

**EXHIBIT 2: Optional Online Installation Re-entrainment/scour testing
of the Terre Kleen18 Hydrodynamic Separator Stormwater Treatment unit per NJDEP
Testing Protocol dated: August 25, 2009, as amended December 15, 2009 by Alden
Research Laboratory dated February 7, 2011.**

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**OPTIONAL ONLINE INSTALLATION
RE-ENTRAINMENT/SCOUR TESTING
OF THE TERRE KLEENTM TK18 HYDRODYNAMIC SEPARATOR
STORMWATER TREATMENT UNIT
PER NJDEP TESTING PROTOCOL OF DECEMBER 15, 2009**

FINAL REPORT

By

James T. Mailloux

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Submitted to

TERRE HILL STORMWATER SYSTEMS

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1.0 INTRODUCTION

Under a contract from Terre Hill Stormwater Systems, Corporation, (Terre Hill), optional re-entrainment verification testing on a 6-ft x 6.5-ft Terre Kleen™ TK18 Hydrodynamic Separator (TK18) was conducted at Alden Research Laboratory, Inc. (Alden), Holden, Massachusetts.

The testing was conducted in accordance with “Section F, Optional Testing for On-Line Installation” of the “Protocol for Manufactured Hydrodynamic Separation Devices for Total Suspended Solids Based on Laboratory Analysis, Dated August 5, 2009, Revised December 15, 2009”, as set forth by the New Jersey Corporation for Advanced Technology (NJCAT) and the New Jersey Department of Environmental Protection (NJDEP), as described in Appendix A.

Testing was conducted in two phases. Phase 1 testing measured the retention of particles in the sediment bed to verify the Maximum Treatment Flow Rate (MTFR). Phase 2 testing was conducted to verify the 10 mg/L effluent concentration differential limit of suspended particles.

The TK18 is a rectangular separating device consisting of an 18-inch diameter influent pipe discharging into a 6.5-ft long x 2-ft wide primary gravel chamber, a secondary settling/grit chamber, an internal flow-through duct, eighteen (18) inclined Lamella plates, an overflow weir and an outlet shelf chamber. The 18-inch influent pipe has an invert located 75 inches above

the wetted floor. The outlet pipe is 24 inches in diameter, with an invert of approximately 72.5 inches and contains a 3-inch rounding at the entrance. The inlet and outlet pipes are oriented with 3% slopes and the centerlines of both pipes are located 2 feet from the left wall (looking downstream).

The test unit supplied by Terre Hill included five (5) 12-inch viewing windows, located approximately 30 inches above the floor, to facilitate observations and documentation of sediment movement. Figure 1 shows a layout drawing of the TK18 test unit and Figure 2 shows a photograph of the unit installed in Alden's test facility.

2.0 TEST FACILITY DESCRIPTION

Figure 3 shows the closed test loop, located in Alden's laboratory/test facility, which was used to test the TK18 Treatment Unit. Water was supplied to the unit with the use of a 20HP and 50HP pump (flow capacity of approximately 10cfs) which draw water from a 50,000-gallon laboratory sump.

A 6" and 12" x 8" calibrated flow meter, connected to a 16" diameter manifold carried the test flow to a section of 16" piping, a 90-degree elbow and minimum of 15' of 18" influent pipe. Water then passed through the test unit and 24" diameter effluent pipe to return to the laboratory sump.

To collect the effluent sediment concentration samples, an isokinetic sampling-tube array was located within the 24" effluent piping, approximately 3' downstream of the test unit. The array consisted of three (3) vertically adjustable sampling tubes, each containing a flow-control shut-off valve.

Photographs of the testing instrumentation are shown in Figure 4 through Figure 6.

3.0 INSTRUMENTATION AND MEASURING TECHNIQUES

3.1 Flow

The inflow to the test unit was measured using a calibrated 6" orifice and 12" x 8" venturi flow meter in unison. Each meter was fabricated per ASME guidelines and calibrated in Alden's Calibration Department prior to the start of testing. Flows were set with butterfly valves and the differential head from each meter was measured using a Rosemount_ 0 to 250-inch Differential Pressure (DP) cell, also calibrated at Alden prior to testing.

