Sarah Matin, P.E.
Water Quality Manager – Southeast
Advanced Drainage Systems

Our reason is water.®

ADS Engineering and Technology Center

The most advanced stormwater engineering center in the world

Dedicated to collaboration and innovation, accelerating the development of stormwater solutions designed to manage water and protect our communities.

State-of-the-Art Laboratories

Materials Science: New material formulations to enhance product performance.

Strength and Fabrication: Testing the durability and performance of new prototypes.

Hydraulics and Fluid Dynamics: 90,000 gallons of water to model real-world conditions.

Automation: Designing and testing new manufacturing technologies.

Controls: Replicating, testing and innovating control systems for manufacturing plants.

3D Printing: Rapid prototyping for innovative product development.

EcoStream Biofiltration

- **WSDOE GULD** approved for basic, metals, and phosphorus treatment
  - 85% of TSS
  - 70% of TP
  - 39% of copper
  - 65% of zinc
  - 50% Nitrogen
- High Flow Rate in a Small Footprint
  - 4x4': 66 GPM (0.147 CFS)
  - 8x16: 524 GPM (1.17 CFS)
- Available with or without plant life

NEW

High Filter Media Area & Flowrate

Simple, Efficient, Cost-Effective Design

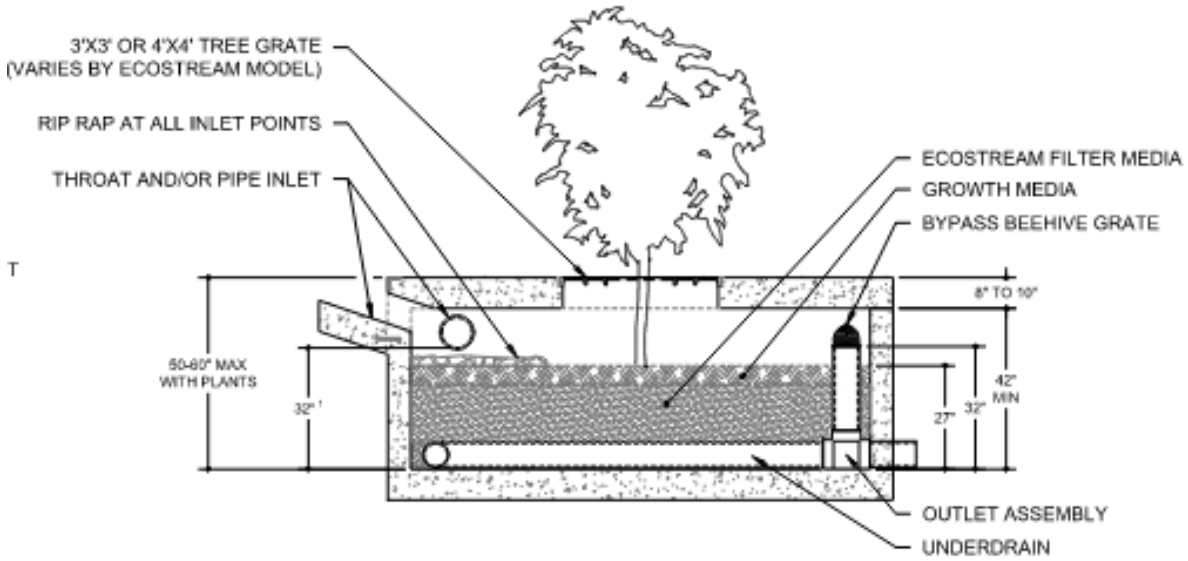
Living Plant Component

Available in Multiple Configurations

Compact Footprint

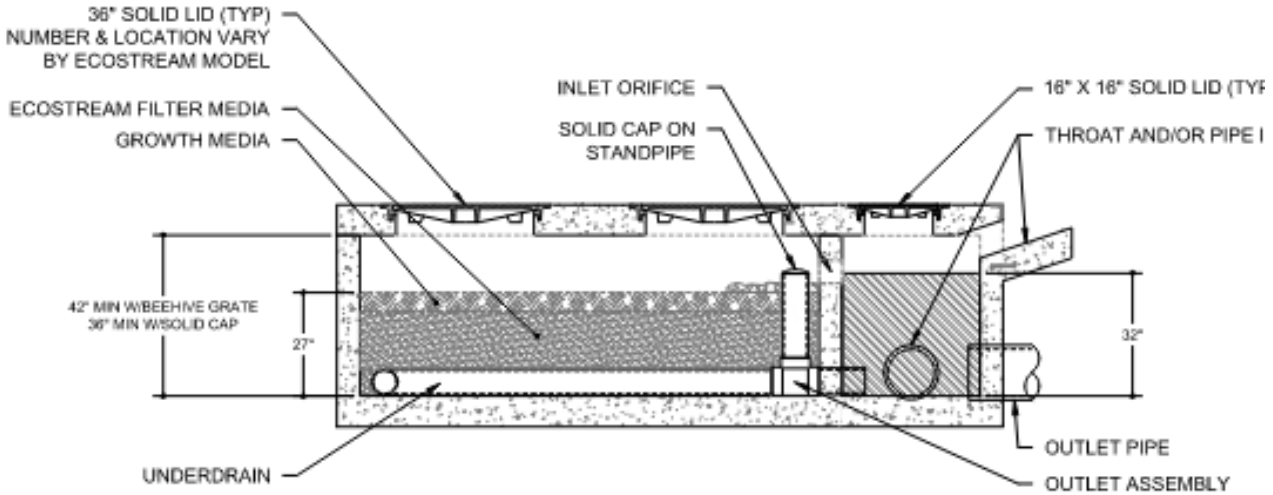
Low Elevation Change between Inlet & Outlet

