CANADIAN ENVIRONMENTAL TECHNOLOGY VERIFICATION

Enhancing the Credibility of Environmental Technologies

TECHNOLOGY VERIFIED: SDD3 Oil Grit Separator®

Performance Claim(s)

Capture test:

During the sediment capture test, the NEXT Stormwater Solutions' SDD3 OGS device with a false floor set to 50% of the manufacturer's recommended maximum sediment storage depth and a constant influent test sediment concentration of 200 mg/L, removed 73, 67, 61, 53, 50, 52, 49 and 47 percent of influent sediment by mass at surface loading rates of 40, 80, 200, 400, 600, 1000, 1400 and 1800 L/min/m2, respectively.

Scour test:

During the scour test, the NEXT Stormwater Solutions' SDD3 OGS device with preloaded test sediment reaching 50% of the manufacturer's recommended maximum sediment storage depth generated corrected effluent concentrations of 0, 9.3, 4.7, 24.3, and 10.5 during a continuous 30 minute test run with 5 minute duration surface loading rates of 200, 800, 1400, 2000, and 2600 L/min/m2, respectively.

Verification is based on independent performance testing completed in accordance with the *Procedure for Laboratory Testing of Oil-Grit Separators (Version 3.0, June 2014).*

VERIFIED PERFORMANCE*:
OCTOBER 2016

John D. Wiebe, PhD
Executive Chairman
GLOBE PERFORMANCE SOLUTIONS

License Number: ETV 2016-04

Issued to: Next Solutions (8091200 CANADA INC.)

Expiration Date: OCTOBER 31, 2019

Canada

* This verification conforms to the Canadian ETV Program's General Verification Protocol and the ISO/FDIS 14034:2015(E). Please refer to Technology Fact Sheet for additional information on the verification of this performance claim.

CANADIAN ETV VERIFIED

SDD3 Oil Grit Separator®

Technology Fact Sheet for NEXT Stormwater Solutions

Technology description and application

The SDD3 (Figure 1) is an Oil-Grit Separator technology that uses both gravitational and centrifugal forces to capture and retain suspended sediments from stormwater runoff. The centrifugal forces are generated by the passive movement of influent stormwater through twin hourglass shaped cones within the technology. Suspended sediments are funneled towards the faster moving water column in the center of the vortex and eventually dropped out of suspension and deposited at the bottom of the unit, returning clean water back up through the exit hatch.

