MAPP-LSH 2019-004

Toe-of-Slope Sediment Retention Device Testing (via ASTM D7351) of New Pig Energy's Trenchless Silt Fence

TRI-MAPP Report

Issued December 2019

Final Report

Submitted to:

New Pig Energy
201 Jefferson Avenue
Tyrone, PA 16686
(814) 686-2307

Attn: Matt Huff
E-mail: mhuff@newpigenergy.com

Submitted by:

TRI Environmental, Inc.
9306 Bee Cave Rd.
Austin, TX 78733

Prepared by:

C. Joel Sprague, P.E.
Technical Director – TRI South Carolina
(864) 346-3107
jsprague@tri-env.com

Date Submitted:

December 20, 2019

Toe-of-Slope Sediment Retention Device Testing (via ASTM D7351) of New Pig Energy's Trenchless Silt Fence

TRI-MAPP Report

Issued December 2019

December 20, 2019

Mr. Matt Huff
New Pig Energy
201 Jefferson Avenue
Tyrone, PA 16686

E-mail: mhuff@newpigenergy.com

REPORT: Toe-of-Slope Sediment Retention Device (SRD) Testing of Trenchless Silt Fence

The large-scale testing reported herein was performed in general accordance with ASTM D7351 using a sandy loam sediment-laden flow representative of the 30-minute peak flow associated with a 24-hour, 4-inch rainfall on a 100-ft long bare soil slope. The tested SRD was installed at the toe-of-slope in accordance with the manufacturer's recommendations and exposed to the simulated runoff.

The testing established the following performance characteristics for the tested material:

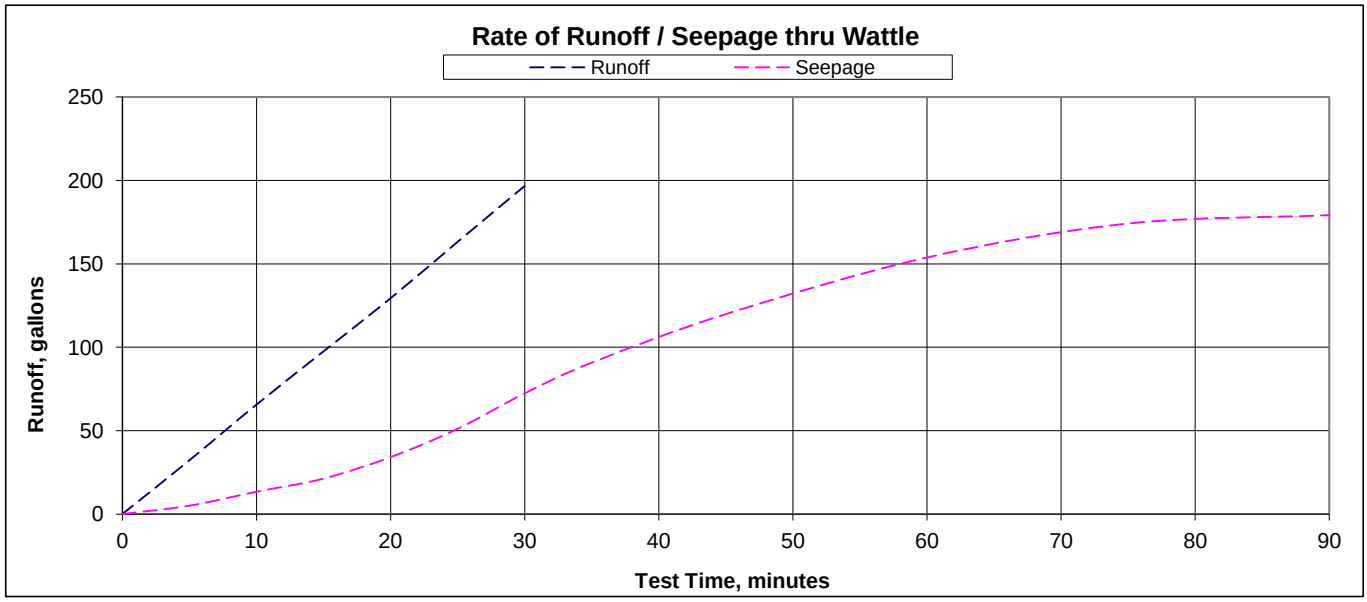
Soil Retention Effectiveness: 94.26%
Seepage Effectiveness: 91.07%