ADS



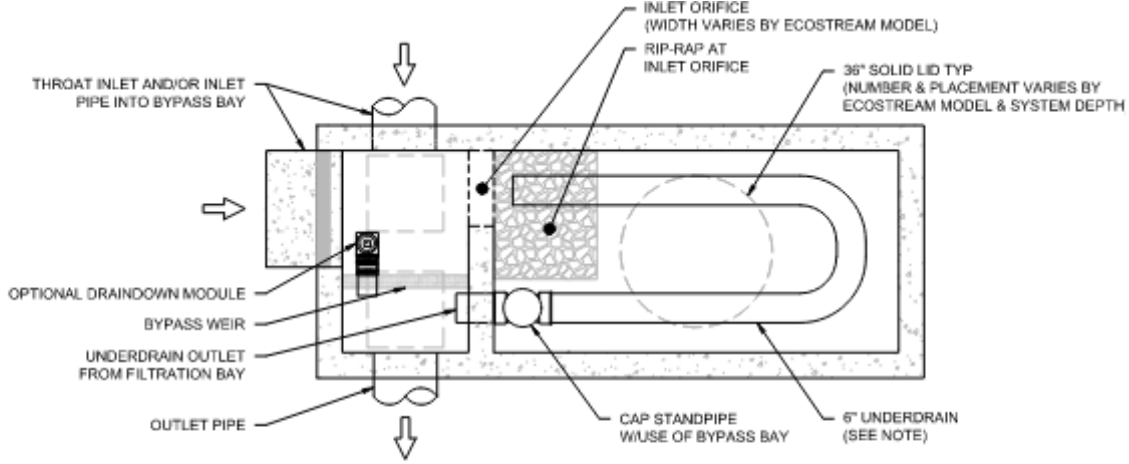
ECOSTREAM PROFILE VIEW WITH STANDPIPE BYPASS (PLANT OPTION)

NOT TO SCALE



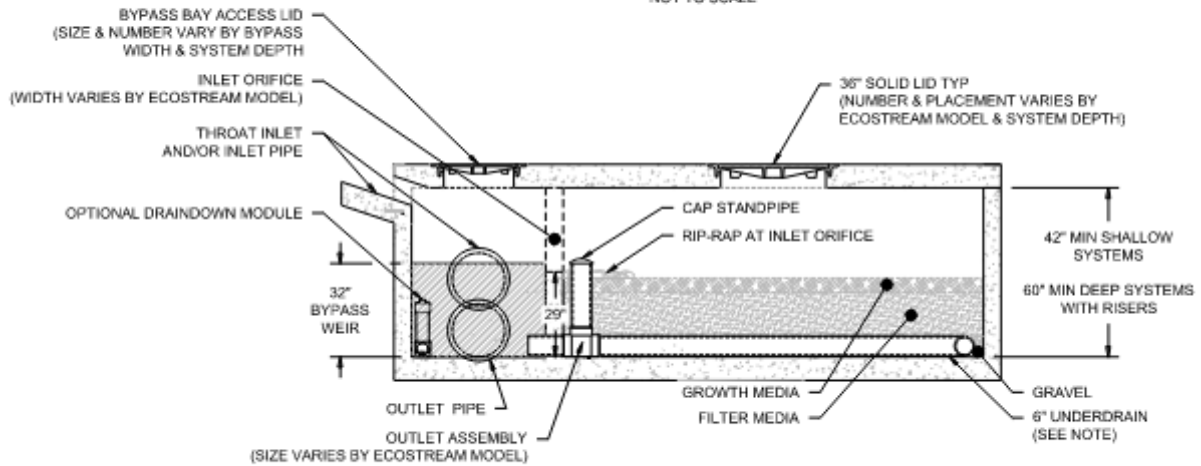
ECOSTREAM PROFILE VIEW WITH BYPASS WEIR (NON-PLANT OPTION*)

