

VERIFICATION STATEMENT

GLOBE Performance Solutions

Verifies the performance of

Cultec Separator™ Row Filtration System

Developed by Cultec, Inc.
Brookfield, Connecticut, USA

Registration: GPS-ETV_VR2021-03-31_v2

In accordance with

ISO 14034:2016

**Environmental Management —
Environmental Technology Verification (ETV)**



John D. Wiebe, PhD
Executive Chairman
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March 31, 2021
Vancouver, BC, Canada



Verification Body
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Technology description and application

Cultec Recharger and Contactor chambers are used for infiltration, detention and/or retention of stormwater underground. The system is comprised of thermoplastic arch-shaped chambers surrounded by clear crushed stone. Water enters the system through a Separator row and then flows through the stone and into a Chamber row prior to exiting. The Cultec stormwater system is sized based on the volume of stormwater which is stored in the voids created by the chamber and the voids in the clear stone surround, with a void ratio of 40%. The entire system is wrapped in a non-woven geotextile and/or impermeable geomembrane. In order to minimize fine particles and silts from blinding the voids in the clear stone surround, a single chamber row is wrapped in non-woven geotextile and placed on a woven geotextile. This row is connected to the inlet pipe of the Cultec system providing a filtration function as the surface stormwater run-off passes through the geotextile wrapped inlet row. Sediment is trapped within the Cultec Separator™ Row and may be removed through back flushing of this row. A typical system installation is illustrated in Figure 1 and Figure 2 below.

