APPENDIX E-1: Infiltration Test Data and Memo

TETRA TECH

MEMO

To:	Bob Jacko - Project Manager, Tintina Resources
From:	Shane Matolyak – Environmental Scientist, Tetra Tech
Date:	July 8, 2016
Subject:	May, 2016 Black Butte Copper Project Infiltration Test Results.

Introduction

Double-ring infiltrometer tests (ASTM D 3385-88) were completed to measure saturated hydraulic conductivity (infiltration) of subsoil at locations within the Black Butte Copper Project that were recently proposed for construction of underground infiltration galleries. Tests were also completed on the soil surface at a location proposed for operation of a surface land application disposal (LAD) system. This work was completed in May, 2016 at the eight locations shown in **Attachment 1**.

These data, along with relevant data from previous infiltration tests, will be used to determine maximum infiltration capacities of the currently proposed water disposal systems. Results of this determination will be provided in the forthcoming revised operating permit application for the Black Butte Copper Project.

This memo provides a data summary specific to the May, 2016 test program. Field data sheets and graphs are provided in **Attachment 2**. The 2012 and 2015 infiltration test results are included in Attachment 3.

Test Locations

Six of the eight infiltration tests identified as 2016-A through 2016-F were located in areas proposed for underground infiltration galleries. These tests were conducted within subsoil at or near the interface with shallow bedrock within which the infiltration gallery piping will be installed. Tests 2016-G and 2016-H were located in an area identified for operation of a surface LAD system and therefore were completed on the surface of undisturbed soil.

Test Results

Infiltration tests were conducted until achieving a steady-state infiltration rate at each site. The final measured infiltration rate was used to represent steady-state conditions at each location with the exceptions of 2016-A, 2016-C, and 2016-D. The final infiltration rates measured at 2016-A and 2016-C appeared anomalously high compared to measurements taken earlier during the tests. Therefore, the minimum infiltration rates measured during these tests were used to represent steady-state infiltration rates for these locations.

Slow infiltration at location 2016-D relative to all other test locations suggests that this location may not be representative of the larger area proposed for infiltration gallery construction. It is also possible that the test pit floor was compacted during excavation thereby impeding infiltration. Due to the slow infiltration a limited number of data points were collected and therefore the minimum measured infiltration rate was used to represent steady-state conditions. Inclusion of this data adds a degree of conservativism to the overall infiltration capacity determined for an infiltration gallery at this location.

Steady-state infiltration rates determined for each of the May, 2016 test locations are reported in **Table 1**.
Steady-state infiltration rates determined for the 2012 and 2015 test locations are reported in Table 2.

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Table 1. May 2016 Infiltration Test Results

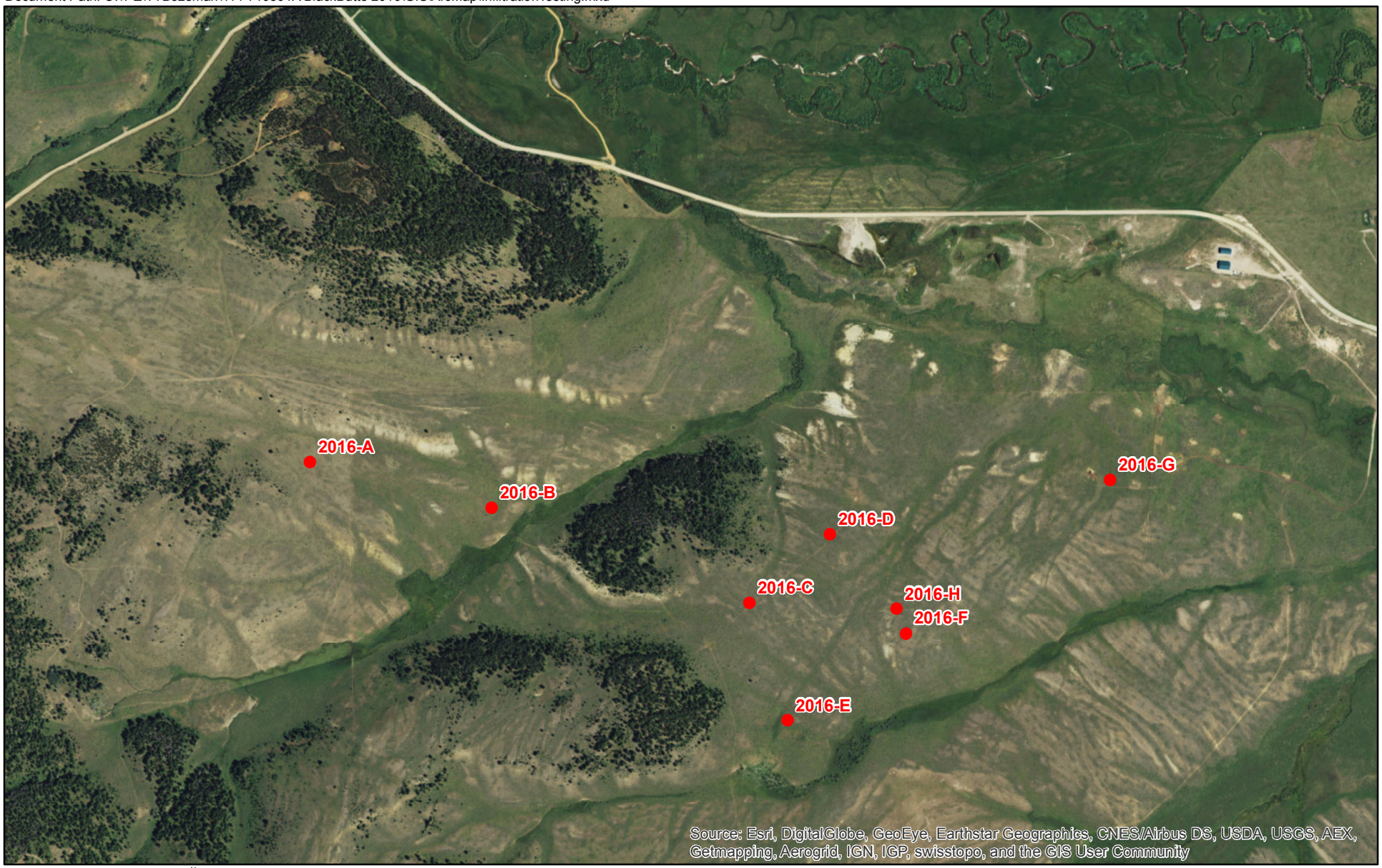
Test Site	Coordinates (UTM NAD 83 Zone 12N)		Infiltration Rate (ft/day)	Infiltration Rate (ft/minute)
	Easting	Northing		
2016-A	507,013	5,179,454	18.6	0.013
2016-B	507,433	5,179,348	13.4	0.009
2016-C	508,029	5,179,129	17.4	0.012
2016-D	508,216	5,179,287	0.23	0.0002
2016-E	508,117	5,178,857	13.5	0.009
2016-F	508,391	5,179,058	11.1	0.008
2016-G	508,863	5,179,413	4.7	0.003
2016-H	508,369	5,179,115	12.9	0.009

Note: 2016 infiltration test pit locations also shown in Figure 2.26 in the revised 2016 MOP Application.

Attachment 1

2016 Test Locations

Document Path: O:\T-Z\TTBozeman\114-710301A BlackButte 2016\GIS\ArcMap\InfiltrationTesting.mxd



N
W
E
S

SCALE IN FEET

0 1,000

May 2016

Figure 1

2016 Infiltration Test Locations

Black Butte Copper MOP

Attachment 2

2016 Field Data and Graphs

Sampler SM
Date 5-9-16
Location 2016-A
Start Time
End Time
Duration (minutes)

Inner Ring Radius (12.7 cm short rings 15 cm tall rings)
Head Depth
Inner Ring Area (507 cm2 short rings 707 cm2 tall rings)

Required constant stream* of H_2O to maintane head in oute ring.
5gal/1:30 min 1 min 30 sec
very Little leakage outside of rings.

Sample Time	Time elapsed from start (min)	Time elapsed from last sample (min)	Water added (mL)	Infiltration Rate (mL/min)	Infiltration Rate (cm/hr)
11:54	0	0	--	Can calculate in office	
11:55	1	1	500		
11:56	2	1	200		
11:57	3	1	550		
11:58	4	1	1400	Disregard * too difficult	
11:59	5	1	700		
12:00	6	1	450	to accurately	measure
12:01	7	1	300		
12:02	8	1	25		
12:03	9	1			
restart 12:09	0			—	—
12:10	1	1	70		
12:11	2	1	250		
12:12	3	1	500		
12:14	5	2	5		
12:16	7	2	400 →	18.6 ft/day	
12:18	9	2	60	based o this	
12:20	11	2	550		
12:22	13	2	700		
12:24	15	2	550		
12:26	17	2	750		

Material is too porous to ma[illegible] rings. Flow of [illegible] even head after ~30 min of [illegible]

→ 153 ft/day based o this

Rings so ~ 2ft bgs on

Sampler CM
Date 5-9-16
Location 2016-B
Start Time 1130
End Time 1130
Duration (minutes) 120

Inner Ring Radius (12.7 cm short rings (15 cm tall rings)
Head Depth 4
Inner Ring Area (507 cm2 short rings 707 cm2 tall rings)

rings set @ 6ft bgs

Sample Time	Time elapsed from start (min)	Time elapsed from last sample (min)	Water added (mL)	Infiltration Rate (mL/min)	Infiltration Rate (cm/hr)
11:30	0	0	--	Can calculate in office	
11:35	5	5	700 mL		
11:40	10	5	1160		
11:45	15	5	1000		
11:50	20	5	1225		
11:55	25	5	1050		
12:00	30	5	1075		
12:05	35	5	950		
12:10	40	5	975		
12:15	45	5	1000		
12:20	50	5	950		
12:25	55	5	900		
12:30	60	5	975		
12:35	65	5	1100		
12:40	70	5	700		
12:45	75	5	950		
12:50	80	5	1125		
12:55	85	5	1000		
1:00	90	5	1025		
1:10	100	10	2025		
1:20	110	10	2025		
1:30	120	10	2000		

weathered
in granodiorite / sandstone

Sampler C. Mathews
Date 5-10-16
Location 2016-C
Start Time
End Time
Duration (minutes)

Inner Ring Radius (12.7 cm short rings 15 cm tall rings)
Head Depth ~3"
Inner Ring Area (507 cm2 short rings 707 cm2 tall rings)

Rings set about 2' bgs

Sample Time	Time elapsed from start (min)	Time elapsed from last sample (min)	Water added (mL)	Infiltration Rate (mL/min)	Infiltration Rate (cm/hr)
11:30	0	0	--	Can calculate in office	
11:35	5	5	1650		
11:40	10	5	1700		
11:45	15	5	1325		
11:50	20	5	1750		
11:55	25	5	1750		
12:00	30	5	1850		
12:10	40	10	2675		
12:15	45	5	1400		
12:20	50	5	1425		
12:25	55	5	1400		
12:30	60	5	1575		
12:35	65	5	1400		
12:40	70	5	1675		
12:45	75	5	1406		
12:50	80	5	2025		
12:55	85	5	1800		
1:00	90	5	1300		
1:05	95	5	1725		
1:10	100	5	1400		
1:15	105	5	1700		
1:20	110	5	1675		
1:25	115	5	1500		
1:30	120	5	1450		
1:35	125	5	1400		
1:40	130	5	1550		
1:50	140	10	3175		
2:00	150	10	3050		
2:10	160	10	3100		
2:20	170	10	3000		
2:30	180	10	3325		
2:40	190	10			

Sampler S. Matolyak
Date 5-10-16
Location 2016-D
Start Time
End Time
Duration (minutes)

Inner Ring Radius (12.7 cm short rings 15 cm tall rings)
Head Depth
Inner Ring Area (507 cm2 short rings 707 cm2 tall rings)

Rings set ≈ 20" bgs on fractured bedrock with high clay content.

Sample Time	Time elapsed from start (min)	Time elapsed from last sample (min)	Water added (mL)	Infiltration Rate (mL/min)	Infiltration Rate (cm/hr)
11:35	0	0	--	Can calculate in office	
11:45	10	10	25		
	dirt clod	felt into	rings ⇒ restart	test	
12:30	0	0			
13:00	30	30	390	10	
13:30	60	30	75	2.5	
14:00	90	30	150	5.0	
14:30	120	30	125		

Rain gage set up @ 12:13, stopped @ 14:30, 3 mm H2O accumulated ⇒ negligible impact on inf test, NOT factored into calculations.