NOT TO SCALE



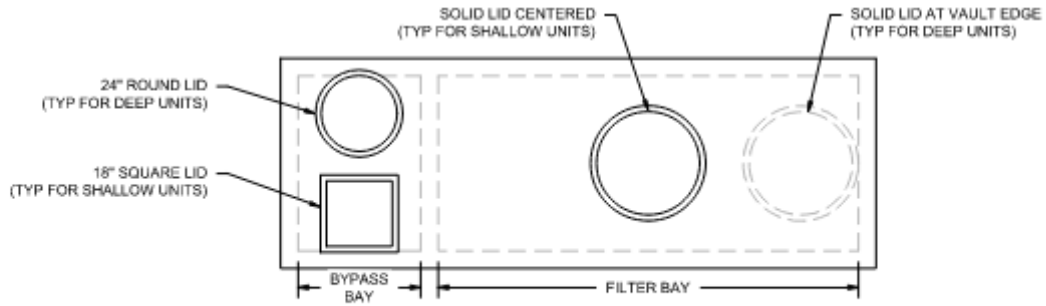
ECOSTREAM PLAN VIEW WITH SOLID LID

NOT TO SCALE



ECOSTREAM PROFILE VIEW WITH SOLID LID

NOT TO SCALE

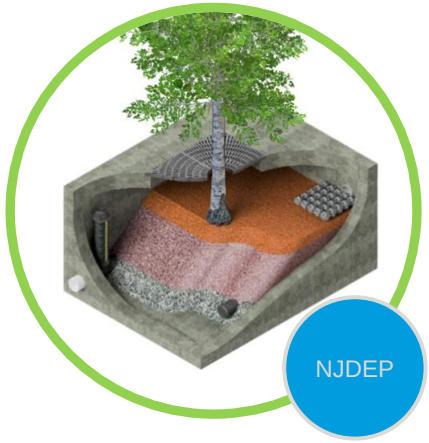


SOLID LID PLACEMENT

SIZE AND NUMBER OF SOLID LIDS VARY BY ECOSTREAM MODEL & SYSTEM DEPTH

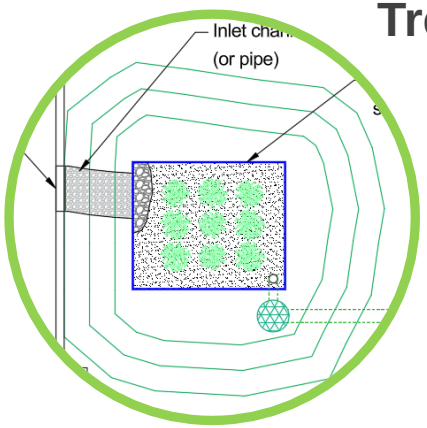

BUT WAIT, THERE'S MORE!

