Attachment 1

Manufactured Treatment Device (MTD) Registration

1. **Manufactured Treatment Device Name: BayFilter EMC**

2. **Company Name: Advanced Drainage Systems**
   Mailing Address: 4640 Trueman Blvd
   City: Hilliard
   State: OH Zip: 43026
3. **Contact Name (**to whom questions should be addressed**):** Travis Dorman
   Mailing Address: 3707 Bloomer Springs Rd
   City: Elkton
   State: VA Zip: 22827
   Phone number: 540-526-6045
   Fax number:
   E-mail address: travis.dorman@adspipe.com
   Web address: adspipe.com

4. **Technology**
   Specific size/capacity of MTD assessed (include units): 522: 22.5 GPM, 530: 30 GPM, 545: 45 GPM per cartridge
   Range of drainage areas served by MTD (acres): Site specific
   Include sizing chart or describe sizing criteria: The design engineer determines the required treatment flow rate per the regulating agency's guidance. Then they use the largest cartridge applicable to their site based on factors such as available driving head and cover depth (typically 545). Then the engineer divides the treatment flow rate by the applicable cartridge flow rate (22.5, 30, 45 GPM respectively) to determine the number of cartridges required.
   Intended application: on-line or offline: Both, online is accomplished with a 3-bay vault for internal bypass.
   Media used (if applicable): Proprietary EMC media

5. **Warranty Information** (describe, or provide web address)**:**

All water quality products manufactured by ADS are warranted for a period of one (1) year to be free of any material and manufacturing defects. This applies only to Separators and Filter Cartridges manufactured by ADS and does not include Precast Concrete Components or other Components not manufactured by ADS. This warranty is limited to providing a replacement unit (the same or equivalent) and does 1not include any installation or other costs associated with its replacement. This warranty does not extend to product defects or system failures due to improper installation, lack of maintenance, or improper system design.

6. **Treatment Type**

☐ Hydrodynamic Structure
☒ Filtering Structure
☐ Manufactured Bioretention System
Provide Infiltration Rate (in/hr):
☐ Other (describe):

7. Water Quality Treatment Mechanisms (check all that apply)

☐ Sedimentation/settling
☐ Infiltration
☒ Filtration (specify filter media) Proprietary EMC
☐ Adsorption/cation exchange
☐ Chelating/precipitation
☐ Chemical treatment
☐ Biological uptake
☐ Other (describe):

8. Performance Testing and Certification (check all that apply):

Performance Claim (include removal efficiencies for treated pollutants, flow criteria, drainage area):

Specific size/Capacity of MTD assessed:

Has the MTD been "approved" by an established granting agency, e.g. New Jersey Department of Environmental Protection (NJDEP) , Washington State Department of Ecology, etc.
☐ **No**
☒ **Yes**; For each approval, indicate (1) the granting agency, (2) use level if awarded (3) the protocol version under which performance testing occurred (if applicable), and (4) the date of award, and attach award letter.

NJDEP Certification: 80% TSS Removal
WA DOE: Basic and Phosphorus GULD. >80% TSS, 64% mean removal of total phosphorus

Was an established testing protocol followed?
☐ **No**

☒ **Yes**, (1) Provide name of testing protocol followed, (2) list any protocol deviations: Both NJDEP and WA DOE tests were performed without deviation under the protocol as interpreted and enforced at the time of the test.

Provide the information below and provide a performance report (attach report):