Sampler C. Matthews
Date 5-11-16
Location 2016-E
Start Time
End Time
Duration (minutes)

Inner Ring Radius (12.7 cm short rings 15 cm tall rings)
Head Depth
Inner Ring Area (507 cm2 short rings 707 cm2 tall rings)

Ring set ~3' bgs

Sample Time	Time elapsed from start (min)	Time elapsed from last sample (min)	Water added (mL)	Infiltration Rate (mL/min)	Infiltration Rate (cm/hr)
9:40	0	0	--	Can calculate in office	
9:45	5	5	1150		
9:50	10	5	1625		
9:55	15	5	2800		
10:00	20	5	2075		
10:05	25	5	2100		
10:10	30	5	2125		
10:15	35	5	2550		
10:20	40	5	2160		
10:25	45	5	2150		
10:30	50	5	1825		
10:35	55	5	2106		
10:40	60	5	2125		
10:45	65	5	2100		
10:50	70	5	2075		
10:55	75	5	2075		
11:00	80	5	1675		
11:05	85	5	2150		
11:10	90	5	1500		
11:15	95	5	1625		
11:20	100	5	1600		
11:25	105	5	1575		
11:30	110	5	1550		
11:35	115	5	1425		
11:40	120	5	1375		
11:45	125	5	1400		
11:50	130	5	1625		
11:55	135	5	1400		
12:00	140	5	1025		
12:10	150	10	2350		
12:20	160	10	2300		
12:30	170	10	2325		
12:40	180	10	2025		
12:50	190	10	2075		
1:00	200	10	2050		
1:10	210	10	2025		

Sampler S. Moalyde
Date 5-11-16
Location 2016-F
Start Time 10:11
End Time 12:16
Duration (minutes) ~~115~~ 125

Inner Ring Radius (12.7 cm short rings 15 cm tall rings)
Head Depth
Inner Ring Area (507 cm2 short rings 707 cm2 tall rings)

Rings set on fractured bedrock ≈ 4" bgs

Sample Time	Time elapsed from start (min)	Time elapsed from last sample (min)	Water added (mL)	Infiltration Rate (mL/min)	Infiltration Rate (cm/hr)
10:11	0	0	--	Can calculate in office	
10:13	2	2	700		
10:15	4	2	600		
10:17	6	2	500		
10:18	~~8~~ 7	~~2~~ 1	350		
10:20	~~10~~ 9	2	400		
10:22	~~12~~ 11	2	350		
10:24	~~14~~ 13	2	425		
10:26	~~16~~ 15	2	47		
10:28	~~18~~ 17	2	425		
10:30	~~20~~ 19	2	350		
10:32	~~22~~ 21	2	390		
10:34	~~24~~ 23	2	490		
10:36	~~26~~ 25	2	375		
10:38	~~28~~ 27	2	400		
10:40	~~30~~ 29	2	350		
10:44	~~34~~ 33	4	700		
10:48	~~38~~ 37	4	~~940~~ 950		
10:52	~~42~~ 41	4	700		
10:56	~~46~~ 45	4	750		
11:00	~~50~~ 49	4	950		
11:04	53	4	700		
11:08	57	4	725		
11:12	61	4	690		
11:16	65	4	700		
11:20	69	4	700		
11:24	73	4	700		
11:28	77	4	690		
11:32	81	4	550		
11:36	85	4	500		
11:40	89	4	640		
11:44	93	4	600		
11:48	97	4	425		

Over

Sampler
Date
Location
Start Time
End Time
Duration (minutes)

Inner Ring Radius (12.7 cm short rings 15 cm tall rings)
Head Depth
Inner Ring Area (507 cm2 short rings 707 cm2 tall rings)

Sample Time	Time elapsed from start (min)	Time elapsed from last sample (min)	Water added (mL)	Infiltration Rate (mL/min)	Infiltration Rate (cm/hr)
~~11:52~~	0	0	--	Can calculate in office	
11:52	101	4	475		
11:56	105	4	475		
12:00	109	4	475		
12:04	103	4	400		
12:08	107	4	510		
12:12	~~110~~ 111	4	500		
12:16	115	4	475		

Sampler C. Matthews
Date 5/12-16
Location 2016 - G
Start Time
End Time
Duration (minutes)

Inner Ring Radius (12.7 cm short rings 15 cm tall rings)
Head Depth
Inner Ring Area (507 cm2 short rings 707 cm2 tall rings)

Sample Time	Time elapsed from start (min)	Time elapsed from last sample (min)	Water added (mL)	Infiltration Rate (mL/min)	Infiltration Rate (cm/hr)
9:50	0	0	--	Can calculate in office	
9:55	5	5	1225		
10:00	10	5	700		
10:05	15	5	1075		
10:10	25	5	900		
10:20	35	10	1725		
10:30	45	10	1275		
10:40	55	10	1650		
10:50	65	10	1250		
11:00	75	10	1300		
11:10	85	10	1050		
11:20	95	10	1075		
11:30	105	10	700		
11:40	115	10	700		
11:50	125	10	700		
12:00	135	10	825		
12:00	145	10	800		
12:20	155	10	700		
12:30	165	10	700		

Sampler S. Matolyak
Date 5-12-16
Location 2016 – H
Start Time 9:44
End Time 11:20
Duration (minutes) 96

Inner Ring Radius (12.7 cm short rings 15 cm tall rings)
Head Depth
Inner Ring Area (507 cm2 short rings 707 cm2 tall rings)

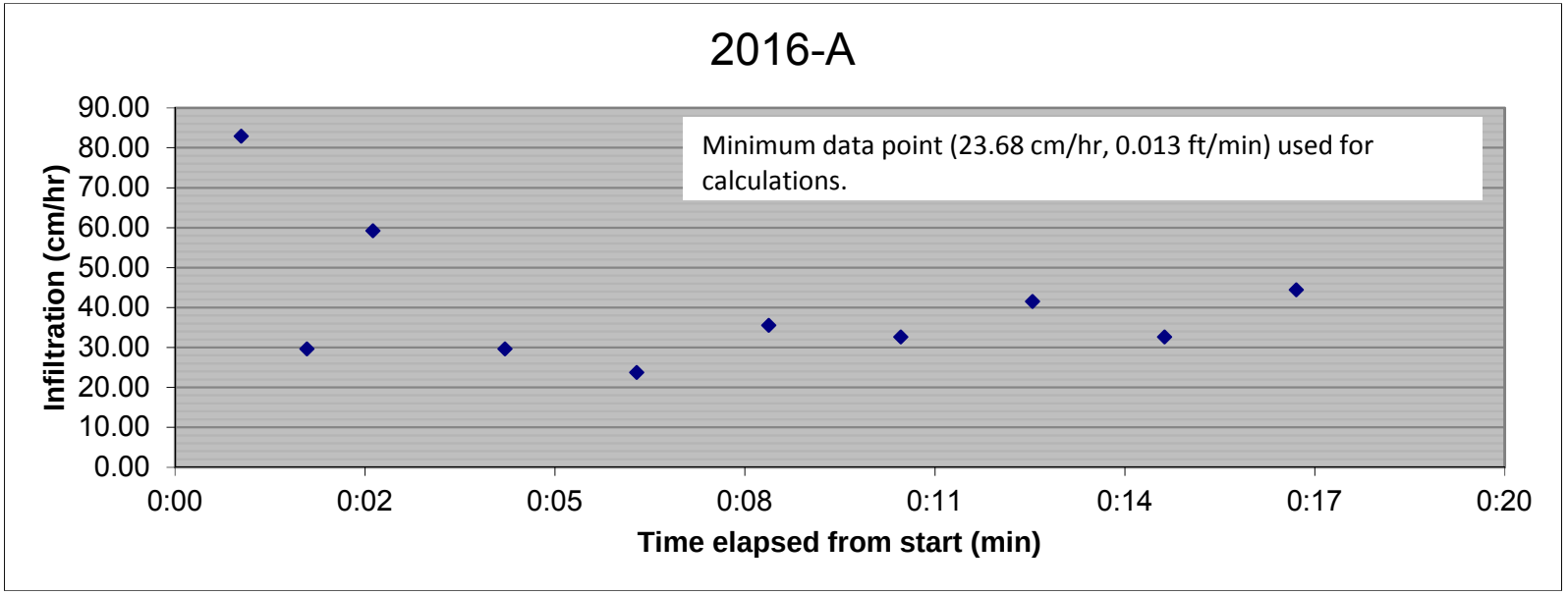
Snow melted overnight so ground may be close to saturation @ start of test

Rings set on ground surface

Sample Time	Time elapsed from start (min)	Time elapsed from last sample (min)	Water added (mL)	Infiltration Rate (mL/min)	Infiltration Rate (cm/hr)
9:44	0	0	--	Can calculate in office	
9:47	3	3	690	230	
9:50	6	3	500	167	
9:54	10	4	700	150	
9:58	14	4	600	125	
10:02	18	4	550	138	
10:06	22	4	575	144	
10:10	26	4	475	119	
10:15	31	5	695	139	
10:20	36	5	600	120	
10:25	41	5	690	138	
10:30	46	5	690	138	
10:35	51	5	695	139	
10:40	56	5	695	139	
10:45	61	5	695	139	
10:50	66	5	695	139	
10:55	71	5	690	138	
11:00	76	5	690	138	
11:05	81	5	690	138	
11:10	86	5	690	138	
11:15	91	5	695	139	
11:20	96	5	690	138	

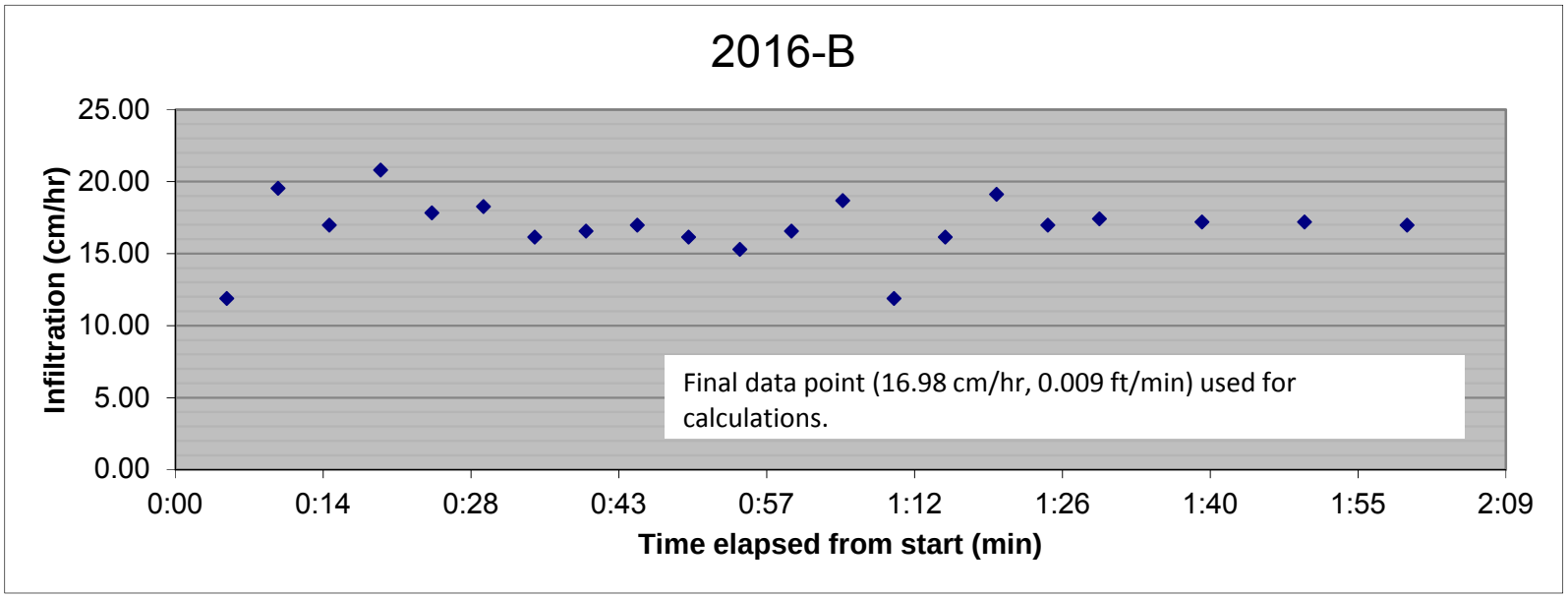
Sampler	S. Matolyak	**Inner Ring Radius (cm)**	12.7
Date	5/9/2016	**Head Depth (cm)**	10
Location	2016-A	**Area of inner ring (cm^2)**	506.71
Start Time	12:09	**Notes: 1" = 2.54 cm**	
End Time	12:26		
Duration (hour:min)	0:17		