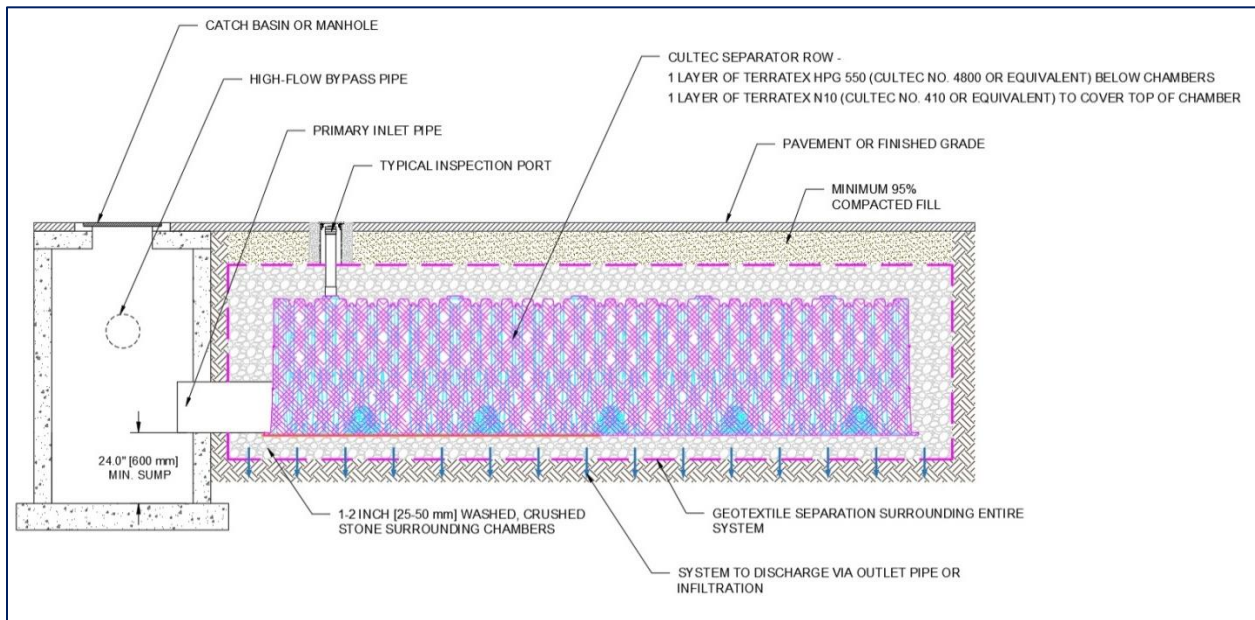


Figure 1: Cultec Separator™ Row Filtration System – Cross-Sectional View

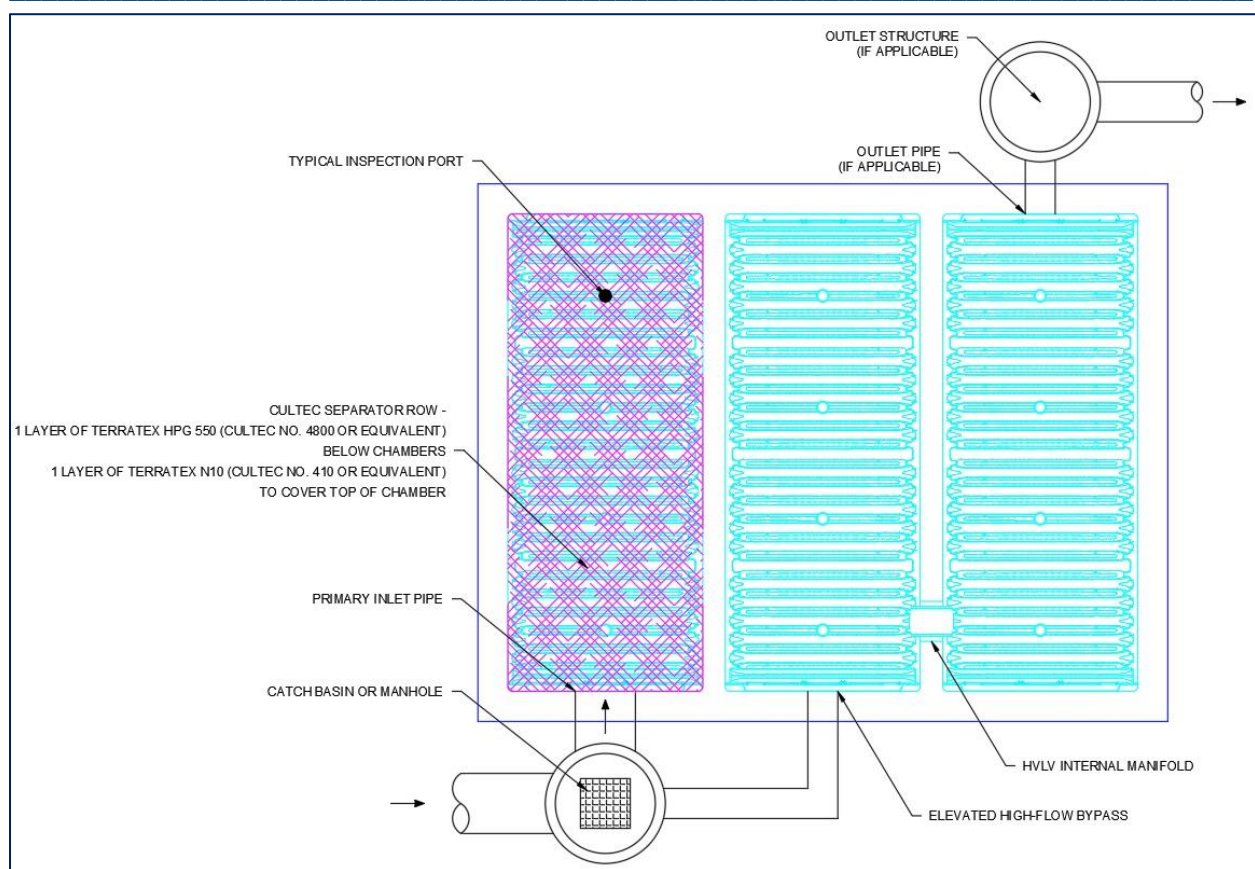


Figure 2: Cultec Separator™ Row Filtration System – Plan View

Performance & testing conditions

The data and results published in this Verification Statement were obtained from the testing program conducted on the Cultec Separator™ Row in accordance with a technology specific test plan (TSTP) developed and approved by the client and test lab (Good Harbour Laboratories, Mississauga, Ontario), and reviewed by Verification Expert and Verifying Organization, in compliance with ISO/IEC 14034.

The device tested was a Cultec Recharger 150XLHD R chamber with a base width of 838 mm (33") and height of 470 mm (18.5").