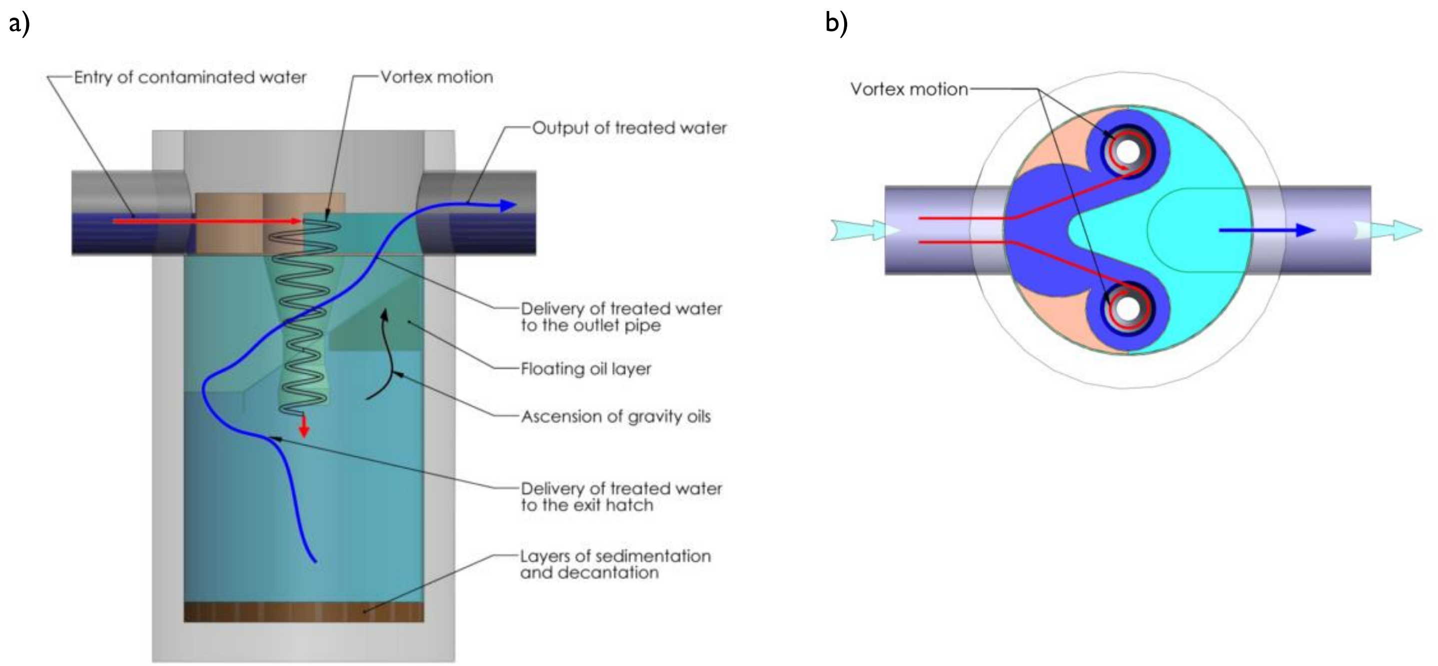

Figure 1. a) Cross sectional and b) Top view flow diagrams of NEXT Stormwater Solutions' SDD3 oil-grit separator technology.

The hour glass shaped cones are large at the top, narrow in the middle to accelerate the hydraulic vortex effect, and wide at the bottom to create a double vortex effect that optimizes particle separation. This design was also intended to reduce scour and re-suspension of previously captured sediment. For very high stormwater flows, excess water will bypass above the centrifuge plate and flow straight into the exit hatch without flowing downward through the cones. Periodic inspections of the unit are recommended once every 6 months and can be done through the unit's top hatch, which also gives access for cleaning out captured sediments using a vacuum truck combined with a water pressure jet.

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Performance conditions

The data and results published in this Technology Fact Sheet were obtained from the testing program conducted on the NEXT Stormwater Solutions SDD3 OGS device, model 900, in accordance with the *Procedure for Laboratory Testing of Oil-Grit Separators* (Version 3.0, June 2014). The Procedure was prepared by the Toronto and Region Conservation Authority (TRCA) for Environment Canada's Environmental Technology Verification (ETV) Program requirements. A copy of the Procedure may be accessed on the Canadian ETV website at www.etvcanada.ca.

Performance claim(s)

<u>Capture test:</u>

During the sediment capture test, the NEXT Stormwater Solutions' SDD3 OGS device with a false floor set to 50% of the manufacturer's recommended maximum sediment storage depth and a constant influent test sediment concentration of 200 mg/L, removed 73, 67, 61, 53, 50, 52, 49 and 47 percent of influent sediment by mass at surface loading rates of 40, 80, 200, 400, 600, 1000, 1400 and 1800 L/min/m^2, respectively.

<u>Scour test:</u>

During the scour test, the NEXT Stormwater Solutions' SDD3 OGS device with preloaded test sediment reaching 50%[1] of the manufacturer's recommended maximum sediment storage depth, generated corrected effluent concentrations of 0, 9.3, 4.7, 24.3, and 10.5 during a continuous 30 minute test run with 5 minute duration surface loading rates of 200, 800, 1400, 2000, and 2600 L/min/m^2, respectively.

Performance results

The test sediment consisted of ground silica (1 – 1000 micron) with a specific gravity of 2.65, uniformly mixed to meet the particle size distribution specified in the testing procedure. The *Procedure for Laboratory Testing of Oil Grit Separators* requires that the three sample average of the test sediment particle size distribution (PSD) meet the specified PSD percent less than values within a boundary threshold of 6%. The comparison of the average test sediment PSD to the CETV specified PSD in Figure 2 below indicates that the test sediment used for the capture (A3) and scour (A4) tests met this condition.

