
8/25/20 9:42	28.0	2.857	0.837	9.318		
8/25/20 9:43	29.0	2.857	0.864	9.652		
8/25/20 9:44	30.0	2.857	0.890	9.955	91.00	
8/25/20 9:45	31.0	5.167	0.915	10.254		
8/25/20 9:46	32.0	5.167	0.943	10.597		
8/25/20 9:47	33.0	5.167	0.968	10.890		
8/25/20 9:48	34.0	5.167	0.994	11.203		
8/25/20 9:49	35.0	5.167	1.018	11.492		
8/25/20 9:50	36.0	5.167	1.044	11.807	122.00	
8/25/20 9:51	37.0	2.832	1.069	12.106		
8/25/20 9:52	38.0	2.832	1.094	12.403		
8/25/20 9:53	39.0	2.832	1.118	12.691		
8/25/20 9:54	40.0	2.832	1.142	12.984		
8/25/20 9:55	41.0	2.832	1.167	13.279	136.16	
8/25/20 9:56	42.0	0.257	1.171	13.332		
8/25/20 9:57	43.0	0.257	1.172	13.342		
8/25/20 9:58	44.0	0.257	1.167	13.278		
8/25/20 9:59	45.0	0.257	1.164	13.249		
8/25/20 10:00	46.0	0.257	1.160	13.195		
8/25/20 10:01	47.0	0.257	1.157	13.160		
8/25/20 10:02	48.0	0.257	1.153	13.114		
8/25/20 10:03	49.0	0.257	1.151	13.087		
8/25/20 10:04	50.0	0.257	1.148	13.054		
8/25/20 10:05	51.0	0.257	1.146	13.027		
8/25/20 10:06	52.0	0.257	1.143	12.992		
8/25/20 10:07	53.0	0.257	1.140	12.960		
8/25/20 10:08	54.0	0.257	1.138	12.934		
8/25/20 10:09	55.0	0.257	1.136	12.907		
8/25/20 10:10	56.0	0.257	1.134	12.884		
8/25/20 10:11	57.0	0.257	1.132	12.864		
8/25/20 10:12	58.0	0.257	1.131	12.846		
8/25/20 10:13	59.0	0.257	1.129	12.823		
8/25/20 10:14	60.0	0.257	1.126	12.793		
8/25/20 10:15	61.0	0.257	1.121	12.737		
8/25/20 10:16	62.0	0.257	1.118	12.698		
8/25/20 10:17	63.0	0.257	1.117	12.688		
8/25/20 10:18	64.0	0.257	1.115	12.664		
8/25/20 10:19	65.0	0.257	1.112	12.620		
8/25/20 10:20	66.0	0.257	1.110	12.600		
8/25/20 10:21	67.0	0.257	1.108	12.571		
8/25/20 10:22	68.0	0.257	1.107	12.562		
8/25/20 10:23	69.0	0.257	1.104	12.533		
8/25/20 10:24	70.0	0.257	1.102	12.505		
8/25/20 10:25	71.0	0.257	1.100	12.478		
8/25/20 10:26	72.0	0.257	1.099	12.464		
8/25/20 10:27	73.0	0.257	1.098	12.458		
8/25/20 10:28	74.0	0.257	1.096	12.434		
8/25/20 10:29	75.0	0.257	1.093	12.396		

PIT Test Characteristics	
Date of Test	8/25/2020
Depth of Test PIT (ft)	4.0
Test Pit Width (ft)	3.0
Test Pit Length (ft)	5.4
Test Pit Area (sf)	16.2
Totalizer Flow (gal)=	201
End of Constant Head Test (420 min >12 in.) (min.)	460
Constant Head Infiltration Rate (at 460 min.)	**0.66**
Falling Head Infiltration Rate (at 580 min.)	**0.63**



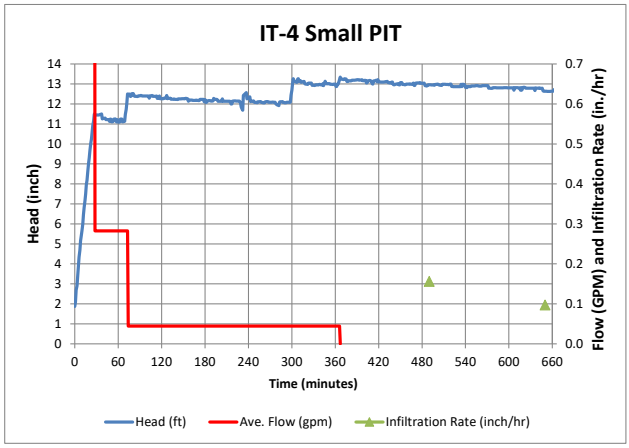
Location:	Carrik Ct.	IT-3	Corr:	0.090		
Date and Time	Time (min.)	Ave. Flow (gpm)	Head (ft)	Corr. Head (inch)	Cumulative Volume (gal)	Infiltration Rate (inch/hr)