Test Setup

Two chambers were used for this study, a receiving chamber and a separation chamber. The two chambers were housed in a containment cell constructed out of wood, lined with an impermeable membrane. The dimensions of the test cell were 142" X 71" X 23.5" (3.58 m X 1.80 m X 0.60 m, L X W X H). The chambers were set up in the test cell in a manner consistent with a normal installation. The floor of the cell was covered with approximately 76 mm (3") of washed, crushed, clear stone¹ which in turn was covered by one layer of woven geotextile fabric as required for the installation of the system. The two chambers sat next to each other, in parallel. Washed crushed stone filled in the space around the test units up to a height of approximately 51 mm (2") from the base.² The test set-up is illustrated in Figure 3.

The geotextiles used for this study were:

Woven: Terratex HPG 550
 Nonwoven: Terratex N10

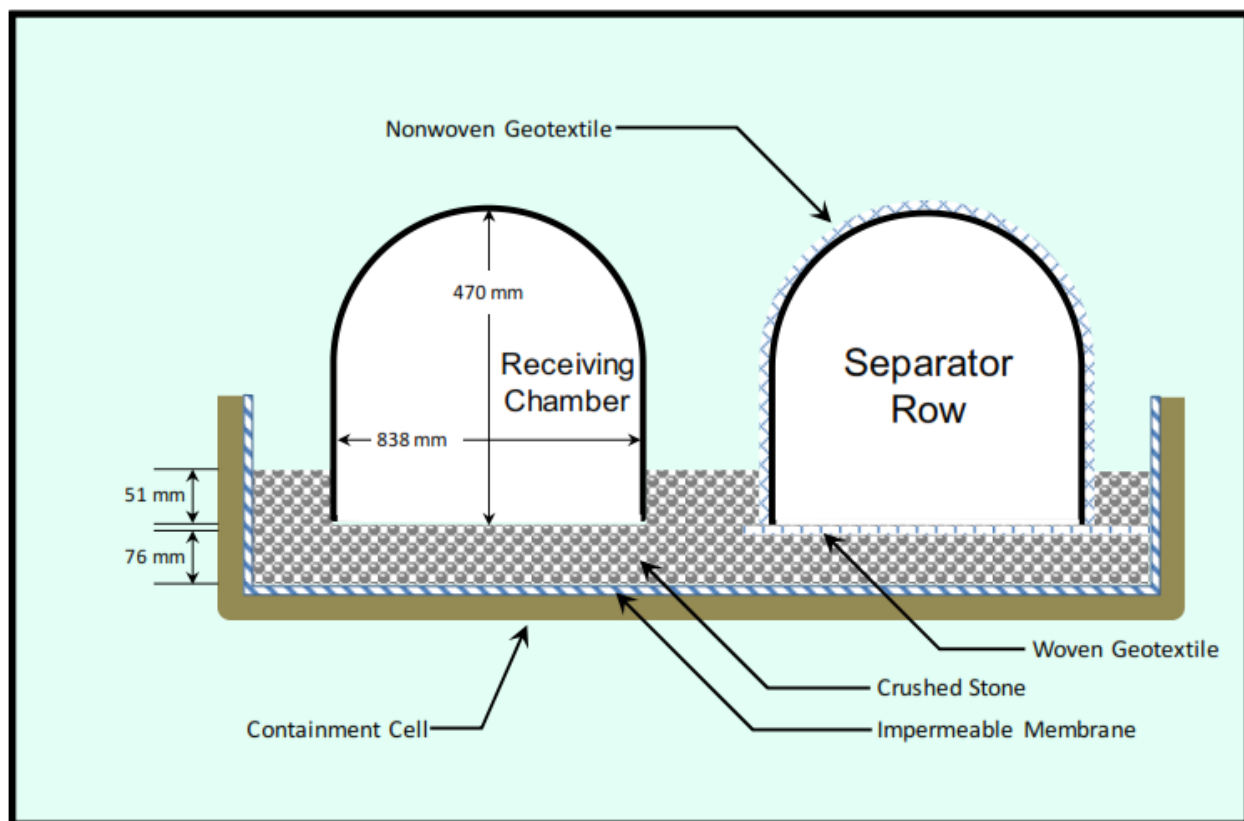


Figure 3: Test Cell Cross-Section for Model Recharger® I50XLHD R

¹ A normal installation would typically have a crushed stone depth of 150 mm (6").

