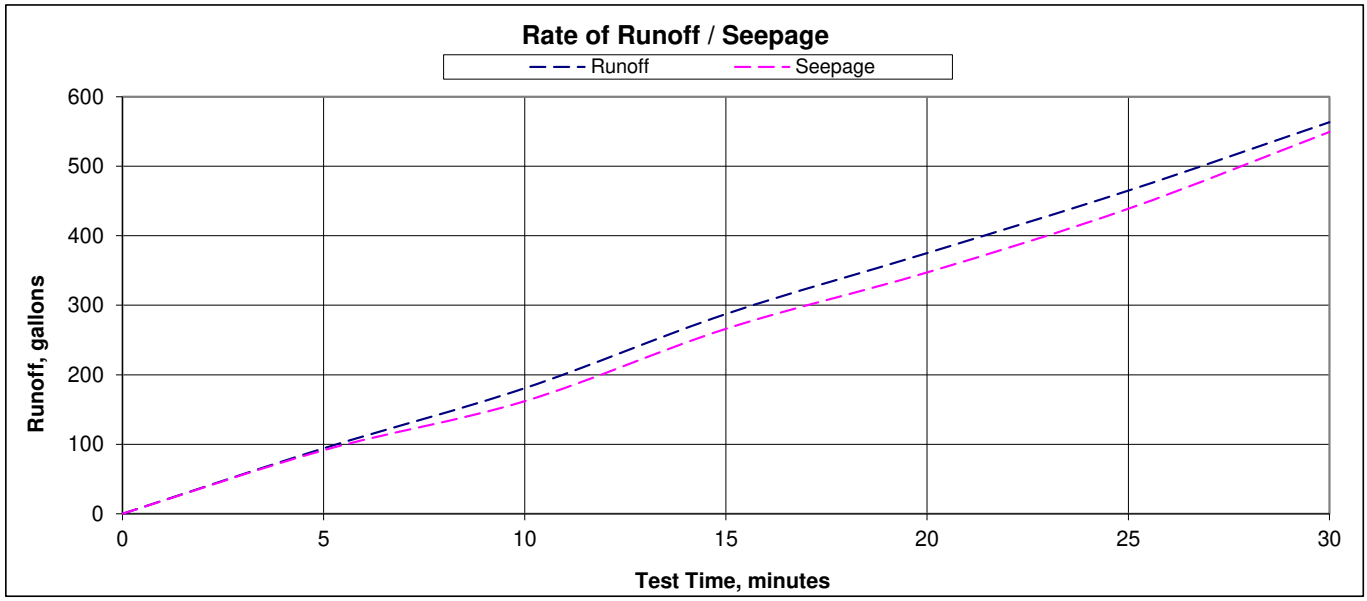
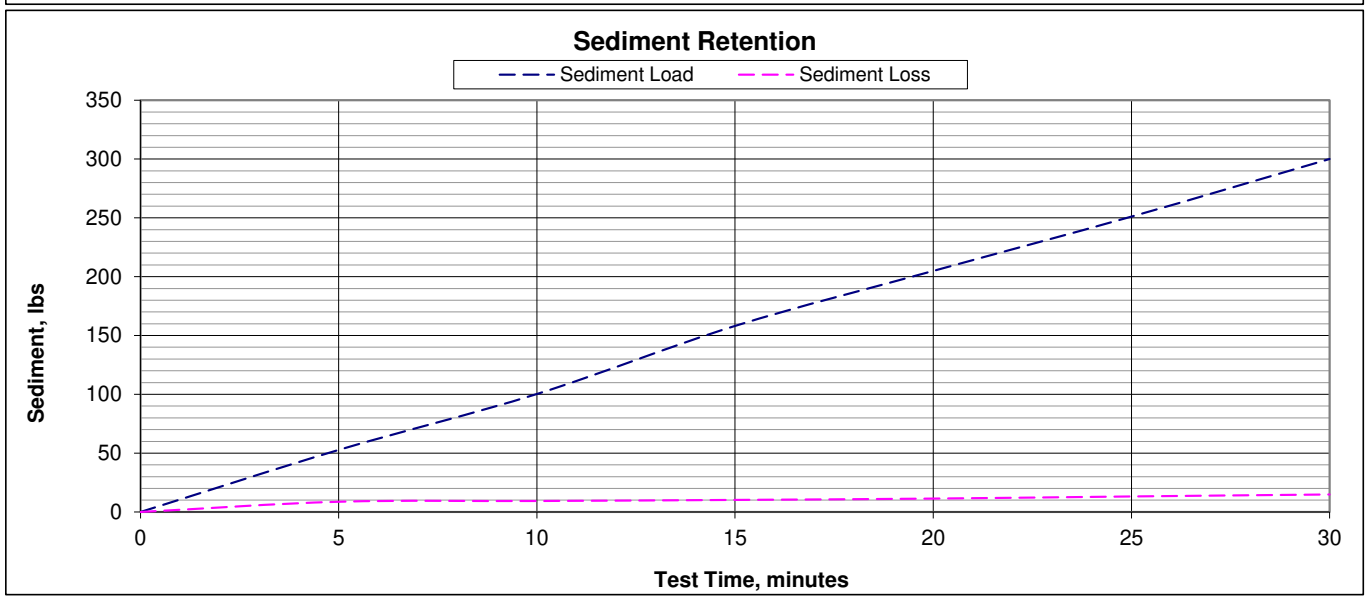
Project:	ASTM D 7351 Testing - modified for inlet protection			
Client:	UltraTech	**Product:**	Grate Guard	
Test Date:	11/16/2023			
SRD/Setup:	Inside 2-ft Square Grated Inlet			
Duration:	30	minutes		
Water / Soil Input:	4700	lbs water	300	lbs soil
Sediment Concentration:	6.0%	manufactured sand		