8/24/20 9:08	0.0	2.782	0.076	-0.164		
8/24/20 9:09	1.0	2.782	0.078	-0.144		
8/24/20 9:10	2.0	2.782	0.074	-0.194		
8/24/20 9:11	3.0	2.782	0.075	-0.186		
8/24/20 9:12	4.0	2.782	0.074	-0.190		
8/24/20 9:13	5.0	2.782	0.075	-0.184		
8/24/20 9:14	6.0	2.782	0.075	-0.179		
8/24/20 9:15	7.0	2.782	0.072	-0.214		
8/24/20 9:16	8.0	2.782	0.073	-0.206		
8/24/20 9:17	9.0	2.782	0.073	-0.203		
8/24/20 9:18	10.0	2.782	0.073	-0.208		
8/24/20 9:19	11.0	2.782	0.070	-0.244		
8/24/20 9:20	12.0	2.782	0.459	4.432		
8/24/20 9:21	13.0	2.782	0.507	4.999		
8/24/20 9:22	14.0	2.782	0.535	5.341		
8/24/20 9:23	15.0	2.782	0.567	5.724		
8/24/20 9:24	16.0	2.782	0.600	6.119		
8/24/20 9:25	17.0	2.782	0.630	6.480		
8/24/20 9:26	18.0	2.782	0.662	6.858		
8/24/20 9:27	19.0	2.782	0.689	7.187		
8/24/20 9:28	20.0	2.782	0.713	7.478		
8/24/20 9:29	21.0	2.782	0.740	7.805		
8/24/20 9:30	22.0	2.782	0.778	8.260		
8/24/20 9:31	23.0	2.782	0.810	8.642		
8/24/20 9:32	24.0	2.782	0.841	9.013		
8/24/20 9:33	25.0	2.782	0.871	9.368		
8/24/20 9:34	26.0	2.782	0.901	9.734		
8/24/20 9:35	27.0	2.782	0.925	10.014		
8/24/20 9:36	28.0	2.782	0.954	10.373		
8/24/20 9:37	29.0	2.782	0.985	10.738		
8/24/20 9:38	30.0	2.782	1.014	11.083		
8/24/20 9:39	31.0	2.782	1.042	11.420		
8/24/20 9:40	32.0	2.782	1.063	11.680		
8/24/20 9:41	33.0	2.782	1.090	11.999	91.80	
8/24/20 9:42	34.0	0.222	1.103	12.157		
8/24/20 9:43	35.0	0.222	1.102	12.139		
8/24/20 9:44	36.0	0.222	1.102	12.144		
8/24/20 9:45	37.0	0.222	1.099	12.106		
8/24/20 9:46	38.0	0.222	1.097	12.083		
8/24/20 9:47	39.0	0.222	1.096	12.074		
8/24/20 9:48	40.0	0.222	1.094	12.052		
8/24/20 9:49	41.0	0.222	1.092	12.023		
8/24/20 9:50	42.0	0.222	1.091	12.007		
8/24/20 9:51	43.0	0.222	1.089	11.983		
8/24/20 9:52	44.0	0.222	1.087	11.966		
8/24/20 9:53	45.0	0.222	1.085	11.941		
8/24/20 9:54	46.0	0.222	1.085	11.934		
8/24/20 9:55	47.0	0.222	1.084	11.924		
8/24/20 9:56	48.0	0.222	1.081	11.891		
8/24/20 9:57	49.0	0.222	1.078	11.858		
8/24/20 9:58	50.0	0.222	1.075	11.822		
8/24/20 9:59	51.0	0.222	1.071	11.776		
8/24/20 10:00	52.0	0.222	1.080	11.881		
8/24/20 10:01	53.0	0.222	1.080	11.884		
8/24/20 10:02	54.0	0.222	1.080	11.875		
8/24/20 10:03	55.0	0.222	1.081	11.891		
8/24/20 10:04	56.0	0.222	1.082	11.902		
8/24/20 10:05	57.0	0.222	1.068	11.737		
8/24/20 10:06	58.0	0.222	1.065	11.699		
8/24/20 10:07	59.0	0.222	1.062	11.664		
8/24/20 10:08	60.0	0.222	1.059	11.627		
8/24/20 10:09	61.0	0.222	1.057	11.609		
8/24/20 10:10	62.0	0.222	1.062	11.662		