EcoStream Options

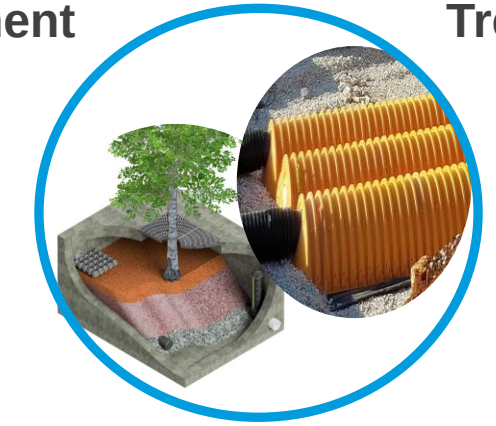


Basic Treatment

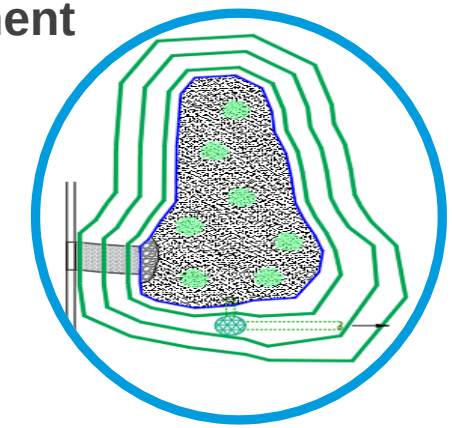
Enhanced Treatment



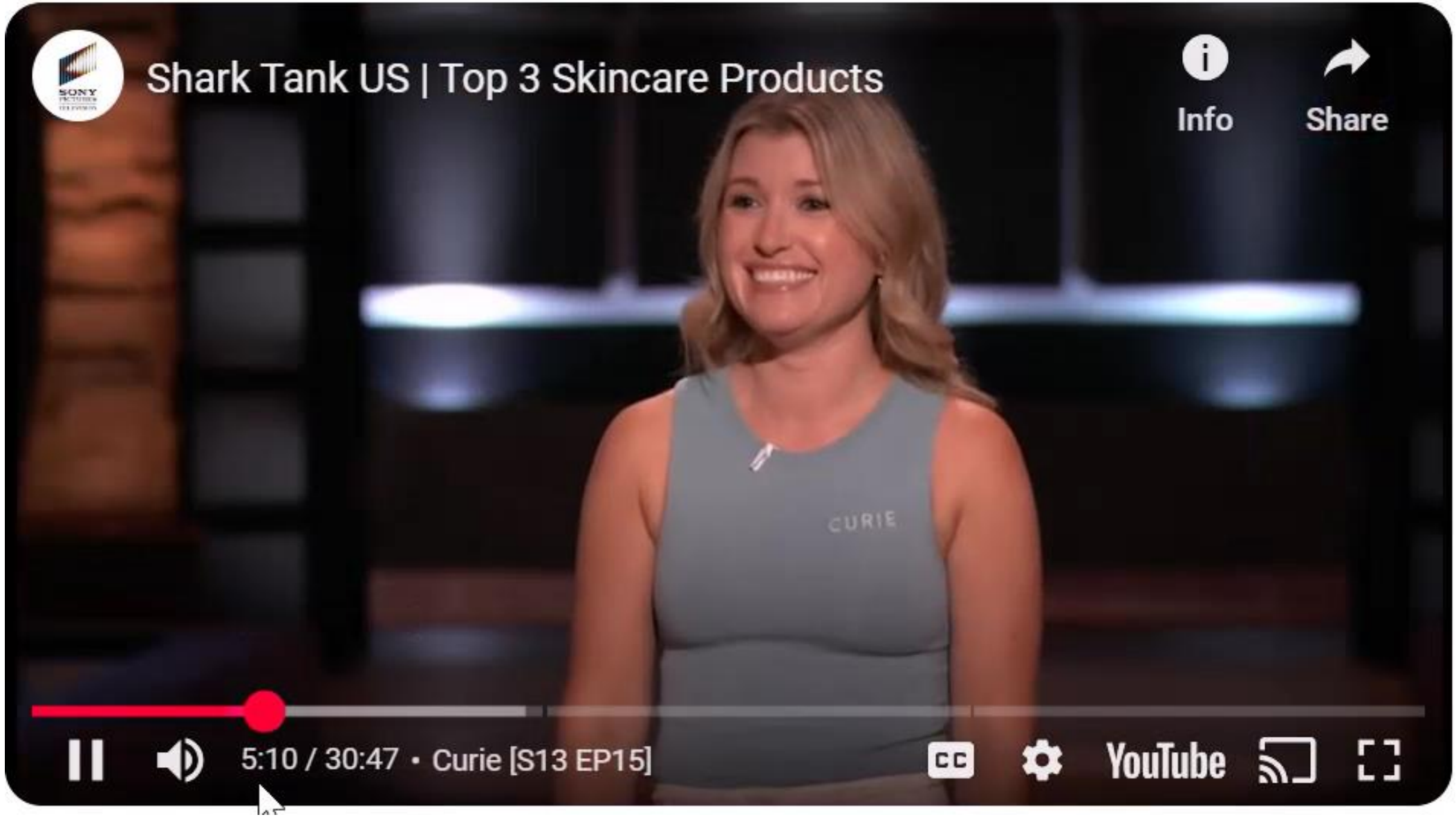
Geometric Liner



Volume Designs



