Florida Stormwater Treatment

Susan McNamee

Hydro International

Susan McNamee

- BS Business Management
- 19 years in Stormwater (retention / detention and water quality
- 2.5 years with Hydro (just water quality)
- Member of FSA and on the education Committee

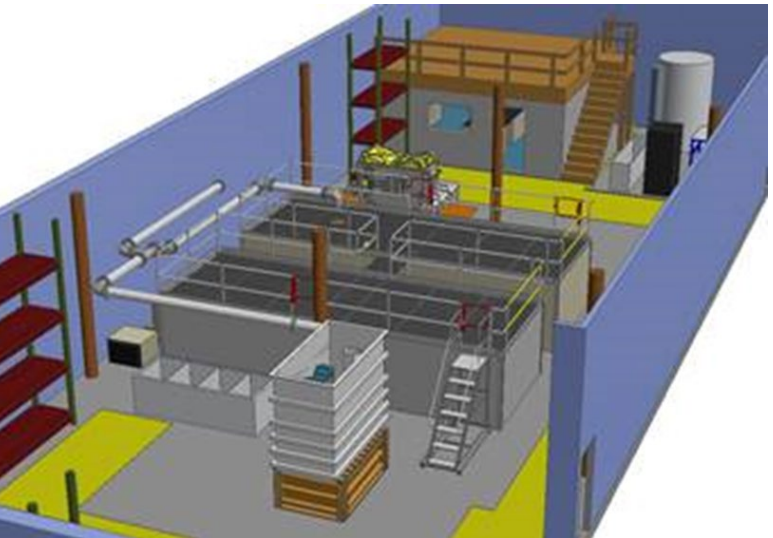
Webinar Overview

- Our Capabilities
- Pollutant Problems
  - Nutrient, Sediment & Trash
- Florida Regulations
- Stormwater Challenges in Florida
  - High water table
  - High flows
  - Tail water/tidal conditions
  - Tight sites
- Hydro's Product line
- Survey

Why Hydro?

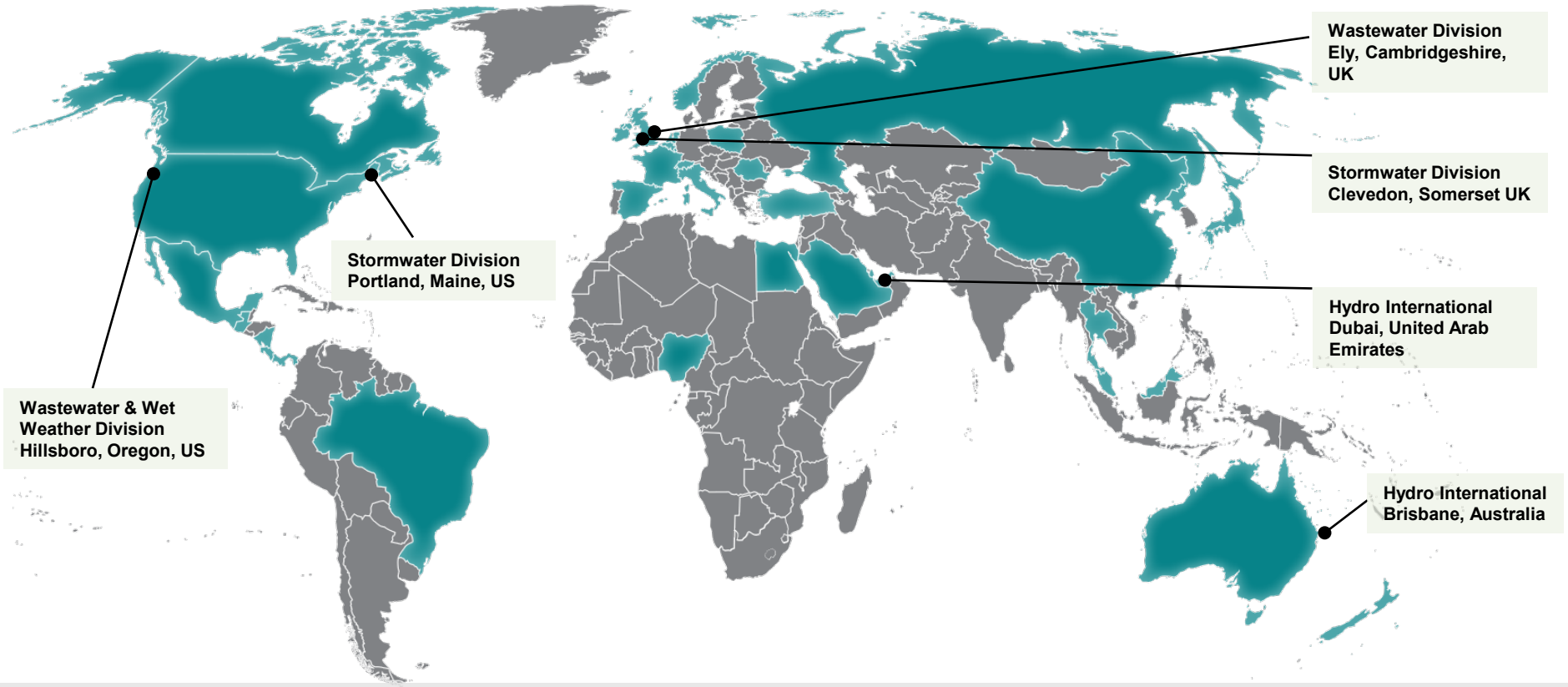
Our Expertise

- We’re a water treatment company first
- We’ve developed our own technologies
- We continually improve and perfect our products in our world-class hydraulics laboratory



We're Local *and* Global

33 Countries



350+ Employees

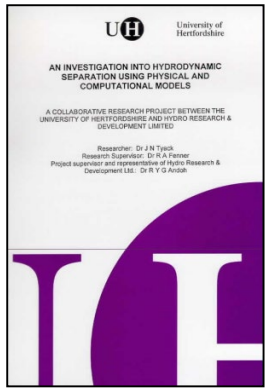
Our Collaborations

Hydro International

liverpool JMU

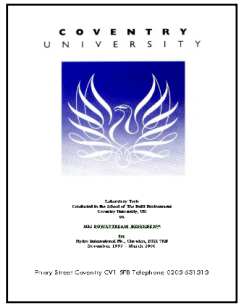
University of New Hampshire

PennState



University of Bradford
MAKING KNOWLEDGE WORK

University of Massachusetts Amherst



Cardiff University
Prifysgol Caerdydd

The University of Alabama

University of Bristol

UF University of Florida

The University Of Sheffield.

University of Minnesota
Driven to Discover℠

stream
The Industrial Doctorate Centre for the Water Sector

University of Exeter

Trinity College Dublin
Coláiste na Tríonóide, Baile Átha Cliath
The University of Dublin

Florida Stormwater Challenges

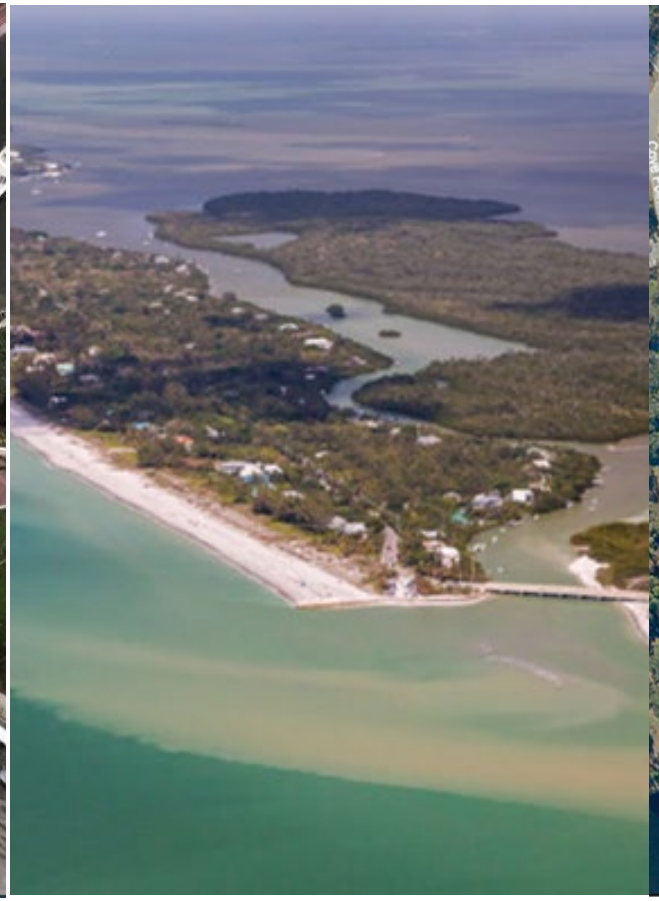
Why Remove Pollutants from Stormwater?

Hydro International

Failure to remove pollutants can result in impaired waterways which, can affect aquatic ecosystems, health issues and create an eyesore.

Sediment Pollution in Florida

Fort Lauderdale River



Shore of Captiva (left) and Sanibel Island

Panama City

Haulover Canal in the northern Indian river lagoon

The Trouble with Trash

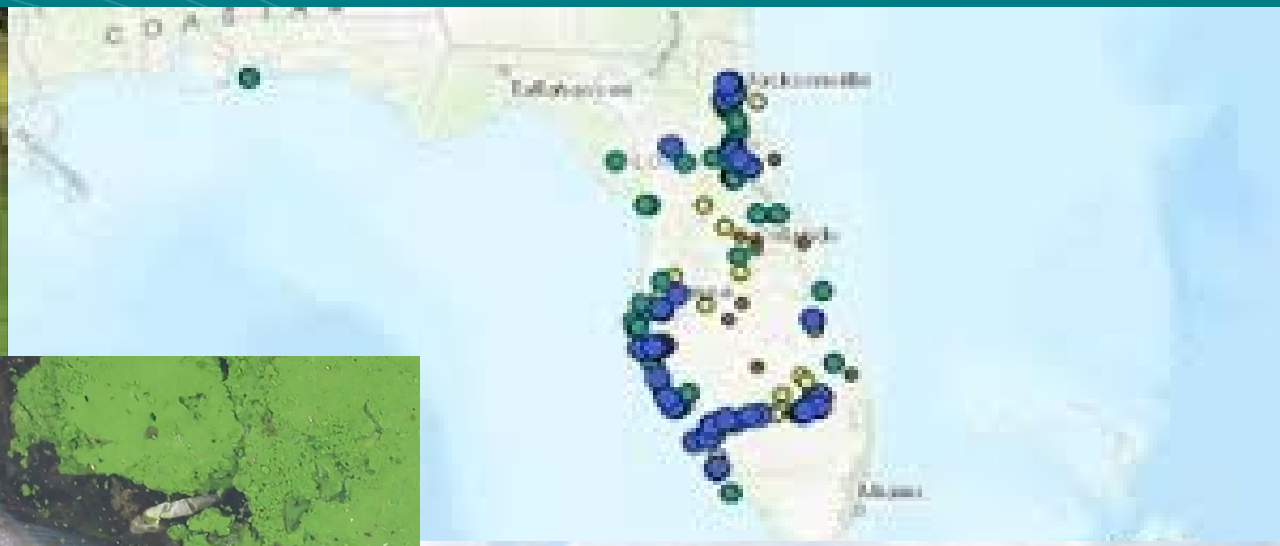
- Degrades natural habitats
- Economic Harm
  - *It's an eyesore that hurts tourism*
  - *Shoreline communities spend millions in cleanup costs*
- Poses public health threats

Aquatic Wildlife

Hydro International

Nutrient Pollution

Hydro International



Hydrocarbons Pollutants

What's at Stake for Our Economy in Florida

Hydro International

Sunshine isn't enough!

- **$2 trillion** annually are potentially at risk.
- On a smaller scale, tourism in Lee and Collier counties alone has yearly economic impact approaching **$4.5 billion**

https://www.naplesnews.com/story/news/environment/2018/07/14/floridas-algae-crisis-how-affecting-tourism-other-businesses/784599002/

What's Florida doing about the Pollutants
https://protectingfloridatogether.gov/

Hydro International

Regulations & Treatment

Hydro International®

Regulations Drive Treatment Types

Your stormwater permit type and local stormwater quality regulations will dictate what pollutants need to be treated and in turn, the type of treatment system we provide to you.

Nutrients | Trash & floatables | Oils & hydrocarbons | Metals | Very fine particles | Industrial materials

Our product line was designed to address a full range of pollutants.