Soil Retention Effectiveness: **95.04%**
Water Retention Effectiveness: **2.07%**





The testing is based upon accepted industry practice as well as the test method listed. Test results reported herein do not apply to samples other than those tested. TRI neither accepts responsibility for nor makes claim as to the final use and purpose

CJS 11/22/23
Quality Review / Date

Testing Overview

The large-scale testing reported herein was performed in general accordance with ASTM D 7351 modified to present the flow to an area inlet. For this testing, a simulated area inlet installation comprised of an approximate 24-inch x 24-inch opening simulating a manhole inlet positioned at the center of a containment area was used. The SRD was installed inside of the inlet opening according to manufacturer recommendations and exposed to simulated runoff. Sediment-laden water was piped and discharged into the fully contained area around the inlet opening and allowed to run into and seep through the installed inlet protection SRD. The amount (via water and soil weight) of sediment-laden flow was measured both upstream and downstream of the SRD. The measurement of sediment that passes through the installed SRD is compared to the measured amount in the upstream flow and is used to quantify the effectiveness of the SRD in retaining sediments while allowing continued seepage. The measurement of water that passes through the installed SRD compared to the amount of the upstream flow is used to quantify the effectiveness of the SRD in allowing continued seepage.

Inlet Protection SRD "Benchmark" Properties

SRD fabric index properties were provided by the manufacturer and are included in Table 1. The properties are for the geotextile filter material comprising the device. These are considered the "benchmark" properties of the product tested.

Table 1. "Benchmark" Test Results (Geotextile Filter Material)

Property	Units	Test Method	Test Result
Grab Tensile Strength	lb	D4632	400 x 275
Grab Tensile Elong.	%	D4632	40 x 22
Trap Tear Strength	lb	D4533	165 x 140
CBR Puncture	lb	D6241	654
AOS	US Sieve	D4751	30
Permittivity	sec^{-1}	D4491	0.25
UV Resistance - 500 hr.	% retained	D4355 / D5035	90

Test Setup

The test procedure requires an integrated system of equipment to accomplish the full-scale testing of inlet protection SRDs. The system used for this testing includes the following components:

- A tank with an internal paddle mixer device mounted on scales capable of holding/weighing 10,000 lb of sediment-laden water.
- An elevated simulated storm drain inlet with a fully contained area for upstream ponding and downstream accessibility for sampling.
- A tank mounted on scales of sufficient volume to collect all runoff passing the SRD.

Concentrated sediment-laden flow is conveyed by pipe from the mixing tank to the simulated storm drain inlet located between the mixing and collection tanks. The fully contained simulated inlet includes an 8 ft diameter retention zone encircling the inlet opening. For the testing reported herein, the sediment-laden water is discharged into the retention zone and allowed to run directly into the inlet and seep through the SRD installed inside the simulated inlet. The seepage migrates through the SRD and drains into the collection tank.

Test Soil

The test soil used had the characteristics shown in Table 2. A soil gradation report can be found in the appendix.

Table 2. Test Soil Characteristics

Soil Characteristic	Test Method	Value
% Gravel	ASTM D 422	0
% Sand		96
% Silt & Clay		4
Plasticity Index, %	ASTM D 4318	NP
Soil Classification	ASTM	SP

Inlet Protection SRD Installation

The inlet protection SRD in this testing was installed inside the inlet in accordance with the provided installation instructions and as shown in the pictures herein. Overflow / Bypass features of the installed SRD can contribute to product performance. The installed SRD was a geotextile bag encasing the steel grate of the inlet sturcture. No overflow/bypass feature was apparent in the tested product.

Mixing Sediment-Laden Runoff

Sediment-laden runoff was created by combining water and soil in the mixing tank and agitating during the test. 4700 lb of water and 300 lb (dry weight) of test soil were combined to create the sediment-laden runoff of 6% (60000 mg/L). These quanities represent the "default" condition given in the standard which is a hypothetical 30-minute, peak flow from a 24-hour, 4-inch rainfall on a 100-ft long x 20-ft wide bare sand soil slope.