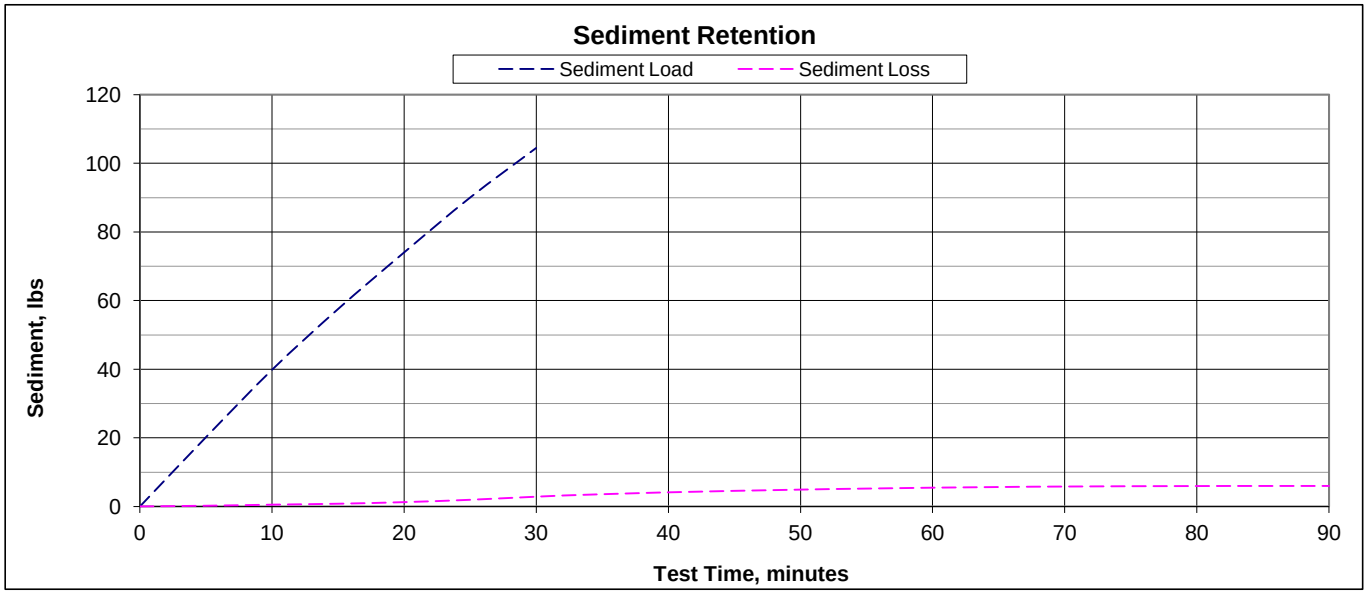
C. Joel Sprague, P.E.
Technical Director
TRI-South Carolina

James E. (Jay) Sprague, CPESC
Laboratory Director
TRI-South Carolina

Project: ASTM D 7351
Client / Listing # / Product: New Pig / Trenchless Silt Fence
Test Date: 12/12/2019
Test Setup: Toe-of-Slope Installation per Manufacturer Recommendation
Duration: 90 minutes
Water / Soil Input: 1640 lbs water 105 lbs soil
Sediment Concentration: Loam @ 6.0%

Soil Retention Effectiveness: 94.26%
Water Retention Effectiveness: 8.93%
Seepage Effectiveness: 91.07%