8/24/20 10:11	63.0	0.222	1.060	11.645		
8/24/20 10:12	64.0	0.222	1.059	11.632		
8/24/20 10:13	65.0	0.222	1.057	11.608		
8/24/20 10:14	66.0	0.222	1.056	11.593		
8/24/20 10:15	67.0	0.222	1.055	11.578		
8/24/20 10:16	68.0	0.222	1.053	11.560		
8/24/20 10:17	69.0	0.222	1.053	11.558		
8/24/20 10:18	70.0	0.222	1.053	11.555		
8/24/20 10:19	71.0	0.222	1.052	11.539		
8/24/20 10:20	72.0	0.222	1.041	11.411		
8/24/20 10:21	73.0	0.222	1.041	11.406		
8/24/20 10:22	74.0	0.222	1.039	11.388		

PIT Test Characteristics	
Date of Test	8/24/2020
Depth of Test PIT (ft)	4.5
Test Pit Width (ft)	3.0
Test Pit Length (ft)	4.5
Test Pit Area (sf)	13.5
Totalizer Flow (gal)=	136
End of Constant Head Test (420 min >12 in.) (min.)	520
Constant Head Infiltration Rate (at 520 min.)	**0.51**
Falling Head Infiltration Rate (at 580 min.)	**0.46**



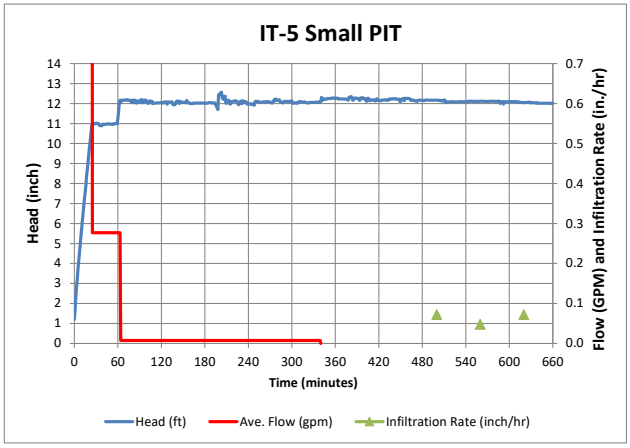
Location:	Carrik Ct.	IT-4	Corr:	-0.050		
Date and Time	Time (min.)	Ave. Flow (gpm)	Head (ft)	Corr. Head (inch)	Cumulative Volume (gal)	Infiltration Rate (inch/hr)
8/24/20 9:42	0.0	4.313	0.106	1.872	0.00	
8/24/20 9:43	1.0	4.313	0.126	2.112		
8/24/20 9:44	2.0	4.313	0.175	2.700		
8/24/20 9:45	3.0	4.313	0.192	2.904		
8/24/20 9:46	4.0	4.313	0.232	3.384		
8/24/20 9:47	5.0	4.313	0.271	3.852		
8/24/20 9:48	6.0	4.313	0.311	4.332		
8/24/20 9:49	7.0	4.313	0.34	4.680		
8/24/20 9:50	8.0	4.313	0.38	5.160		
8/24/20 9:51	9.0	4.313	0.4	5.400		
8/24/20 9:52	10.0	4.313	0.42	5.640		
8/24/20 9:53	11.0	4.313	0.449	5.988		
8/24/20 9:54	12.0	4.313	0.489	6.468		
8/24/20 9:55	13.0	4.313	0.518	6.816		
8/24/20 9:56	14.0	4.313	0.547	7.164		
8/24/20 9:57	15.0	4.313	0.575	7.500		
8/24/20 9:58	16.0	4.313	0.614	7.968	69.00	
8/24/20 9:59	17.0	2.273	0.632	8.184		
8/24/20 10:00	18.0	2.273	0.672	8.664		
8/24/20 10:01	19.0	2.273	0.702	9.024		
8/24/20 10:02	20.0	2.273	0.724	9.288		
8/24/20 10:03	21.0	2.273	0.755	9.660		
8/24/20 10:04	22.0	2.273	0.786	10.032		
8/24/20 10:05	23.0	2.273	0.803	10.236		
8/24/20 10:06	24.0	2.273	0.831	10.572		
8/24/20 10:07	25.0	2.273	0.86	10.920		
8/24/20 10:08	26.0	2.273	0.879	11.148		
8/24/20 10:09	27.0	2.273	0.908	11.496	94.00	
8/24/20 10:10	28.0	0.283	0.904	11.448		
8/24/20 10:11	29.0	0.283	0.904	11.448		
8/24/20 10:12	30.0	0.283	0.904	11.448		
8/24/20 10:13	31.0	0.283	0.904	11.448		
8/24/20 10:14	32.0	0.283	0.904	11.448		
8/24/20 10:15	33.0	0.283	0.904	11.448		
8/24/20 10:16	34.0	0.283	0.905	11.460		
8/24/20 10:17	35.0	0.283	0.906	11.472		
8/24/20 10:18	36.0	0.283	0.907	11.484		