The test flows were averaged and recorded approximately every 6 seconds throughout the duration of the test using a computerized data acquisition (DA) program. The accuracy of the flow measurement is estimated at $\pm 2\%$.

Photographs of the pumps and flow meters are shown in Figure 5 and Figure 6.

3.2 Sample Collection

As described in Section 2.0, isokinetic sampling tubes were located within the effluent piping to collect the sediment concentration samples. The tubes ranged from 0.50 to 1.0 inches in diameter, depending on the location within the pipe. Each tube was vertically adjusted and calibrated prior to testing, to match the velocities at the test flow. A photograph of a typical sampling array is shown in Figure 4.

3.3 Sample Concentration Analyses

Sample concentrations can be analyzed using one of two analytical methods: Suspended Solids Concentration (SSC), or Total Suspended Solids (TSS). SSC methodology utilizes the entire sample in the analysis, as opposed to the TSS method, which requires the sample to be split prior to processing. Two sets of samples were collected to allow both analytical methods to be used for the present study. The SSC samples were processed at Alden as described below and the TSS samples were processed at Alpha Analytical Labs per Standard Methods 2540D.

SSC Analysis:

Collected samples were filtered and analyzed by Alden in accordance with Method B, as described in ASTM Designation: D 3977-97 (Re-approved 2002), "Standard Test Methods for Determining Sediment Concentration in Water Samples".

The required silica sand used in the sediment testing did not result in any dissolved solids in the samples and therefore, simplified the ASTM testing methods for determining sediment concentration.

Samples were collected in graduated 2-Liter beakers which were cleaned, dried and weighed to the nearest 0.1-gram, using an Ohaus_ 4000g x 0.1g digital scale, model SCD-010, prior to sampling.

Collected samples were also weighed to the nearest 0.1-gram using the Ohaus_ digital scale. Each collected sample was filtered through a pre-rinsed Whatman_ 934-AH, 47-mm, 1.5-micron, glass microfiber filter paper, using a laboratory vacuum-filtering system.

Prior to processing, each filter was rinsed and placed in a designated dish and dried in an Oakton Stable Temp gravity convection oven, model 05015-59, at 225 degrees F for a minimum of 2 hours.

Each dried filter/dish set was then weighed to the nearest 0.0001-gram, using an AND_ analytical balance, model ER-182A. Once filtered, each sample and dish was dried at a temperature between 175 and 220 degrees F (below boiling) for 20 to 30 minutes until visually dry. The oven temperature was increased to 225 degrees F and the samples were dried for an additional 2-½ to 3 hours.

The dry samples and dishes were then weighed to the nearest 0.0001-gram, using the AND_ balance. Net sediment weight (mg) was determined by subtracting the dried filter weight from the dried sample weight and multiplying the result by 1,000. The net sample volume, in liters, was determined by subtracting the beaker and net sediment weight from the overall sample weight and dividing by 1,000. Each sample sediment concentration, in mg/liter, was determined by dividing the net sediment weight by the net sample volume.

3.4 Test Sediment and Particle Size Distribution

In order to satisfy the particle size distribution set forth by the NJDEP testing protocol, Alden developed a sediment mix composed of NJ#00N and F110 silica sand, available from US Silica. Figure 7 shows the theoretical PSD of each grade of sand, as well as the mix ratios and resulting percentages.

Table 1 shows the PSD required by NJDEP, as well as the PSD provided by US Silica and actual PSD as determined by conducting a sieve analysis on the test mix. A graphical presentation of the data is shown on Figure 8.

4.0 TEST PROCEDURE

The TK18 unit was tested in accordance with "Section F" of the 2009 NJCAT/NJDEP testing protocol for Manufactured Hydrodynamic Sedimentation Devices (see Appendix A). The

guideline requires at a minimum, documentation showing the net effluent re-entrainment concentration to be less than 10 mg/L. In accordance with the guideline, these tests were conducted with initial sediment loading corresponding to 50% of the unit's capture capacity (8.25" as stated by Terre Hill). Additionally, the test matrix was expanded to include Suspended Sediment Concentration (SSC) analysis.