² For a normal installation, the stone completely fills the column between chamber rows and up to a minimum of 6" above the top of the crown of the chamber.

The laboratory test set-up was a water flow loop, capable of moving water at a rate of up to 900 L/min. The loop was comprised of water reservoirs, pumps, stand pipe, receiving tank and a flow meter, in addition to the test cell.

Fresh water was pumped from the storage tank through a flow meter to the stand pipe, and from there it flowed by gravity through an inlet pipe to the separation chamber in the test cell. Sediment was added at an addition port in the inlet pipe upstream of the separation chamber.

From the water supply tanks, water was pumped by a centrifugal pump. Flow measurement was done using an electromagnetic type flow meter with an accuracy of $\pm 0.5\%$ of reading (1 – 200 gpm). The data logger was configured to record a flow measurement once every minute.

The influent pipe was 100 mm (4 inches) in diameter and sediment addition was done through a port at the crown of the influent pipe, 4 pipe diameters (406 mm) upstream of the containment cell. The sediment feeder was a volumetric screw feeder with vibratory hopper.

Water flow exited the receiving chamber and terminated with a free-fall into the Receiving Tank. Water was pumped from the Receiving Tank back to the storage tanks to complete the flow loop.

Sample Collection & Parameter Measurement

Background water samples were collected in 1 L jars from the standpipe. The sample was taken by submerging the jar below the surface of the water until full.

Effluent samples were also grabbed by hand. The effluent pipe drained freely into the Receiving Tank and the effluent sample was taken at that point. The sampling technique was to take the grab sample by sweeping a wide-mouth 1 L jar through the stream of effluent flow such that the jar was full after a single pass.

Effluent water temperature was taken using a data logger submerged into the receiving tank during each run and configured to take a temperature reading once every minute. Run and sampling times were measured using NIST traceable stopwatches. The sediment feed samples that were taken during the run were collected in 500 mL jars and weighed on an analytical balance.

Test Sediment

The final test sediment particle size distribution (PSD) met the required tolerances of the Canada ETV Procedure for Laboratory Testing of Oil-Grit Separators (Rev. June 6, 2014 – Ver. 3.0). Three replicate samples of the test sediment blend were sent to a qualified 3rd party analytical laboratory for analysis of the sediment PSD in a manner consistent with ASTM method D422-63 (Reapproved 2007), “Standard Test Method for Particle-Size Analysis of Soils”. The samples were composite samples created by taking samples throughout the blending process and in various positions within the blending drum.

Removal Efficiency Testing

The objective of this study was to establish a baseline for treatment performance (removal efficiency) over a range of flow rates up to 125% of the maximum treatment flow rate (MTFR) with an influent suspended sediment concentration (SSC) of 200 mg/L. Sediment removal efficiency testing was conducted at 25%, 50%, 75%, 100% and 125% MTFR. The sediment feed rate had a coefficient of variance (COV) ≤ 0.10 and the influent sediment concentration was maintained within ± 20 mg/L of target, based on the average sediment feed rate and water flow rate for the run. The water flow rates were held within 10% of target with a COV of 0.03 and water temperatures were maintained below 25°C.

A minimum of eight influent background samples were taken at regular intervals. A minimum of 15 effluent samples were collected during each test run. The first sample was collected after a minimum of 3 detention times (DT), at which time a constant flow and sediment feed were established. The interval between sequential effluent samples was evenly spaced; however, when the test sediment feed was interrupted for measurement, the next effluent sample was collected after waiting at least 3 DT to re-establish equilibrium conditions.

The system detention time was determined empirically by measuring the height of water in the containment cell during clean water flow at the chosen flow rate. The wet volume of the system was calculated and the approximate volume of the stones was subtracted. The remaining volume was the estimated water volume in the containment cell, which was divided by the flow rate to give detention time.