Gross Pollutant Removal ◄ ····· ► Finest Pollutant Removal

Hydro DryScreen®

2nd Generation Baffle Box

First Defense®

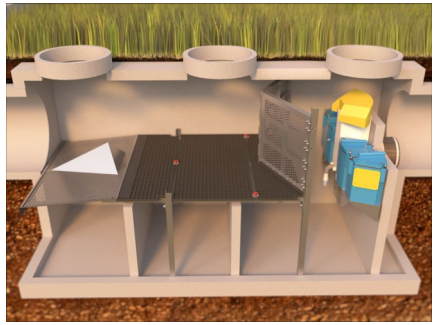
Advanced Vortex Separators

Downstream Defender®

Filtration System

Up-Flo® Filter

2nd Generation Filtration System



Hydro DryScreen® with Up-Flo® Filter

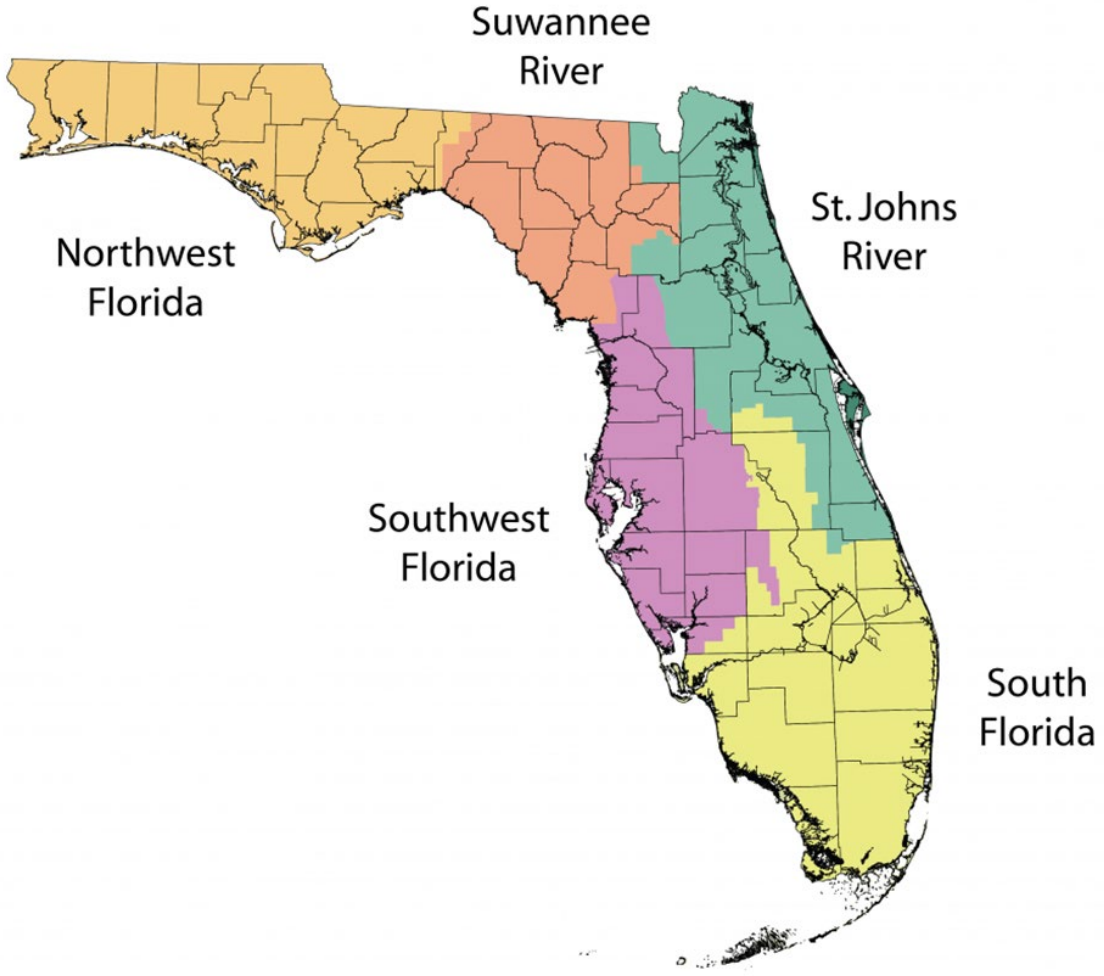
Bioretention

Bioinfiltrator®

Florida Regulations

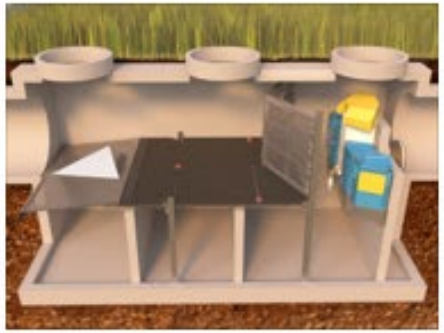
- FDEP – NPDES
  - SMALL-Disturb one of less five acres
  - LARGE – Disturbs five or greater

- 5 Water Management Districts
  - Impaired waters
  - Capture water quality volume (1,2,3+ inc
  - Reduce your load TP, TN
  - 80% TSS, Trash, Hydrocarbons
- Counties
  - What is accepted?
  - Do you get credit ?



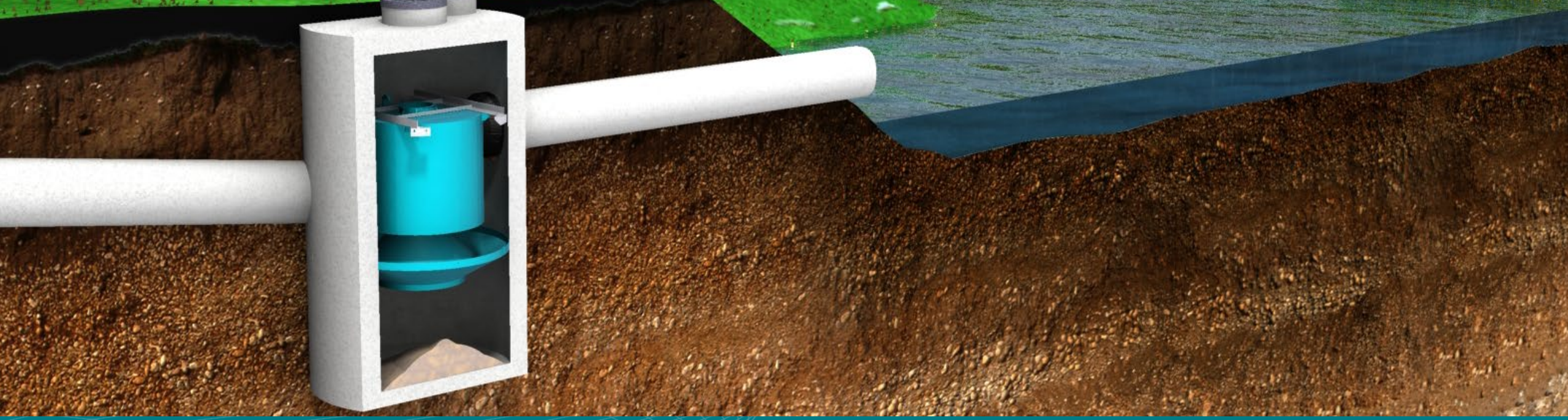
Site Conditions to Overcome

- Tailwater and Tidal Conditions
- High ground water | High water table
- High flows
- Tight sites



Product Solutions

Hydro International®



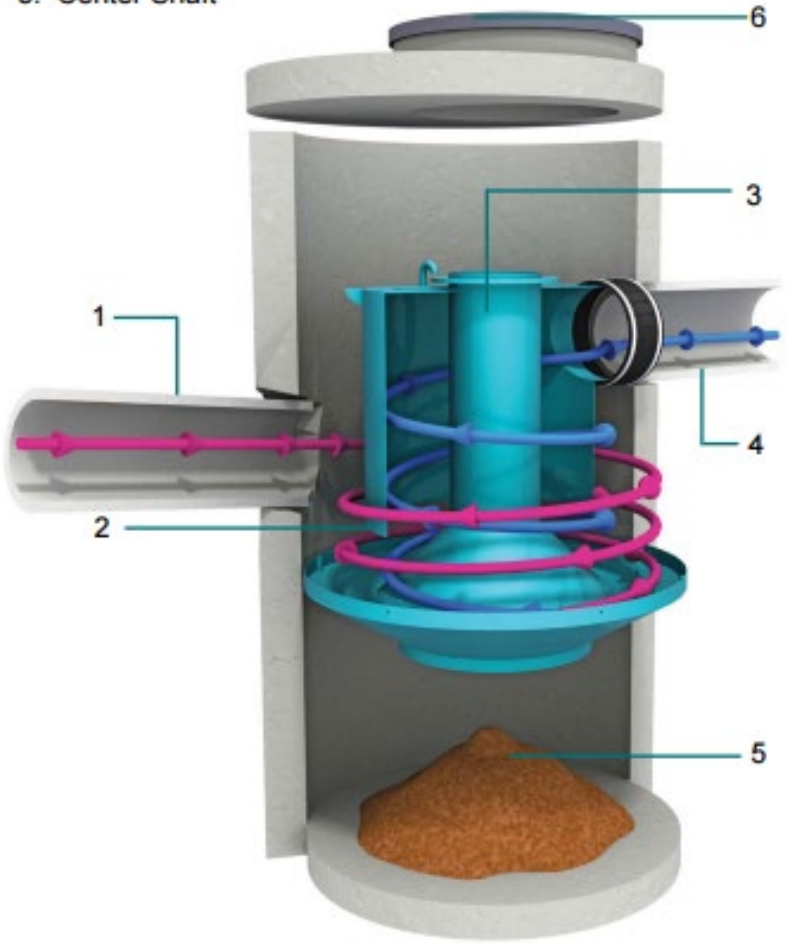
Downstream Defender® Hydrodynamic Separator

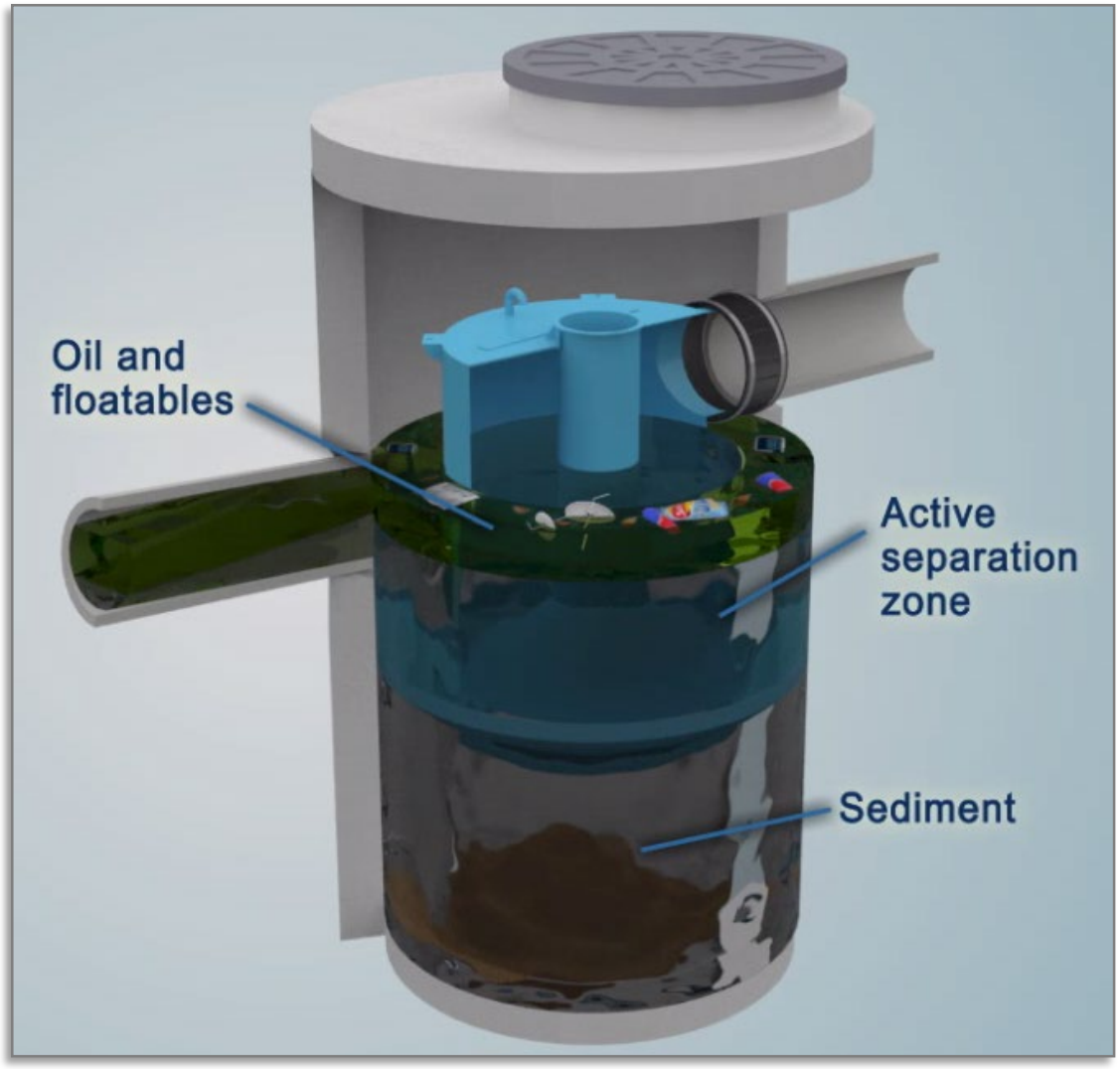
Hydro International®

Downstream Defender

Components

1. Inlet to Precast Vortex Chamber
2. Cylindrical Baffle
3. Center Shaft
4. Outlet Pipe
5. Sediment Storage Sump
6. Access Lid





