Measuring Infiltration Rates

Introduction:

Infiltration is the movement of water into a soil profile. The rate at which infiltration occurs is controlled by the inherent properties of the soil, the level of soil saturation when rainfall starts, and by the ways in which humans have modified the landscape. Infiltration rates, in turn, control runoff rates and soil erosion, which are important because these processes directly influence the behavior of hillslopes.

Methods - Sprinkling Infiltrometer

The idea here is simple. Create artificial rainfall and generate runoff while collecting data over time. The amount of rainfall is measured using rain gauges and the run off is measured using a collection bucket. The difference between rainfall and runoff is infiltration. The experimental set up is illustrated below.

Before beginning the experiment, select a very gently sloping area about 1 m^2. Determine and mark the lowest point in this area; dig a pit at the lowest point which is about 30 cm in diameter and in depth.

Use the metal flashing to create a tear-drop shaped drainage basin with the hole you dug at the downstream end. Press the flashing into the ground. Use stakes to secure the metal to the ground. Estimate the area of your plot by considering it a series of narrow rectangles.

At the down-gradient end, secure the funnel to the metal flashing and use plaster to create a good seal so that any run off generated goes into the bucket not under or around the flashing.

Fill at least two backpack sprayers with water and have at least three, preferably four, people on hand. Have two people sprinkling, one person taking data, and another reading rain gauges and emptying buckets to measure run off.

Name: _____

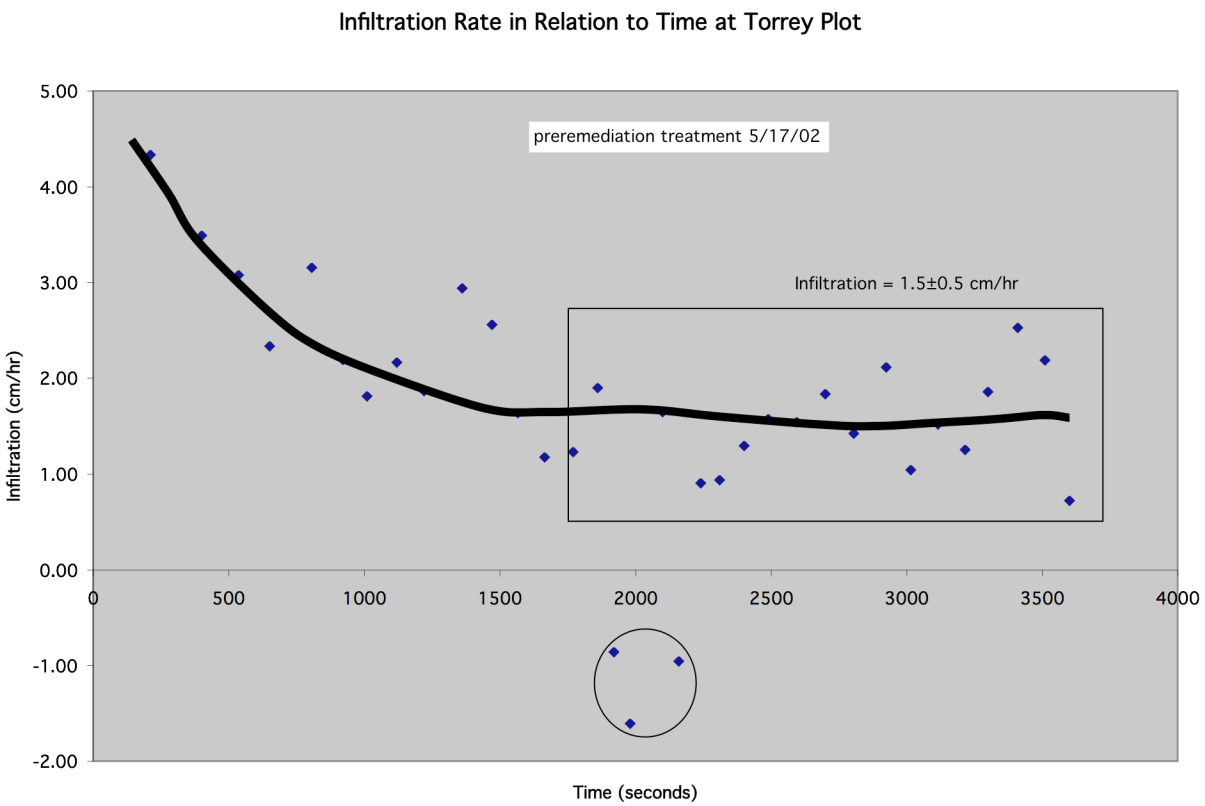
Write a brief interpretation (3 paragraphs) of the exercise by commenting on the following questions (one per paragraph).