8/24/20 10:19	37.0	0.283	0.908	11.496		
8/24/20 10:20	38.0	0.283	0.888	11.256		
8/24/20 10:21	39.0	0.283	0.889	11.268		
8/24/20 10:22	40.0	0.283	0.89	11.280		
8/24/20 10:23	41.0	0.283	0.89	11.280		
8/24/20 10:24	42.0	0.283	0.891	11.292		
8/24/20 10:25	43.0	0.283	0.885	11.220		
8/24/20 10:26	44.0	0.283	0.885	11.220		
8/24/20 10:27	45.0	0.283	0.885	11.220		
8/24/20 10:28	46.0	0.283	0.885	11.220		
8/24/20 10:29	47.0	0.283	0.885	11.220		
8/24/20 10:30	48.0	0.283	0.877	11.124		
8/24/20 10:31	49.0	0.283	0.887	11.244		
8/24/20 10:32	50.0	0.283	0.886	11.232		
8/24/20 10:33	51.0	0.283	0.876	11.112		
8/24/20 10:34	52.0	0.283	0.876	11.112		
8/24/20 10:35	53.0	0.283	0.877	11.124		
8/24/20 10:36	54.0	0.283	0.887	11.244		
8/24/20 10:37	55.0	0.283	0.887	11.244		
8/24/20 10:38	56.0	0.283	0.888	11.256		
8/24/20 10:39	57.0	0.283	0.878	11.136		
8/24/20 10:40	58.0	0.283	0.875	11.100		
8/24/20 10:41	59.0	0.283	0.885	11.220		
8/24/20 10:42	60.0	0.283	0.875	11.100		
8/24/20 10:43	61.0	0.283	0.874	11.088		
8/24/20 10:44	62.0	0.283	0.874	11.088		
8/24/20 10:45	63.0	0.283	0.887	11.244		
8/24/20 10:46	64.0	0.283	0.887	11.244		
8/24/20 10:47	65.0	0.283	0.887	11.244		
8/24/20 10:48	66.0	0.283	0.876	11.112		
8/24/20 10:49	67.0	0.283	0.876	11.112		
8/24/20 10:50	68.0	0.283	0.879	11.148		
8/24/20 10:51	69.0	0.283	0.878	11.136		
8/24/20 10:52	70.0	0.283	0.907	11.484		
8/24/20 10:53	71.0	0.283	0.927	11.724		
8/24/20 10:54	72.0	0.283	0.955	12.060		

PIT Test Characteristics	
Date of Test	8/24/2020
Depth of Test PIT (ft)	4.5
Test Pit Width (ft)	3.0
Test Pit Length (ft)	4.5
Test Pit Area (sf)	13.5
Totalizer Flow (gal)=	120
End of Constant Head Test (420 min >12 in.) (min.)	490
Constant Head Infiltration Rate (at 490 min.)	**0.16**
Falling Head Infiltration Rate (at 650 min.)	**0.10**



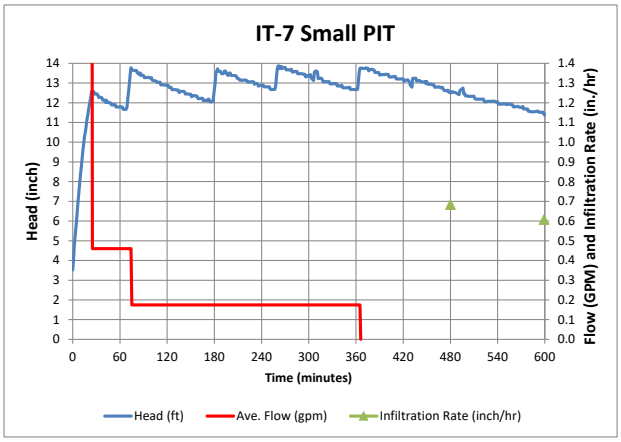
Location:	Carrik Ct.	IT-5	Corr:	-0.100		
Date and Time	**Time (min.)**	**Ave. Flow (gpm)**	**Head (ft)**	**Corr. Head (inch)**	**Cumulative Volume (gal)**	**Infiltration Rate (inch/hr)**
8/24/20 10:16	0.0	3.550	0.000	1.200	0.00	
8/24/20 10:17	1.0	3.550	0.040	1.680		
8/24/20 10:18	2.0	3.550	0.090	2.280		
8/24/20 10:19	3.0	3.550	0.131	2.772		
8/24/20 10:20	4.0	3.550	0.170	3.240		
8/24/20 10:21	5.0	3.550	0.210	3.720		
8/24/20 10:22	6.0	3.550	0.241	4.092		
8/24/20 10:23	7.0	3.550	0.280	4.560		
8/24/20 10:24	8.0	3.550	0.311	4.932		
8/24/20 10:25	9.0	3.550	0.344	5.328		
8/24/20 10:26	10.0	3.550	0.373	5.676		