Separators are Designed for

- Coarse particles and sediment
- Sediment-bound metals
- Trash & floatables
- High Flow
- Hydrocarbons

Acceptance FDEP on Material to TP and TN

"Methodology for Calculating Nutrient Load Reductions Using the FSA Assessment Tool" (Bateman, 2012)

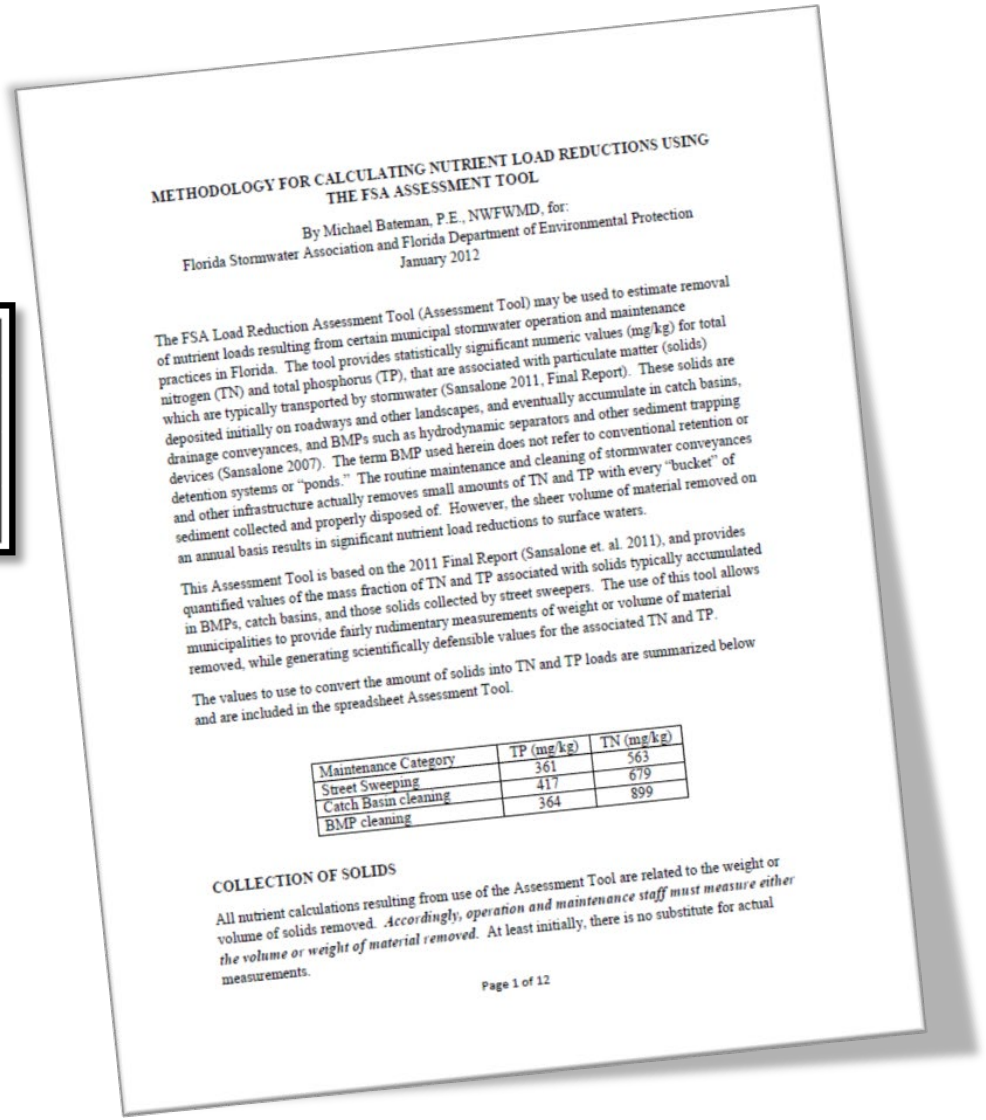
Maintenance Category	TP (mg/kg)	TN (mg/kg)
Street Sweeping	361	563
Catch Basin cleaning	417	679
BMP cleaning	364	899

TSS = 4013 lbs/acre-foot

TP = 1.67 lbs/acre-foot

TN = 2.73 lbs/acre-foot

Accepted by FDEP, 100% trash capture by CA Waterboard and can be molded in BMPTrains



METHODOLOGY FOR CALCULATING NUTRIENT LOAD REDUCTIONS USING THE FSA ASSESSMENT TOOL

By Michael Bateman, P.E., NWFWMD, for:
Florida Stormwater Association and Florida Department of Environmental Protection
January 2012

The FSA Load Reduction Assessment Tool (Assessment Tool) may be used to estimate removal of nutrient loads resulting from certain municipal stormwater operation and maintenance practices in Florida. The tool provides statistically significant numeric values (mg/kg) for total nitrogen (TN) and total phosphorus (TP), that are associated with particulate matter (solids) which are typically transported by stormwater (Sansalone 2011, Final Report). These solids are deposited initially on roadways and other landscapes, and eventually accumulate in catch basins, drainage conveyances, and BMPs such as hydrodynamic separators and other sediment trapping devices (Sansalone 2007). The term BMP used herein does not refer to conventional retention or detention systems or "ponds." The routine maintenance and cleaning of stormwater conveyances and other infrastructure actually removes small amounts of TN and TP with every "bucket" of sediment collected and properly disposed of. However, the sheer volume of material removed on an annual basis results in significant nutrient load reductions to surface waters.

This Assessment Tool is based on the 2011 Final Report (Sansalone et. al. 2011), and provides quantified values of the mass fraction of TN and TP associated with solids typically accumulated in BMPs, catch basins, and those solids collected by street sweepers. The use of this tool allows municipalities to provide fairly rudimentary measurements of weight or volume of material removed, while generating scientifically defensible values for the associated TN and TP.

The values to use to convert the amount of solids into TN and TP loads are summarized below and are included in the spreadsheet Assessment Tool.

Maintenance Category	TP (mg/kg)	TN (mg/kg)
Street Sweeping	361	563
Catch Basin cleaning	417	679
BMP cleaning	364	899

COLLECTION OF SOLIDS

All nutrient calculations resulting from use of the Assessment Tool are related to the weight or volume of solids removed. *Accordingly, operation and maintenance staff must measure either the volume or weight of material removed.* At least initially, there is no substitute for actual measurements.

Page 1 of 12

Pollutant Removal

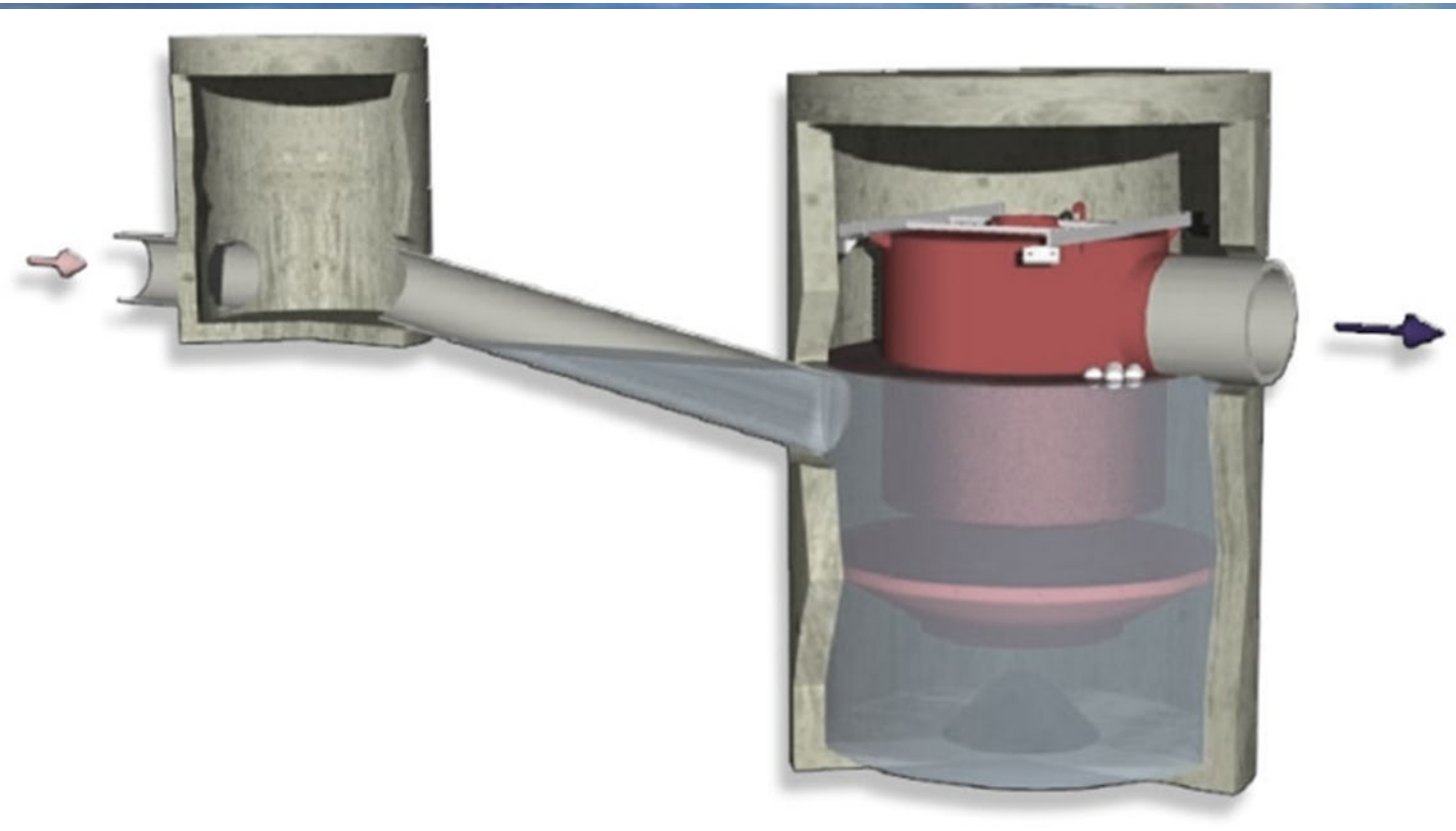
Sediment, sediment-bound metals, organic material

Oil/hydrocarbons

Trash

Tail Water or Tidal Conditions

The system was already designed to function in submerged conditions so it can handle tidal conditions and tail water



Easy Maintenance

Hydro International

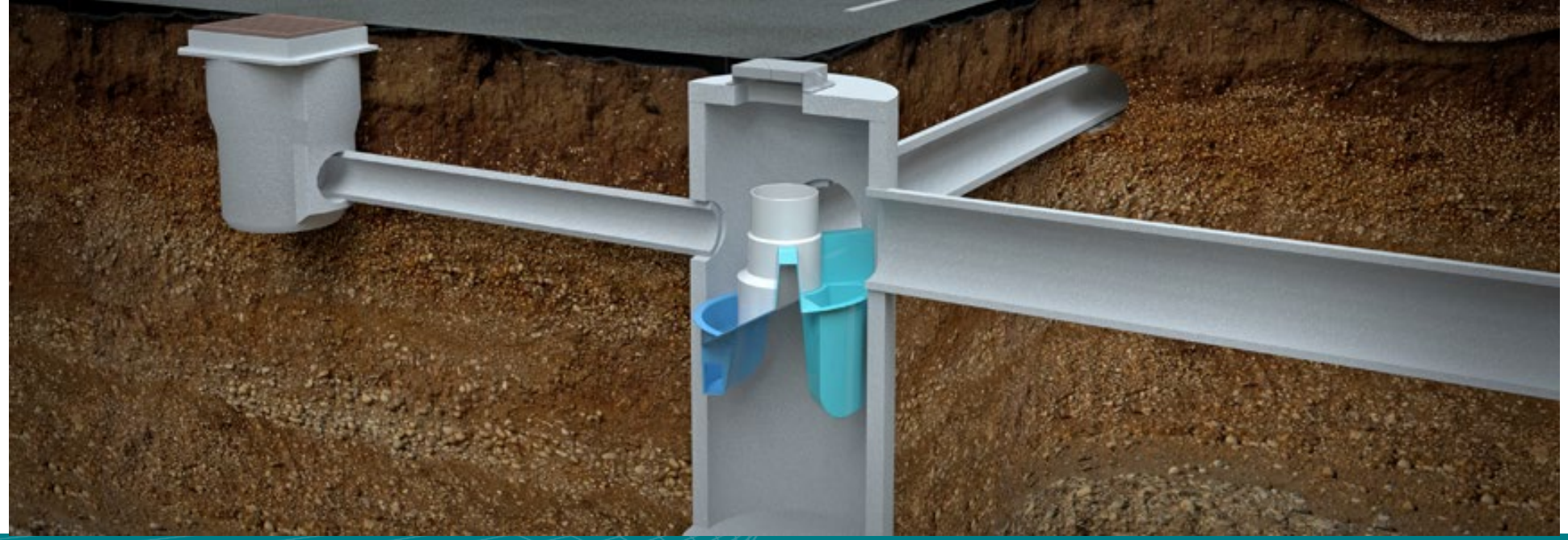
Hydro International

Downstream Defender®

Simple maintenance.