For lab tests:
Summarize the specific settings for each test run (flow rates, run times, loading rates) and performance for each run:

i. An electric pump with a capacity of 200-gpm and a PVC flow system were used to reach the range of flow rates tested in this study. Municipal tap water entered the source tank and was pumped to the head tanks. From there, it flowed to the storage tank, which was controlled by a float sensor. The finer components of the test sediment (Coarse Spec and Min-U-Sil 40, < 250 μm) were diluted to a stock solution in the slurry tub, where an electric mixer (Neptune L-1-CL) was used to ensure uniform distribution. Splitting the sediment into two separate feeds was necessary, due to the difficulty of maintaining uniform distribution of coarse sediments (Red Flint, > 250 μm) in the water column. To achieve better accuracy and consistency, the doser was used for Red Flint sand. A peristaltic pump drove the mixed stock solution through an injection line and into the mixing tank at a rate of 0.25 gpm, where it combined with coarse sediment from the doser and water from the storage tank (**Figure 4**). The resulting water-sediment mixture had a target concentration of 200 mg/L and was discharged from the mixing tank at a rate of 44.75 gpm. The peristaltic pump and the doser were calibrated accordingly to produce the nominal influent TSS concentration. A 30-foot long, 4-inch PVC delivery line ensured that the influent was mixed sufficiently before it reached the EMC test tank.

ii. The flow rate of treated water was monitored as it left the test tank. Measurements were initially obtained by an ISCO 750 area velocity flow module, but readings were unreliable, sometimes varying more than 30%, in spite of stable flow rates through the filter. Consultation with an ISCO technician indicated the inaccuracies were because of the sensor's position, which was slightly below the water level. To measure effluent flow more accurately, an ultrasonic sensor was mounted above the notched chamber of a v-notch weir and set to record a flow measurement every minute. In addition, a HOBO data logger was placed in the notched chamber and set to record temperature and pressure every minute, and the timed-bucket method was used every 10 minutes to corroborate data from electronic flow measurement.

iii. If a synthetic sediment product was used, include information about the particle size distribution of the test material:

Table 2 - Particle Size Distribution of Test Sediment as Analyzed by ECS

Particle Size (µm)	Test Blend % Finer by Mass Analyzed By ECS				
	NJ Blend A	NJ Blend B	NJ Blend C	Average	NJDEP Specification (minimum % passing)
1000	98	98	98	98	98
500	95	95	95	95	93
250	89	90	90	90	88
150	79	78	77	78	73
100	60	59	60	60	58
75	48	48	48	48	48
50	45	46	45.5	46	43
20	36	34	35	35	33
8	20	20	20	20	18
5	14	14	14	14	8
2	5.5	5	5	5	3

iv. If less than full-scale setup was tested, describe the ratio of that tested to the full-scale MTD: A full scale unit was tested.

For field tests:

i. Provide the address, average annual rainfall and characterized rainfall pattern, and the average annual number of storms for the field-test location: The Woodinville Sammamish test site located near the intersection of NE 175th Street and 131st Ave NE in Woodinville, Washington. Rainfall patterns are characterized as typical for the Pacific Northwest. We utilized 12 qualified rain events between November 2013 and March 2015 with antecedent periods between 12 and 336 hours and rainfall durations between 3 and 14 hours.

ii. Provide the total contributing drainage area for the test site, percent of impervious area in the drainage area, and percentages of land uses within the drainage area (acres): The treatment area spans 52 acres, 49 of which are occupied by completely constructed office, commercial, and transportation facilities. The remaining three acres are covered by ground vegetation. **Appendix E** shows the project site and the three major drainage basins (A, B, and C). The region highlighted in red was identified by the city as a 100% infiltration area and is labeled as such.

iii. Describe pretreatment, bypass conditions, or other special circumstances at the test site: At the Woodinville site, runoff is conveyed to the BayFilter™ EMC system after it passes through a BaySeparator via a 48" diameter corrugated polyethylene stormwater inlet pipe. Low and moderate effluent flows are then directed by an 18"

HDPE inlet pipe to a 44'x10' precast vault (**Figure 1**), where the EMCs are situated. Inside the vault, the filter cartridges are connected to an outlet pipe by a PVC under-drain. Flows greater than 4 cfs are diverted within the BaySeparator and bypass the filter system entirely. The bypass flow is conveyed into a 4' diameter manhole located downstream of the filter vault.

iv. Provide the number of storms monitored and describe the monitored storm events (amount of precipitation, duration, etc.):