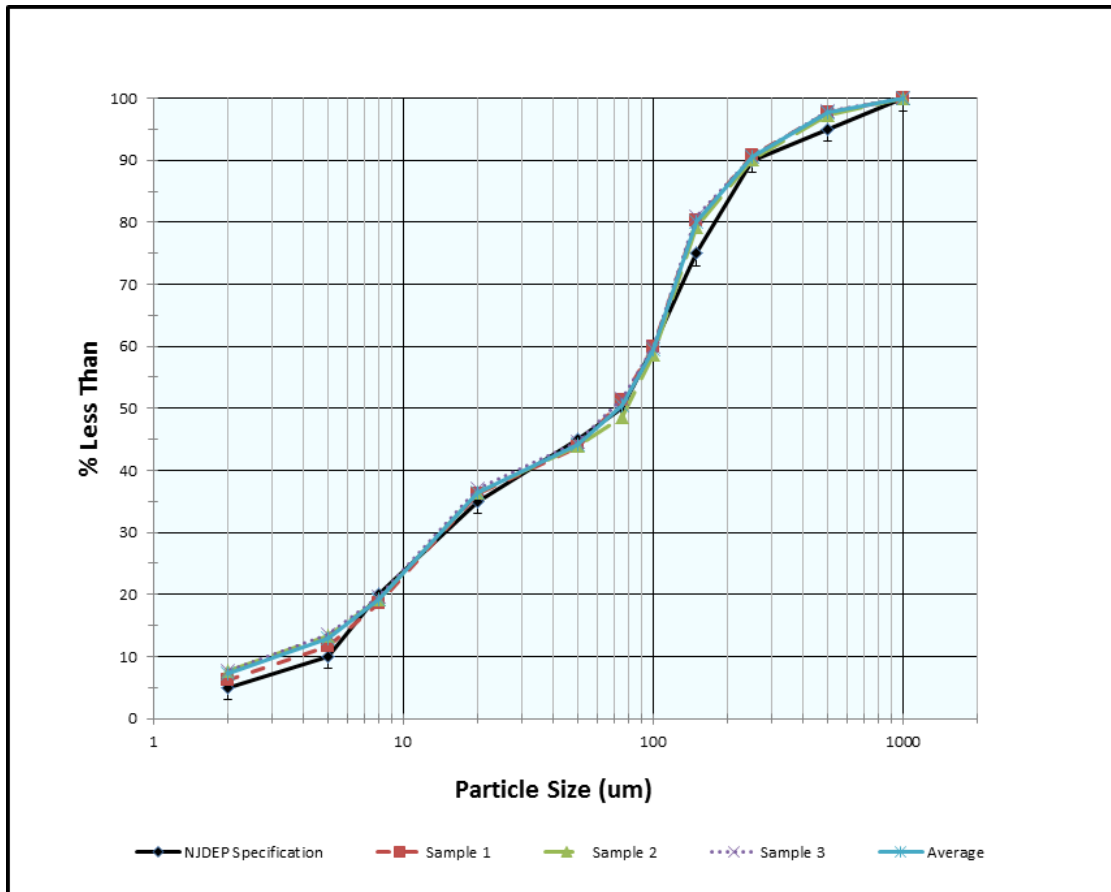
The sediment feed rate was checked using six calibration samples taken at evenly spaced intervals over the duration of each test run. Each sample was collected over an interval timed to the nearest 0.01 second and was a minimum of 0.1 liters, or the collection interval did not exceed one minute, whichever came first. The COV of the samples was < 0.10. The feed rate samples were also used to calculate an influent concentration in order to double check the concentration calculated by mass balance.

Performance claims

When installed with Terratex HPG 550 and Terratex N10 geotextiles, and tested with silica sediment having a particle size distribution conforming to the *Canadian Environmental Technology Verification Program Procedure for Laboratory Testing of Oil-Grit Separators*, the Cultec Recharger® 150XLHD Separator Row™ will remove at least the following fractions of suspended sediment at the corresponding flow rates: 80% at 24 gpm, 77% at 49 gpm, 73% at 73 gpm, 70% at 97 gpm, and 65% at 121 gpm. These performance claims are verified statistically at a 95% level of confidence.