Stormwater Solutions

Turning Water Around...®



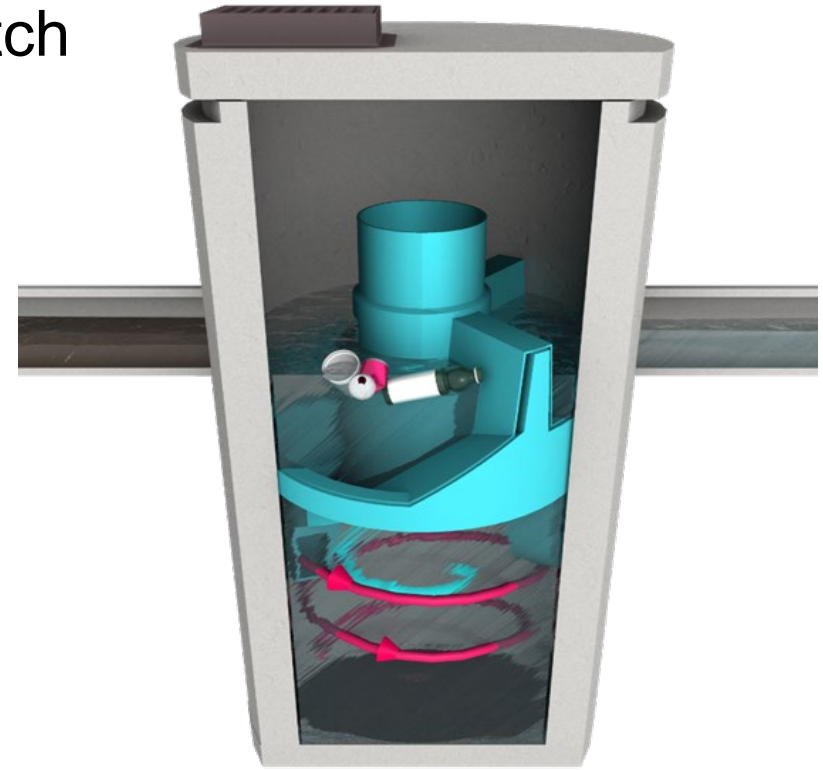
Reasons to Specify
First Defense® Hydrodynamic Separator

Hydro International®

Product Profile – First Defense

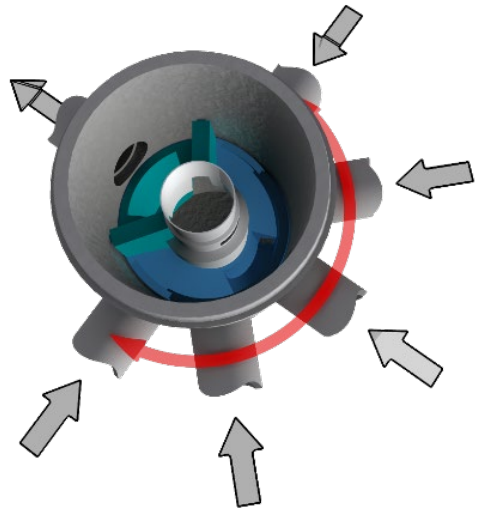
- Flexible inlet angles
- Multiple pipes
- Inverts do not need to match
- Can handle high flows through a small footprint
- Works with large pipes
- Grate Inlet

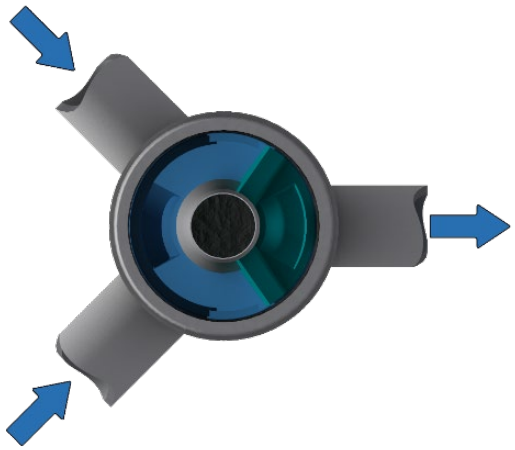
Grate option



Inlet

Outlet





Downstream Defender vs. First Defense

Downstream Defender®

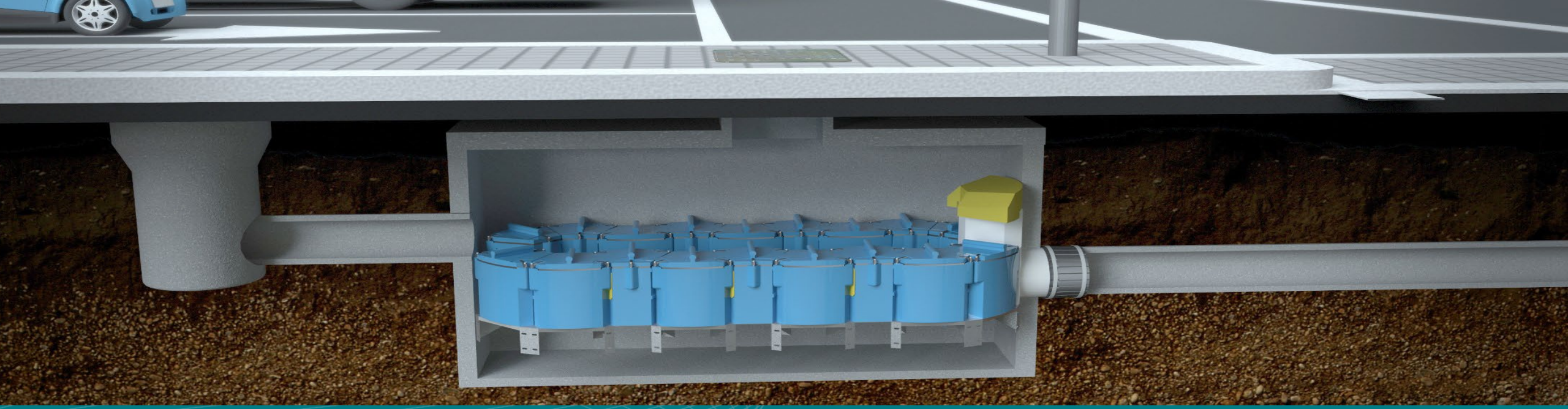
DEPENDABLE POLLUTANT CAPTURE

- Trash capture
- Oil capture
- Tail water & Tidal conditions
- Large drainage areas

First Defense®

SIMPLE DESIGN & SITE FLEXIBILITY

- Easy design/site flexibility
- High peak flow
- Surface inlet/grate
- Multiple inlet



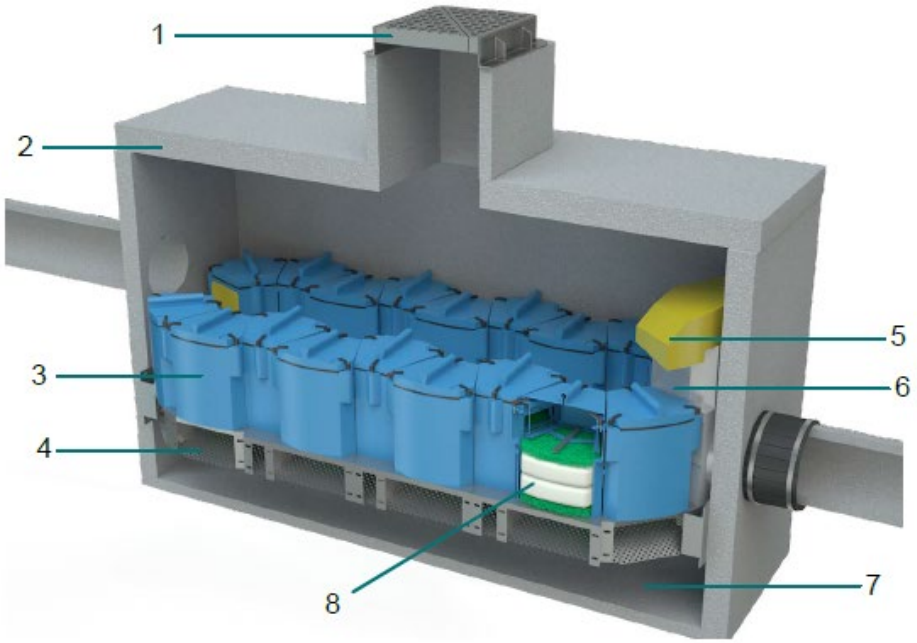
Up-Flo® Filter

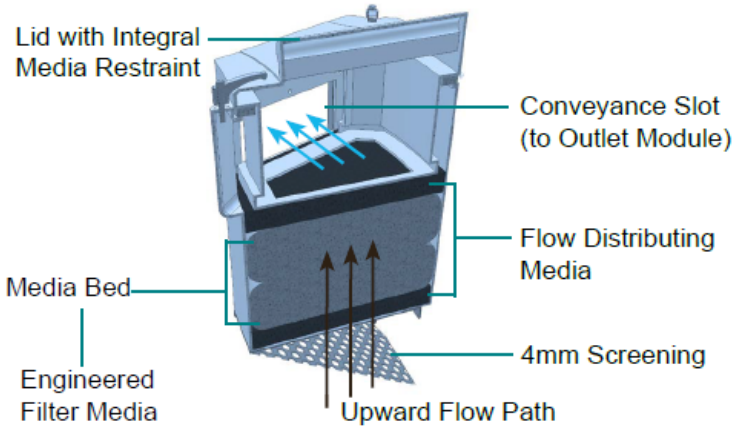
Hydro International®

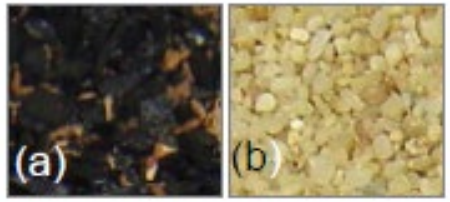
Product Profile

System Components

1. Inlet grate (pictured) or Inlet Pipe (not shown)
2. Precast Filtration Chamber
3. Filter Module
4. 4mm Screening
5. Bypass Hood/Siphon
6. Outlet Module with Drain Down Filter
7. Pollutant Storage Sump
8. Media bags

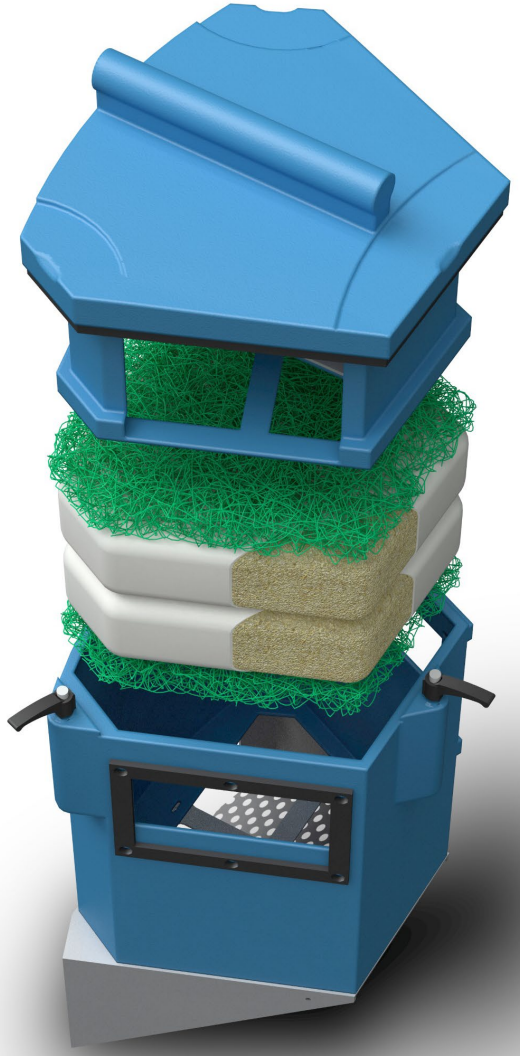






Home

Filter Components



Designed for Florida

- Accepted by FDEP
- 92% TSS Removal
- TN = 70% (BMP Trains)
- TP = 50% (BMP Trains)
- Design flow in FL 9 GPM

University of Florida Field Monitoring

- Full-Scale 4-ft Manhole with 6 Filter Modules

Depending on the storm event intensity and wind direction the drainage area can vary from 5,400 to 8,600 ft^2 (0.12 to 0.20 acres) of pavement. The catchment drains to inlet A as shown in **Figure 4(b) and 4(a)**. Runoff captured by inlet A is the source of influent to the downstream Up-Flo® filter.