Irregular Shapes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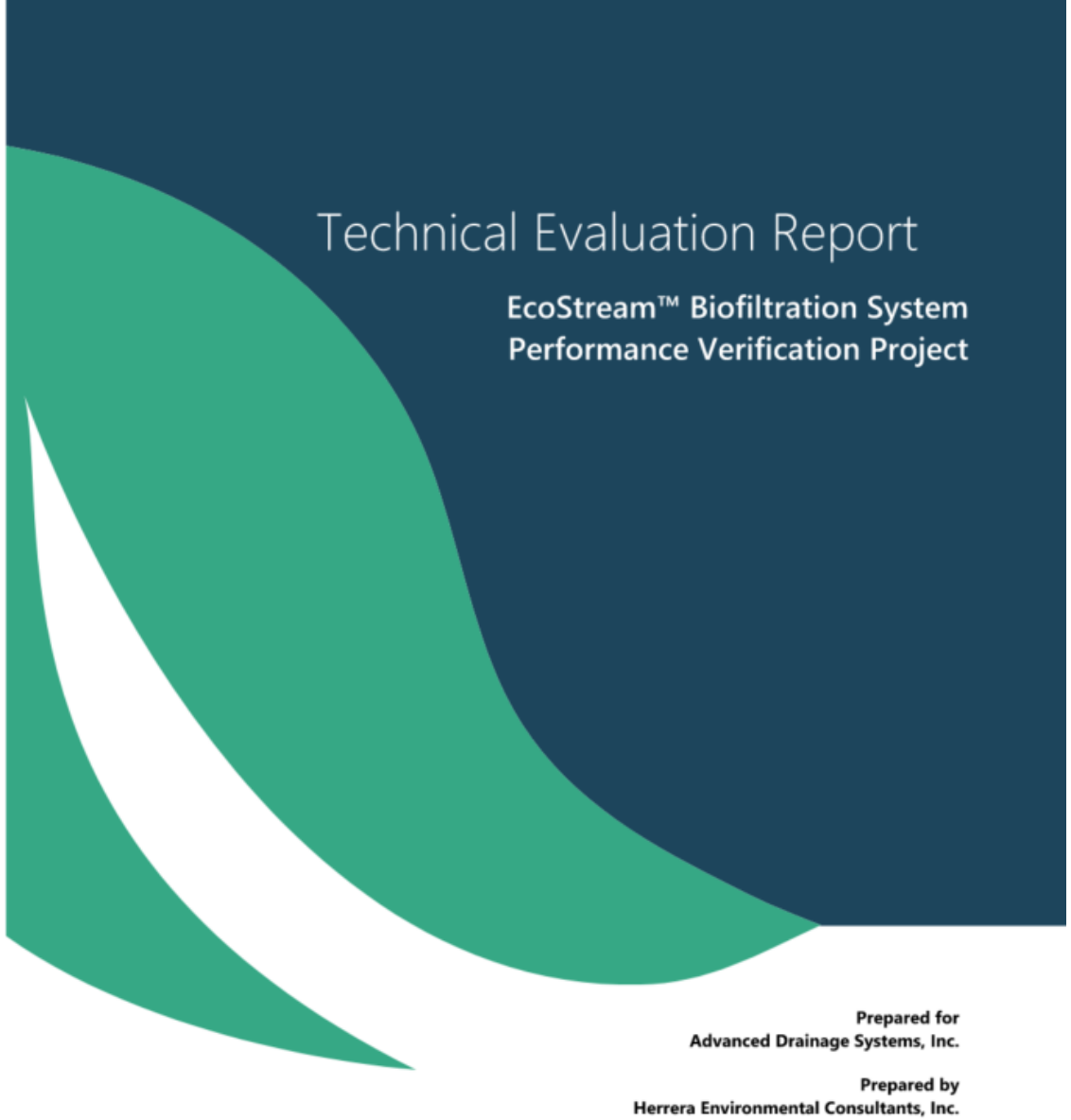

HERRERA
Science + Planning + Design

Table 8. Water Quality Results for the EcoStream™ System and Comparison to TAPE Criteria.