Testing of the TK18 was conducted in two phases, as described below:

4.1 Phase 1 – Determination of Overall Sediment Washout

The sedimentation chamber was pre-loaded with the test sediment to a level corresponding to 50% (15.6 ft³, 8.25") of the unit's capture capacity as claimed by Terre Hill. The unit was slowly filled to the invert of the effluent pipe and the system remained idle for a minimum of 2 hours prior to testing.

Testing was conducted by introducing a flow of clean water (no sediment) into the unit at a rate equal to 200% (9.22 cfs) of the MTFR for a period of 15 minutes (maximum duration), under steady-state conditions, while continuously obtaining flow data.

After completion of the minimum run duration, the unit was drained and the sediment bed leveled and measured to determine the overall net loss. If the loss was less than 10%, the testing moved on to Phase 2.

4.2 Phase 2 – Measurement of the net effluent concentrations

After successful completion of Phase 1 testing, the unit was filled with clean water and a steady state flow of 200% (9.22 cfs) of the MTFR was run through the unit for a period of 30 minutes, during which time background and effluent samples were collected at 5-minute intervals. Two samples were collected at each interval and location for SSC and TSS SM2540 analysis. An additional background sample was collected at the end of the testing for particle size distribution (PSD) analysis.

5.0 RESULTS

5.1 Phase 1

The unit was preloaded with the 50-1000 micron PSD sediment to a volume equal to 50% of the chamber capacity (8.25"). The unit was operated for a minimum of 15 minutes at a target steady state flow of 9.22 cfs (4138 gpm). The average flow recorded through the test duration was 4,096 gpm (-1%), with a Standard Deviation (SD) of 14.5 and Coefficient of Variance (COV) of 0.004. The unit was drained at the completion of the run cycle and sediment bed leveled and measured. The differential of the sediment bed was found to be less than 5%, well within the 10% requirement.

5.2 Phase 2

The unit was operated for a minimum of 30 minutes at a target steady state flow of 9.22 cfs (4138 gpm). The average flow recorded through the test duration was 4,131 gpm (-0.2%), with a Standard Deviation (SD) of 14.9 and Coefficient of Variance (COV) of 0.004. Background and effluent samples were collected every 5 minutes, with the effluent sample collected 40 seconds after the background sample, which is equal to 1 residence time from the location of the background sample to effluent sample).

The TSS analysis for the background and effluent samples resulted in Non-Detected (ND) concentrations, being below the 5 mg/L reporting limit (RL) of the analytical laboratory.

Assuming minimum background and maximum effluent values, the maximum net effluent concentration would be below 5 mg/L.

The SSC analysis resulted in net effluent concentrations ranging from -1.5 mg/L to 4.1 mg/L, with a mean net concentration of 1.2 mg/L. The SSC data summary is shown in Table 2.

The PSD of the background ranged from 22 µm to 37 µm.

6.0 SUMMARY

Re-entrainment testing resulted in acceptable re-suspension of the 50-1000 µm sediment bed at 50% loading capacity, with differential effluent concentrations ranging from -1.5 to 4.1 mg/L for a 200% flow of 4138 gpm (9.22 cfs).

TABLES

Table 1
Test Sediment Particle Size Distribution

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Test Sediment Particle Size Distribution

Range microns	NJDEP			US Silica			Alden Sieve		
	Target %	Microns	% Finer	Sieve	Microns	% Finer	Sieve	Microns	% Finer
< 50	0%	50	0%	1%	50	1%	1%	50	1%
50-100	25%	100	25%	26%	100	27%	22%	100	23%
100-250	55%	250	80%	53%	250	80%	56%	250	78%
250-500	10%	500	90%	11%	500	91%	5%	500	84%
500-1000	10%	1000	100%	9%	1000	100%	16%	1000	100%

Table 2
SSC Sample Analyses

Table 2
SSC Sample Analyses

Sample	Background mg/L	Effluent mg/L	EFF - BG mg/L
1	8.1	12.2	4.1
2	7.5	10.3	2.8
3	10.8	9.8	-1.0
4	6.3	8.1	1.8
5	6.6	7.8	1.2
6	10.3	8.8	-1.5
MEAN	8.3	9.5	1.2