PHYSICAL MODEL TESTING AND MONITORING OF A HYDRO INTERNATIONAL (HI) UP-FLO FILTER SUBJECT TO RAINFALL-RUNOFF LOADING EVENTS

Monitoring Report for Hydro International Up-Flo Filter Prepared By:

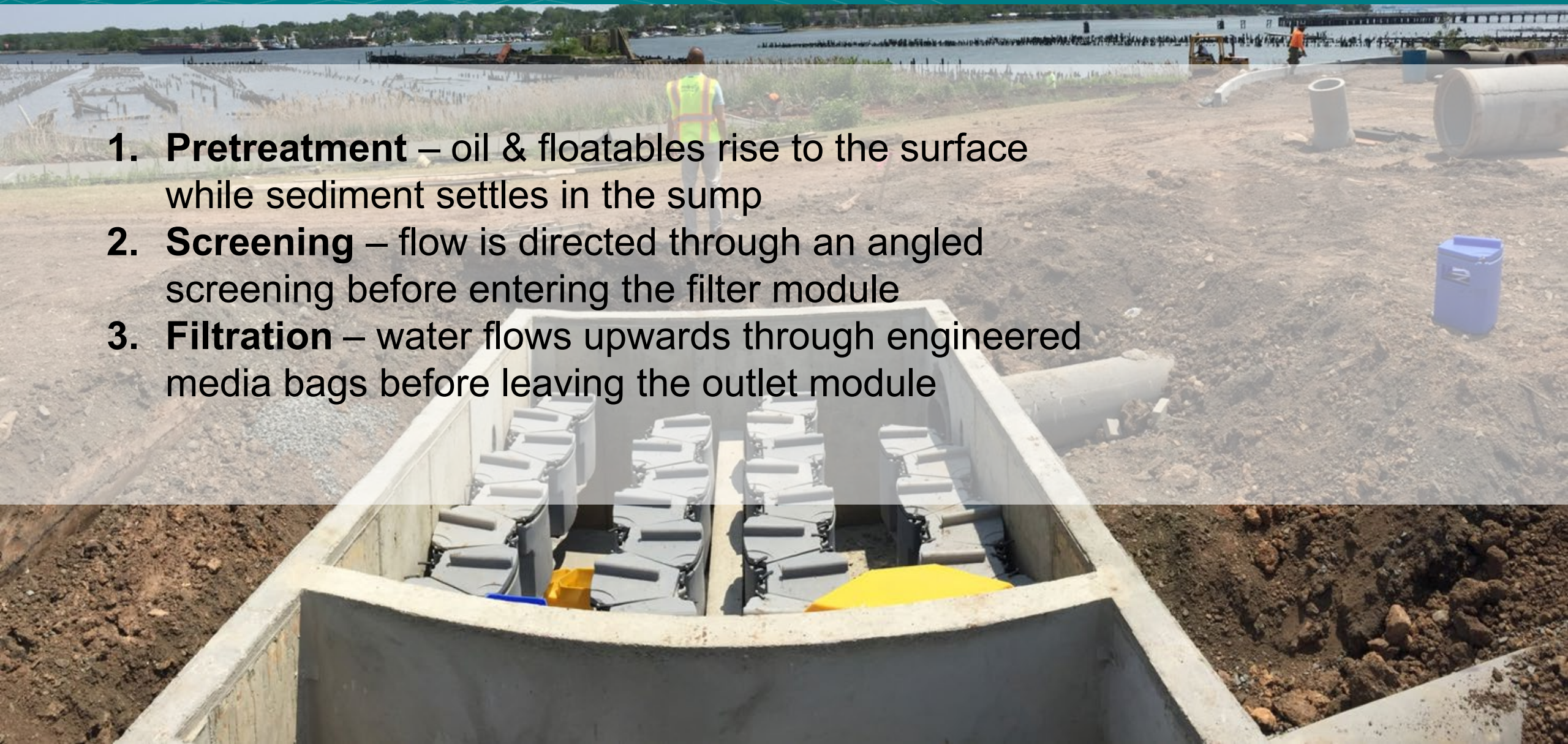
University of Florida
Engineering School of Sustainable Infrastructure and Environment (ESSIE)
University of Florida
Gainesville, FL 32611 USA

Draft Version: 05 April 2017

Pollutant's Captured

- Trash
- TSS – sediment
- Oil & Hydrocarbons
- TP & TN

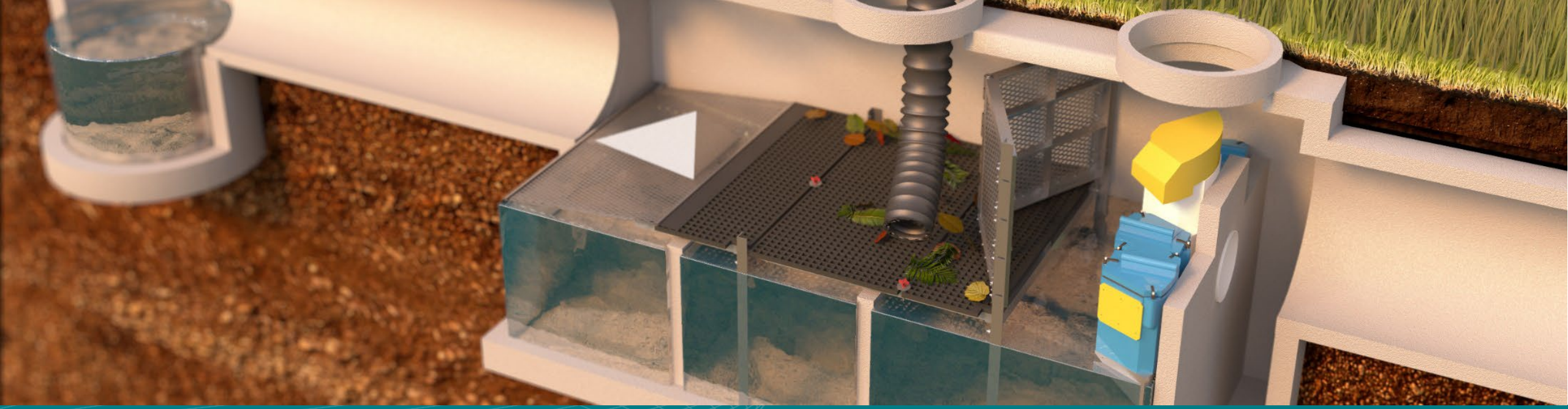
System Efficiency



1. **Pretreatment** – oil & floatables rise to the surface while sediment settles in the sump
2. **Screening** – flow is directed through an angled screening before entering the filter module
3. **Filtration** – water flows upwards through engineered media bags before leaving the outlet module

Easy Maintenance, Less Often

- Straightforward sump access, light-weight media packs are easily replaced without removing the entire filter module
- Longer media life means you can go longer between servicings.



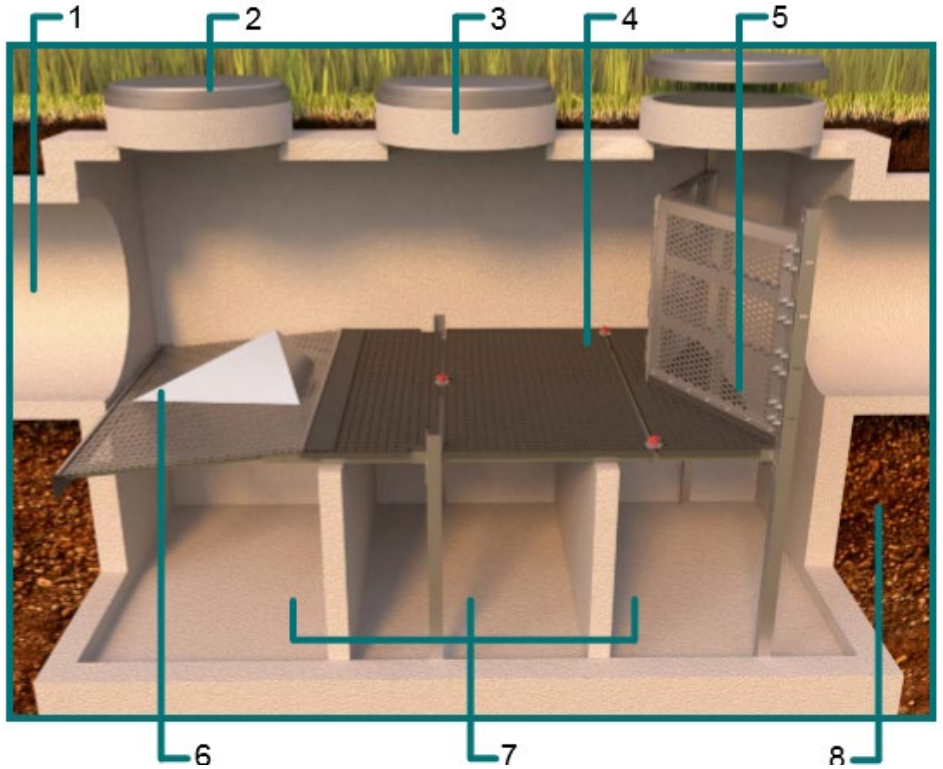
Hydro DryScreen® Next Generation Baffle Box & Up-Flo® Filter

Hydro International®

Hydro DryScreen® with and without Up-Flo ® Filter

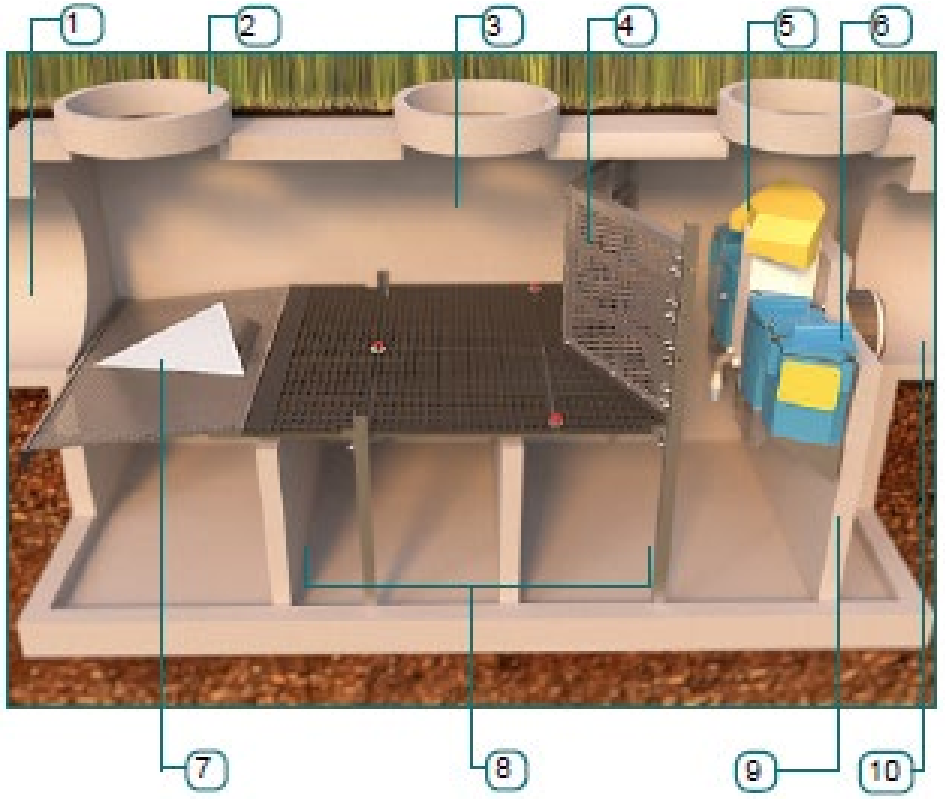
Components

1. Inlet Pipe
2. Access Lids
3. Precast Vault
4. Adjustable Height Dry Screen
5. Vertical Screened Weir
6. Flow Spreader
7. Sediment Storage Sump
8. Outlet Pipe