Sample Time	Time elapsed from start (hour:min)	Time elapsed from last sample (min)	Time Elapsed Reformat	Water added (mL)	Infiltration Rate (mL/min)	Infiltration Rate (cm/hr)
12:09	--	--		--	--	--
12:10	0:01	0:01	1	700	700	82.89
12:11	0:02	0:01	1	250	250	29.60
12:12	0:03	0:01	1	500	500	59.21
12:14	0:05	0:02	2	500	250	29.60
12:16	0:07	0:02	2	400	200	23.68
12:18	0:09	0:02	2	600	300	35.52
12:20	0:11	0:02	2	550	275	32.56
12:22	0:13	0:02	2	700	350	41.44
12:24	0:15	0:02	2	550	275	32.56
12:26	0:17	0:02	2	750	375	44.40



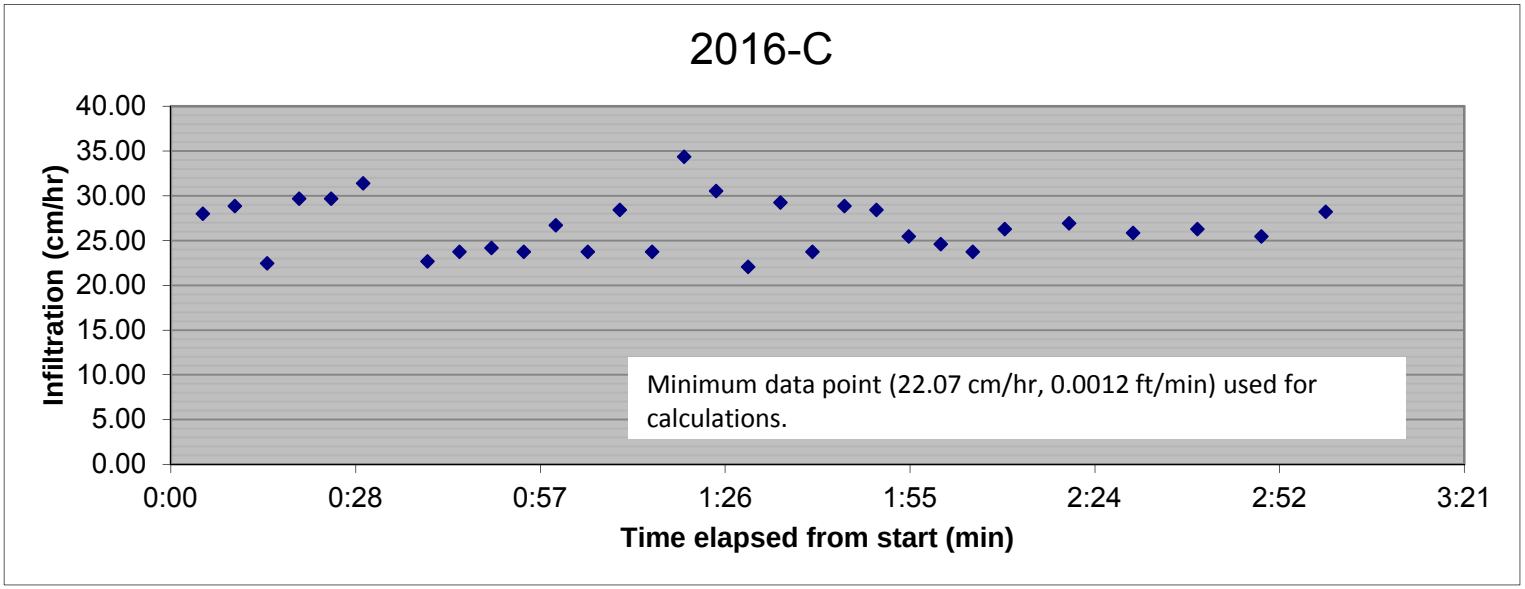
Sampler	C. Mathews	**Inner Ring Radius (cm)**	15
Date	5/9/2016	**Head Depth (cm)**	10
Location	2016-B	**Area of inner ring (cm^2)**	706.86
Start Time	11:30	**Notes: 1" = 2.54 cm**	
End Time	13:30		
Duration (hour:min)	2:00		

Sample Time	Time elapsed from start (hour:min)	Time elapsed from last sample (min)	Time Elapsed Reformat	Water added (mL)	Infiltration Rate (mL/min)	Infiltration Rate (cm/hr)
11:30	--	--		--	--	--
11:35	0:05	0:05	5	700	140	11.88
11:40	0:10	0:05	5	1150	230	19.52
11:45	0:15	0:05	5	1000	200	16.98
11:50	0:20	0:05	5	1225	245	20.80
11:55	0:25	0:05	5	1050	210	17.83
12:00	0:30	0:05	5	1075	215	18.25
12:05	0:35	0:05	5	950	190	16.13
12:10	0:40	0:05	5	975	195	16.55
12:15	0:45	0:05	5	1000	200	16.98
12:20	0:50	0:05	5	950	190	16.13
12:25	0:55	0:05	5	900	180	15.28
12:30	1:00	0:05	5	975	195	16.55
12:35	1:05	0:05	5	1100	220	18.67
12:40	1:10	0:05	5	700	140	11.88
12:45	1:15	0:05	5	950	190	16.13
12:50	1:20	0:05	5	1125	225	19.10
12:55	1:25	0:05	5	1000	200	16.98
13:00	1:30	0:05	5	1025	205	17.40
13:10	1:40	0:10	10	2025	203	17.19
13:20	1:50	0:10	10	2025	203	17.19
13:30	2:00	0:10	10	2000	200	16.98


2016-B
25.00
20.00
15.00
10.00
5.00
0.00
Infiltration (cm/hr)
0:00
0:14
0:28
0:43
0:57
1:12
1:26
1:40
1:55
2:09
Time elapsed from start (min)
Final data point (16.98 cm/hr, 0.009 ft/min) used for calculations.

Sampler	C. Mathews	**Inner Ring Radius (cm)**	15
Date	5/10/2016	**Head Depth (cm)**	10
Location	2016-C	**Area of inner ring (cm^2)**	706.86
Start Time	11:30	**Notes: 1" = 2.54 cm**	
End Time	14:30		
Duration (hour:min)	3:00		

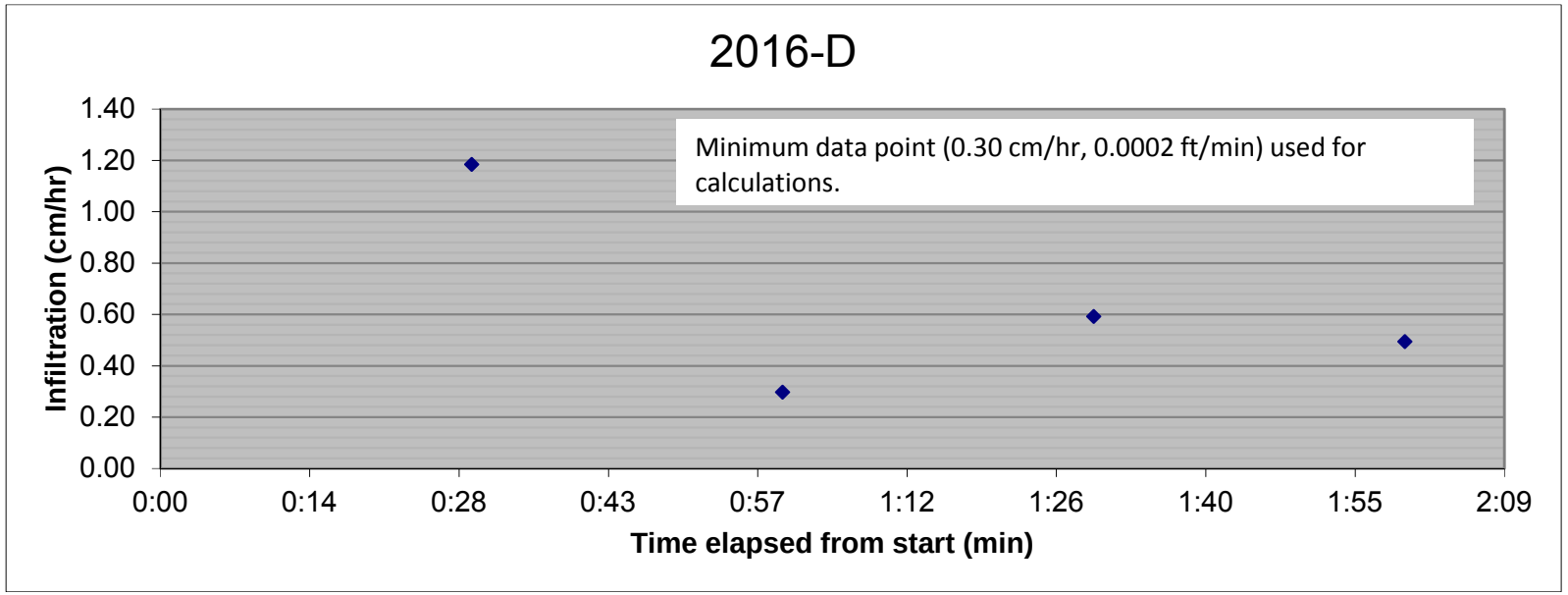
Sample Time	Time elapsed from start (hour:min)	Time elapsed from last sample (min)	Time Elapsed Reformat	Water added (mL)	Infiltration Rate (mL/min)	Infiltration Rate (cm/hr)
11:30	--	--		--	--	--
11:35	0:05	0:05	5	1650	330	28.01
11:40	0:10	0:05	5	1700	340	28.86
11:45	0:15	0:05	5	1325	265	22.49
11:50	0:20	0:05	5	1750	350	29.71
11:55	0:25	0:05	5	1750	350	29.71
12:00	0:30	0:05	5	1850	370	31.41
12:10	0:40	0:10	10	2675	268	22.71
12:15	0:45	0:05	5	1400	280	23.77
12:20	0:50	0:05	5	1425	285	24.19
12:25	0:55	0:05	5	1400	280	23.77
12:30	1:00	0:05	5	1575	315	26.74
12:35	1:05	0:05	5	1400	280	23.77
12:40	1:10	0:05	5	1675	335	28.44
12:45	1:15	0:05	5	1400	280	23.77
12:50	1:20	0:05	5	2025	405	34.38
12:55	1:25	0:05	5	1800	360	30.56
13:00	1:30	0:05	5	1300	260	22.07
13:05	1:35	0:05	5	1725	345	29.28
13:10	1:40	0:05	5	1400	280	23.77
13:15	1:45	0:05	5	1700	340	28.86
13:20	1:50	0:05	5	1675	335	28.44
13:25	1:55	0:05	5	1500	300	25.46
13:30	2:00	0:05	5	1450	290	24.62
13:35	2:05	0:05	5	1400	280	23.77
13:40	2:10	0:05	5	1550	310	26.31
13:50	2:20	0:10	10	3175	318	26.95
14:00	2:30	0:10	10	3050	305	25.89
14:10	2:40	0:10	10	3100	310	26.31
14:20	2:50	0:10	10	3000	300	25.46
14:30	3:00	0:10	10	3325	333	28.22


2016-C
Infiltration (cm/hr)
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
0:00
0:28
0:57
1:26
1:55
2:24
2:52
3:21
Time elapsed from start (min)
Minimum data point (22.07 cm/hr, 0.0012 ft/min) used for calculations.

geomet

Sampler	S. Matolyak	**Inner Ring Radius (cm)**	12.7
Date	5/10/2016	**Head Depth (cm)**	10
Location	2016-D	**Area of inner ring (cm^2)**	506.71
Start Time	12:30	**Notes: 1" = 2.54 cm**	
End Time	14:30		
Duration (hour:min)	2:00		