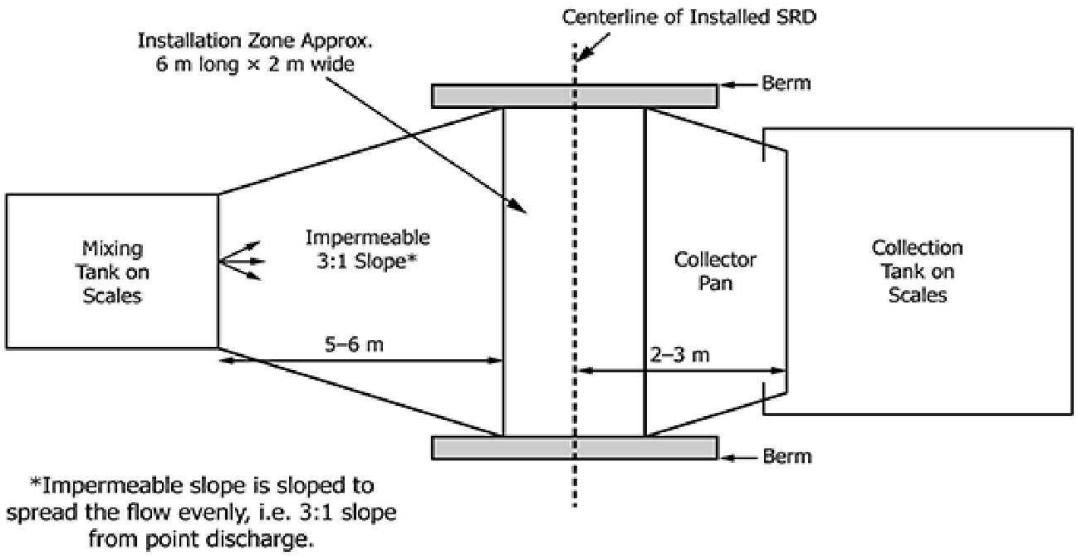


The testing is based upon accepted industry practice as well as the test method listed. Test results reported herein do not apply to samples other than those tested. TRI neither accepts responsibility for nor makes claim as to the final use and purpose

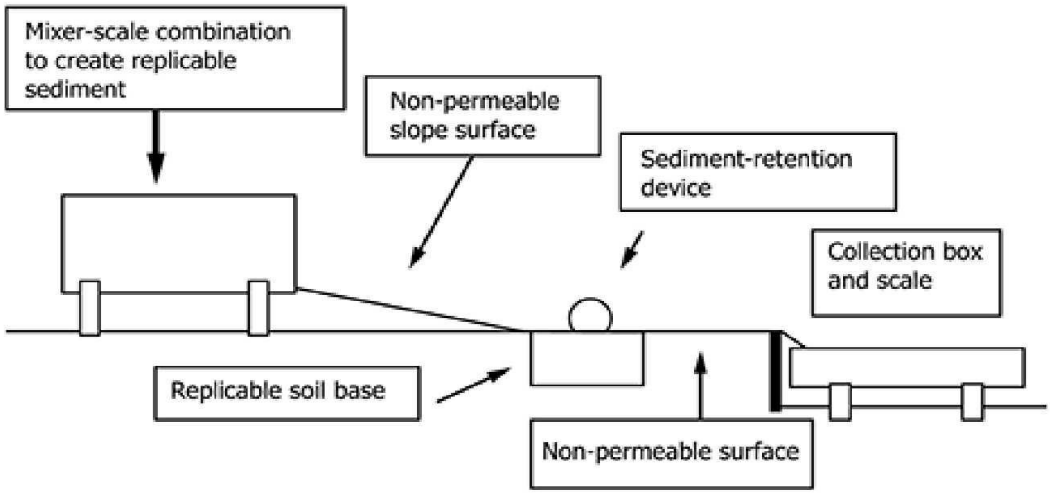
CJS 12/20/19
Quality Review / Date

Testing Overview

The large-scale testing reported herein was performed in general accordance with ASTM D7351. Schematics of the D7351 setup are shown below. For this testing, a simulated toe-of-slope installation 7-ft wide was used. The SRD was installed in the middle of the installation zone according to manufacturer recommendations and exposed to simulated runoff. Sediment-laden water was mixed and discharged onto the 3:1 slope and allowed to run to and seep through the installed SRD. The weight of sediment-laden flow was measured in both the mixing and collection tanks during the test. Additionally, grab samples of the seepage were taken every 5 minutes. 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.