Specific Test Procedure

After the SRD is installed, the sediment-laden runoff is discharged evenly for 30 minutes while agitation is maintained. The quantity of released runoff is measured at 5-minute intervals by noting the reduction in weight in the mixing tank, adjusting the valve on the tank outlet to increase/decrease flow to stay as close as possible to the target (5000 lb / 30 min = 167 lb / min). For this testing, the discharge flow is introduced to allow it to flow up to and into the SRD. Retention observations and ponding depths, and associated times, are recorded during the test. As runoff passing the SRD system is collected, the weight and volume of the collection tank is recorded and grab samples are taken, at 5 minute intervals. Cutoff time is the earlier of 90 minutes or when there is low-volume ponding and minimal discharge. Grab samples are evaluated in a lab to determine turbidity (when requested) and to determine percent dry solids content. Sediment retention effectiveness and water retention effectiveness are calculated from the grab sample sediment concentrations and the associated measured runoff and seepage.


Inlet Testing Setup (Typical)


Product Installed / Grate In Place / Test Initiated


Deposition At End-of-Flow / Close-up of Captured Sediment

APPENDIX - DATA

Retention Effectiveness Calculations

Client: UltraTech **Product:** Grate Guard

SRD/Setup: Inside 2-ft Square Grated Inlet **Soil:** Manufactured Sand @ 6% Sed. Conc.

Date: 11/16/2023 **Start Time:** 16:15 **End Time:** 16:50

Sample Number	Test Time, minutes	Turbidity	Total Weight, g	Dry Weight, g	Bottle Weight, g	Dry Sediment Weight, mg	Total Collected Water Wt., g	Total Collected Volume, l	Sediment Conc., mg/l	% Solids	Reservoir Weight, lb	Assoc. Water Discharge, gal	Cumm Water Discharge, gal	Coll. Tank Depth, in	plot time	SRD Ponding Height, in	Cumm Soil Loss, lbs	Assoc. Solids Loss, lbs	Soil Retention Effectiveness, %	Water Retention Effectiveness, %
Upstream													0		0		0			
B0	0	729	387.13	171.04	156.32	14723	59.77	0.25	58893	6.38%	5000	94.1	94.1		5.0		52.7	52.7		
B5	5	863	394.56	171.57	156.81	14760	66.18	0.25	59039	6.21%	4162	86.6	180.7		10.0		100.3	47.5		
B10	10	875	389.85	171.49	157.20	14290	61.16	0.25	57161	6.14%	3392	106.7	287.4		15.0		158.2	57.9		
B15	15	948	387.97	172.65	158.74	13911	56.58	0.25	55644	6.07%	2444	87.7	375.1		20.0		204.9	46.7		
B20	20	875	384.99	168.92	155.27	13654	60.80	0.25	54617	5.94%	1666	89.9	465.0		25.0		251.1	46.2		
B25	25	1035	381.66	170.326	157.65	12675	53.68	0.25	50701	5.66%	870	98.4	563.4		30.0		300.0	49.0		
B30	30	868	386.20	168.123	155.19	12936	62.89	0.25	51742	5.60%	0	-	-		-		-	-		
Water Added To Mixer (lbs): 4700				Soil Added To Mixer (lbs): 300				AVGS:	55400	6.00%	TOTALS:	563.4						300.0		
Downstream													0		0		0			
A0	0	648	387.63	161.73	156.83	4904	69.07	0.25	19615	2.12%	0	91.4	91.4	0.0	5	0.0	8.7	8.7		
A5	5	702	365.25	157.60	157.34	264	50.31	0.25	1058	0.13%	771	70.6	162.0	39.3	10	22.0	9.3	0.6		
A10	10	558	365.50	157.50	157.31	183	50.69	0.25	733	0.09%	1361	104.1	266.1	69.3	15	38.0	10.2	0.9		
A15	15	682	379.62	156.55	156.27	274	66.80	0.25	1098	0.12%	2230	81.1	347.2	113.5	20	51.0	11.4	1.1		
A20	20	849	374.05	157.47	157.01	463	59.58	0.25	1850	0.21%	2908	91.6	438.9	148.0	25	58.0	13.2	1.8		
A25	25	650	384.32	157.88	157.29	591	69.14	0.25	2364	0.26%	3674	110.5	549.4	187.0	30	63.0	14.9	1.7		
A30	30	579	381.56	157.28	157.04	239	67.24	0.25	956	0.11%	4598	2.4	551.7	234.0	30	45.0	14.9	0.0	**95.04%**	**2.07%**
A35	35	391	376.45	157.51	157.48	37	61.46	0.25	148	0.02%	4618	-	-	-	-	-	-	-		
A45	45																			
A60	60																			
A75	75																			
A90	90																			
									3478	0.38%	4618	551.7						14.9		
									(avg)	(avg)	(total)	(total)						(approx.)		

Soil Collected (lbs): n/a