8/24/20 10:27	11.0	3.550	0.413	6.156		
8/24/20 10:28	12.0	3.550	0.442	6.504		
8/24/20 10:29	13.0	3.550	0.472	6.864		
8/24/20 10:30	14.0	3.550	0.503	7.236	59.00	
8/24/20 10:31	15.0	3.550	0.533	7.596		
8/24/20 10:32	16.0	3.550	0.562	7.944		
8/24/20 10:33	17.0	3.550	0.601	8.412		
8/24/20 10:34	18.0	3.550	0.630	8.760		
8/24/20 10:35	19.0	3.550	0.661	9.132		
8/24/20 10:36	20.0	3.550	0.690	9.480		
8/24/20 10:37	21.0	3.550	0.720	9.840		
8/24/20 10:38	22.0	3.550	0.750	10.200		
8/24/20 10:39	23.0	3.550	0.780	10.560		
8/24/20 10:40	24.0	3.550	0.806	10.872	85.20	
8/24/20 10:41	25.0	0.277	0.816	10.992		
8/24/20 10:42	26.0	0.277	0.816	10.992		
8/24/20 10:43	27.0	0.277	0.815	10.980		
8/24/20 10:44	28.0	0.277	0.815	10.980		
8/24/20 10:45	29.0	0.277	0.818	11.016		
8/24/20 10:46	30.0	0.277	0.818	11.016		
8/24/20 10:47	31.0	0.277	0.818	11.016		
8/24/20 10:48	32.0	0.277	0.817	11.004		
8/24/20 10:49	33.0	0.277	0.817	11.004		
8/24/20 10:50	34.0	0.277	0.810	10.920		
8/24/20 10:51	35.0	0.277	0.809	10.908		
8/24/20 10:52	36.0	0.277	0.808	10.896		
8/24/20 10:53	37.0	0.277	0.808	10.896		
8/24/20 10:54	38.0	0.277	0.807	10.884		
8/24/20 10:55	39.0	0.277	0.814	10.968		
8/24/20 10:56	40.0	0.277	0.813	10.956		
8/24/20 10:57	41.0	0.277	0.813	10.956		
8/24/20 10:58	42.0	0.277	0.813	10.956		
8/24/20 10:59	43.0	0.277	0.813	10.956		
8/24/20 11:00	44.0	0.277	0.815	10.980		
8/24/20 11:01	45.0	0.277	0.815	10.980		
8/24/20 11:02	46.0	0.277	0.815	10.980		
8/24/20 11:03	47.0	0.277	0.815	10.980		
8/24/20 11:04	48.0	0.277	0.815	10.980		
8/24/20 11:05	49.0	0.277	0.814	10.968		
8/24/20 11:06	50.0	0.277	0.814	10.968		
8/24/20 11:07	51.0	0.277	0.814	10.968		
8/24/20 11:08	52.0	0.277	0.813	10.956		
8/24/20 11:09	53.0	0.277	0.813	10.956		
8/24/20 11:10	54.0	0.277	0.816	10.992		
8/24/20 11:11	55.0	0.277	0.816	10.992		
8/24/20 11:12	56.0	0.277	0.816	10.992		
8/24/20 11:13	57.0	0.277	0.817	11.004		
8/24/20 11:14	58.0	0.277	0.817	11.004		
8/24/20 11:15	59.0	0.277	0.815	10.980		
8/24/20 11:16	60.0	0.277	0.835	11.220		
8/24/20 11:17	61.0	0.277	0.865	11.580		
8/24/20 11:18	62.0	0.277	0.904	12.048		
8/24/20 11:19	63.0	0.277	0.914	12.168	96.01	
8/24/20 11:20	64.0	0.008	0.904	12.048		
8/24/20 11:21	65.0	0.008	0.914	12.168		
8/24/20 11:22	66.0	0.008	0.914	12.168		
8/24/20 11:23	67.0	0.008	0.914	12.168		
8/24/20 11:24	68.0	0.008	0.913	12.156		
8/24/20 11:25	69.0	0.008	0.915	12.180		
8/24/20 11:26	70.0	0.008	0.915	12.180		
8/24/20 11:27	71.0	0.008	0.915	12.180		