Date	Total Suspended Solids (mg/L)			Total Phosphorus (mg/L)			Dissolved Copper (µg/L)			Dissolved Zinc (µg/L)			90th Percentile Sampled Effluent Flow (gpm)	Peak Inflow (gpm)
	IN	OUT	Percent Reduction	IN	OUT	Percent Reduction[a]	IN	OUT	Percent Reduction	IN	OUT	Percent Reduction		
9/24/2023	341 J	33 J	**90%**	0.640	0.099	**80%**	16.7 J	6.16 J	**63%**	29.9 J	11.2 J	**63%**	37.7	39.6
9/26/2023	90	**11**	88%	0.440	0.080	**82%**	18.3 J	10.3 J	**44%**	31.5 J	11.0	**65%**	12.2	17.5
10/10/2023	126	**15**	**88%**	0.620	0.085	**83%**	10.5 J	5.00 J	**52%**	30.5 J	9.22 J	**70%**	16.8	43.6
Maintenance October 19, 2023 – Mulch and Top 3 Inches of Media Replaced After 1.6 Percent Water Year														
10/24/2023	37	**15**	59%	0.221 J	0.145	34%	8.26	5.84	29%	27.5	9.53	**65%**	56.2	58.6
11/1/2023	55	**9**	84%	0.204	0.067	**67%**	9.14 J	5.35 J	**41%**	27.7 J	7.41 J	**73%**	16.2	18.1
11/3/2023	72	**6**	92%	0.165	0.047	**72%**	8.94 J	5.74 J	**36%**	24.5 J	7.39 J	**70%**	24.4	26.6
11/6/2023	57	**11**	81%	0.235	0.078	**67%**	12.9 J	8.62 J	**33%**	31.2 J	11.8 J	**62%**	37.6	42.3
11/9/2023	39	**12**	69%	0.191	0.0800	**58%**	19.2 J	11.1 J	**42%**	46.3 J	18.6 J	**60%**	25.5	38.4
11/11/2023	36	**8**	78%	0.138	0.050	**64%**	9.39 J	5.08 J	**46%**	49.8 J	22.8 J	54%	12.6	30.4
Maintenance November 18, 2023 – Mulch and Top 3 Inches of Media Replaced After 2.8 Percent Water Year														
12/1/2023	68	28	59%	0.235	0.125	47%	8.60	6.65	23%	39.4	19.6	50%	51.9	53.4
12/1/2023	57	**8**	86%	0.160	0.041	**74%**	6.47 J	3.06 J	**53%**	27.6 J	12.5 J	55%	13.7	15.2
12/4/2023	48	**4**	92%	0.110	0.039	**65%**	8.89	6.39	28%	30.7	8.00	**74%**	20.9	26.1
12/19/2023	168	**13**	**92%**	0.469	0.081	**83%**	9.88 J	5.70 J	**42%**	32.9 J	11.5 J	**65%**	19.1	21.7
12/25/2023	60 J	**4**	93%	0.235	0.0330	**86%**	9.94 J	6.76 J	32%	32.5 J	9.61 J	**70%**	44.8	66.7
Maintenance January 4, 2024 – Mulch and Top 3 Inches of Media Replaced After 5.4 Percent Water Year														
1/5/2024	28	**5**	82%	0.109	0.041	**62%**	8.27 J	5.47 J	**34%**	27.2 J	7.56 J	**72%**	37.4	43.4
1/8/2024[b]	–	–	–	–	–	–	–	–	–	–	–	–	6.5	15.7
Maintenance January 27, 2024 – Mulch and Top 3 Inches of Media Replaced After 6.7 Percent Water Year														
2/14/2024	41	**7**	83%	0.184	0.043	**77%**	6.95	4.78	**31%**	34.4	15.2	56%	43.3	64.8
SUMMARY (all data)														
Maximum	341	33	93%	0.640	0.145	86%	19.20	11.10	63%	49.8	22.8	74%	56.2	66.7
Median	57	10	85%	0.213	0.073	70%	9.27	5.79	39%	31.0	11.1	65%	25.0	39.0
Minimum	28	4	59%	0.109	0.033	34%	6.47	3.06	23%	24.5	7.4	50%	6.5	15.2
Total n-value	16	16	16	16	16	16	16	16	16	16	16	16	16	16
TAPE SUMMARY (screened data)														
Criteria		<20	≥80%			≥50%			≥30%			≥60%		
Qualifying n-value[c]		16	3			16			16			16		
UCL95 Mean		**15**												
LCL95 Mean			NC			**62.8%**			**35.0%**			**61.1%**		

BOLD values exceed TAPE criteria for individual events.
BOLD values exceed TAPE criteria bootstrap mean analysis.
Note: Design flow rate = 50 gpm.

[a] Influent total phosphorus concentrations over 0.5 mg/L are considered 0.5 mg/L for percent removal calculations and system performance evaluation.
[b] Analysis canceled for composite samples. Grab samples analyzed only.
[c] The qualifying n-value indicates the number of samples used to calculate summary statistics for each parameter after excluding samples based on influent and special case screening. Minimum require n-value per TAPE (2018) is 15. Full description of screening is provided in the other footnotes to this table and in the Water Quality Treatment Performance Evaluation section.

– = No composite samples analyzed for this event
J = estimate due to lab QA (see Appendix F)
U = Result was not detected above the associated laboratory reporting limit

Table 8. Water Quality Results for the EcoStream™ System and Comparison to TAPE Criteria.

Date	Total Suspended Solids (mg/L)			Total Phosphorus (mg/L)			Dissolved Copper (µg/L)			Dissolved Zinc (µg/L)			90th Percentile Sampled Effluent Flow (gpm)	Peak Inflow (gpm)
	IN	OUT	Percent Reduction	IN	OUT	Percent Reduction[a]	IN	OUT	Percent Reduction	IN	OUT	Percent Reduction		

Table 9. Results of Other Parameters Collected for the EcoStream™ System.