- What do your measurements suggest about differences in infiltration rates at the sites we studied?
- What factors would you expect to influence the rate at which infiltration occurs over time and space?
- What are the limitations associated with inferring infiltration rates across the landscape based on the measurements you have made?

Name: _____

avg Rainfall (cm)	running Time for Rainfall (seconds)	incremental time	precip (cm/hr)	Time (minutes)	Time (seconds)	Total Time (seconds)	Runoff Incremental over time interval (mL)	Sum Runoff with time (mL)	Runoff over time interval(cm)	incremetnal time	normalized runoff (cm/hr)	rainfall rate (cm/hr)	Infiltration rate Incremental over time interval (cm/hr)
1.23	861	861	5.16	3	30	210	600	600	0.09	210	1.59	5.93	4.34
1.40	1710	849	5.94	6	40	400	830	1430	0.13	190	2.44	5.93	3.49
1.60	2360	650	8.86	8	55	535	690	2120	0.11	135	2.85	5.93	3.08
1.30	3195	835	5.60	10	50	650	740	2860	0.11	115	3.59	5.93	2.34
0.40	3600	405	3.56	13	25	805	770	3630	0.12	155	2.77	5.93	3.16
				15	20	920	770	4400	0.12	115	3.74	5.93	2.19
5.93	rainfall			16	50	1010	664	5064	0.10	90	4.12	5.93	1.81
	(cm/hr)			18	40	1120	742	5806	0.12	110	3.76	5.93	2.17
				20	20	1220	728	6534	0.11	100	4.06	5.93	1.87
				22	40	1360	750	7284	0.12	140	2.99	5.93	2.94
				24	30	1470	664	7948	0.10	110	3.37	5.93	2.56
				26	5	1565	730	8678	0.11	95	4.29	5.93	1.64
				27	45	1665	852	9530	0.13	100	4.76	5.93	1.17
				29	30	1770	884	10414	0.14	105	4.70	5.93	1.23
				31		1860	650	11064	0.10	90	4.03	5.93	1.90
				32		1920	730	11794	0.11	60	6.79	5.93	-0.86
				33		1980	810	12604	0.13	60	7.53	5.93	-1.60
				35		2100	920	13524	0.14	120	4.28	5.93	1.65
				36		2160	740	14264	0.11	60	6.88	5.93	-0.95
				37	20	2240	720	14984	0.11	80	5.02	5.93	0.91
				38	30	2310	626	15610	0.10	70	4.99	5.93	0.94
				40		2400	747	16357	0.12	90	4.63	5.93	1.30
				41	30	2490	702	17059	0.11	90	4.35	5.93	1.58
				43	15	2595	825	17884	0.13	105	4.39	5.93	1.54
				45		2700	770	18654	0.12	105	4.09	5.93	1.84
				46	45	2805	848	19502	0.13	105	4.51	5.93	1.42
				48	45	2925	820	20322	0.13	120	3.81	5.93	2.12
				50	15	3015	788	21110	0.12	90	4.89	5.93	1.04
				51	55	3115	790	21900	0.12	100	4.41	5.93	1.52
				53	35	3215	838	22738	0.13	100	4.68	5.93	1.25
				55		3300	620	23358	0.10	85	4.07	5.93	1.86
				56	50	3410	670	24028	0.10	110	3.40	5.93	2.53
				58	30	3510	670	24698	0.10	100	3.74	5.93	2.19
				60		3600	840	25538	0.13	90	5.21	5.93	0.72

These are real data collected on the UVM campus near Torrey Hall, setup pictured above and the data are graphed below. *Think about* why the infiltration rate falls over time and then levels out.



Name: ________________________

SITE:

OBSERVERS:

MEASURE
Infiltration Plot Area (cm2)

CALCULATE - RAINFALL RATE

avg Rainfall (cm)	incremental time (hour)	precip (cm/hr)

AVERAGE rainfall RATE (cm/hr)

MEASURE

RAIN GAUGE DATA

Running Time (seconds)	incremental time (seconds)	gauge 1	gauge 2	gauge 3

MEASURE - RUN OFF

Time (minutes)	Time (seconds)		Runoff Incremental volume over time interval (cc)

CALCULATE - INFILTRATION

Time Interval (seconds)	Runoff over time interval (cm)	incremental time (hour)	normalized runoff (cm/hr)	rainfall rate (cm/hr)	Infiltration rate Incremental over time interval (cm/hr)