[1] See "Variances from testing procedure" section below

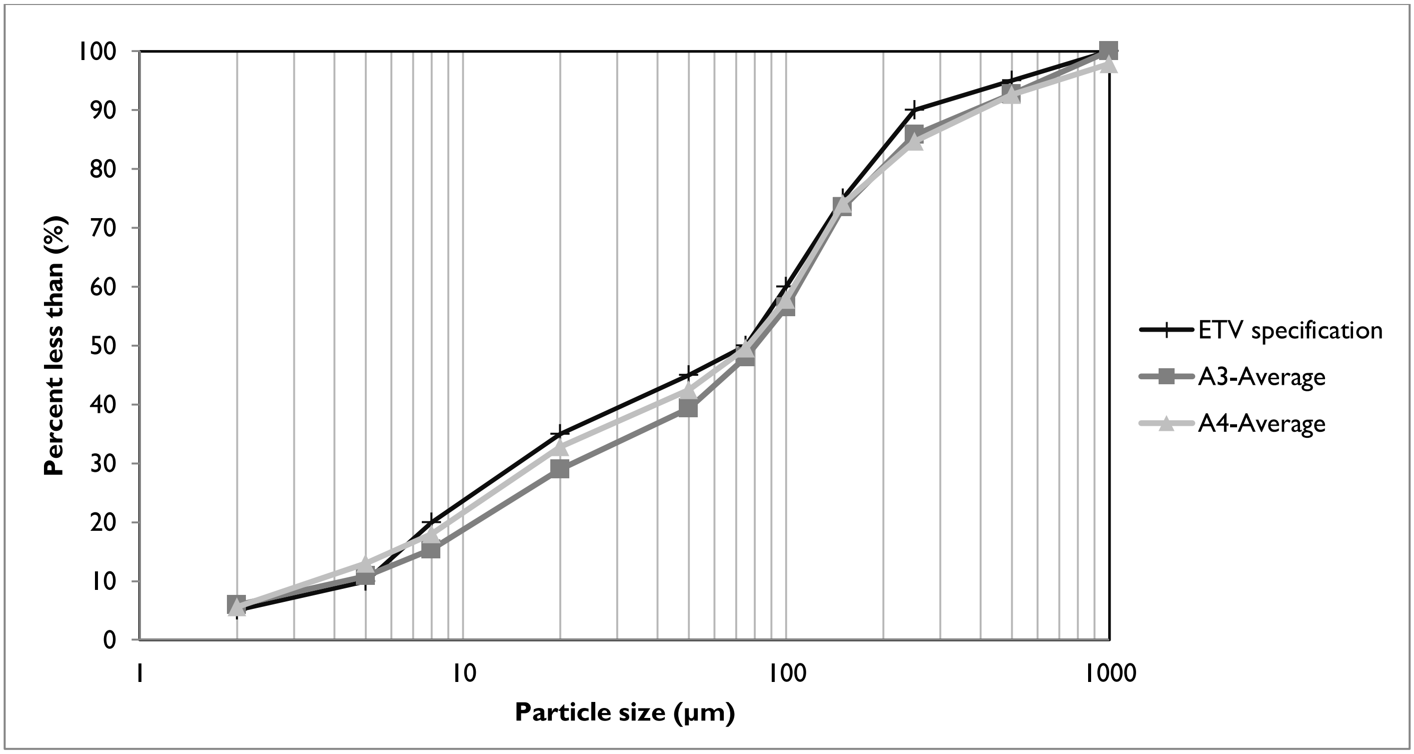

Figure 2. Test sediment particle size distribution (PSD) used for the capture (A3- Average) and scour test (A4 –Average) in relation to the specified PSD.

The capacity of the device to retain sediment was determined at eight surface loading rates using the modified mass balance method. This method involved measuring the mass and particle size distribution of the injected and retained sediment for each test run. Performance was evaluated with a false floor simulating the technology filled to 50% of the manufacturer's recommended maximum sediment storage depth. The test was carried out with clean water that maintained a sediment concentration well below 20 mg/L. Based on these conditions, removal efficiencies for individual particle size classes and for the test sediment as a whole were determined for each of the tested surface loading rates (Table 1).

In some instances, the removal efficiencies were above 100% for certain particle size fractions (marked with asterisks in Table 1). These discrepancies are attributed to errors inherent to the analytical method used to measure PSD. Due to these errors, the removal efficiency results by particle size fraction should be interpreted with caution (refer to Bulletin # CETV 2016-11-0001 published on the Canadian ETV website at www.etvcanada.ca). The results for "all particle sizes" are based on measurements of the total injected and retained sediment mass, and are therefore not subject to PSD analysis errors.

Table 1. Removal efficiencies (%) at specified surface loading rates.