Table 4 – Rainfall Event Hydrological Data

Rainfall Event	Precipitation (Inches)	Antecedent Dry Period (hours)	Rainfall Duration (hours)	Mean Rainfall Intensity (in/hr)
November 11, 2013	0.37	48	5	0.07
November 18, 2013	0.26	84	3	0.09
December 13, 2013	0.20	336	6	0.04
December 17, 2013	0.24	48	4	0.06
February 13, 2014	0.68	36	14	0.05
February 25, 2014	0.43	216	7	0.06
May 12, 2014	0.45	48	7	0.07
May 27, 2014	0.46	84	8	0.06
June 19, 2014	0.24	12	7	0.03
July 30, 2014	0.21	48	6	0.03
March 17, 2015	0.22	168	6	0.04
March 30, 2015	0.31	120	7	0.06
TAPE Guideline	**0.15**	**6**	**1**	**0.03**

v. Describe whether or not monitoring examined seasonal variation in MTD performance: Events were included from all 4 seasons as noted above and described in the report.

vi. If particle size distribution was determined for monitored runoff and/or sediment collected by the MTD, provide this information: PSD was analyzed on 8 events, see table below:

Table 16 – Particle Size Distribution Influent Concentration

Parameter	Mean	Flow-Weighted Mean
Median Particle Size (microns)	53.81	54.22
d^{10} (microns)	9.49	9.30
d^{50} (microns)	53.81	54.22
d^{90} (microns)	200.97	192.25

9. MTD History:

How long has this specific model/design been on the market? 15+ years

List no more than three locations where the assessed model size(s) has/have been installed in Virginia. If applicable, provide permitting authority. If known, provide latitude & longitude: Fairfax, Richmond, Charlottesville

List no more than three locations where the assessed model size(s) has/have been installed outside of Virginia. If applicable, provide permitting authority. If known, provide latitude & longitude: New York, New Jersey, Maryland

10. Maintenance:

What is the generic inspection and maintenance plan/procedure? (attach necessary documents): Inspect 6 months after install and annually thereafter. Maintenance should be performed if the cartridges are still submerged 48-72 hours after rain event. All cartridges are removed, a vac truck cleans the vault itself, and new cartridges are installed.

Is there a maintenance track record/history that can be documented?
☒ No, no track record.
☐ Yes, track record exists; (provide maintenance track record, location, and sizing of three to five MTDs installed in Virginia [preferred] or elsewhere): We don't track maintenance events in a way that makes this request possible.

Recognizing that maintenance is an integral function of the MTD, provide the following: amount of runoff treated, the water quality of the runoff, and what is the expected maintenance frequency for this MTD in Virginia, per year? 2-3 years depending on site conditions.

Total life expectancy of MTD when properly operated in Virginia and, if relevant, life expectancy of media: The cartridges have a life expectancy of 2-3 years on average.

For media or amendments functioning based on cation exchange or adsorption, how long will the media last before breakthrough (indicator capacity is nearly reached) occurs? NA

For media or amendments functioning based on cation exchange or adsorption, how has the longevity of the media or amendments been quantified prior to breakthrough (attach necessary performance data or documents)? NA

Is the maintenance procedure and/or are materials/components proprietary?
☒ Yes, proprietary
☐ No, not proprietary

Maintenance complexity (check all that apply):
☒ Confined space training required for maintenance
☒ Liquid pumping and transportation
Specify method: Vac Truck
☒ Solids removal and disposal
Specify method: Subject to local ordinance, usually landfill
Other noteworthy maintenance parameter (describe):

11. Comments

Include any additional explanations or comments: NA

12. Certification

Signed by the company president or responsible officer of the organization:

"I certify that all information submitted is to the best of my knowledge and belief true, accurate, and complete."

Signature: _____ _____

Name: _____Travis Dorman_____

Title: __Water Quality Manager- East _____

Date: ____1/6/22_____

NOTE: All information submitted to the department will be made publicly accessible to all interested parties. This MTD registration form will be posted on the Virginia Stormwater BMP Clearinghouse website.