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January 25, 2018

Jim Murphy, Chief
NJDEP
Bureau of Non-Point Pollution Control
Division of Water Quality
Mail Code 401-02B, PO Box 420
Trenton, NJ 08625-0420

Dear Mr. Murphy,

Based on my review, evaluation and assessment of the testing conducted on the Hydroworks HydroStorm (Model HS 4) hydrodynamic separator at the Alden Research Laboratory, Inc. (Alden), Holden, Massachusetts, under the direct supervision of Alden's senior stormwater engineer, James Mailloux, the test protocol requirements contained in the *"New Jersey Laboratory Testing Protocol to Assess Total Suspended Solids Removal by a Hydrodynamic Sedimentation Manufactured Treatment Device (January 25, 2013)"* (NJDEP HDS Protocol) were met or exceeded. Specifically

Test Sediment Feed

The mean PSD of the test sediments comply with the PSD criteria established by the NJDEP HDS protocol. The removal efficiency test sediment PSD analysis was plotted against the NJDEP removal efficiency test PSD specification. The test sediment was shown to be slightly finer than the sediment blend specified by the protocol (<75μ); the test sediment d_{50} was 67 microns. The scour test sediment PSD analysis was plotted against the NJDEP scour test PSD specification and shown to meet the protocol specifications.

Removal Efficiency Testing

In accordance with the NJDEP HDS Protocol, removal efficiency testing was executed on the HydroStorm (HS 4), a 4-ft. diameter commercially available unit, to establish the ability of the HydroStorm to remove the specified test sediment at 25%, 50%, 75%, 100% and 125% of the

target MTFR. The HS 4 demonstrated 50.1% annualized weighted solids removal as defined in the NJDEP HDS Protocol. The flow rates, feed rates and influent concentration all met the NJDEP HDS test protocol's coefficient of variance requirements and the background concentration for all five test runs never exceeded 20 mg/L (maximum of 8.9 mg/L).

Scour Testing

To demonstrate the ability of the HydroStorm to be used as an online treatment device, scour testing was conducted at 228% of the MTFR which exceeds the 200% MTFR required by the NJDEP HDS Protocol. The scour test was conducted with the 50% capacity (6") false floor installed. An additional 4" of the 50-1000-micron test sediment was preloaded on top of the false floor, resulting in the unit being preloaded to the 83% storage capacity of 10".

The average flow rate during the online scour test was 2.01 cfs (903 gpm), which represents 228% of the MTFR (MTFR = 0.88 cfs). Background concentrations were <3.1 mg/L throughout the scour testing, which complies with the 20 mg/L maximum background concentration specified by the test protocol. Unadjusted effluent concentrations ranged from 10.9 mg/L to 30.3 mg/L, with an average concentration of 16.8 mg/L. When adjusted for background concentrations, the average effluent concentration was 14.6 mg/L. These results confirm that the HS 4 did not scour at 200% MTFR and meets the criteria for online use.

Maintenance Frequency

The predicted maintenance frequency for all HydroStorm models is 50 months.

Sincerely,

Richard S. Magee, Sc.D., P.E., BCEE

Table A-1 MTFRs and Sediment Removal Intervals for HydroStorm Models

Model	Diameter (ft)	Maximum Treatment Flow Rate[1] (cfs)	Treatment Area (ft^2)	Hydraulic Loading Rate (gpm/ft^2)	50% Maximum Sediment Storage[3] (ft^3)	Sediment Removal Interval[2] (years)
HS 3	3	0.50	7.1	31.4	3.6	4.2
HS 4	4	0.88	12.6	31.4	6.3	4.2
HS 5	5	1.37	19.6	31.4	9.8	4.2
HS 6	6	1.98	28.3	31.4	14.2	4.2
HS 7	7	2.69	38.5	31.4	19.3	4.2
HS 8	8	3.52	50.3	31.4	25.2	4.2
HS 9	9	4.45	63.6	31.4	31.8	4.2
HS 10	10	5.49	78.5	31.4	39.3	4.2
HS 11	11	6.65	95.0	31.4	47.5	4.2
HS 12	12	7.91	113.0	31.4	56.5	4.2

1. Based on a verified loading rate of 31.4 gpm/ft^2 for test sediment with a mean particle size of 67 µm and an annualized weighted TSS removal of at least 50% using the methodology in the current NJDEP HDS protocol.
2. Sediment Removal Interval (years) = (50% HDS MTD Max Sediment Storage Volume) / (3.366 * MTFR * TSS Removal Efficiency) calculated using equation in Appendix B, Part B of the NJDEP HDS Protocol.
3. 50% Sediment Storage Capacity is equal to manhole area x 6 inches of sediment depth. Each HydroStorm separator has a 12-inch-deep sediment sump.

Table A-2 Standard Dimensions for HydroStorm Models

Model	Diameter (ft)	Maximum Treatment Flow Rate (cfs)	Total Chamber Depth (ft)	Treatment Chamber Depth[1] (ft)	Aspect Ratio[2] (Depth/Diameter)	Sediment Sump Depth (ft)
HS 3	3	0.50	3	2.5	0.83	0.5
HS 4	4	0.88	4	3.5	0.88	0.5
HS 5	5	1.37	4	3.5	0.70	0.5
HS 6	6	1.98	4	3.5	0.58	0.5
HS 7	7	2.69	6	5.5	0.79	0.5
HS 8	8	3.52	7	6.5	0.81	0.5
HS 9	9	4.45	7.5	7	0.78	0.5
HS 10	10	5.49	8	7.5	0.75	0.5
HS 11	11	6.65	9	8.5	0.77	0.5
HS 12	12	7.91	9.5	9	0.75	0.5

1. Treatment chamber depth is defined as the total chamber depth minus ½ the sediment storage depth.
   The aspect ratio is the unit's treatment chamber depth/diameter. The aspect ratio for the tested unit (HS 4) is 0.875. Larger models (>250% MTFR of the unit tested, >2.2 cfs) must be geometrically proportionate to the test unit. A variance of 15% is allowable (0.74 to 1.00).
2. For units <250% MTFR (5 and 6 ft models), the depth must be equal or greater than the depth of the unit treated.