FIGURES

Figure 1 Terre Hill TK18 Test Unit

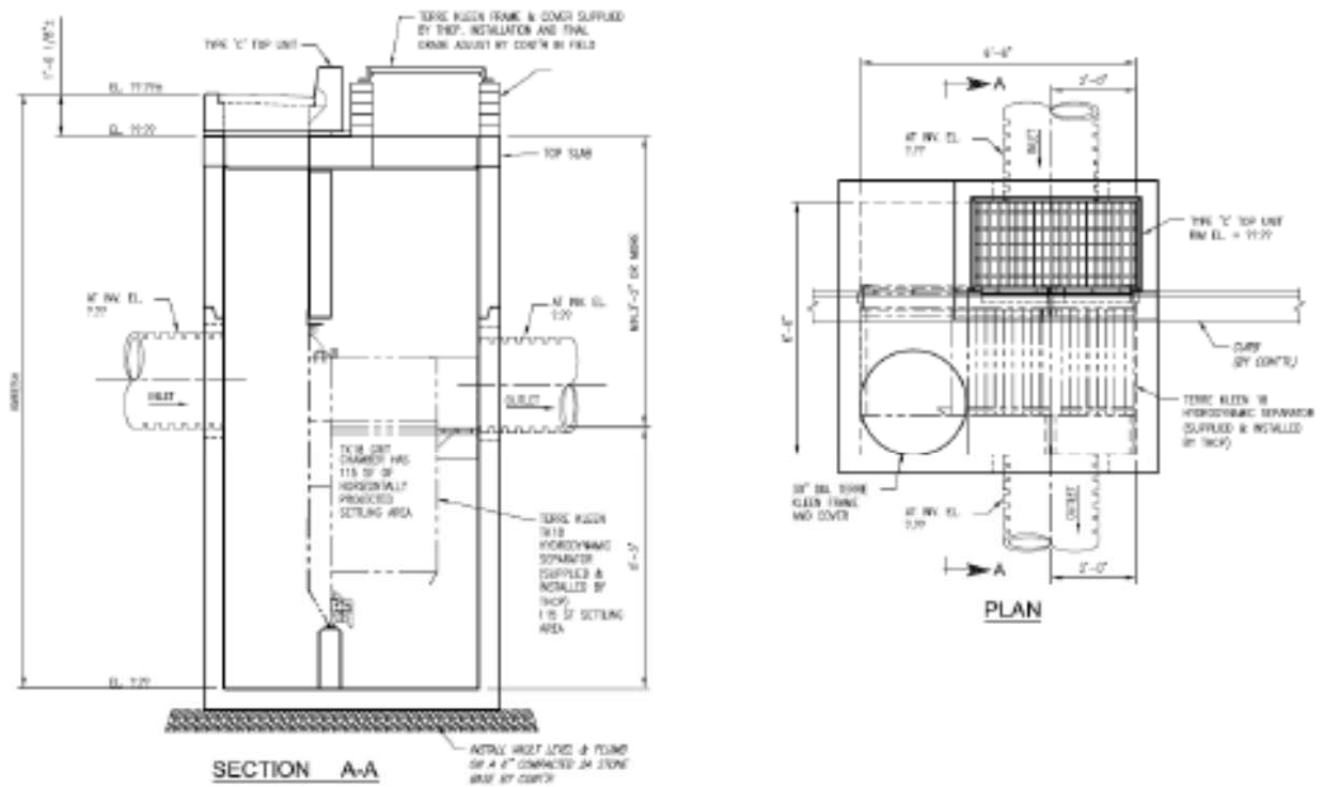


Figure 1 Terre Hill TK18 Test Unit

Figure 2 TK18 in Alden's Test-Loop



Figure 2 TK18 in Alden's Test-Loop

Figure 3: Alden's Stormwater Laboratory Flow Loop

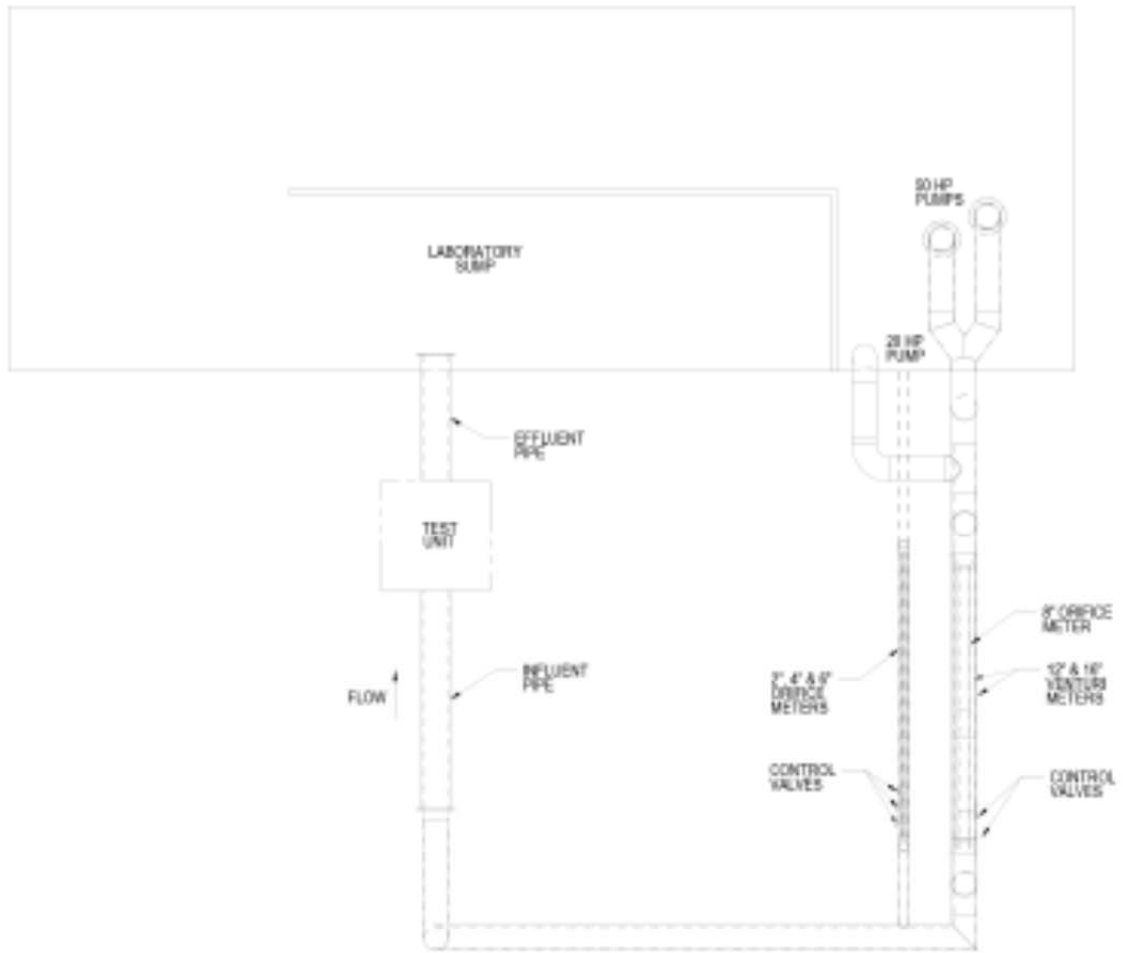


Figure 3: Alden's Stormwater Laboratory Flow Loop

Figure 4: Typical Sampling Tube Array



Figure 4: Typical Sampling Tube Array

Figure 5: Test Loop Flow Meters

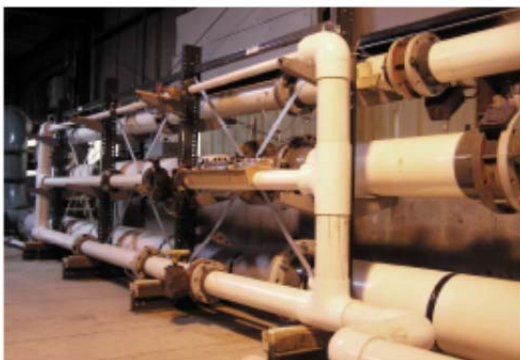


Figure 5: Test Loop Flow Meters

Figure 6: 50 HP and 20 HP Supply Pumps



Figure 6: 50 HP and 20 HP Supply Pumps

Figure 7: Test sediment mix using commercially available US Silica sand

Range	Target NJCAT	Mesh	Microns	NJ # 00N 20%	F-110 80%	%	%	Total 100.0%
500-1000	10%	30	600	45		9.0		9.0
250-500	10%	40	425	52		10.4		11.0
		50	300	3		0.6		
100-250	55%	70	212		4		3.2	52.8
		100	150		18		14.4	
		120	125					
		140	106		44		35.2	
50-100	25%	170	88					26.4
		200	75		25		20.0	
		270	53		8		6.4	
< 50					1		0.8	0.8
		Total		100	100			100