8/24/20 11:28	72.0	0.008	0.915	12.180		
8/24/20 11:29	73.0	0.008	0.916	12.192		
8/24/20 11:30	74.0	0.008	0.914	12.168		

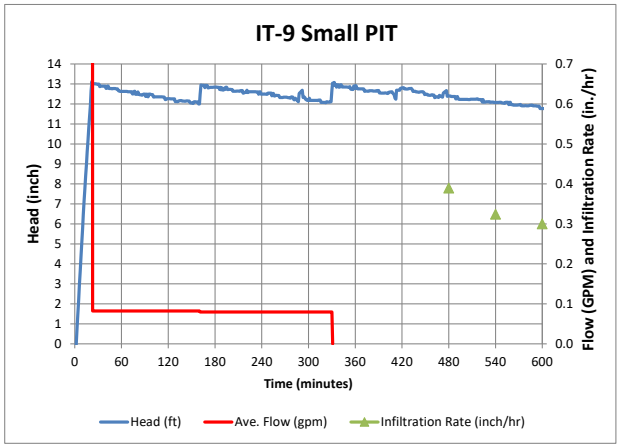
PIT Test Characteristics	
Date of Test	8/24/2020
Depth of Test PIT (ft)	4.5
Test Pit Width (ft)	3.0
Test Pit Length (ft)	4.5
Test Pit Area (sf)	13.5
Totalizer Flow (gal)=	98
End of Constant Head Test (420 min >12 in.) (min.)	482
Constant Head Infiltration Rate (at 500 min.)	**0.07**
Falling Head Infiltration Rate (at 620 min.)	**0.07**



Location:	Carrik Ct.	IT-7	Corr:	-0.250		
Date and Time	Time (min.)	Ave. Flow (gpm)	Head (ft)	Corr. Head (inch)	Cumulative Volume (gal)	Infiltration Rate (inch/hr)
8/25/20 8:58	0.0	4.208	0.043	3.516	0.00	
8/25/20 8:59	1.0	4.208	0.091	4.092		
8/25/20 9:00	2.0	4.208	0.145	4.740		
8/25/20 9:01	3.0	4.208	0.185	5.220		
8/25/20 9:02	4.0	4.208	0.223	5.676		
8/25/20 9:03	5.0	4.208	0.262	6.144		
8/25/20 9:04	6.0	4.208	0.302	6.624		
8/25/20 9:05	7.0	4.208	0.343	7.116		
8/25/20 9:06	8.0	4.208	0.382	7.584		
8/25/20 9:07	9.0	4.208	0.412	7.944		
8/25/20 9:08	10.0	4.208	0.452	8.424		
8/25/20 9:09	11.0	4.208	0.482	8.784		
8/25/20 9:10	12.0	4.208	0.52	9.240		
8/25/20 9:11	13.0	4.208	0.55	9.600		
8/25/20 9:12	14.0	4.208	0.579	9.948		
8/25/20 9:13	15.0	4.208	0.609	10.308		
8/25/20 9:14	16.0	4.208	0.627	10.524		
8/25/20 9:15	17.0	4.208	0.648	10.776		
8/25/20 9:16	18.0	4.208	0.678	11.136		
8/25/20 9:17	19.0	4.208	0.697	11.364		
8/25/20 9:18	20.0	4.208	0.717	11.604		
8/25/20 9:19	21.0	4.208	0.737	11.844		
8/25/20 9:20	22.0	4.208	0.757	12.084		
8/25/20 9:21	23.0	4.208	0.777	12.324		
8/25/20 9:22	24.0	4.208	0.798	12.576	101.00	
8/25/20 9:23	25.0	0.460	0.798	12.576		
8/25/20 9:24	26.0	0.460	0.798	12.576		
8/25/20 9:25	27.0	0.460	0.795	12.540		
8/25/20 9:26	28.0	0.460	0.786	12.432		
8/25/20 9:27	29.0	0.460	0.787	12.444		
8/25/20 9:28	30.0	0.460	0.787	12.444		
8/25/20 9:29	31.0	0.460	0.788	12.456		
8/25/20 9:30	32.0	0.460	0.782	12.384		
8/25/20 9:31	33.0	0.460	0.772	12.264		
8/25/20 9:32	34.0	0.460	0.773	12.276		
8/25/20 9:33	35.0	0.460	0.773	12.276		
8/25/20 9:34	36.0	0.460	0.773	12.276		
8/25/20 9:35	37.0	0.460	0.771	12.252		
8/25/20 9:36	38.0	0.460	0.761	12.132		
8/25/20 9:37	39.0	0.460	0.761	12.132		
8/25/20 9:38	40.0	0.460	0.761	12.132		
8/25/20 9:39	41.0	0.460	0.761	12.132		
8/25/20 9:40	42.0	0.460	0.751	12.012		
8/25/20 9:41	43.0	0.460	0.761	12.132		
8/25/20 9:42	44.0	0.460	0.751	12.012		
8/25/20 9:43	45.0	0.460	0.751	12.012		
8/25/20 9:44	46.0	0.460	0.751	12.012		