D7351 Schematic (Plan)



D7351 Schematic (Profile)

SRD "Benchmark" Testing

Published literature was reviewed to establish "benchmark" properties of the product tested. Relevant properties are presented in Table 1.

Table 1. "Benchmark" Product Properties

Property	Units	MARV
Main Outer Layer	Style	Beltech 940
Grab Tensile Strength (ASTM D4632) MD x CD	lbs	125 x 101
Flow Rate (ASTM D4491)	gpm/ft2	4
AOS (ASTM D4751)	mm	0.6
UV Resistance - 500 hrs (ASTM D4355)	% retained	80
12" Stabilizer Panel Inside	Style	Beltech 1935
Grab Tensile Strength (ASTM D4632) MD x CD	lbs	140 x 130
Flow Rate (ASTM D4491)	gpm/ft2	10
AOS (ASTM D4751)	mm	0.6
UV Resistance - 500 hrs (ASTM D4355)	% retained	70

Test Setup

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

• A mixing tank with an internal paddle 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 discharged from the mixing tank to an impermeable slope located between the mixing and the SRD installation zone. The installation zone is about 4 feet by the width of the slope and is comprised of prepared soil subgrade to allow full-scale installation of the SRD. The discharged sediment-laden water is allowed to run up to and seep through, over, and/or under (but not around the ends of) an SRD installed along the toe of the slope. The seepage drains into the collection tank.

Test Soil

The test soil used in the test plots had the characteristics shown in Table 2.

Table 2. Test Soil Characteristics

Soil Characteristic	Test Method	Value
% Gravel	ASTM D 422	0
% Sand		65
% Silt		20
% Clay		15
Liquid Limit, %	ASTM D 4318	26
Plasticity Index, %		5
Soil Classification	USDA	Sandy Loam
Soil Classification	ASTM	Silty Clayey Sand (SC-SM)

Preparation of the Installation Zone

The installation zone subgrade soil is placed and compacted. Compaction is verified to be 90% (± 3%) of Standard Proctor density and moisture content is verified to be within ±3% of optimum moisture content using ASTM D2937 (drive cylinder method).

Toe-of-Slope SRD Installation

The SRD is installed in the installation zone in accordance with the installation instructions provided by the manufacturer and as shown in the pictures herein.

Test SRD Installation Details

Mixing Sediment-Laden Runoff

Sediment-laden runoff was created by combining water and soil in the mixing tank and agitating during the test. 1640 lb of water and 105 lb (dry weight) of test soil were combined to create the sediment-laden runoff of 6% (60000 mg/L). These quantities 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 soil slope. The water and soil quantities were adjusted to reflect a 7-ft wide installation.

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 (1745 lb / 30 min = 58 lb / min). For this testing, the discharge flow is introduced to allow it to flow up to and through 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 in 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 (using a Hach 2100 AN Turbidimeter) and to determine percent dry solids content. Drying of collected sediments is accomplished in a forced air oven at 110°C for a minimum of 24 hours or until all moisture is driven off. All weighing of sediments is done with laboratory scales accurate to ± 0.01 grams.