Figure 7: Test sediment mix using commercially available US Silica sand

Figure 8: Test sediment mix PSD

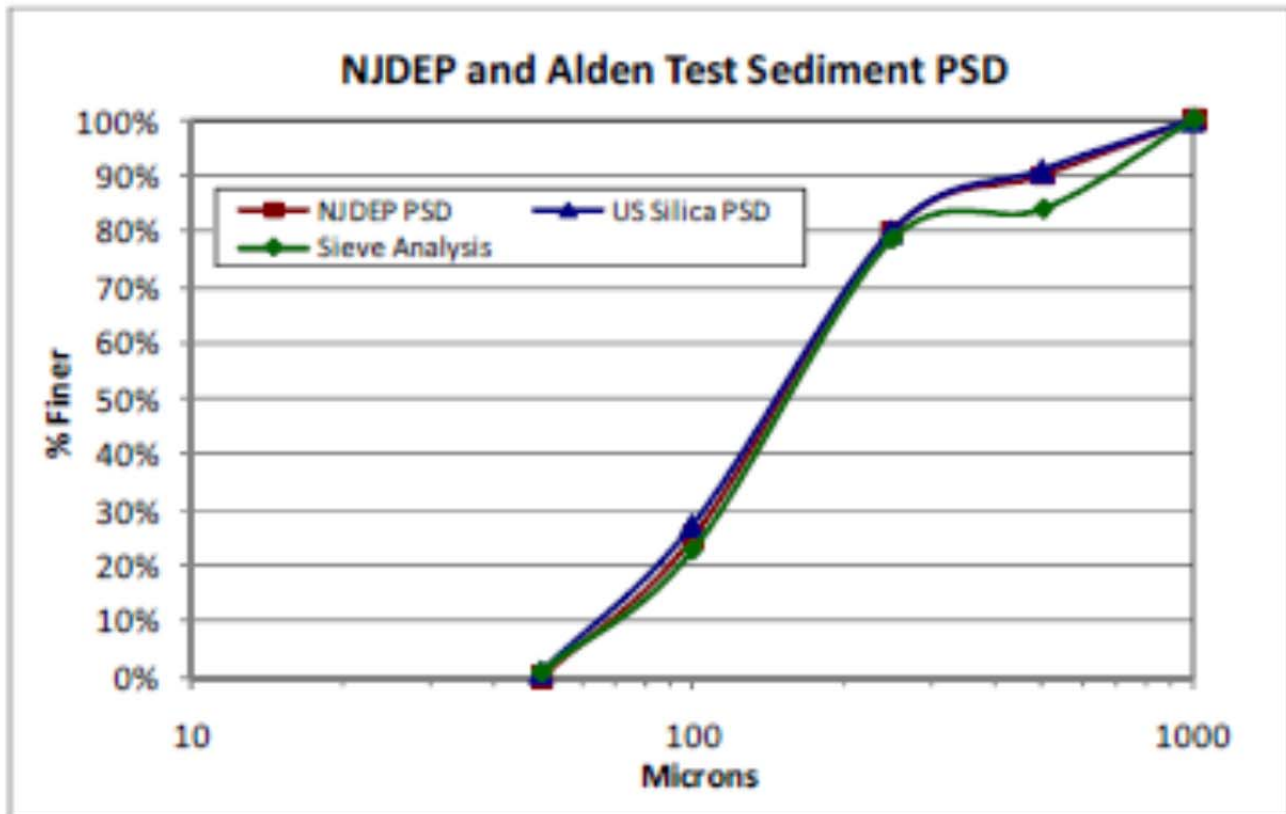


Figure 8: Test sediment mix PSD

APPENDIX A: NJCAT/NJDEP OPTIONAL ONLINE RE-SUSPENSION LABORATORY TESTING PROTOCOL

F. Optional Testing for On-Line Installation

Purpose

Currently, all approved MTD's approved by NJDEP must be located offline from a storm sewer or other conveyance system so that the MTD cannot receive runoff rates in excess of the NJDEP's Stormwater Quality Design (NJWQD) rates as defined in N.J.A.C. 7:8-5.5. However, testing may be conducted at the manufacturer's option to determine whether the MTD may be located online in a storm sewer or other conveyance system that conveys runoff rates greater than the peak runoff rate from the

NJWQD storm. To qualify for such testing, however, the MTD must also be able to internally convey flow rates equal to or greater than the capacity of the upstream storm sewer or other conveyance system in which the MTD is located without overflow, bypassing, or surcharging or the use of an external influent bypass system.

Procedure

First, the sedimentation chamber of the MTD shall be preloaded to 50% of the manufacturer's recommended maximum sediment storage volume with material consistent with the particle distribution for particles 50 microns and greater in the New Jersey Particle Size Distribution (NJPSD) described in Table 1. In doing so, a false bottom may first be placed in the sedimentation chamber at a level below the 50% maximum sediment storage volume level and then covered with sufficient material as specified above to achieve 50% of the maximum sediment storage volume. In doing so, however, the level of the false bottom must be at least 12 inches below the 50% maximum sediment storage volume level or at the 40% maximum sediment storage level, whichever level is lower. The MTD shall also be filled with clean water to its normal, dry weather opening depth prior to conducting the test.