Performance results

TEST SEDIMENT PARTICLE SIZE DISTRIBUTION IN RELATION TO SPECIFIED PSD



SUSPENDED SEDIMENT REMOVAL EFFICIENCY AT A FLOW RATE OF 24 GPM

	Suspended Sediment Concentration (mg/L)														
Sample #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Effluent	39.6	38.7	39.2	39.8	39.1	39.5	41.7	41.9	41.1	42.4	43.2	41.6	40.8	41.1	41.6
Background	2		2		2		2		2		2		2		2
Adjusted Effluent	37.6	36.7	37.2	37.8	37.1	37.5	39.7	39.9	39.1	40.4	41.2	39.6	38.8	39.1	39.6
Average Adjusted Effluent Concentration	38.8 mg/L					Removal Efficiency					80.2%				

SUSPENDED SEDIMENT REMOVAL EFFICIENCY AT A FLOW RATE OF 48 GPM

	Suspended Sediment Concentration (mg/L)														
Sample #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Effluent	47.1	47.0	47.1	46.8	47.3	47.3	49.0	50.1	49.5	50.4	49.1	50.2	52.2	49.7	51.8
Background	2		2		2		2		2		2		2		2
Adjusted Effluent	45.1	45.0	45.1	44.8	45.3	45.3	47.0	48.1	47.5	48.4	47.1	48.2	50.2	47.7	49.8
Average Adjusted Effluent Concentration	47.0 mg/L					Removal Efficiency					76.9%				

SUSPENDED SEDIMENT REMOVAL EFFICIENCY AT A FLOW RATE OF 73 GPM

	Suspended Sediment Concentration (mg/L)														
Sample #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Effluent	54.3	55.2	53.3	53.8	55.8	55.8	55.3	54.5	53.5	56.2	56.4	56.5	58.4	56.8	57.7
Background	2		2		2		2		2		2		2		2
Adjusted Effluent	52.3	53.2	51.3	51.8	53.8	53.8	53.3	52.5	51.5	54.2	54.4	54.5	56.4	54.8	55.7
Average Adjusted Effluent Concentration	53.6 mg/L					Removal Efficiency					73.3%				

SUSPENDED SEDIMENT REMOVAL EFFICIENCY AT A FLOW RATE OF 97 GPM

	Suspended Sediment Concentration (mg/L)														
Sample #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Effluent	58.4	59.4	59.0	61.2	61.6	61.1	58.9	60.4	59.9	63.9	63.3	62.5	61.9	61.0	61.0
Background	2		2		2		2		2		2		2		2
Adjusted Effluent	56.4	57.4	57.0	59.2	59.6	59.1	56.9	58.4	57.9	61.9	61.3	60.5	59.9	59.0	59.0
Average Adjusted Effluent Concentration	58.9 mg/L					Removal Efficiency					70.0 %				

SUSPENDED SEDIMENT REMOVAL EFFICIENCY AT A FLOW RATE OF 121 GPM

	Suspended Sediment Concentration (mg/L)														
Sample #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Effluent	72.0	72.8	71.7	72.1	70.1	72.1	69.3	72.3	77.2	71.0	70.7	72.7	71.1	70.4	73.0
Background	2		2		2		2		2		2		2		2
Adjusted Effluent	70.0	70.8	69.7	70.1	68.1	70.1	67.3	70.3	75.2*	69.0	68.7	70.7	69.1	68.4	71.0
Average Adjusted Effluent Concentration	69.9 mg/L					Removal Efficiency					65.3%				

*Note: This data point was considered to be a significant outlier and was therefore omitted as part of the overall statistical calculations to verify performance at a 95% level of confidence.

Verification

This verification was completed by the Verification Expert, the Centre for Advancement of Water and Wastewater Technologies (“CAWT”), contracted by GLOBE Performance Solutions, using the International Standard **ISO 14034:2016 Environmental Management – Environmental Technology Verification (ETV)**. Data and information provided by Cultec, Inc. to support the performance claim included the final test report prepared by Good Harbour Laboratories of Mississauga, Ontario and dated November 9, 2017. The test report is based on testing completed in compliance with the requirements of ISO/IEC 17025.

What is ISO 14034:2016 Environmental Management – Environmental Technology Verification (ETV)?

ISO 14034:2016 specifies principles, procedures and requirements for environmental technology verification (ETV), and was developed and published by the *International Organization for Standardization (ISO)*. The objective of ETV is to provide credible, reliable and independent verification of the performance of environmental technologies. An environmental technology is a technology that either results in an environmental added value or measures parameters that indicate an environmental impact. Such technologies have an increasingly important role in addressing environmental challenges and achieving sustainable development.

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