Date	Total Copper (µg/L)			Total Zinc (µg/L)			Total Kjeldahl Nitrogen (mg/L)			Nitrate+Nitrite as N (mg/L)			Orthophosphorus (mg/L)			Hardness (mg CaCO3/L)			90th Percentile Sampled Effluent Flow (gpm)	Peak Inflow (gpm)
	IN	OUT	% Red.	IN	OUT	% Red.	IN	OUT	% Red.	IN	OUT	% Red.	IN	OUT	% Red.	IN	OUT	% Red.		
9/24/2023	109 J	11.3	90%	1,240 J	29.5	98%	2.2	0.9	59%	0.69	0.52	25%	0.039	0.019	51%	60.5	20.5	66%	37.7	39.6
9/26/2023	67.4	14.1	79%	594	24.0	96%	2.4	1.2	50%	1.25	1.11	11%	0.056 J	0.021 J	62%	78.8	53.2	32%	12.2	17.5
10/10/2023	92.1	8.52	91%	1,170	20.5	98%	2.2	1.1	50%	0.91	1.03	-13%	0.023 J	0.016	30%	126	99.4	21%	16.8	43.6
10/24/2023	31.9 J	12.1	62%	186 J	23.4	87%	–	–	–	–	–	–	0.035 J	0.063 J	-80%	25.8	18.0	30%	56.2	58.6
11/1/2023	9.69 J	6.32	35%	32.6	9.67	70%	–	–	–	–	–	–	0.035	0.021	40%	48.4	37.2	23%	16.2	18.1
11/3/2023	17.7	7.65	57%	88.5	10.9	88%	–	–	–	–	–	–	0.019 J	0.009 J	53%	24.8	15.6	37%	24.4	26.6
11/6/2023	37.3	14.3	62%	154	26.4	83%	–	–	–	–	–	–	0.031 J	0.017 J	45%	47.6	38.8	18%	37.6	42.3
11/9/2023	40.5	16.0	60%	124	35.7	71%	–	–	–	–	–	–	0.041	0.020	51%	65.8	49.7	24%	25.5	38.4
11/11/2023	22.3	8.02	64%	89.2	34.4	61%	–	–	–	–	–	–	0.029	0.010	66%	46.4	35.1	24%	12.6	30.4
12/1/2023	41.3	20.3	51%	234	71.0	70%	–	–	–	–	–	–	0.034	0.040	-18%	45.3	47.0	-3.8%	51.9	53.4
12/1/2023	21.6	6.03 J	72%	105	24.1	77%	–	–	–	–	–	–	0.025	0.011	56%	31.0	47.3	-53%	13.7	15.2
12/4/2023	21.9	7.66 J	65%	108	13.2	88%	–	–	–	–	–	–	0.016 J	0.010 J	38%	27.5	18.3	33%	20.9	26.1
12/19/2023	50.1	12.1	76%	348	32.1	91%	–	–	–	–	–	–	0.029 J	0.017 J	41%	129	89.5	31%	19.1	21.7
12/25/2023	21.4	9.55	55%	96.0	15.2	84%	–	–	–	–	–	–	0.020 J	0.013 J	35%	43.9	34.6	21%	44.8	66.7
1/5/2024	20.9	7.76 J	63%	79.1	13.9	82%	–	–	–	–	–	–	0.019	0.011	42%	45.5	30.8	32%	37.4	43.4
1/8/2024[a]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	6.5	15.7
2/14/2024	9.77	6.25	36%	53.8	20.2	62%	–	–	–	–	–	–	0.018	0.016	11%	51.7	49.8	3.7%	43.3	64.8
SUMMARY (all data)																				
Median	27.1	9.0	63%	116	24	84%	2.2	1.1	50%	0.91	1.03	11%	0.029	0.017	42%	47	38	24%		
Total n-Value	16	16	16	16	16	16	3	3	3	3	3	3	16	16	16	16	16	16		

[a] Analysis canceled for composite samples. Grab samples analyzed only.

– = parameter not analyzed

U = non-detect

BOLD values exceed TAPE criteria for individual events.

BOLD values exceed TAPE criteria bootstrap mean analysis.

Note: Design flow rate = 50 gpm.