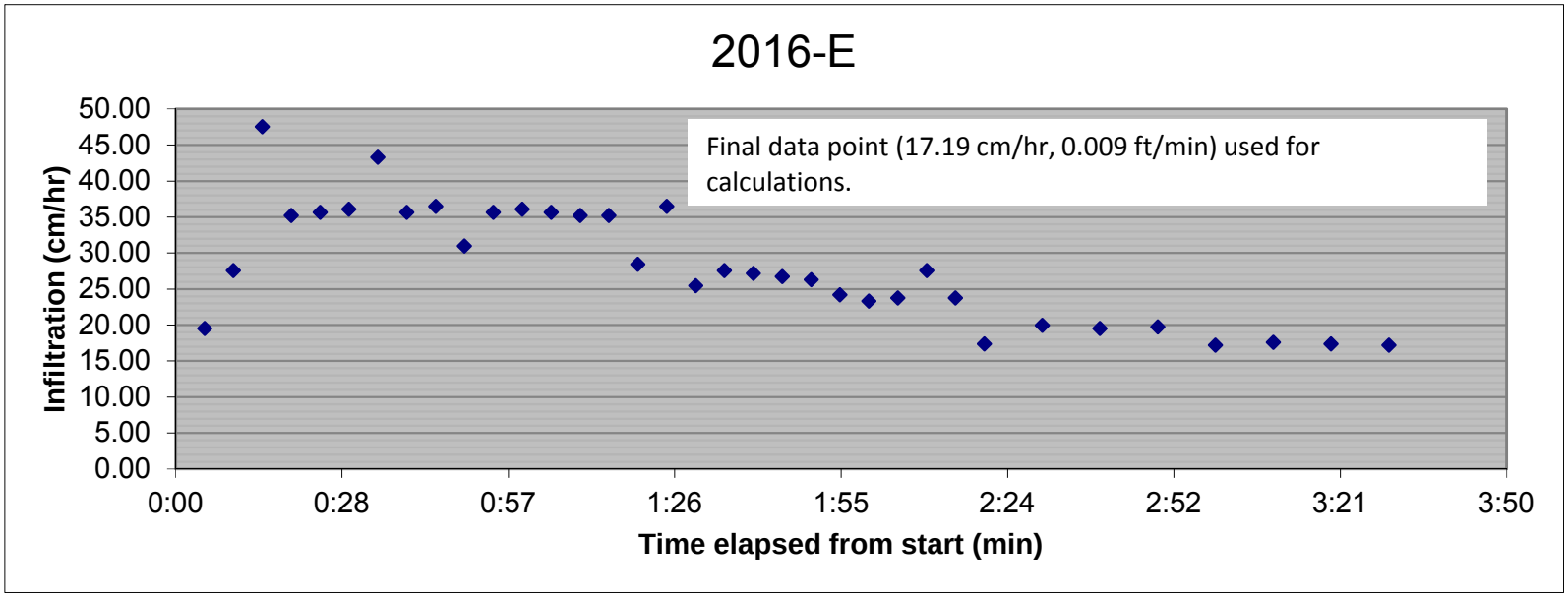
Sample Time	Time elapsed from start (hour:min)	Time elapsed from last sample (min)	Time Elapsed Reformat	Water added (mL)	Infiltration Rate (mL/min)	Infiltration Rate (cm/hr)
12:30	--	--		--	--	--
13:00	0:30	0:30	30	300	10	1.18
13:30	1:00	0:30	30	75	3	0.30
14:00	1:30	0:30	30	150	5	0.59
14:30	2:00	0:30	30	125	4	0.49



Sampler	C. Mathews	**Inner Ring Radius (cm)**	15
Date	5/11/2016	**Head Depth (cm)**	10
Location	2016-E	**Area of inner ring (cm^2)**	706.86
Start Time	9:40	**Notes: 1" = 2.54 cm**	
End Time	13:10		
Duration (hour:min)	3:30		

Sample Time	Time elapsed from start (hour:min)	Time elapsed from last sample (min)	Time Elapsed Reformat	Water added (mL)	Infiltration Rate (mL/min)	Infiltration Rate (cm/hr)
9:40	--	--	--	--	--	--
9:45	0:05	0:05	5	1150	230	19.52
9:50	0:10	0:05	5	1625	325	27.59
9:55	0:15	0:05	5	2800	560	47.53
10:00	0:20	0:05	5	2075	415	35.23
10:05	0:25	0:05	5	2100	420	35.65
10:10	0:30	0:05	5	2125	425	36.08
10:15	0:35	0:05	5	2550	510	43.29
10:20	0:40	0:05	5	2100	420	35.65
10:25	0:45	0:05	5	2150	430	36.50
10:30	0:50	0:05	5	1825	365	30.98
10:35	0:55	0:05	5	2100	420	35.65
10:40	1:00	0:05	5	2125	425	36.08
10:45	1:05	0:05	5	2100	420	35.65
10:50	1:10	0:05	5	2075	415	35.23
10:55	1:15	0:05	5	2075	415	35.23
11:00	1:20	0:05	5	1675	335	28.44
11:05	1:25	0:05	5	2150	430	36.50
11:10	1:30	0:05	5	1500	300	25.46
11:15	1:35	0:05	5	1625	325	27.59
11:20	1:40	0:05	5	1600	320	27.16
11:25	1:45	0:05	5	1575	315	26.74
11:30	1:50	0:05	5	1550	310	26.31
11:35	1:55	0:05	5	1425	285	24.19
11:40	2:00	0:05	5	1375	275	23.34
11:45	2:05	0:05	5	1400	280	23.77
11:50	2:10	0:05	5	1625	325	27.59
11:55	2:15	0:05	5	1400	280	23.77
12:00	2:20	0:05	5	1025	205	17.40
12:10	2:30	0:10	10	2350	235	19.95

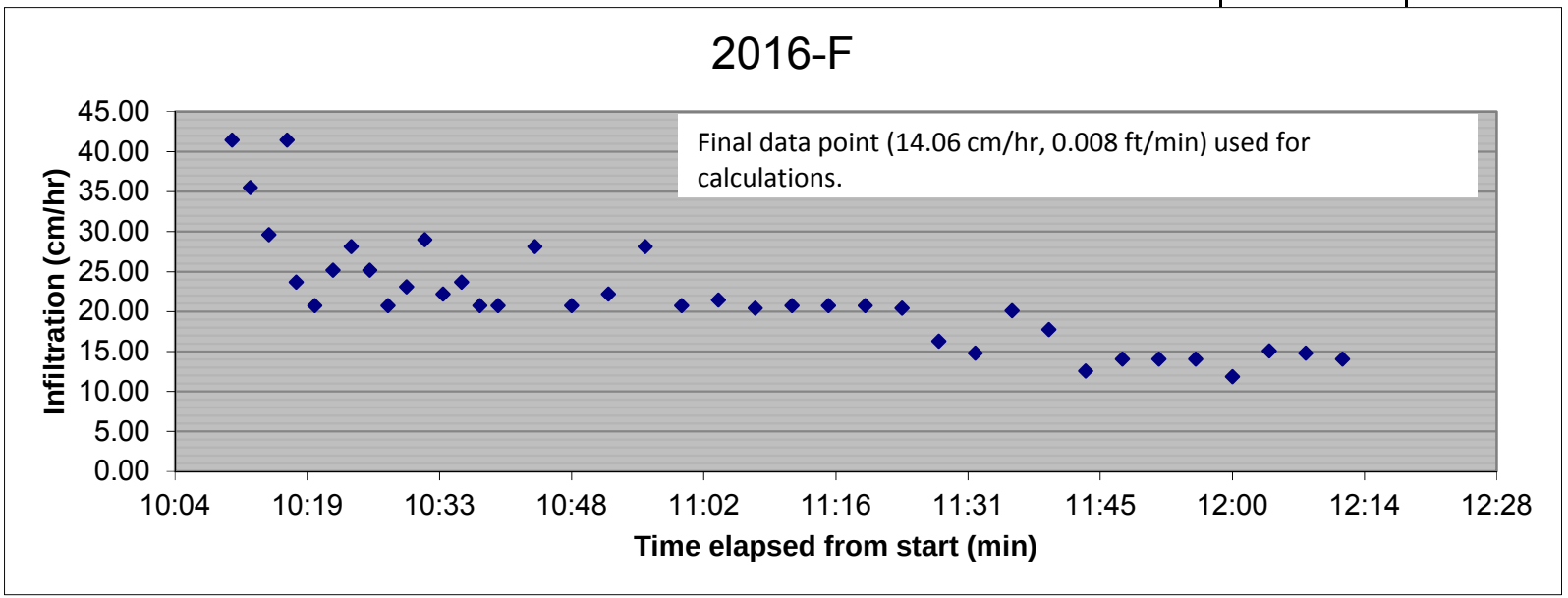
12:20	2:40	0:10	10	2300	230	19.52
12:30	2:50	0:10	10	2325	233	19.74
12:40	3:00	0:10	10	2025	203	17.19
12:50	3:10	0:10	10	2075	208	17.61
13:00	3:20	0:10	10	2050	205	17.40
13:10	3:30	0:10	10	2025	203	17.19



Sampler	S. Matolyak	**Inner Ring Radius (cm)**	12.7
Date	5/11/2016	**Head Depth (cm)**	10
Location	2016-F	**Area of inner ring (cm^2)**	506.71
Start Time	10:11	**Notes: 1" = 2.54 cm**	
End Time	12:16		
Duration (hour:min)	2:05		

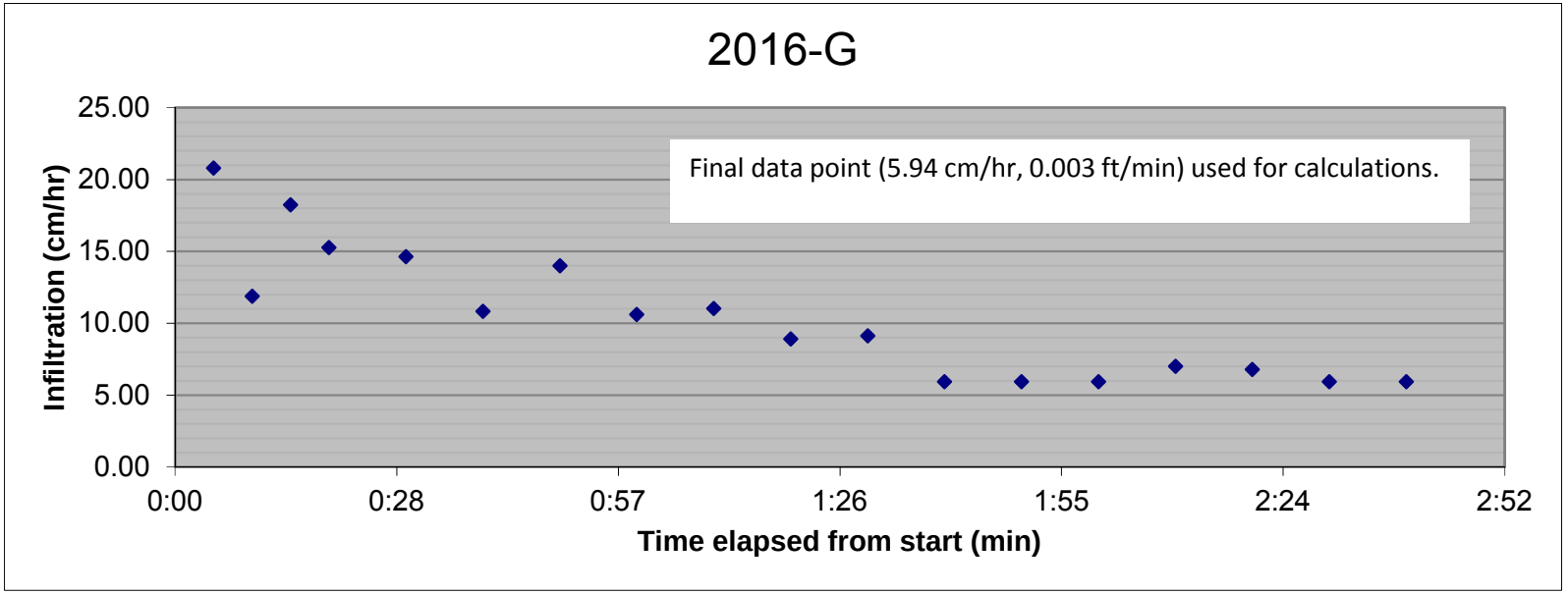
Sample Time	Time elapsed from start (hour:min)	Time elapsed from last sample (min)	Time Elapsed Reformat	Water added (mL)	Infiltration Rate (mL/min)	Infiltration Rate (cm/hr)
10:11	--	--	--	--	--	--
10:13	0:02	0:02	2	700	350	41.44
10:15	0:04	0:02	2	600	300	35.52
10:17	0:06	0:02	2	500	250	29.60
10:18	0:07	0:01	1	350	350	41.44
10:20	0:09	0:02	2	400	200	23.68
10:22	0:11	0:02	2	350	175	20.72
10:24	0:13	0:02	2	425	213	25.16
10:26	0:15	0:02	2	475	238	28.12
10:28	0:17	0:02	2	425	213	25.16
10:30	0:19	0:02	2	350	175	20.72
10:32	0:21	0:02	2	390	195	23.09
10:34	0:23	0:02	2	490	245	29.01
10:36	0:25	0:02	2	375	188	22.20
10:38	0:27	0:02	2	400	200	23.68
10:40	0:29	0:02	2	350	175	20.72
10:44	0:33	0:04	4	700	175	20.72
10:48	0:37	0:04	4	950	238	28.12
10:52	0:41	0:04	4	700	175	20.72
10:56	0:45	0:04	4	750	188	22.20
11:00	0:49	0:04	4	950	238	28.12
11:04	0:53	0:04	4	700	175	20.72
11:08	0:57	0:04	4	725	181	21.46
11:12	1:01	0:04	4	690	173	20.43
11:16	1:05	0:04	4	700	175	20.72
11:20	1:09	0:04	4	700	175	20.72
11:24	1:13	0:04	4	700	175	20.72
11:28	1:17	0:04	4	690	173	20.43
11:32	1:21	0:04	4	550	138	16.28
11:36	1:25	0:04	4	500	125	14.80