8/25/20 9:45	47.0	0.460	0.75	12.000		
8/25/20 9:46	48.0	0.460	0.75	12.000		
8/25/20 9:47	49.0	0.460	0.741	11.892		
8/25/20 9:48	50.0	0.460	0.741	11.892		
8/25/20 9:49	51.0	0.460	0.74	11.880		
8/25/20 9:50	52.0	0.460	0.742	11.904		
8/25/20 9:51	53.0	0.460	0.742	11.904		
8/25/20 9:52	54.0	0.460	0.742	11.904		
8/25/20 9:53	55.0	0.460	0.732	11.784		
8/25/20 9:54	56.0	0.460	0.732	11.784		
8/25/20 9:55	57.0	0.460	0.732	11.784		
8/25/20 9:56	58.0	0.460	0.732	11.784		
8/25/20 9:57	59.0	0.460	0.733	11.796		
8/25/20 9:58	60.0	0.460	0.733	11.796		
8/25/20 9:59	61.0	0.460	0.733	11.796		
8/25/20 10:00	62.0	0.460	0.732	11.784		
8/25/20 10:01	63.0	0.460	0.732	11.784		
8/25/20 10:02	64.0	0.460	0.722	11.664		
8/25/20 10:03	65.0	0.460	0.722	11.664		
8/25/20 10:04	66.0	0.460	0.722	11.664		
8/25/20 10:05	67.0	0.460	0.721	11.652		
8/25/20 10:06	68.0	0.460	0.722	11.664		
8/25/20 10:07	69.0	0.460	0.732	11.784		
8/25/20 10:08	70.0	0.460	0.771	12.252		
8/25/20 10:09	71.0	0.460	0.801	12.612		
8/25/20 10:10	72.0	0.460	0.829	12.948		
8/25/20 10:11	73.0	0.460	0.869	13.428		
8/25/20 10:12	74.0	0.460	0.898	13.776	124.00	

PIT Test Characteristics	
Date of Test	8/25/2020
Depth of Test PIT (ft)	4.0
Test Pit Width (ft)	3.0
Test Pit Length (ft)	5.3
Test Pit Area (sf)	15.9
Totalizer Flow (gal)=	170
End of Constant Head Test (420 min >12 in.) (min.)	480
Constant Head Infiltration Rate (at 480 min.)	**0.68**
Falling Head Infiltration Rate (at 600 min.)	**0.61**



Location:	Carrik Ct.	IT-9	Corr:	0.130		
Date and Time	Time (min.)	Ave. Flow (gpm)	Head (ft)	Corr. Head (inch)	Cumulative Volume (gal)	Infiltration Rate (inch/hr)
8/25/20 9:17	0.0	6.739	-0.001	-1.572	0.00	
8/25/20 9:18	1.0	6.739	0.067	-0.756		
8/25/20 9:19	2.0	6.739	0.136	0.072		
8/25/20 9:20	3.0	6.739	0.206	0.912		
8/25/20 9:21	4.0	6.739	0.255	1.500		
8/25/20 9:22	5.0	6.739	0.316	2.232		
8/25/20 9:23	6.0	6.739	0.375	2.940		
8/25/20 9:24	7.0	6.739	0.434	3.648		
8/25/20 9:25	8.0	6.739	0.5	4.440		
8/25/20 9:26	9.0	6.739	0.55	5.040		
8/25/20 9:27	10.0	6.739	0.61	5.760	79.00	
8/25/20 9:28	11.0	6.739	0.669	6.468		
8/25/20 9:29	12.0	6.739	0.729	7.188		
8/25/20 9:30	13.0	6.739	0.772	7.704		
8/25/20 9:31	14.0	6.739	0.831	8.412		
8/25/20 9:32	15.0	6.739	0.881	9.012	108.20	
8/25/20 9:33	16.0	6.739	0.931	9.612		
8/25/20 9:34	17.0	6.739	0.98	10.200		
8/25/20 9:35	18.0	6.739	1.027	10.764		
8/25/20 9:36	19.0	6.739	1.076	11.352		
8/25/20 9:37	20.0	6.739	1.125	11.940		
8/25/20 9:38	21.0	6.739	1.185	12.660		