Next, a constant flow of clear water shall be run through the MTD at a rate equal to 200 percent of the MTD's selected MTPR for either 15 minutes or until a volume of water equal to five times the MTD's maximum storage volume has passed through the MTD, whichever is greater, after the influent and effluent flow rates have equalized. As noted above, the MTD must be able to internally convey this flow rate without upstream overflow, bypass, or surcharging or the use of an external influent bypass system.

Upon completion of this portion of the scour test and prior to proceeding to the next portion, the volume of sediment remaining in the chamber shall be determined. If the volume of preloaded sediment has been reduced by more than 10% (i.e., the remaining sediment volume is less than 90% of the preloaded sediment storage volume), then the applicant has the option to lower the MTPR and rerun the test from the beginning or to limit the applicability of the verification, certification and/or acknowledgment to off-line installations only. It should be noted that no additional material needs to be placed in the MTD's sedimentation chamber before proceeding with the next portion of the scour test if the volume of preloaded sediment remaining after the first portion of the test has been reduced by less than 10% (i.e., the remaining sediment volume is more than 90% of the preloaded sediment storage volume).

Following the successful completion of the testing described above, a constant flow of clear water shall once again be run through the MTD at a rate equal to 200 percent of the MTD's selected MTPR for either 30 minutes or until a volume of water equal to ten times the MTD's maximum storage volume has passed through the MTD, whichever is greater, after the influent and effluent flow rates have equalized. During this time period, a minimum of six samples of the effluent from the MTD shall be taken at equal time increments. All samples shall be tested for TSS in accordance with Standard Method APHA 2540D. If the average TSS concentration of all effluent samples is no more than 10 mg/l higher than the background TSS concentration of the clear water influent, then the MTD may be located online.

It should be noted that all TSS effluent and background sample data and analytic results must be provided as part of the submittal for interim certification.