11:40	1:29	0:04	4	680	170	20.13
11:44	1:33	0:04	4	600	150	17.76
11:48	1:37	0:04	4	425	106	12.58
11:52	1:41	0:04	4	475	119	14.06
11:56	1:45	0:04	4	475	119	14.06
12:00	1:49	0:04	4	475	119	14.06
12:04	1:53	0:04	4	400	100	11.84
12:08	1:57	0:04	4	510	128	15.10
12:12	2:01	0:04	4	500	125	14.80
12:16	2:05	0:04	4	475	119	14.06



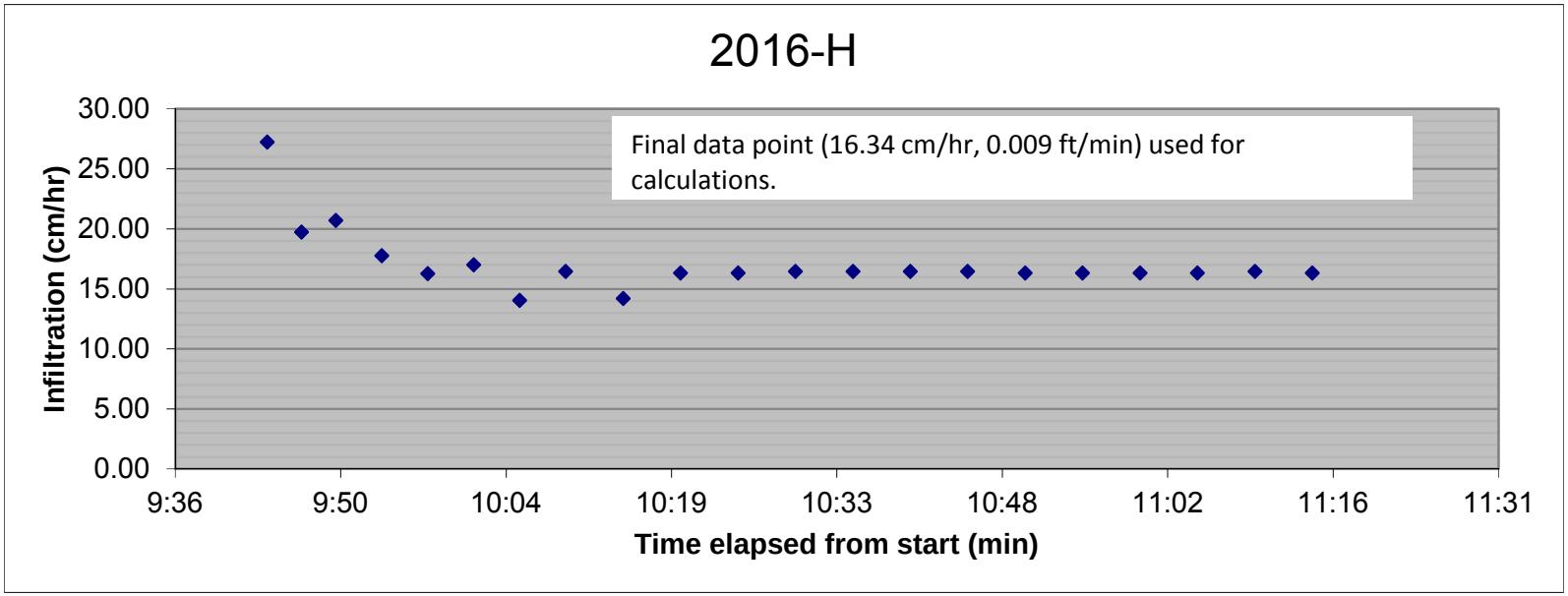
Sampler	C. Mathews	**Inner Ring Radius (cm)**	15
Date	5/12/2016	**Head Depth (cm)**	10
Location	2016-G	**Area of inner ring (cm^2)**	706.86
Start Time	9:50	**Notes: 1" = 2.54 cm**	
End Time	12:30		
Duration (hour:min)	2:40		

Sample Time	Time elapsed from start (hour:min)	Time elapsed from last sample (min)	Time Elapsed Reformat	Water added (mL)	Infiltration Rate (mL/min)	Infiltration Rate (cm/hr)
9:50	--	--	--	--	--	--
9:55	0:05	0:05	5	1225	245	20.80
10:00	0:10	0:05	5	700	140	11.88
10:05	0:15	0:05	5	1075	215	18.25
10:10	0:20	0:05	5	900	180	15.28
10:20	0:30	0:10	10	1725	173	14.64
10:30	0:40	0:10	10	1275	128	10.82
10:40	0:50	0:10	10	1650	165	14.01
10:50	1:00	0:10	10	1250	125	10.61
11:00	1:10	0:10	10	1300	130	11.03
11:10	1:20	0:10	10	1050	105	8.91
11:20	1:30	0:10	10	1075	108	9.12
11:30	1:40	0:10	10	700	70	5.94
11:40	1:50	0:10	10	700	70	5.94
11:50	2:00	0:10	10	700	70	5.94
12:00	2:10	0:10	10	825	83	7.00
12:10	2:20	0:10	10	800	80	6.79
12:20	2:30	0:10	10	700	70	5.94
12:30	2:40	0:10	10	700	70	5.94


2016-G
Final data point (5.94 cm/hr, 0.003 ft/min) used for calculations.
Infiltration (cm/hr)
25.00
20.00
15.00
10.00
5.00
0.00
0:00
0:28
0:57
1:26
1:55
2:24
2:52
Time elapsed from start (min)

Sampler	S. Matolyak	**Inner Ring Radius (cm)**	12.7
Date	5/12/2016	**Head Depth (cm)**	10
Location	2016-H	**Area of inner ring (cm^2)**	506.71
Start Time	9:44	**Notes: 1" = 2.54 cm**	
End Time	11:20		
Duration (hour:min)	1:36		

Sample Time	Time elapsed from start (hour:min)	Time elapsed from last sample (min)	Time Elapsed Reformat	Water added (mL)	Infiltration Rate (mL/min)	Infiltration Rate (cm/hr)
9:44	--	--	--	--	--	--
9:47	0:03	0:03	3	690	230	27.23
9:50	0:06	0:03	3	500	167	19.74
9:54	0:10	0:04	4	700	175	20.72
9:58	0:14	0:04	4	600	150	17.76
10:02	0:18	0:04	4	550	138	16.28
10:06	0:22	0:04	4	575	144	17.02
10:10	0:26	0:04	4	475	119	14.06
10:15	0:31	0:05	5	695	139	16.46
10:20	0:36	0:05	5	600	120	14.21
10:25	0:41	0:05	5	690	138	16.34
10:30	0:46	0:05	5	690	138	16.34
10:35	0:51	0:05	5	695	139	16.46
10:40	0:56	0:05	5	695	139	16.46
10:45	1:01	0:05	5	695	139	16.46
10:50	1:06	0:05	5	695	139	16.46
10:55	1:11	0:05	5	690	138	16.34
11:00	1:16	0:05	5	690	138	16.34
11:05	1:21	0:05	5	690	138	16.34
11:10	1:26	0:05	5	690	138	16.34
11:15	1:31	0:05	5	695	139	16.46
11:20	1:36	0:05	5	690	138	16.34


2016-H
Final data point (16.34 cm/hr, 0.009 ft/min) used for calculations.
Infiltration (cm/hr)
30.00
25.00
20.00
15.00
10.00
5.00
0.00
9:36
9:50
10:04
10:19
10:33
10:48
11:02
11:16
11:31
Time elapsed from start (min)

Attachment 3

2012 and 2015 Field Data and Graphs

Table 2. 2012 and 2015 Infiltration Test Results

Test Site	Coordinates (UTM NAD 83 Zone 12N)		Infiltration Rate (ft/day)	Infiltration Rate (ft/minute)
	Easting	Northing		
BB2	506,846	5,179,071	6.6	0.004
BB3	507,244	5,179,612	2.8	0.002
BB5	507,531	5,179,535	8.7	0.006
SP-11	506,474	5,179,626	1.2	0.001
2015-A	506,045	5,178,769	4.3	0.003
2015-B	506,066	5,178,611	16.3	0.011
2015-C	506,020	5,178,313	8.3	0.006
2015-D	506,082	5,178,146	2.3	0.002

Note: See Figure 2.26 in the revised MOP Application for 2012 and 2015 infiltration test pit locations.

Sampler SM
Date 6-27-12
Location BB2 Soft surface
Start Time
End Time
Duration (minutes)

Inner Ring Radius (12.7 cm short rings 15 cm tall rings)
Head Depth 7 cm
Inner Ring Area (507 cm2 short rings 707 cm2 tall rings)

12" BGS

Sample Time	Time elapsed from start (min)	Time elapsed from last sample (min)	Water added (mL)	Infiltration Rate (mL/min)	Infiltration Rate (cm/hr)
9:15	0	0	--	Can calc in office	
9:20	5	5	1150	230.0	
9:25	10	5	1220	244.0	
9:30	15	5	1150	230.0	
9:36	21	6	1270	211.7	
9:41	26	5	1400	280.0	
9:46	31	5	1075	215.0	
9:56	41	10	2109	210.0	
10:06	51	10	1740	174.0	
10:16	61	10	2660	266.0	
10:26	71	10	1875	187.5	
10:36	81	10	1875	187.5	
10:46	91	10	1560	156.0	
10:56	101	10	1850	185.0	
11:06	111	10	1400	140.0	
11:21	126	15	2200	146.7	
11:36	141	15	2109	140.0	
11:51	156	15	2725	181.7	
12:04	171	15	1400	93.3	? 2
12:17	186	15	1275	85.0	5

Bentonite used to seal inner ring is coating bottom of entire Ringed area likely contributing to very slow infiltration @ last 2 measurements.

Sampler SM
Date 6-28-12
Location BB3 P-lithic
Start Time
End Time
Duration (minutes)

Inner Ring Radius (12.7 cm short rings (15 cm tall rings))
Head Depth 8 cm
Inner Ring Area (507 cm2 short rings (707 cm2 tall rings))

Sample Time	Time elapsed from start (min)	Time elapsed from last sample (min)	Water added (mL)	Infiltration Rate (mL/min)	Infiltration Rate (cm/hr)
9:38:00	0	0	--	Can calc in office	
9:48	10	10	3500		
9:58	20	10	500		
10:09	0	0	--		
10:19	10	10	550	5.50	
~~10:29~~	~~20~~	~~10~~	~~1100~~	~~11.00~~	
10:39	0	0	--		
10:49	10	10	200	20.0	
10:59	20	10	240	24.0	
11:09	30	10	345	34.5	
11:29	50	20	400	20.0	
11:49	70	20	875	43.75	
12:09	90	20	825	41.25	

Fixed a leak

plus 60 min pre-wetting due to across-ring leak

Suspect leaking across ring occurred throughout test. Rings set on surface of vertically bedded shale parent material and horizontal fractures could have transmitted water at depths beyond that which could be sealed w/ bentonite.

Sampler CM
Date 11-11-15
Location 2015-A
Start Time
End Time
Duration (minutes)

Inner Ring Radius ~~(12.7 cm short rings~~ (15 cm tall rings)
Head Depth 6"
Inner Ring Area ~~(507 cm2 short rings~~ (707 cm2 tall rings)

Rings set at 23" below ground surface on fracture/shake.