8/25/20 9:39	22.0	6.739	1.224	13.128	148.25	
8/25/20 9:40	23.0	0.082	1.214	13.008		
8/25/20 9:41	24.0	0.082	1.214	13.008		
8/25/20 9:42	25.0	0.082	1.214	13.008		
8/25/20 9:43	26.0	0.082	1.214	13.008		
8/25/20 9:44	27.0	0.082	1.214	13.008		
8/25/20 9:45	28.0	0.082	1.213	12.996		
8/25/20 9:46	29.0	0.082	1.213	12.996		
8/25/20 9:47	30.0	0.082	1.213	12.996		
8/25/20 9:48	31.0	0.082	1.213	12.996		
8/25/20 9:49	32.0	0.082	1.202	12.864		
8/25/20 9:50	33.0	0.082	1.204	12.888		
8/25/20 9:51	34.0	0.082	1.204	12.888		
8/25/20 9:52	35.0	0.082	1.204	12.888		
8/25/20 9:53	36.0	0.082	1.204	12.888		
8/25/20 9:54	37.0	0.082	1.204	12.888		
8/25/20 9:55	38.0	0.082	1.204	12.888		
8/25/20 9:56	39.0	0.082	1.204	12.888		
8/25/20 9:57	40.0	0.082	1.195	12.780		
8/25/20 9:58	41.0	0.082	1.195	12.780		
8/25/20 9:59	42.0	0.082	1.205	12.900		
8/25/20 10:00	43.0	0.082	1.204	12.888		
8/25/20 10:01	44.0	0.082	1.194	12.768		
8/25/20 10:02	45.0	0.082	1.194	12.768		
8/25/20 10:03	46.0	0.082	1.194	12.768		
8/25/20 10:04	47.0	0.082	1.194	12.768		
8/25/20 10:05	48.0	0.082	1.193	12.756		
8/25/20 10:06	49.0	0.082	1.194	12.768		
8/25/20 10:07	50.0	0.082	1.194	12.768		
8/25/20 10:08	51.0	0.082	1.194	12.768		
8/25/20 10:09	52.0	0.082	1.194	12.768		
8/25/20 10:10	53.0	0.082	1.193	12.756		
8/25/20 10:11	54.0	0.082	1.193	12.756		
8/25/20 10:12	55.0	0.082	1.193	12.756		
8/25/20 10:13	56.0	0.082	1.185	12.660		
8/25/20 10:14	57.0	0.082	1.185	12.660		
8/25/20 10:15	58.0	0.082	1.182	12.624		
8/25/20 10:16	59.0	0.082	1.182	12.624		
8/25/20 10:17	60.0	0.082	1.182	12.624		
8/25/20 10:18	61.0	0.082	1.182	12.624		
8/25/20 10:19	62.0	0.082	1.182	12.624		
8/25/20 10:20	63.0	0.082	1.182	12.624		
8/25/20 10:21	64.0	0.082	1.182	12.624		
8/25/20 10:22	65.0	0.082	1.182	12.624		
8/25/20 10:23	66.0	0.082	1.182	12.624		
8/25/20 10:24	67.0	0.082	1.182	12.624		
8/25/20 10:25	68.0	0.082	1.181	12.612		
8/25/20 10:26	69.0	0.082	1.181	12.612		
8/25/20 10:27	70.0	0.082	1.181	12.612		
8/25/20 10:28	71.0	0.082	1.181	12.612		
8/25/20 10:29	72.0	0.082	1.181	12.612		
8/25/20 10:30	73.0	0.082	1.181	12.612		
8/25/20 10:31	74.0	0.082	1.172	12.504		

PIT Test Characteristics	
Date of Test	8/25/2020
Depth of Test PIT (ft)	4.0
Test Pit Width (ft)	3.0
Test Pit Length (ft)	5.0
Test Pit Area (sf)	15.0
Totalizer Flow (gal)=	173
End of Constant Head Test (420 min >12 in.) (min.)	440
Constant Head Infiltration Rate (at 480 min.)	**0.39**
Falling Head Infiltration Rate (at 600 min.)	**0.30**