



Designation: C1746/C1746M – 24

Standard Test Method for Measurement of Suspended Sediment Removal Efficiency of Hydrodynamic Stormwater Separators and Underground Settling Devices¹

This standard is issued under the fixed designation C1746/C1746M; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This test method concerns measurement of the efficiency of hydrodynamic separators and underground settling devices in removing suspended sediment from simulated stormwater runoff under conditions defined herein. This test method is intended to be applied in a laboratory setting to provide a common basis for comparing system performance. This test method is not intended for use in determining field removal efficiency.

1.2 This test method is intended to provide accurate, repeatable data for any stakeholder interested in evaluating HDS performance. Meeting the requirements of the test does not necessarily mean any given Authority Having Jurisdiction (AHJ) will certify the results. AHJs should be consulted prior to undertaking testing since some AHJs may require certain modifications, exclusions of certain methods, or additional criteria be met for HDS certification. This test method does not certify HDS devices; it is up to the AHJ to certify results from this test method and to certify that a given HDS's performance will meet their specific performance goals.

1.3 Units tested shall be of a size commonly manufactured and available for purchase. In order to facilitate testing it is permissible to substitute alternate materials for the housing and structural components of the test units if operational components are at full size, with identical dimensions, configurations and materials specified for commercial use. Scale models are not permissible. This test method is not intended to address product scaling.

1.4 This test method is not for measuring the removal efficiency of filters or the scouring potential of hydrodynamic separators and underground settling devices.

1.5 This test method addresses gravity flow operation only. It does not address performance of units operating under pressurized or surcharge conditions.

¹ This test method is under the jurisdiction of ASTM Committee E64 on Stormwater Control Measures and is the direct responsibility of Subcommittee E64.01 on Lab Evaluation.

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1.6 The values stated in inch-pound units are to be regarded as standard, except for methods to establish and report sediment concentration and particle size. It is convention to exclusively describe sediment concentration in mg/L and particle size in mm or μm , both of which are SI units. The SI units given in parentheses are mathematical conversions, which are provided for information purposes only and are not considered standard. Reporting of test results in units other than inch-pound units shall not be regarded as non-conformance with this test method.

1.7 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.8 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*²

C1893 Practice for Laboratory Performance Verification of Hydrodynamic Separators for the Treatment of Stormwater Runoff

D2216 Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

D3977 Test Methods for Determining Sediment Concentration in Water Samples

D4959 Test Method for Determination of Water Content of Soil By Direct Heating

D6913/D6913M Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis

D7573 Test Method for Total Carbon and Organic Carbon in

² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at www.astm.org/contact. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

Water by High Temperature Catalytic Combustion and Infrared Detection

D7928 Test Method for Particle-Size Distribution (Gravimetric) of Fine-Grained Soils Using the Sedimentation (Hydrometer) Analysis

E3317 Specification for Silica-Based Sediments for the Evaluation of Stormwater Treatment Devices

E3318 Terminology for Standards Relating to Stormwater Control Measures

3. Terminology

3.1 Definitions:

3.1.1 For definitions of common technical terms used in this standard, refer to Terminology E3318.

4. Summary of Test Method

4.1 This test method describes procedures and equipment required to measure the suspended sediment removal efficiency of hydrodynamic separators and underground settling devices used for treating stormwater runoff.

4.2 The test method allows the suspended sediment removal efficiency to be determined based on a mass recovery technique.

NOTE 1—Acceptance of test results attained according to this specification may be subject to specific requirements set by a Quality Assurance Project Plan, a specific verification protocol, or Authority Having Jurisdiction (AHJ). It is advised to review one or all of the above to ensure compliance.

5. Significance and Use

5.1 Each device has unique flow patterns and turbulence characteristics. In addition, each device exhibits a wide range of efficiencies as discharge, particle-size distribution, particle density, and flow viscosity (that is, water temperature) change. In order to properly compare performance, the inherent factors, flow patterns and turbulence, must be isolated from the environmental factors, particle and water properties. The testing procedures described in Sections 7 and 8 provide a method of measuring the removal efficiency of these devices under a given flow condition, particle-size distribution, particle density, and fluid viscosity. Therefore, the results of testing represent performance only under this specific set of conditions.

5.2 Since this test is for only a single size unit it does not generate sufficient data for prediction of scaling unless the test is repeated for multiple unit sizes or scaling is in accordance with Practice C1893.

6. Apparatus

6.1 The experimental setup includes a water supply, piping, fittings, background sampling port, sediment delivery system, false floor within the unit tested, flow meter, temperature instrumentation, scales/balances, and sample containers.

6.2 Water Supply

6.2.1 Water upstream of the sediment delivery system shall be “clear”. Clear water is defined as water free of test sediment with a background SSC concentration that does not exceed 20.0 mg/L.

6.2.2 “Recirculated” water that passes through the test unit shall not be redirected into the test unit until it is indistinguish-

able from “clear” water. Water may require filtering to make it indistinguishable from “clear” water.

6.2.3 The use of flocculants, surfactants, etc. is not an acceptable means to reduce background SSC levels.

6.2.4 If a non-potable water source is used, VOC testing in accordance with Test Method D7573 shall be conducted and the values shall be reported.

6.3 Piping

6.3.1 Piping shall be a smooth, non-corrugated interior wall pipe with an accepted Manning’s n value of <0.022 or a roughness of $<5\text{mm}$.

6.3.2 The influent and effluent interior pipe diameters shall be the same size and must not exceed 25 % of the inside diameter or inside width (shortest dimension) of the unit being tested.

6.3.3 The influent piping to the test unit shall be straight pipe (without bends), at a pipe slope of 1 %-2 %, and shall be a minimum of (10) pipe diameters in length to ensure stable flow conditions upstream from the test unit.

6.3.4 The maximum length of pipe from the point where sediment is injected to the test unit shall not exceed a distance of 3 ft [0.91 m] upstream of the inlet.

6.3.5 The effluent piping from the test unit shall be straight pipe (without bends), at a pipe slope of 1 %-2 %, and 3 ft [0.91 m] to 5 ft [1.52 m] in length to ensure stable flow conditions at the outlet. The effluent piping shall discharge the water in a free-fall condition.

6.4 Background Sampling Port

6.4.1 The background sampling port shall be at a fixed, pre-determined location on the influent pipe upstream from the sediment delivery system.

6.4.2 The background sampling port shall be placed at a pre-determined location along the centerline of the influent pipe.

6.4.3 The background sampling port shall utilize a pipe saddle clamp that provides a tee with a minimum diameter of $\frac{3}{4}$ in. [19 mm] and a ball valve.

6.4.4 The background sampling port opening shall not extend higher than the invert of the influent pipe.

6.5 Sediment Delivery System

6.5.1 The sediment delivery system must be 3 ft [0.91 m] or less upstream from the test unit and shall inject sediment at the crown of the influent pipe using an auger, vibratory hopper, or other suitable means of sediment addition that provides a consistent, calibrated concentration of solids.

6.5.2 The sediment delivery system must ensure that all solids that leave the system are injected into the influent pipe. Solids remaining in the sediment delivery system will need to be measured and recorded.

6.6 False Floor

6.6.1 A false floor shall be installed to simulate the 50 % sediment capacity depth.

6.6.2 Sediment shall not be added to the false floor prior to the commencement of sediment removal efficiency testing.

6.7 Flow Meter

6.7.1 A flow meter or equivalent device must be located upstream of the tested unit. If a constant flow rate is required