Photos 1-3

Sample Time	Time elapsed from start (min)	Time elapsed from last sample (min)	Water added (mL)	Infiltration Rate (mL/min)	Infiltration Rate (cm/hr)
12:00	0	0	--	Can calculate in office	
12:01	1	1	225		
12:02	1	2	250		
12:03	1	3	200		
12:05	2	5	325		
12:07	2	7	200		
12:09	2	9	250		
12:11	2	11	200		
12:13	2	13	225		
12:15	2	15	200		
12:20	5	20	550		
12:25	5	25	550		
12:30	5	30	500		
12:40	10	40	1050		
12:50	10	50	900		
1:00	10	60	975		
1:15	15	75	1150		
1:30	15	90	1400		
1:45	15	105	1725		
2:00	15	120	1650		
2:20	20	140	1600		
2:40	20	160	1675		
3:00	20	180	1650		
3:30	30	210	1950		

Sampler SM
Date 11-11-15
Location 2015-B
Start Time 12:25
End Time
Duration (minutes)

Photos 4-6

Inner Ring Radius (12.7 cm short rings ~~15 cm tall rings~~)
Head Depth 3"
Inner Ring Area (507 cm2 short rings ~~707 cm2 tall rings~~)

Rings set ~24" below ground surface on top of fractured shale

Sample Time	Time elapsed from start (min)	Time elapsed from last sample (min)	Water added (mL)	Infiltration Rate (mL/min)	Infiltration Rate (cm/hr)
12:25	0	0	--	Can calculate in office	
12:26	1	1	1125		
12:27	2	1	700		
12:28	3	1	950		
12:29	4	1	1075		
12:32		3	1625		
12:34	9	2	1200	600	
12:36	12	2	1200	600	
12:38	14	2	1350		
12:40	16	2	1200	600	
12:42	18	2	1150		
12:44		2	975		
12:46		2	1200		
12:48		2	1150		
12:50		2	1000	500	
12:52		2	700	350	
12:54		2	1000	500	
12:56		2	925		
12:58		2	1350	725	
1:00		2	750	375	
1:02	37	2	1000	500	
1:04	39	2	975		
1:06	41	2	1150	575	
1:08	43	2	700	~~575~~ 350	
1:10	45	2	450	225	
1:12	47	2	650	325	
1:14	49	2	475		
1:16	51	2	600	300	
1:18	53	2	700	350	
1:20	55	2	1100	550	
1:22	57	2	700	350	
1:24	59	2	675		
1:26	61	2	675		

Sampler
Date
Location
Start Time
End Time
Duration (minutes)

Inner Ring Radius (12.7 cm short rings 15 cm tall rings)
Head Depth
Inner Ring Area (507 cm2 short rings 707 cm2 tall rings)

575
250
325

2015-B CONTINUED

Sample Time	Time elapsed from start (min)	Time elapsed from last sample (min)	Water added (mL)	Infiltration Rate (mL/min)	Infiltration Rate (cm/hr)
1	0	0	--	Can calculate in office	
1:28	63	2	700	350	
1:30	65	2	550	275	
1:32	67	2	675	337.5	
1:34	69	2	600	300	
1:36	71	2	700	350	
1:38	73	2	700	350	
1:40	75	2	700	350	
~~1:42~~	~~77~~				
1:44	79	4	1025		
1:46	81	2	700	350	
1:48	83	2	700	350	
1:50	85	2	500	250	
1:52	87	2	600	300	
1:54	89	2	600		
1:56	91	2	55	5	
1:58	93	2	500	50	
2:00	95	2	650	325	
2:02	97	2	700	350	
2:04	99	2	675		
2:06	101	2	700	35	
~~2:08~~	~~103~~	2			
2:10	105	4	105	~~525~~ 262.5	
2:12	107	2	700	350	
2:14	109	2	550	275	
2:16	111	2	600	300	
2:18	113	2	525		
2:20	115	2	500	250	
2:22	117	2	475		
2:24	119	2	350	175	
2:26	121	2	325		
2:28	123	2	450	225	
2:30	125	2	550	275	
2:32	127		700		
2:34	129	3	450		
2:36	131	2	350		
2:38	133	2	550		
2:42	137	4	45		

TETRA TECH

CLIENT ______ DATE ______

JOB TITLE 2015-B Continued JOB NUMBER ______

SUBJECT Black Butte CAD BY ______ SHEET 3 of 3

			added ml	ml/min
2:46	141	4	500	125
2:50	145	4	475	
2:54	149	4	500	125
2:58	153	4	700	175
3:02	157	4	675	≈169
3:06	161	4	600	150
3:10	165	4	600	150
3:14	169	4	700	175

Sampler CM
Date 11-12-15
Location 2015-C
Start Time
End Time
Duration (minutes)

Inner Ring Radius ~~(12.7 cm short rings~~ (15 cm tall rings)
Head Depth 6"
Inner Ring Area (~~507 cm2 short rings~~ (707 cm2 tall rings)

Photos 7-9

Sample Time	Time elapsed from start (min)	Time elapsed from last sample (min)	Water added (mL)	Infiltration Rate (mL/min)	Infiltration Rate (cm/hr)
10:00	0	0	--	Can calculate in office	
10:02	2	2	1100	550	
10:04	4	2	700	350	
10:06	6	2	725	312.5	
10:08	8	2	700	350	
10:10	10	2	750	375	
10:15	15	5	1700	340	
10:20	20	5	1400	280	
10:25	25	5	1250	250	
10:30	30	5	1200	240	
10:35	35	5	1200	240	
10:40	40	5	1250	250	
10:45	45	5	1250	250	
10:50	50	5	1175	235	
11:00	60	10	2100	210	
11:10	70	10	2150	215	
11:20	80	10	2100	210	
11:30	90	10	2050	205	
11:40	100	10	1850	185	
11:50	110	10	1675	167	
12:00	120	10	1750	175	
12:15	135	15	2350	156	
12:30	150	15	2300	140	
12:45	165	15	2100	140	
1:00	180	15	1950	130	
1:20	200	20	2800	140	
1:40	220	20	2350	117.5	
2:00	240	20	2500	125	
2:20	260	20	2475	124	

Sampler SM
Date 11-12-15
Location 2015-D
Start Time 10:30
End Time 13:45
Duration (minutes) 195

Inner Ring Radius (12.7 cm short rings ~~15 cm tall rings~~)
Head Depth 3"
Inner Ring Area (507 cm2 short rings ~~707 cm2 tall rings~~)

Rings Test site is on grassy high point between two sage filled swales. Top soil ≈ 36", about 12" deeper than other 3 sites. Rings set on contact w/ weathered shale

Photos 12-14

Sample Time	Time elapsed from start (min)	Time elapsed from last sample (min)	Water added (mL)	Infiltration Rate (mL/min)	Infiltration Rate (cm/hr)
10:30	0	0	--	Can calculate in office	
10:35	5	5	200	40	
10:40	10	5	150	30	
10:45	15	5	150	30	
10:50	20	5	110	22	
11:00	30	10	275	27.5	
11:10	40	10	300	30	
11:20	50	10	275	27.5	
11:30	60	10	325	32.5	
11:45	75	15	500	33.3	
12:00	90	15	525	35.0	
12:15	105	15	500	33.3	
12:30	120	15	450	30	
12:45	135	15	375	25	
1:00	150	15	450	30	
1:15	165	15	350	23.3	
1:30	180	15	350	23.3	
1:45	195	15	~~350~~ 375	25	

Knocked hook gage prior to measurement *

Sampler SM
Date 6-27-17
Location BB-5 subsurface
Start Time
End Time
Duration (minutes)

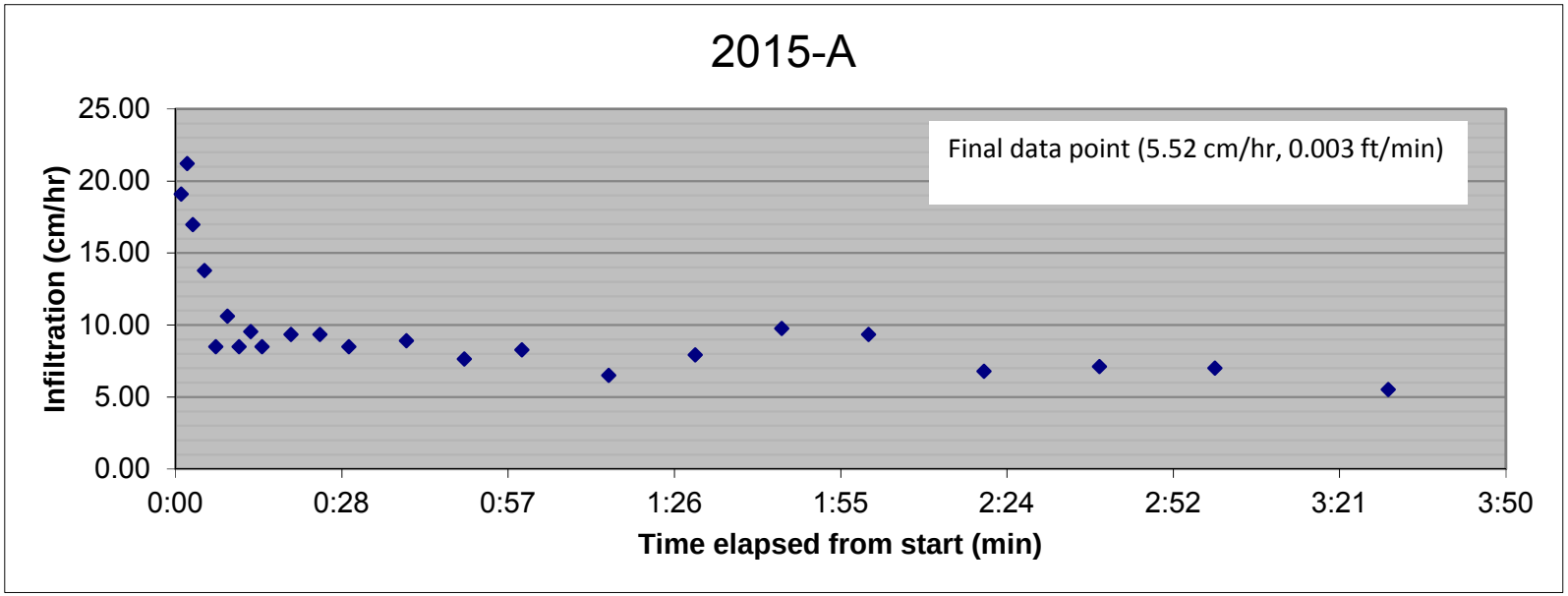
12" Below ground surface (BGS)

Inner Ring Radius (12.7 cm short rings (15 cm tall rings)
Head Depth 7 cm
Inner Ring Area (507 cm2 short rings (707 cm2 tall rings)

Sample Time	Time elapsed from start (min)	Time elapsed from last sample (min)	Water added (mL)	Infiltration Rate (mL/min)	Infiltration Rate (cm/hr)
13:29	0	0	--	Can calc in office	
13:34	~~10~~ 5	5	875	175	
13:39	10	5	900	180	
13:44	15	5	700	140	
13:49	20	5	900	180	→disturbed by Doyle
13:54	25	5	735	147	
14:04	35	10	1625	162.5	
14:14	45	10	1535	153.5	
14:24	55	10	1400	140.0	
14:34	65	10	1400	140.0	
14:49	80	15	2100	140.0	
15:04	95	15	2100	140.0	
15:19	110	15	2080	138.7	
15:34	125	15	1980	132.0	
15:49	140	15	1950	130.0	

Sampler	C. Mathews	**Inner Ring Radius (cm)**	15
Date	11/11/2015	**Head Depth (cm)**	6
Location	2015-A	**Area of inner ring (cm^2)**	706.86
Start Time	12:00	**Notes: 1" = 2.54 cm**	
End Time	15:30		
Duration (hour:min)	3:30		

Sample Time	Time elapsed from start (hour:min)	Time elapsed from last sample (min)	Time Elapsed Reformat	Water added (mL)	Infiltration Rate (mL/min)	Infiltration Rate (cm/hr)
12:00	--	--		--	--	--
12:01	0:01	0:01	1	225	225	19.10
12:02	0:02	0:01	1	250	250	21.22
12:03	0:03	0:01	1	200	200	16.98
12:05	0:05	0:02	2	325	163	13.79
12:07	0:07	0:02	2	200	100	8.49
12:09	0:09	0:02	2	250	125	10.61
12:11	0:11	0:02	2	200	100	8.49
12:13	0:13	0:02	2	225	113	9.55
12:15	0:15	0:02	2	200	100	8.49
12:20	0:20	0:05	5	550	110	9.34
12:25	0:25	0:05	5	550	110	9.34
12:30	0:30	0:05	5	500	100	8.49
12:40	0:40	0:10	10	1050	105	8.91
12:50	0:50	0:10	10	900	90	7.64
13:00	1:00	0:10	10	975	98	8.28
13:15	1:15	0:15	15	1150	77	6.51
13:30	1:30	0:15	15	1400	93	7.92
13:45	1:45	0:15	15	1725	115	9.76
14:00	2:00	0:15	15	1650	110	9.34
14:20	2:20	0:20	20	1600	80	6.79
14:40	2:40	0:20	20	1675	84	7.11
15:00	3:00	0:20	20	1650	83	7.00
15:30	3:30	0:30	30	1950	65	5.52