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Science + Planning + Design

August 2024

GENERAL USE LEVEL DESIGNATION FOR BASIC (TSS), METALS & PHOSPHORUS TREATMENT

For

Advanced Drainage Systems, Inc.
EcoStream™ Biofiltration System

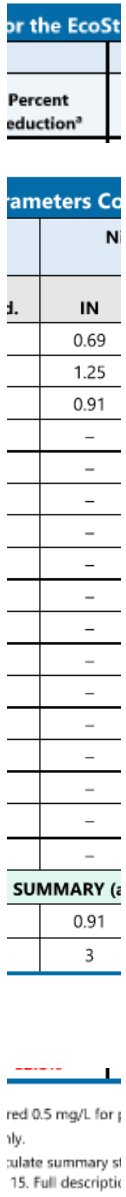
Ecology's Decision

Based on Advanced Drainage Systems, Inc. (ADS) application submissions for the EcoStream™ Biofiltration System (EcoStream), Ecology hereby issues the following use level designation:

1) General Use Level Designation (GULD) for Basic, Metals, and Phosphorus Treatment:
   - Sized at a hydraulic loading rate of no more than 3.125 gallons per minute (gpm) per square foot (sq ft) of media surface area.
   - Constructed with a minimum media thickness of 5-inches of Growth Media and 15-inches of Biofiltration Media.

2) Ecology approves the EcoStream at the hydraulic loading rate listed above, to achieve the maximum water quality design flow rate. The water quality design flow rates are calculated using the following procedures:
   - Western Washington: For treatment installed upstream of detention or retention, the water quality design flow rate is the peak 15-minute off-line flow rate as calculated using the latest version of the Western Washington Hydrology Model or other Ecology- approved continuous runoff model and as described in section III-2.6 of the 2024 Stormwater Management Manual for Western Washington (SWMMWW).
   - Eastern Washington: For treatment installed upstream of detention or retention, the water quality design flow rate is the peak 15-minute off-line flow rate as calculated using one of the three methods described in Chapter 6.5.1 of the 2024 Stormwater Management Manual for Eastern Washington (SWMMEW) or local manual.
   - Entire State: For treatment installed downstream of detention, the water quality design flow rate is the full 2-year release rate of the detention facility.

3) This General Use Level Designation has no expiration date, but Ecology may revoke or amend the designation, and is subject to the conditions specified below.



Center for Environmental Systems
Stevens Institute of Technology
One Castle Point
Hoboken, NJ 07030-0000

April 3, 2023

Gabriel Mahon, Chief
NJDEP
Bureau of Non-Point Pollution Control
Division of Water Quality
401 E. State Street
Mail Code 401-02B, PO Box 420
Trenton, NJ 08625-0420

Dear Mr. Mahon,

Based on my review, evaluation and assessment of the testing conducted on a full-scale, commercially available EcoStream™ BioFiltration System, and observed by William R. Warfel, Boggs Environmental Consultants, Inc., Middletown, MD, the test protocol requirements contained in the "New Jersey Laboratory Testing Protocol to Assess Total Suspended Solids Removal by a Filtration Manufactured Treatment Device" (NJDEP Filtration Protocol, January 14, 2022) were met or exceeded. Specifically:

Test Sediment Feed

The mean PSD of the EcoStream Biofiltration System (EcoStream) test sediment complied with the PSD criteria established by the NJDEP Filtration protocol. The Advanced Drainage Systems (ADS) EcoStream removal efficiency test sediment PSD analysis was plotted against the NJDEP removal efficiency test PSD specification. The test sediment was shown to be finer than the sediment blend specified by the protocol (<75µm); the test sediment d_{50} was approximately 68 microns.

Removal Efficiency (RE) Testing

Sixty-two (62) removal efficiency test runs were completed in accordance with the NJDEP test protocol. Twenty-five (25) of the 62 test runs were conducted during removal efficiency testing and 37 tests were conducted during mass loading testing. The target flow rate and influent sediment concentration were 66 gpm and 200 mg/L for the removal efficiency testing. The

August 2024

GENERAL USE LEVEL DESIGNATION FOR
BASIC (TSS), METALS & PHOSPHORUS TREATMENT

For

State of Washington
TAPE
GULD
Basic
Enhanced/Metals
Phosphorus

NEW JERSEY · DEPARTMENT OF ENVIRONMENTAL PROTECTION ·

NJCAT
Corporation for Advanced Technology

- Eastern Washington: For treatment installed upstream of detention or retention, the water quality design flow rate is the peak 15-minute off-line flow rate as calculated using one of the three methods described in Chapter 6.5.1 of the 2024 Stormwater Management Manual for Eastern Washington (SWMMEW) or local manual.
- Entire State: For treatment installed downstream of detention, the water quality design flow rate is the full 2-year release rate of the detention facility.

3) This General Use Level Designation has no expiration date, but Ecology may revoke or amend the designation, and is subject to the conditions specified below.

Center for Environmental Systems
Stevens Institute of Technology
One Castle Point
Hoboken, NJ 07030-0000

April 3, 2023

(ADS) EcoStream removal efficiency test sediment PSD analysis was plotted against the NJDEP removal efficiency test PSD specification. The test sediment was shown to be finer than the sediment blend specified by the protocol (<75µm); the test sediment d_{50} was approximately 68 microns.

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