Test Setup and Product Installed

Initial Test Flow and Ponding/Seepage

Continued Seepage Reduces Ponding / Retained Solids after Seepage Ends

APPENDIX - DATA

ASTM 7351 Soil Retention and Water Seepage Effectiveness

Client / Product: New Pig / Trenchless Silt Fence Soil: DDRF Loam - 6% Sediment Concentration

Test Setup: Toe-of-Slope Installation per Manufacturer Recommenda

Date: 12/12/2019 Start Time: 12:15 PM End Time: 1:45 PM

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, mm	plot time	SRD Ponding Height, mm	Cumm Soil Loss, lbs	Assoc. Solids Loss, lbs	Soil Retention Effectiveness, %	Water Retention Effectiveness, %
Upstream													0		0		0			
B0	0	9334	380.92	173.23	156.85	16380	50.84	0.25	65520	7.31%	1745	32.2	32.2		5.0		20.2	20.2		
B5	5	7549	380.41	171.75	156.84	14910	51.82	0.25	59640	6.67%	1456	33.4	65.6		10.0		39.8	19.6		
B10	10	7178	375.94	170.69	156.38	14310	48.87	0.25	57240	6.52%	1158	31.9	97.5		15.0		57.6	17.7		
B15	15	7339	376.90	170.02	156.91	13110	49.97	0.25	52440	5.96%	874	31.8	129.3		20.0		74.1	16.5		
B20	20	7539	374.18	169.17	156.69	12480	48.32	0.25	49920	5.74%	592	33.8	163.1		25.0		90.1	16.0		
B25	25	9999	380.49	168.08	156.89	11190	55.52	0.25	44760	5.00%	294	33.5	196.7		30.0		104.5	14.5		
B30	30	7166	380.67	167.68	156.88	10800	56.11	0.25	43200	4.83%	0	-	-		-		-	-		
Water Added To Mixer (lbs): 1640				Soil Added To Mixer (lbs): 105				AVGS:	53246	6.00%	TOTALS:	196.6						104.5		
Downstream													0		0		0			
A0	0	9999	-	-	-	-	-	-	-	0.48%	0	5.0	5.0	0.0	5	0.0	0.2	0.2		
A5	5	9999	384.41	158.14	157.05	1090	69.22	0.25	4360	0.48%	42	8.4	13.4	0.0	10	108.0	0.5	0.3		
A10	10	9999	380.90	158.29	157.33	960	65.28	0.25	3840	0.43%	112	7.9	21.3	11.0	15	163.0	0.8	0.3		
A15	15	9999	388.88	157.27	156.33	940	75.28	0.25	3760	0.40%	178	12.9	34.1	17.0	20	203.0	1.3	0.5		
A20	20	9999	388.31	158.10	157.03	1070	73.18	0.25	4280	0.46%	286	16.9	51.1	24.0	25	230.0	2.0	0.7		
A25	25	9999	368.01	158.05	156.97	1080	52.99	0.25	4320	0.51%	428	21.2	72.3	33.0	30	256.0	2.9	0.9		
A30	30	9999	372.04	158.16	157.06	1100	56.82	0.25	4400	0.51%	606	18.4	90.7	42.0	35	272.0	3.6	0.7	**94.26%**	**8.93%**
A35	35	9999	381.06	158.39	157.41	980	65.26	0.25	3920	0.44%	760	29.1	119.8	49.0	45	247.0	4.6	1.0		
A45	45	9999	373.82	157.70	156.90	800	59.22	0.25	3200	0.37%	1004	33.9	153.7	61.0	60	200.0	5.5	0.9		
A60	60	9999	379.33	157.58	156.93	650	64.82	0.25	2600	0.29%	1288	20.3	174.1	76.0	75	136.0	6.0	0.4		
A75	75	6767	386.29	157.62	157.13	490	71.54	0.25	1960	0.21%	1458	5.0	179.1	83.0	90	78.0	6.0	0.1		
A90	90	5198	369.57	157.88	157.52	360	54.17	0.25	1440	0.17%	1500	-	-	85.0	-	53.0	-	-		
									3462	0.40%	1500	179.1						6.0		
									(avg)	(avg)	(total)	(total)						(approx.)		

Soil Collected (lbs): **n/a**