Components

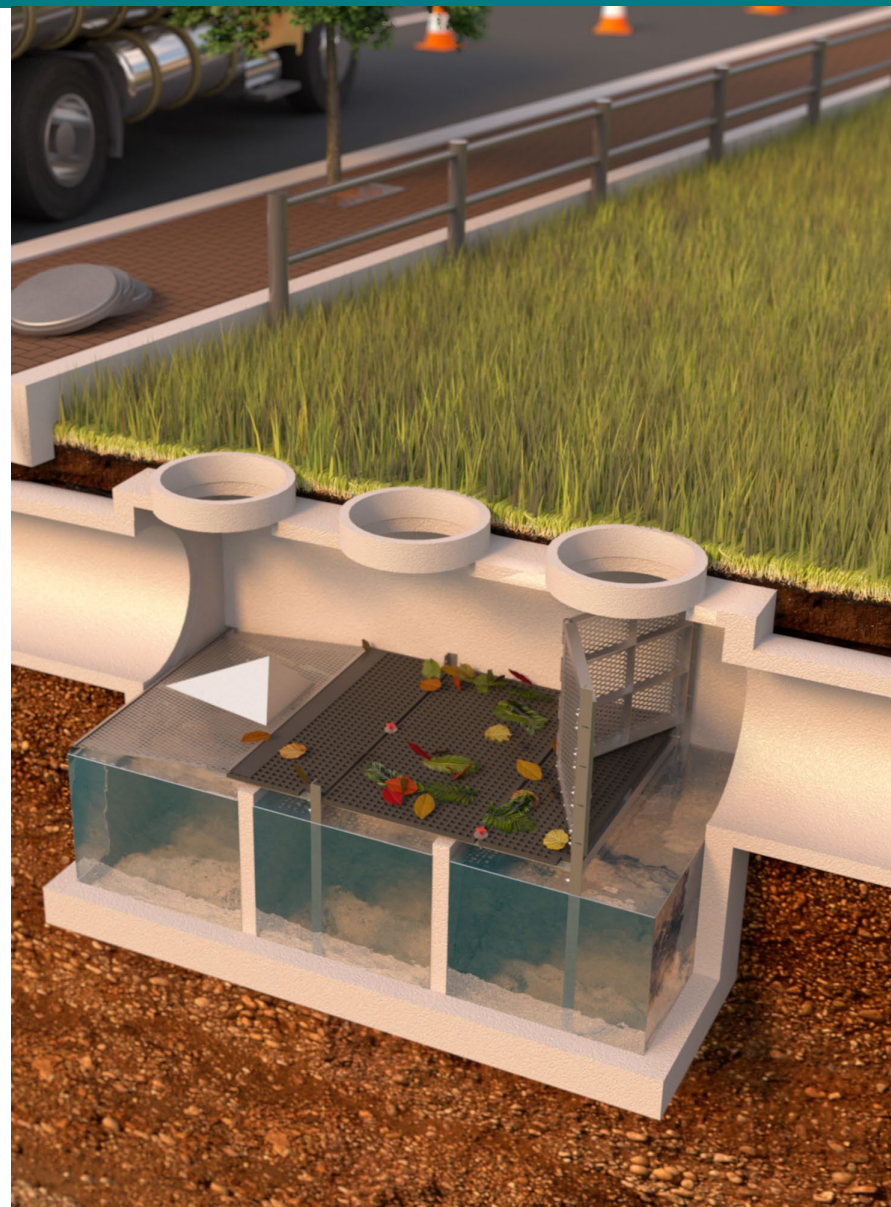
1. Inlet Pipe
2. Access Lids
3. Precast Vault
4. Adjustable Height Dry Screen
5. Up-Flo Filter Bypass Hood
6. Up-Flo Filter module
7. Flow Spreader
8. Sediment Storage Sump
9. Weir Wall
10. Outlet Pipe



Hydro DryScreen® Next Generation Baffle Box

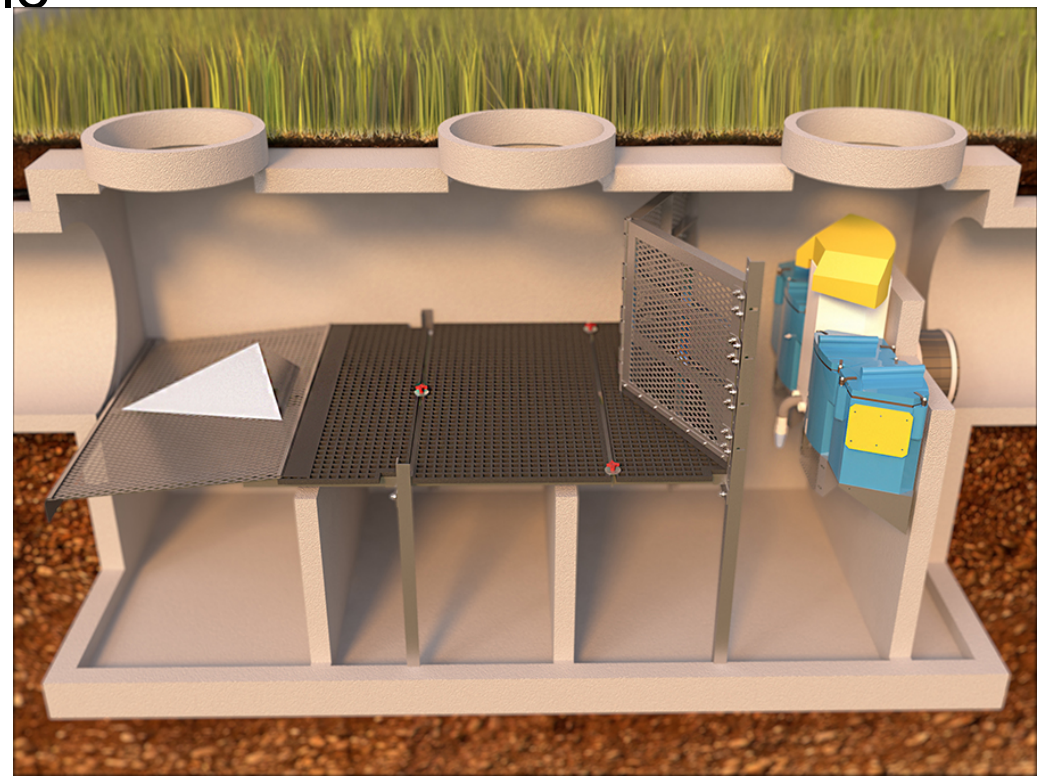
1. Large pipes and large peak flows
2. Shallow sites or areas with a high water table
3. Trash and floatable removal
4. Nutrient removal
5. Sediment removal

Coarse particles	High flow	Nutrients	Trash & floatables



Hydro DryScreen® Next Generation Baffle Box with Up-Flo® Filter

1. Large pipes and large peak flows
2. Shallow sites or areas with a high-water table
3. Trash and floatable removal
4. Nutrient removal
5. Sediment removal
6. Particulate & dissolved metals
7. Nutrients
8. Very fine particles



Accepted by California Water Boards for 100% Trash Capture

- Both Hydro DryScreen® & Up-Flo Filter are Accepted by California Water Boards for 100% Trash Capture

- Four years of trash study data demonstrates that Hydro DryScreen removes 97% of trash collected

Hydro Dryscreen Type 2 Baffle Box Removals

Hydro International

Type 2 or Nutrient Separating Baffle Box

*Type 2 baffle boxes averaged

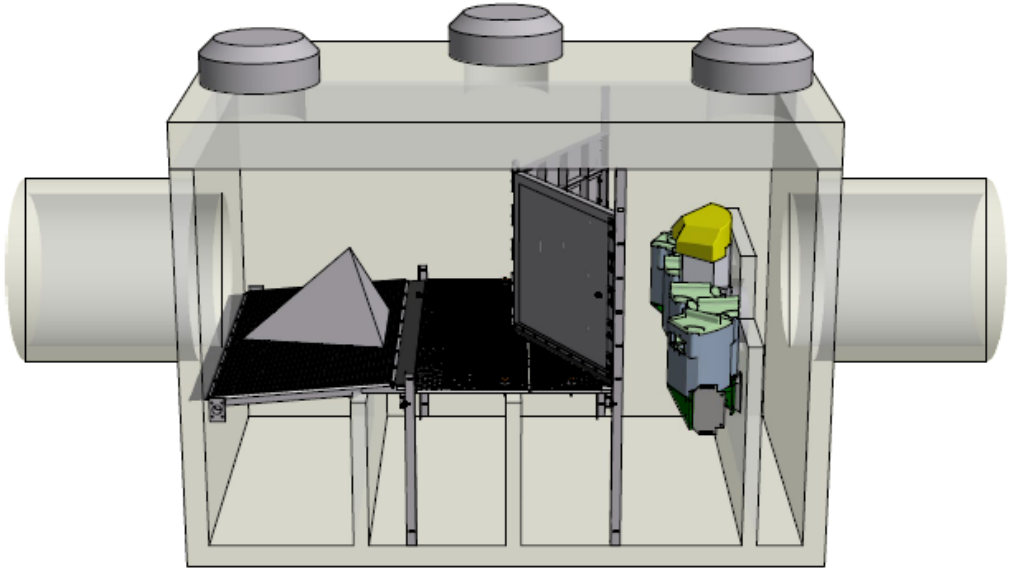
- 67.2% TSS removal
- 19% TN removal
- 15.5% TP removal.

*Final Report Baffle box Effectiveness Monitoring Project FDEP – Jan 7 2010

Hydro Dryscreen w/ UpFlo filter Removals

Now accepted for use by the **Florida Department of Environmental Protection** for the following removal efficiencies:

- **92% Sediment Removal**
- **70% Nitrogen Removal**
- **50% Phosphorous Removal**



https://fldeploc.dep.state.fl.us/tech_portal/accept_list.asp?prog_choice=Water

https://floridadep.gov/sites/default/files/BMP%20Efficiencies%20July%202018.pdf

FDEP Accepted -July 2018 List

Hydro International

BMP Type	Standard BMPs	TP % Reduction	TN % Reduction	Data Source
Baffle Boxes	**Baffle boxes—First generation (hydrodynamic separator)[1]**	2.30 %	0.50 %	Final report, Contract S0236, *Effectiveness of baffle boxes plus media filter,* by GPI Southeast 2010; *Demonstration bio media for ultra-urban stormwater treatment,* by University of Central Florida (UCF) for Florida Department of Transportation (FDOT); and Final report, Contract S0497, *Baffle box with media filtration installation and effectiveness evaluation* by City of Casselberry
	Baffle boxes—Second generation[1]	15.5 %	19.05 %	
	Baffle boxes—Second generation plus media filter[1]	BMPTRAINs model	BMPTRAINs model	
Hydrodynamic Separators	**Hydrodynamic separators**	10 %	N/A	May 2016, *Draft Pinellas County stormwater manual*

Statewide Best Management Practice (BMP) Efficiencies for Nonpoint Source Management of Surface Waters
Draft – July 2018

This document describes the DEP methods to calculate total nitrogen (TN) and total phosphorus (TP) reductions for urban stormwater loads related to surface watershed restoration, when site-specific information is not available. These calculation methods represent typical BMP performance, which may be useful to stakeholders when selecting BMPs to achieve surface water nutrient load reductions related to the development and implementation of basin management action plans (BMAPs), 4e plans, and 4b/reasonable assurance plans (RAPs). DEP assigns nutrient removal efficiencies and nutrient credits to BMPs on a case-by-case basis, using the information in this document as a guide during the decision-making process. This working document will be updated periodically as new information becomes available. To download the latest version, visit: http://publicfiles.dep.state.fl.us/DEAR/BMAP/Resources/.

These calculation methods are not designed for use with Environmental Resource Permits (ERPs). The appropriate permitting agency should be consulted for its approved calculation methods.

Table 1 lists the removal efficiencies for various standard BMP types. **Table 2** lists the TN and TP reductions for provisional nonpoint source management BMPs. **Table 3** lists the BMPs for which data are lacking and water quality benefits are unknown. As additional data become available, these BMPs may be assigned provisional load reduction credits.

It should be noted that for certain BMPs, reductions resulting from regular required maintenance are implicit in the initial credit given during installation or implementation. Therefore, operations and maintenance (O&M) required for the BMP will not qualify for additional credits. However, if a project did not receive credits for the initial installation or implementation of the BMP, regular maintenance may qualify for credit. Decisions will be made on a case-by-case basis.

Specific activities ineligible for nutrient credits include macroalgal harvesting and natural wetlands as filters, as listed in **Table 4**. Macroalgal harvesting from an impaired waterbody is not eligible for credits, because it is a biological result of nutrient loading that should be abated before it reaches the waterbody of concern. See **Table 2** for information about aquatic vegetation harvesting that is eligible for credit, based on specific conditions. Filtration from natural wetlands is ineligible for credit, because this is considered part of the existing conditions when required load reductions are determined. Various types of artificial wetlands and modular wetland treatment systems are eligible for nutrient credits.