Particle size fraction (µm)	Surface loading rate (L/min/m²)							
	40	80	200	400	600	1000	1400	1800
500-1000	97.9	86.3	100*	91.3	93.6	100*	91.0	94.4
250 - 500	83.9	95.9	94.1	97.6	100*	96.9	100*	94.4
150 - 250	90.3	95.1	99.8	90.1	93.0	96.3	90.5	94.4
100 - 150	100*	100*	99.8	99.8	88.9	95.1	89.4	88.8
75 - 100	97.9	92.3	94.1	65.1	63.0	74.5	61.3	52.4
50 - 75	71.4	72.3	49.0	32.6	23.3	18.2	18.1	16.1
20 - 50	70.0	43.1	14.0	13.3	7.2	2.5	2.5	6.9
8 - 20	31.8	13.8	6.0	5.8	1.3	4.4	4.5	3.3
5 – 8	18.8	25.3	14.1	5.5	6.3	6.6	6.5	5.3
< 5	11.7	6.4	5.9	4.1	4.7	9.2	6.6	3.0
All particle sizes	**73**	**67**	**61**	**53**	**50**	**52**	**49**	**47**

* Removal efficiencies were calculated to be above 100%. Calculated values were between 102.7 and 117.5%. See text and Bulletin # CETV 2016-11-0001 for explanation.

Figure 3 below compares the particle size distribution (PSD) of the three sample average of the test sediment to the PSD of the retained sediment at each of the tested surface loading rates. In general, the capture efficiency for fine particles decreased as surface loading rates increased.

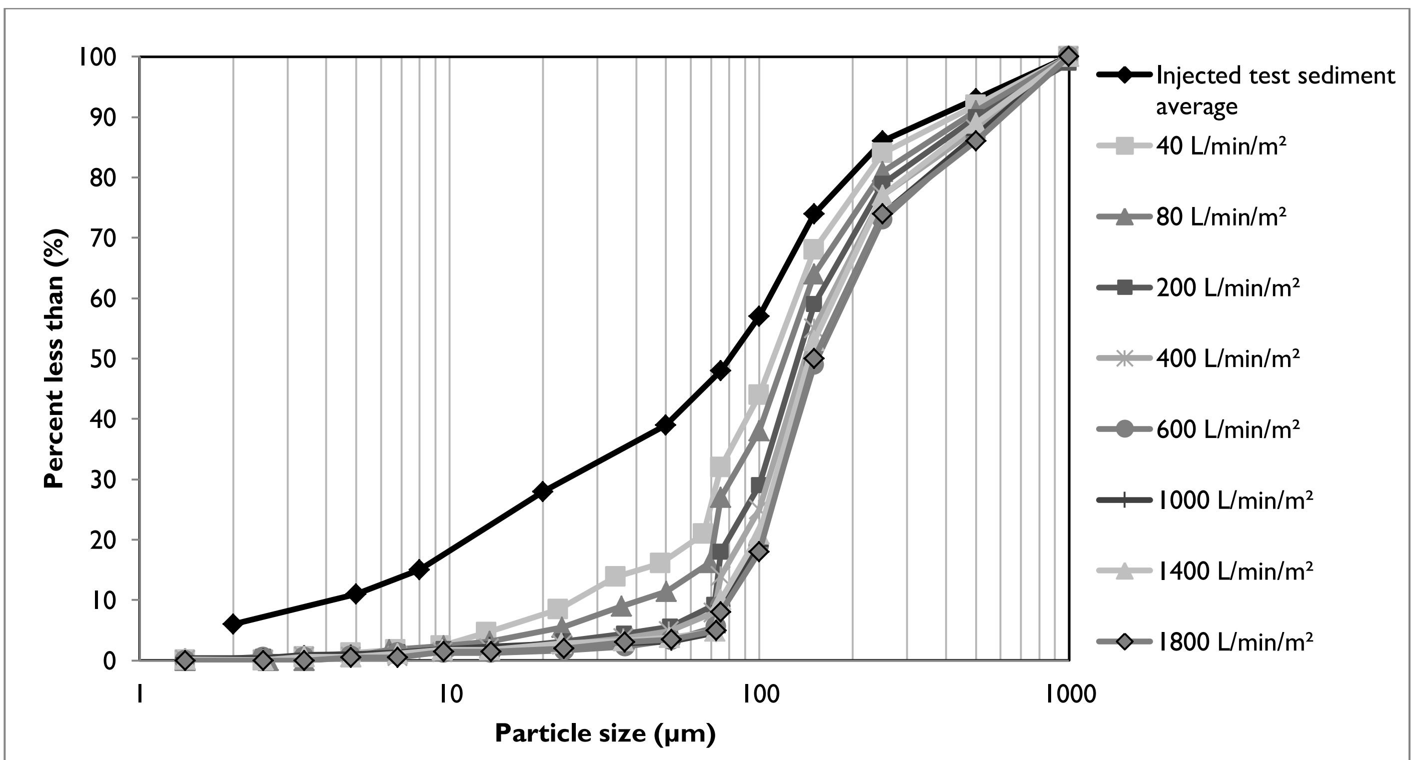

Figure 3. Particle size distribution of retained sediment in relation to the injected test sediment average.