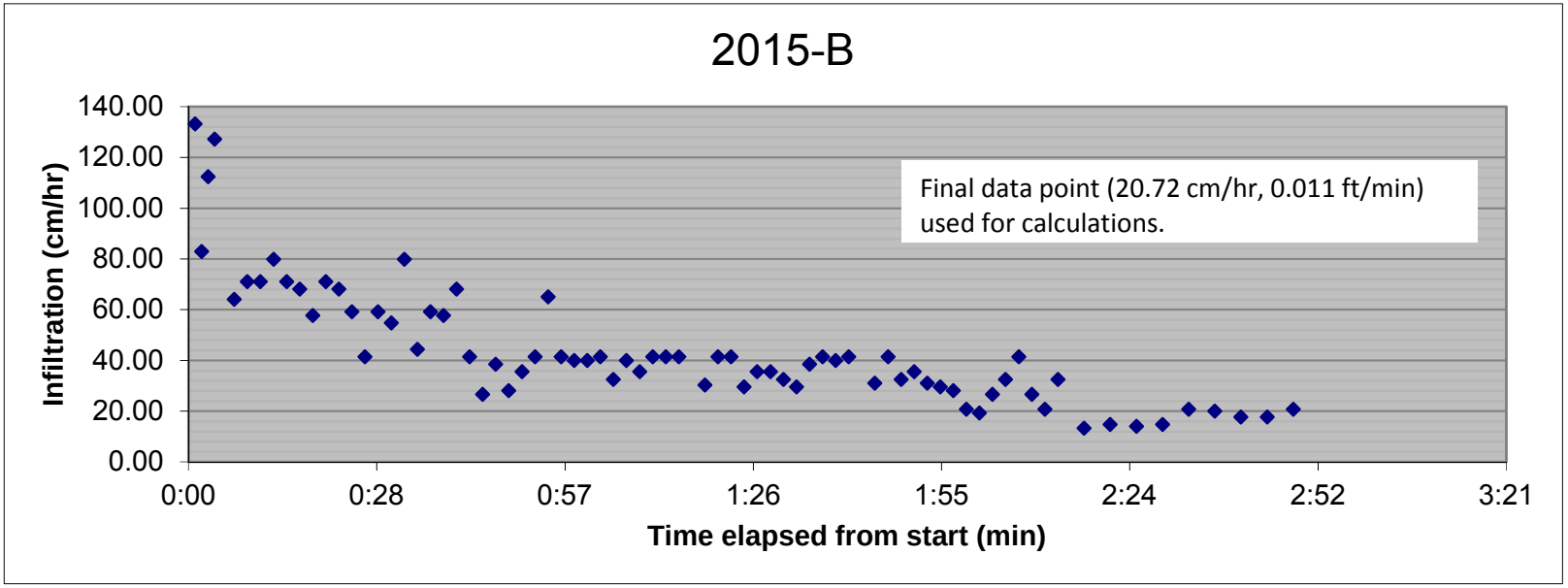

2015-A
Final data point (5.52 cm/hr, 0.003 ft/min)
Infiltration (cm/hr)
25.00
20.00
15.00
10.00
5.00
0.00
0:00
0:28
0:57
1:26
1:55
2:24
2:52
3:21
3:50
Time elapsed from start (min)

Sampler	S. Matolyak	**Inner Ring Radius (cm)**	12.7
Date	11/11/2015	**Head Depth (cm)**	3
Location	2015-B	**Area of inner ring (cm^2)**	506.71
Start Time	12:25	**Notes: 1" = 2.54 cm**	
End Time	15:14		
Duration (hour:min)	2:49		

Sample Time	Time elapsed from start (hour:min)	Time elapsed from last sample (min)	Time Elapsed Reformat	Water added (mL)	Infiltration Rate (mL/min)	Infiltration Rate (cm/hr)
12:25	--	--		--	--	--
12:26	0:01	0:01	1	1125	1125	133.21
12:27	0:02	0:01	1	700	700	82.89
12:28	0:03	0:01	1	950	950	112.49
12:29	0:04	0:01	1	1075	1075	127.29
12:32	0:07	0:03	3	1625	542	64.14
12:34	0:09	0:02	2	1200	600	71.05
12:36	0:11	0:02	2	1200	600	71.05
12:38	0:13	0:02	2	1350	675	79.93
12:40	0:15	0:02	2	1200	600	71.05
12:42	0:17	0:02	2	1150	575	68.09
12:44	0:19	0:02	2	975	488	57.73
12:46	0:21	0:02	2	1200	600	71.05
12:48	0:23	0:02	2	1150	575	68.09
12:50	0:25	0:02	2	1000	500	59.21
12:52	0:27	0:02	2	700	350	41.44
12:54	0:29	0:02	2	1000	500	59.21
12:56	0:31	0:02	2	925	463	54.77
12:58	0:33	0:02	2	1350	675	79.93
13:00	0:35	0:02	2	750	375	44.40
13:02	0:37	0:02	2	1000	500	59.21
13:04	0:39	0:02	2	975	488	57.73
13:06	0:41	0:02	2	1150	575	68.09
13:08	0:43	0:02	2	700	350	41.44
13:10	0:45	0:02	2	450	225	26.64
13:12	0:47	0:02	2	650	325	38.48
13:14	0:49	0:02	2	475	238	28.12
13:16	0:51	0:02	2	600	300	35.52
13:18	0:53	0:02	2	700	350	41.44
13:20	0:55	0:02	2	1100	550	65.13

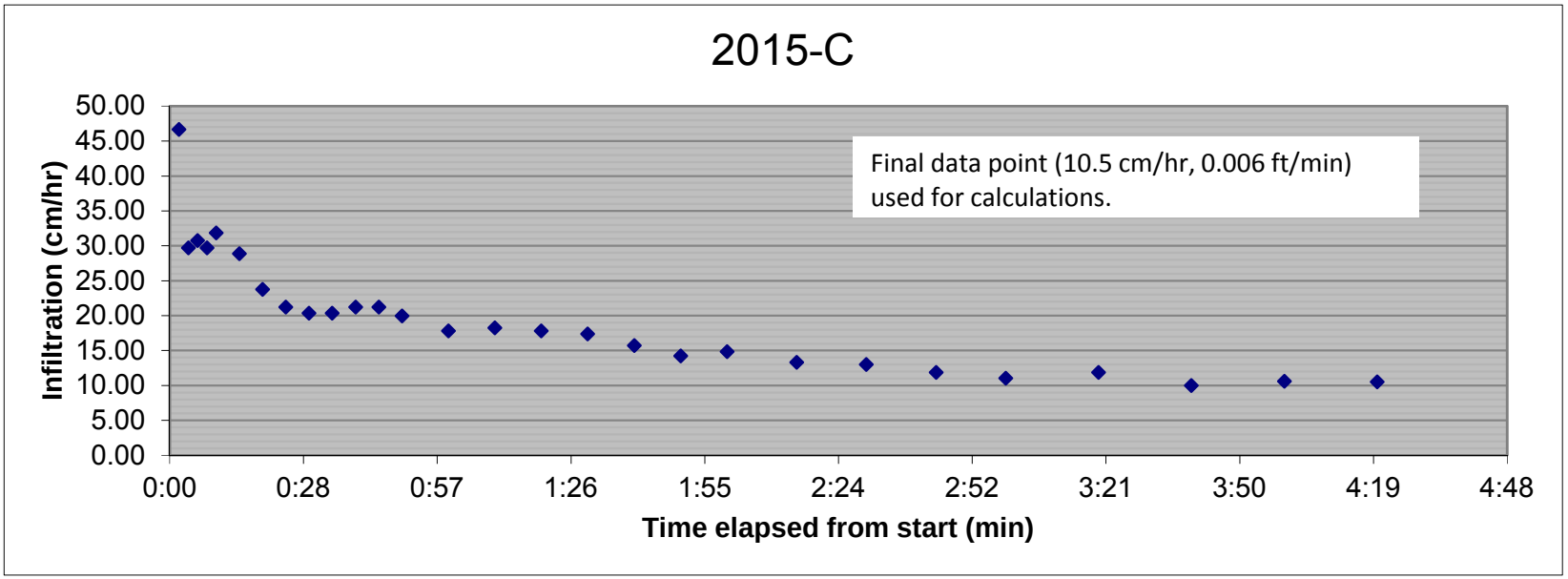
13:22	0:57	0:02	2	700	350	41.44
13:24	0:59	0:02	2	675	338	39.96
13:26	1:01	0:02	2	675	338	39.96
13:28	1:03	0:02	2	700	350	41.44
13:30	1:05	0:02	2	550	275	32.56
13:32	1:07	0:02	2	675	338	39.96
13:34	1:09	0:02	2	600	300	35.52
13:36	1:11	0:02	2	700	350	41.44
13:38	1:13	0:02	2	700	350	41.44
13:40	1:15	0:02	2	700	350	41.44
13:44	1:19	0:04	4	1025	256	30.34
13:46	1:21	0:02	2	700	350	41.44
13:48	1:23	0:02	2	700	350	41.44
13:50	1:25	0:02	2	500	250	29.60
13:52	1:27	0:02	2	600	300	35.52
13:54	1:29	0:02	2	600	300	35.52
13:56	1:31	0:02	2	550	275	32.56
13:58	1:33	0:02	2	500	250	29.60
14:00	1:35	0:02	2	650	325	38.48
14:02	1:37	0:02	2	700	350	41.44
14:04	1:39	0:02	2	675	338	39.96
14:06	1:41	0:02	2	700	350	41.44
14:10	1:45	0:04	4	1050	263	31.08
14:12	1:47	0:02	2	700	350	41.44
14:14	1:49	0:02	2	550	275	32.56
14:16	1:51	0:02	2	600	300	35.52
14:18	1:53	0:02	2	525	263	31.08
14:20	1:55	0:02	2	500	250	29.60
14:22	1:57	0:02	2	475	238	28.12
14:24	1:59	0:02	2	350	175	20.72
14:26	2:01	0:02	2	325	163	19.24
14:28	2:03	0:02	2	450	225	26.64
14:30	2:05	0:02	2	550	275	32.56
14:32	2:07	0:02	2	700	350	41.44
14:34	2:09	0:02	2	450	225	26.64
14:36	2:11	0:02	2	350	175	20.72
14:38	2:13	0:02	2	550	275	32.56
14:42	2:17	0:04	4	450	113	13.32
14:46	2:21	0:04	4	500	125	14.80
14:50	2:25	0:04	4	475	119	14.06

14:54	2:29	0:04	4	500	125	14.80
14:58	2:33	0:04	4	700	175	20.72
15:02	2:37	0:04	4	675	169	19.98
15:06	2:41	0:04	4	600	150	17.76
15:10	2:45	0:04	4	600	150	17.76
15:14	2:49	0:04	4	700	175	20.72



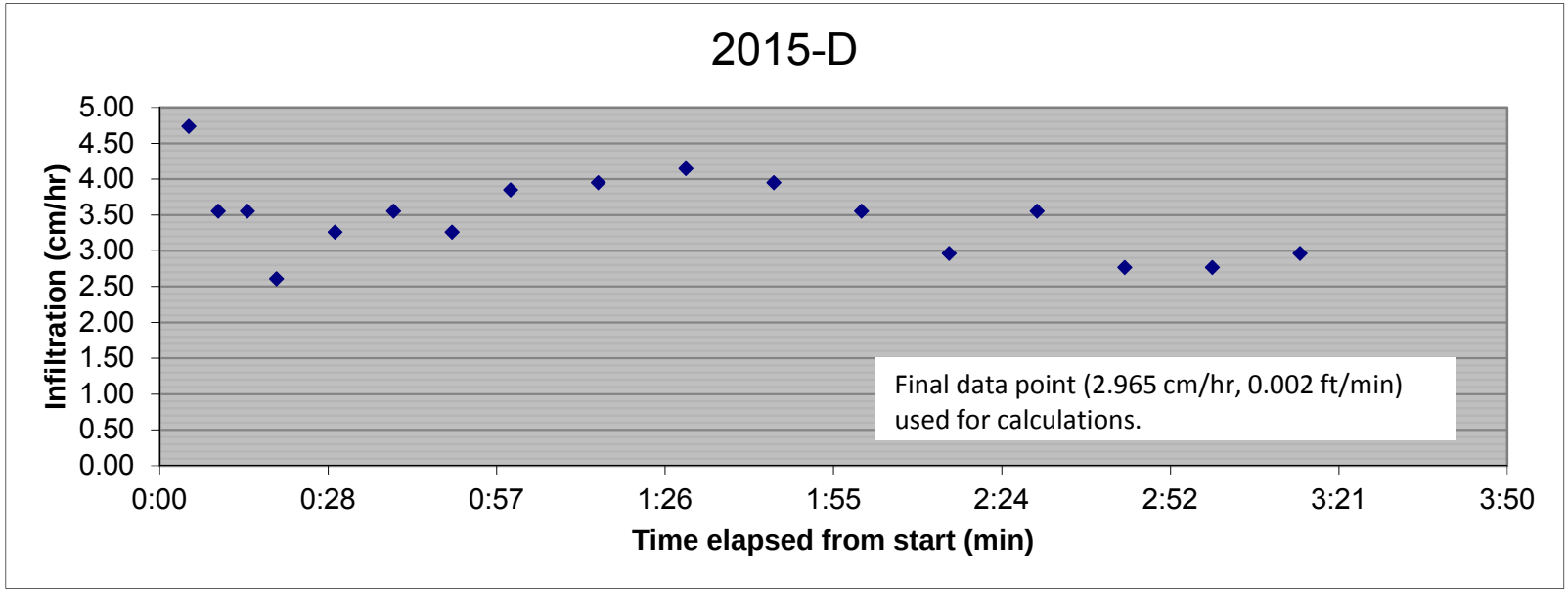
Sampler	C. Mathews	**Inner Ring Radius (cm)**	15
Date	11/12/2015	**Head Depth (cm)**	6
Location	2015-C	**Area of inner ring (cm^2)**	706.86
Start Time	10:00	**Notes: 1" = 2.54 cm**	
End Time	14:20		
Duration (hour:min)	4:20		