Equations for online and offline retention BMPs are listed in **Table 5** and are based on the volume resulting from multiplying the corresponding inches of retention and the sub-basin area. In addition, this document includes the wet detention removal efficiency curves for TP (**Figure 1**) and TN (**Figure 2**).

Screens must be ***Dry***

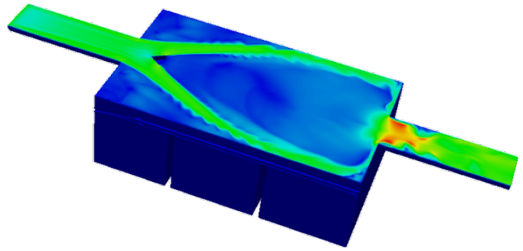
Hydro International

Screens need to be kept up and out of the wet sump so that water doesn't erode organic material and cause nutrient pollution.

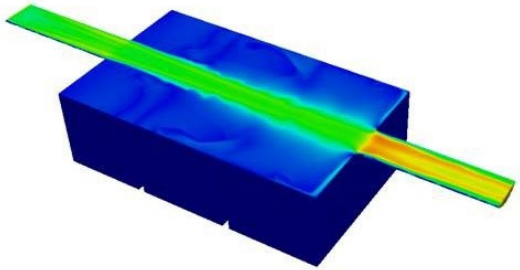
Even Flow Distribution

Splitting the flow means more screen surface area is used so you can go longer without blinding

Hydro DryScreen®

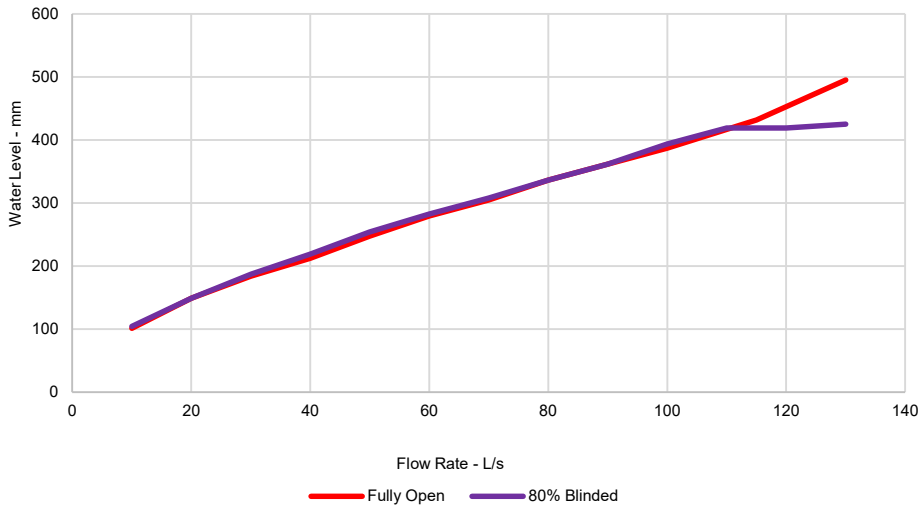


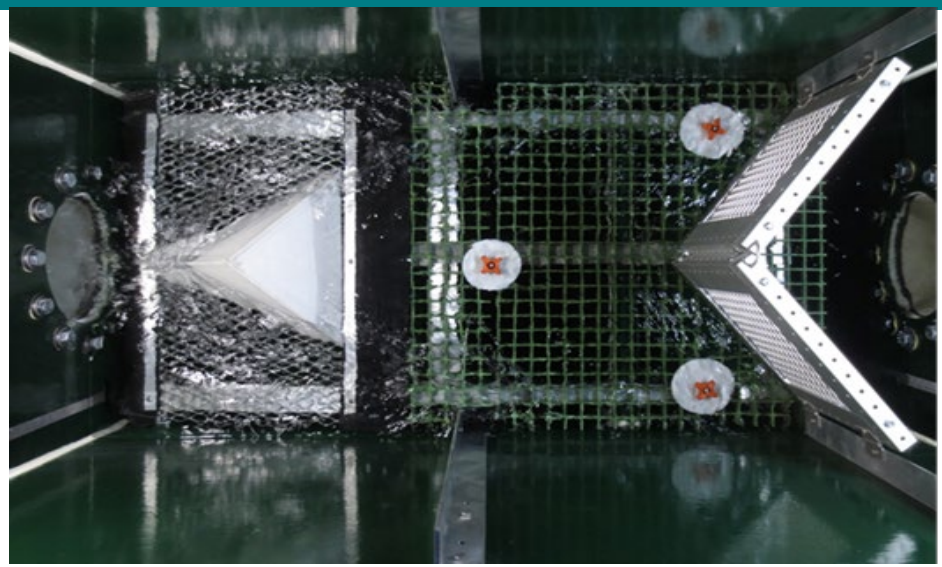
Other Screening Baffle Boxes

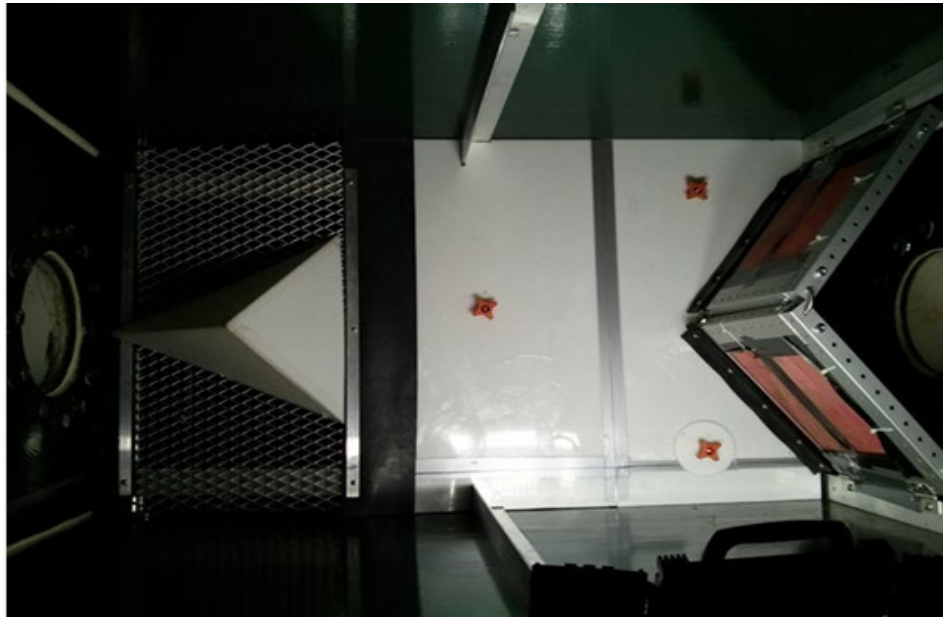


Performs when Screen is 80% Blinded

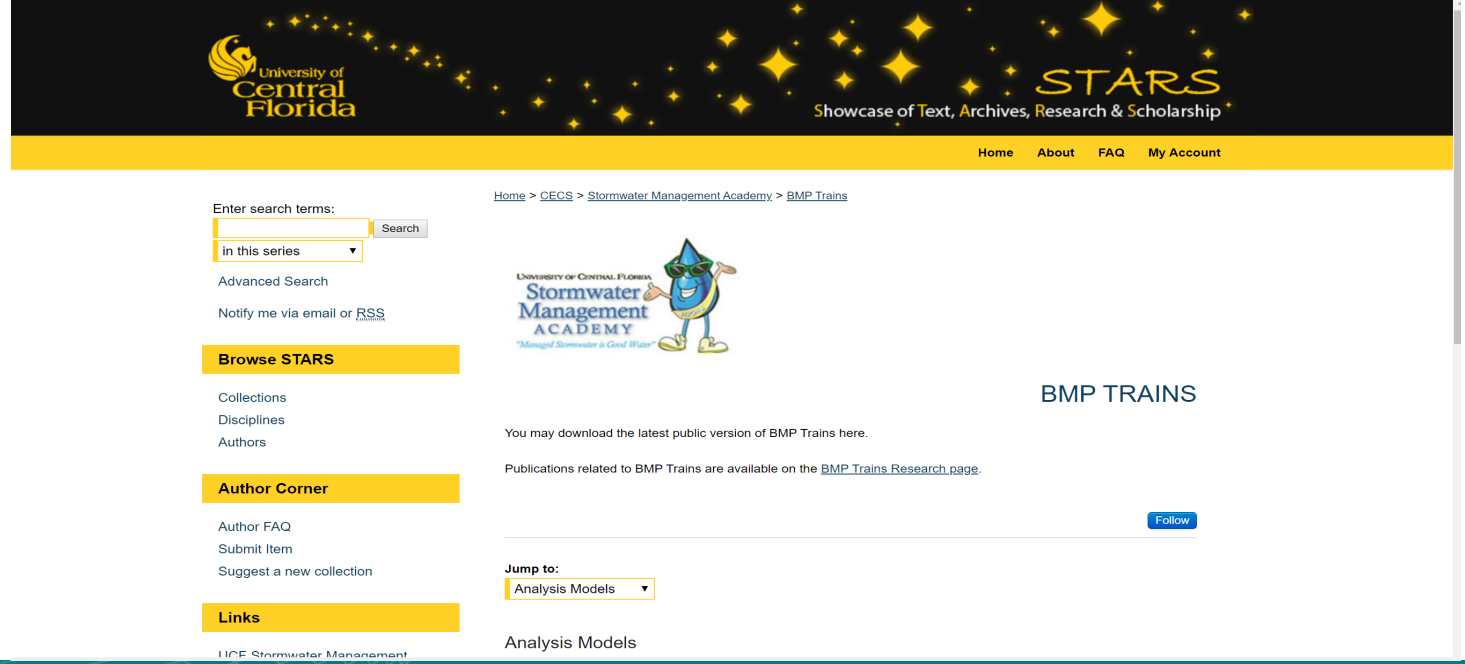
If you don’t split the flow, you’ll pulverize the leaves, paper, cigarette butts and other pollutants allowing them to fall into the sump







Testing shows that the DryScreen performs as intended even when the screen is blinded up to 80%



BMPTRAINS AND CPZ MEDIA

https://stars.library.ucf.edu/bmptrains/

Hydro International

Filtration – Click on the View Media Mixes

Hydro International

FILTRATION (Underdrained Dry Basin or Upflow Filter after Wet Detention) 11/8/2019 V 8.6

Blue Numbers -	Input data
Red Numbers -	Calculated or Carryover

FILTRATION SERVING EITHER WET POND OR DRY POND: the last mile

GO TO STORMWATER TREATMENT ANALYSIS

FOR UNDERDRAINS GO TO LATTERAL SPACING CALCULATOR

Note: No loading from this BMP area and media must match location.

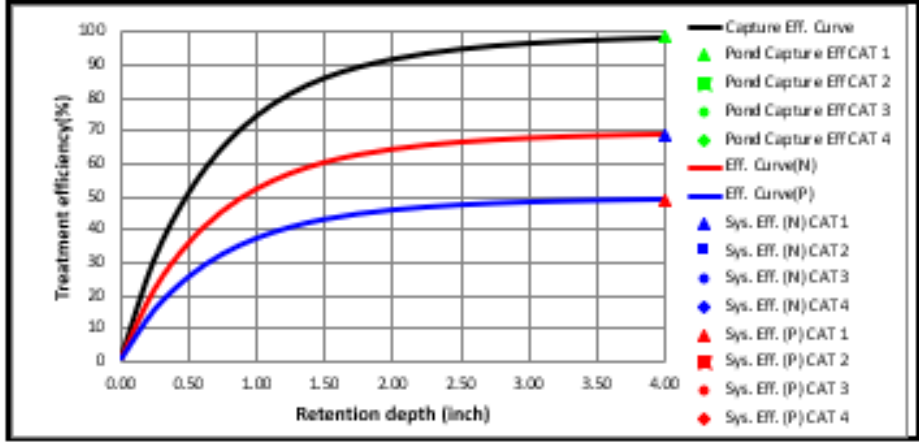
	Basin 1	Catchment 2	Catchment 3	Catchment 4	
Contributing catchment area:	11.100	0.000	0.000	0.000	ac
Treatment depth (0.0-4.0 inches):	4.00				in
Treatment volume provided for treatment depth:	3.700	0.000	0.000	0.000	ac-ft
Provided water capture efficiency:	93.464	0.000	0.000	0.000	%
Required treatment efficiency (Nitrogen):	70.000				%
Required treatment efficiency (Phosphorus):	30.000				%
Type of media mixes:	UDM2*				
Provided treatment efficiency (Nitrogen):	63.925				%
Provided treatment efficiency (Phosphorus):	49.232				%
Is this effluent filtration for a wet detention pond?	Yes				

View Media Mixes

REQUIRED REMAINING TREATMENT EFFICIENCIES.