Table 2 shows the results of the sediment scour and re-suspension test. This test involved preloading fresh test sediment into the sedimentation chamber of the device. The sediment was placed on a false floor to mimic a device filled to approximately 63%[1] of the maximum recommended sediment storage depth. Clean water was run continuously through the device at five surface loading rates over a 30 minute period. Each flow rate was maintained for 5 minutes with a one minute transition time between flow rates. Effluent samples were collected at one minute sampling intervals and analyzed for Suspended Sediment Concentration (SSC) and PSD by recognized methods. The effluent samples were subsequently adjusted based on the background concentration of the influent water and the smallest 5% of particles captured during the 40 L/min/m² sediment capture test, as per the method described in Bulletin # CETV 2016-09-0001, published on the Canadian ETV website at www.etvcanada.ca.

Table 2. Scour test adjusted effluent sediment concentration.

Run	Surface loading rate (L/min/m²)	Run time (min)*	Background sample concentration (mg/L)	Adjusted effluent suspended sediment concentration (mg/L)**	Average (mg/L)
1	200	1	1.10	0	0
		2		0	
		3		0	
		4		0	
		5		0	
2	800	1	1.50	14.96	9.28
		2		0.94	
		3		0.90	
		4		17.11	
		5		12.51	
3	1400	1	0.80	0	4.66
		2		0	
		3		0	
		4		0	
		5		23.32	
4	2000	1	0.80	18.08	24.25
		2		29.11	
		3		30.01	
		4		24.06	
		5		20.00	
5	2600	1	1.40	11.71	10.51
		2		18.01	
		3		7.98	
		4		7.86	
		5		7.01	

* The time taken to change between flow rates did not exceed 1 minute.

** The adjusted effluent suspended sediment concentration represents the actual measured effluent concentration minus the smallest 5% of sediment particles (i.e. d5) removed during the 40 L/min/m² capture test, minus the background concentration. For more information see Bulletin # CETV 2016-09-0001.

Variances from testing procedure

The following minor deviations from the *Procedure for Laboratory Testing of Oil-Grit Separators* (Version 3.0, June 2014) have been noted:

1. According to the testing Procedure of the scour test, the false floor is to be installed 10.2 cm below the 50% of the manufacturer's recommended maximum sediment storage depth and the test sediment is to be preloaded up to the 50% level. However, the SDD3-900 was tested with the false floor set at the 50% storage depth and sediments filled on top reaching 10.2 cm above the false floor simulating the device to be approximately 63% full as opposed to 50%. Simulating the device to be filled to a higher capacity with sediments closer to the outlet would likely increase rather than decrease scour. Hence the test is considered to be a conservative evaluation of the device's scour prevention performance.

2. As part of the capture test, evaluation of the 40 L/min/m^2 surface loading rate was split into 3 parts due to the long duration needed to feed the required minimum of 11.3 kg of test sediment into the unit. At the end of the first and second parts, the flow rates were maintained up until 3 water changes to prevent capture of particles that would have been washed out under normal circumstances. The amended procedure was reviewed and approved by the verifier prior to testing.

Verification

The verification was completed by Toronto and Region Conservation Authority, using the Canadian ETV Program's General Verification Protocol (March, 2000) and taking into account ISO/FDIS 14034:2015(E). Data and information provided by NEXT Stormwater Solutions to support the performance claim included the following: Performance test report prepared by Centre des technologies de l'eau, and dated March 2016; the report is based on testing completed in accordance with the *Procedure for Laboratory Testing of Oil-Grit Separators* (Version 3.0, June 2014).

What is Canadian ETV?

Canadian Environmental Technology Verification (ETV) is delivered by GLOBE Performance Solutions under a license agreement from Environment Canada. Canadian ETV is designed to support Canada's environment industry by providing credible and independent verification of technology performance claims.

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