Sample Time	Time elapsed from start (hour:min)	Time elapsed from last sample (min)	Time Elapsed Reformat	Water added (mL)	Infiltration Rate (mL/min)	Infiltration Rate (cm/hr)
10:00	--	--		--	--	--
10:02	0:02	0:02	2	1100	550	46.69
10:04	0:04	0:02	2	700	350	29.71
10:06	0:06	0:02	2	725	363	30.77
10:08	0:08	0:02	2	700	350	29.71
10:10	0:10	0:02	2	750	375	31.83
10:15	0:15	0:05	5	1700	340	28.86
10:20	0:20	0:05	5	1400	280	23.77
10:25	0:25	0:05	5	1250	250	21.22
10:30	0:30	0:05	5	1200	240	20.37
10:35	0:35	0:05	5	1200	240	20.37
10:40	0:40	0:05	5	1250	250	21.22
10:45	0:45	0:05	5	1250	250	21.22
10:50	0:50	0:05	5	1175	235	19.95
11:00	1:00	0:10	10	2100	210	17.83
11:10	1:10	0:10	10	2150	215	18.25
11:20	1:20	0:10	10	2100	210	17.83
11:30	1:30	0:10	10	2050	205	17.40
11:40	1:40	0:10	10	1850	185	15.70
11:50	1:50	0:10	10	1675	168	14.22
12:00	2:00	0:10	10	1750	175	14.85
12:15	2:15	0:15	15	2350	157	13.30
12:30	2:30	0:15	15	2300	153	13.02
12:45	2:45	0:15	15	2100	140	11.88
13:00	3:00	0:15	15	1950	130	11.03
13:20	3:20	0:20	20	2800	140	11.88
13:40	3:40	0:20	20	2350	118	9.97
14:00	4:00	0:20	20	2500	125	10.61
14:20	4:20	0:20	20	2475	124	10.50


2015-C
Infiltration (cm/hr)
50.00
45.00
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
0:00
0:28
0:57
1:26
1:55
2:24
2:52
3:21
3:50
4:19
4:48
Time elapsed from start (min)
Final data point (10.5 cm/hr, 0.006 ft/min) used for calculations.

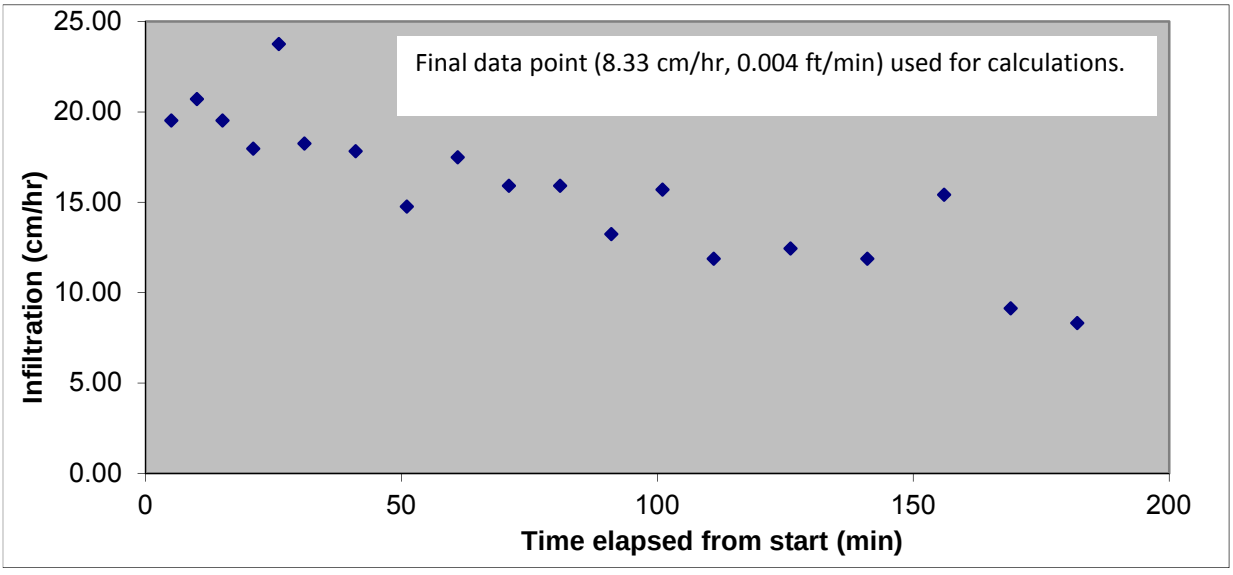
Sampler	S. Matolyak	**Inner Ring Radius (cm)**	12.7
Date	11/12/2015	**Head Depth (cm)**	3
Location	2015-D	**Area of inner ring (cm^2)**	506.71
Start Time	10:30	**Notes: 1" = 2.54 cm**	
End Time	13:45		
Duration (hour:min)	3:15		

Sample Time	Time elapsed from start (hour:min)	Time elapsed from last sample (min)	Time Elapsed Reformat	Water added (mL)	Infiltration Rate (mL/min)	Infiltration Rate (cm/hr)
10:30	--	--		--	--	--
10:35	0:05	0:05	5	200	40	4.74
10:40	0:10	0:05	5	150	30	3.55
10:45	0:15	0:05	5	150	30	3.55
10:50	0:20	0:05	5	110	22	2.61
11:00	0:30	0:10	10	275	28	3.26
11:10	0:40	0:10	10	300	30	3.55
11:20	0:50	0:10	10	275	28	3.26
11:30	1:00	0:10	10	325	33	3.85
11:45	1:15	0:15	15	500	33	3.95
12:00	1:30	0:15	15	525	35	4.14
12:15	1:45	0:15	15	500	33	3.95
12:30	2:00	0:15	15	450	30	3.55
12:45	2:15	0:15	15	375	25	2.96
13:00	2:30	0:15	15	450	30	3.55
13:15	2:45	0:15	15	350	23	2.76
13:30	3:00	0:15	15	350	23	2.76
13:45	3:15	0:15	15	375	25	2.96


2015-D
Infiltration (cm/hr)
5.00
4.50
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
0:00
0:28
0:57
1:26
1:55
2:24
2:52
3:21
3:50
Time elapsed from start (min)
Final data point (2.965 cm/hr, 0.002 ft/min) used for calculations.

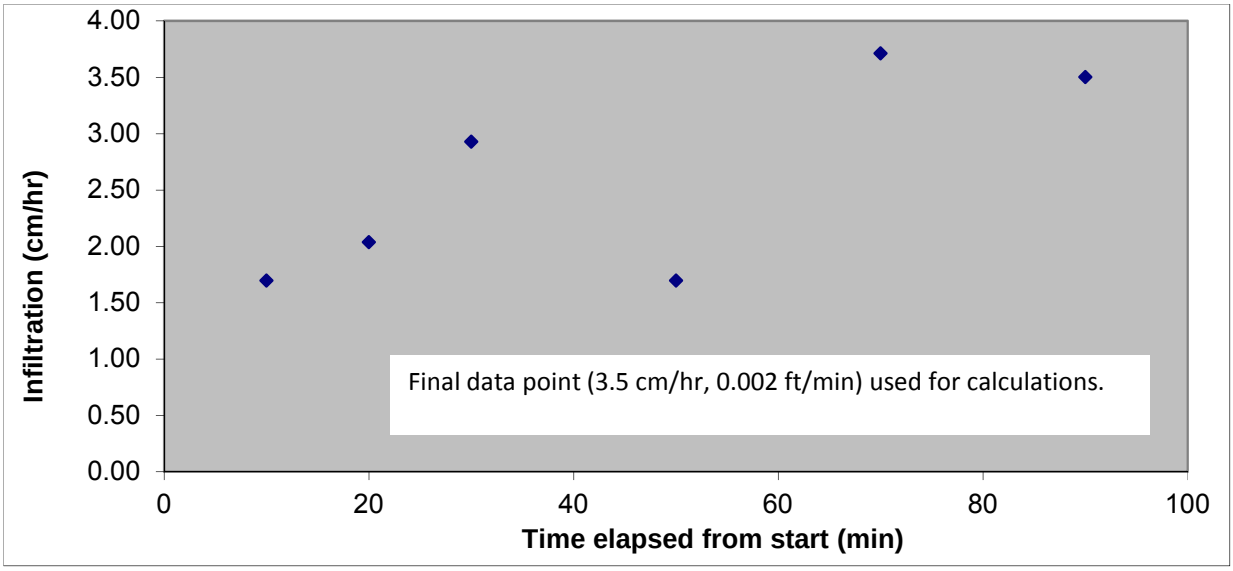
Sampler	SM	**Inner Ring Radius (cm)**	15	
Date	6/27/2012	**Head Depth (cm)**	6	2 1/8"
Location	BB_2 Sub-surface	**Area of inner ring (cm^2)**	706.86	
Start Time	9:15	**Notes: 1" = 2.54 cm**		
End Time	12:17			
Duration (min)	182			

Sample Time	Time elapsed from start (min)	Time elapsed from last sample (min)	Water added (mL)	Infiltration Rate (mL/min)	Infiltration Rate (cm/hr)
9:15	--	--	--	--	--
9:20	5	5	1150	230.0	19.52
9:25	10	5	1220	244.0	20.71
9:30	15	5	1150	230.0	19.52
9:36	21	6	1270	211.7	17.97
9:41	26	5	1400	280.0	23.77
9:46	31	5	1075	215.0	18.25
9:56	41	10	2100	210.0	17.83
10:06	51	10	1740	174.0	14.77
10:16	61	10	2060	206.0	17.49
10:26	71	10	1875	187.5	15.92
10:36	81	10	1875	187.5	15.92
10:46	91	10	1560	156.0	13.24
10:56	101	10	1850	185.0	15.70
11:06	111	10	1400	140.0	11.88
11:21	126	15	2200	146.7	12.45
11:36	141	15	2100	140.0	11.88
11:51	156	15	2725	181.7	15.42
12:04	169	13	1400	107.7	9.14
12:17	182	13	1275	98.1	8.33



Sampler	SM	**Inner Ring Radius (cm)**	15	
Date	6/26/2012	**Head Depth (cm)**	6	2 1/8"
Location	BB_3 Sub-surface	**Area of inner ring (cm^2)**	706.86	
Start Time	10:39	**Notes: 1" = 2.54 cm**		
End Time	12:09			
Duration (min)	90			

Sample Time	Time elapsed from start (min)	Time elapsed from last sample (min)	Water added (mL)	Infiltration Rate (mL/min)	Infiltration Rate (cm/hr)
10:39	--	--	--	--	--
10:49	10	10	200	20.0	1.70
10:59	20	10	240	24.0	2.04
11:09	30	10	345	34.5	2.93
11:29	50	20	400	20.0	1.70
11:49	70	20	875	43.8	3.71
12:09	90	20	825	41.3	3.50



Sampler	SM	**Inner Ring Radius (cm)**	15	
Date	6/27/2012	**Head Depth (cm)**	6	2 1/8"
Location	BB_5 Sub-surface	**Area of inner ring (cm^2)**	706.86	
Start Time	13:29	**Notes: 1" = 2.54 cm**		
End Time	15:49			
Duration (min)	140			

Sample Time	Time elapsed from start (min)	Time elapsed from last sample (min)	Water added (mL)	Infiltration Rate (mL/min)	Infiltration Rate (cm/hr)
13:29	--	--	--	--	--
13:34	5	5	875	175.0	14.85
13:39	10	5	900	180.0	15.28
13:44	15	5	700	140.0	11.88
13:49	20	6	900	150.0	12.73
13:54	25	5	735	147.0	12.48
14:04	35	10	1625	162.5	13.79
14:14	45	10	1535	153.5	13.03
14:24	55	10	1400	140.0	11.88
14:34	65	10	1400	140.0	11.88
14:49	80	15	2100	140.0	11.88
15:04	95	15	2100	140.0	11.88
15:19	110	15	2080	138.7	11.77
15:34	125	15	1980	132.0	11.20
15:49	140	15	1950	130.0	11.03