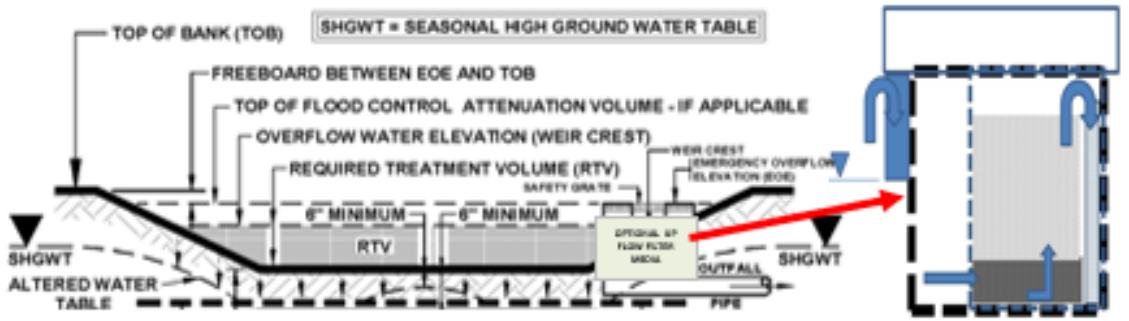
	Basin 1	Catchment 2	Catchment 3	Catchment 4	
Remaining treatment efficiency needed (Nitrogen):	1.075				%
Remaining treatment efficiency needed (Phosphorus):	30.768				%

ERROR MESSAGE WINDOW FOR FILTRATION INCLUDING BIOFILTRATION:



NOTE FOR TREATMENT EFFICIENCY GRAPH:

The purpose of this graph is to help illustrate the treatment efficiency of the system as the function of retention depth. The graph illustrates that there is a point of diminished return as the retention depth is substantially increased. Therefore, to provide the most economical BMP treatment system, other alternatives such as "treatment trains" and compensatory treatment should be considered.



The use of a Biosorption Activated Media may be required.

Source of Graphic: Stormwater Management Academy, University of Central Florida

User Defined Media

Hydro International

V 8.6

MIX:	TN Removal %	TP Removal %	Water storage fraction
B&G ECT	55	65	0.25
B&G OTE	45	45	0.25
B&G ECT3	45	45	0.25
SAT	30	45	0.25
B&G CTS12	60	90	0.25
B&G CTS24	75	95	0.25
UDM1*	70	50	0.25
UDM2*	70	50	0.25
UDM3*			
UDM4*			

* User Defined Media Mix

Here you enter the removal rates of the CPZ
TN = 70%
TP = 50%

GO TO STORMWATER TREATMENT ANALYSIS

RETENTION BASIN	TREE WELL	RAIN GARDEN	SWALE
VEGETATED FILTER	FILTRATION		

FILTRATION MEDIA TABLE

DESCRIPTION OF MEDIA		PROJECTED TREATMENT PERFORMANCE *			TYPICAL OPERATING LIMITING FILTRATION RATE (in/hr)
Media and Typical Location in BMP Treatment Train	MATERIAL	TSS REMOVAL EFFICIENCY	TN REMOVAL EFFICIENCY	TP REMOVAL** EFFICIENCY	
B&GECT [ref A] A final BMP, ex. Up-Flow Filter in Baffle box and a constructed wetland [USER DEFINED BMP]	Expanded Clay[2] Tire Chips[1]	70%	55%	65%	96 in/hr
B&GOTE [ref A,B] Up-Flow Filter at Wet Pond or Dry Basin Outflow [FILTRATION]	Organics[1] Tire Chips[1] Expanded Clay[4]	60%	45%	45%	96 in/hr
B&GECT3 [ref C] After Wet Detention using Up-Flow Filter	Expanded Clay[4] Tire Chip[1]	60%	45%	45%	96 in/hr
SAT [ref D] A final BMP, as a Down-Flow Filter [FILTRATION]	Sand[3]	85%	30%	45%	2 in/hr
B&GCTS [ref E,F] Down-Flow Filters 12" depth*** at wet pond or dry basin pervious pave, tree well, rain garden, swale, and strips	Clay[5] Tire Crumb[5] Sand[7] & Topsoil[3]	90%	60%	90%	1.0 in/hr
B&GCTS [ref E,F] Down-Flow Filters 24" depth*** at wet pond or dry basin pervious pave, tree well, rain garden, swale, and strips	Clay[5] Tire Crumb[5] Sand[7] & Topsoil[3]	95%	75%	95%	1.0 in/hr

NOTES [1] No generally accepted BMP at this time. Also can be used as a downstream BMP but the removal must be lowered.
*All Effectiveness Estimates to nearest 5%; **Phosphorus removal has limited life expectancy; ***24" depth has TN and TP removals of 75 & 95%
acronyms B&G - BOLD & GOLD; SAT - Sand Austin Ty; ECT - Expanded Clay and Tire; ECT3 Expanded Clay and Tire in Treatment Train

Hydro Installations in FL

Hydro International

FDOT T6442 Unit 1

Opportunity Name
FDOT T6442 Unit 1

Opportunity Number
18_12_1378

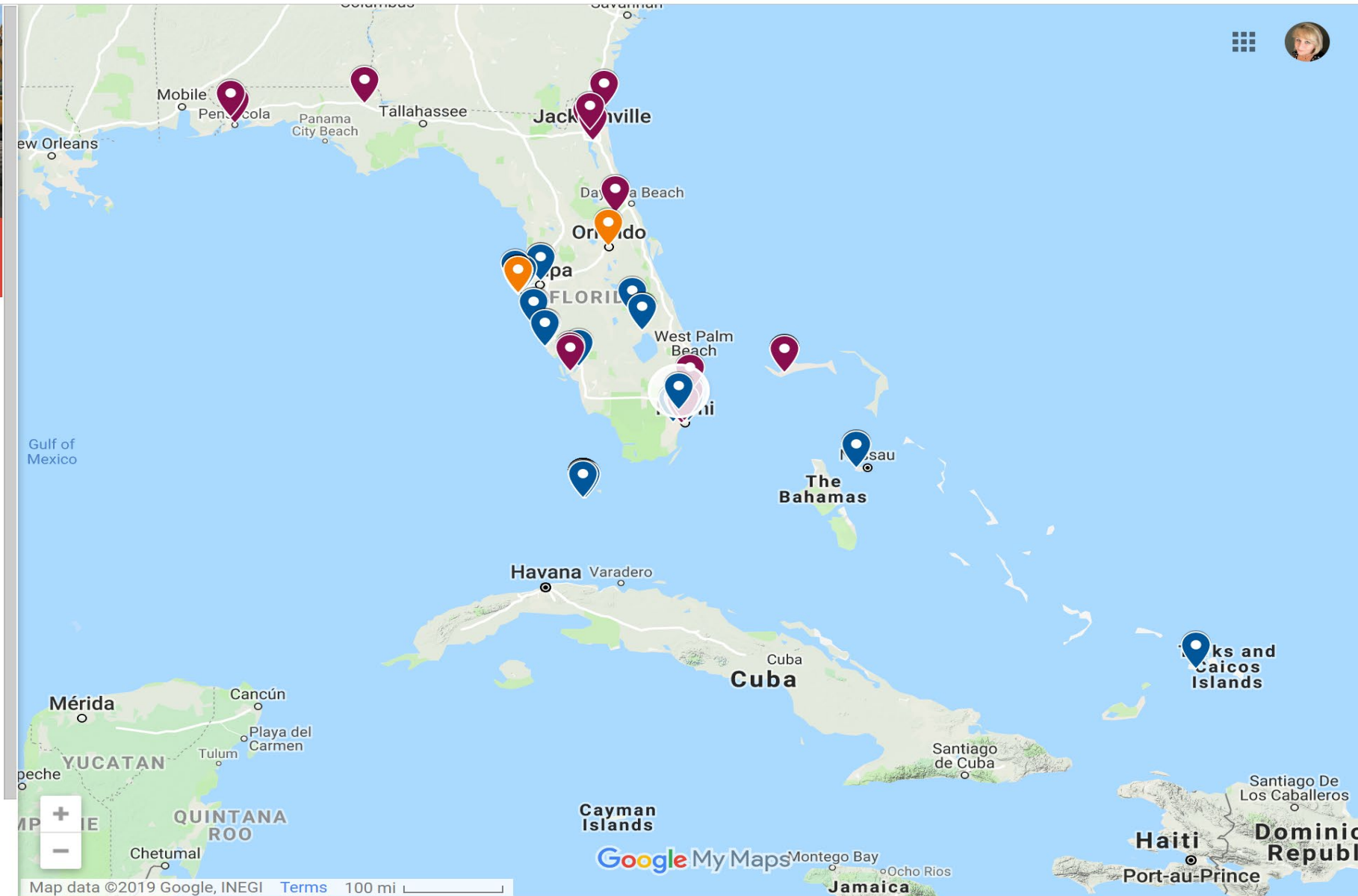
Close Date
May 2019

Address
4631 nw 207th dr

City
miami gardens

State
fl

Quantity
2



Possible Future FL Stormwater System Design – Nutrient Removal Treatment Train

Downstream Defender Pretreatment upstream of infiltration

StormTech Infiltration for runoff reduction

Reg-U-Flo Flow Control to optimize retention/detention

Up-Flo Filter to remove fines, nutrients where Zero Runoff cannot be eliminated and/or TMDLs exist

FSA Training Center

Hydro International

Florida Stormwater Association

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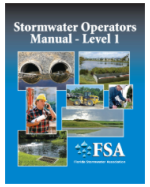
Fogarty Training Center

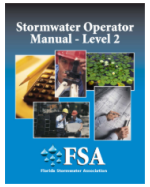
FSA's Training Center was created in 2005 in response to the need for up-to-date, high quality training for stormwater professionals. All classes are taught by qualified expert trainers and include all materials. That's not all, FSA's Stormwater Operator Certification Training is recognized by FDEP and helps fulfill the training requirements of your MS4 permit! View the Stormwater Operator Certification Renewal Date List for recertification deadlines. The Center was named FSA's Fogarty Training Center in 2016 in recognition of the work of Keith Fogarty, Past President of FSA and long-time trainer, who was the driving force in creating the Association's training program.



FSA Operator Certification - Level 1

Class Information - Class Fees

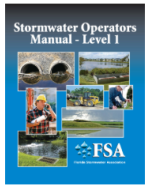
Registration Information



FSA Operator Certification - Level 2

Class Information - Class Fees

Registration Information



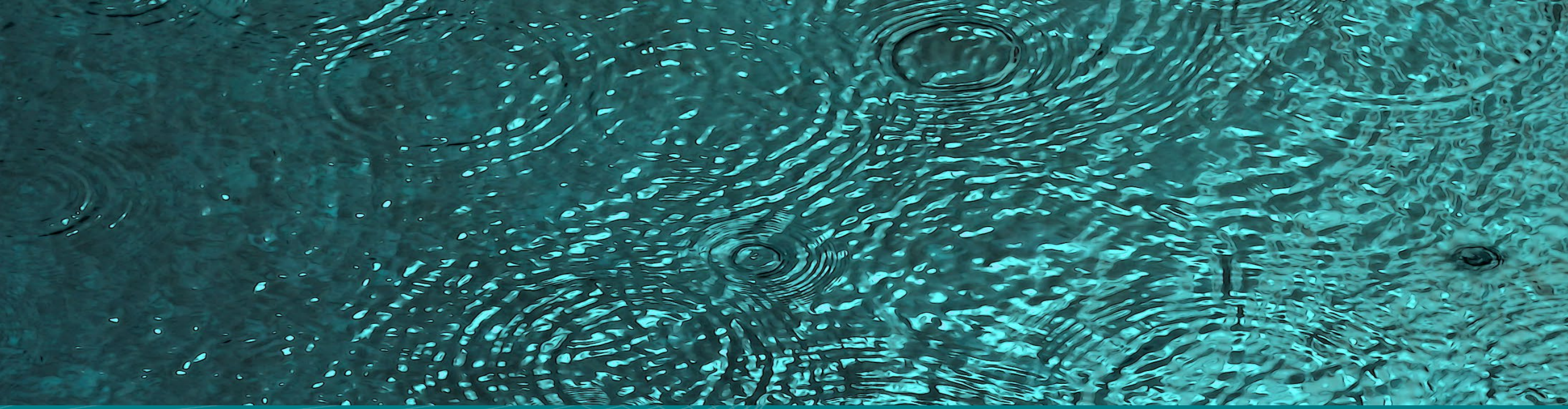
FSA Operator Re-Certification - Level 1 and Level 2

Class Information - Class Fees

Registration Information

FDEP's Stormwater, Erosion & Sedimentation Control Inspector Training & Certification

Registration Information



Thank you

Susan McNamee – Regional Sales Manager Florida

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