5 May, 2021

Mr. Leo Cosentini
California State Water Resources Control Board
Division of Water Quality
P.O. Box 100
Sacramento, CA 95812-100

Re: Application for Reinstatement of Hydro DryScreen® as an Approved Full Trash Capture Device

Dear Mr. Cosentini,

Hydro International® is pleased to resubmit this application for the Hydro DryScreen® for Re-certification as a full trash capture device. The device was delisted at our request several months ago as we were under the impression our proposed solution for vector control would not be allowed. However in subsequent conversations vector control have indicated the proposed access hatches in the screen decks are acceptable and that we should resubmit our application.

No changes have been made to the product previously approved for full trash capture other than the addition of vector control access hatches in the screen deck.

Documentation for this application is being submitted in accordance with the California State Water Resources Control Board *Trash Treatment Control Device Application Requirements*.

Please contact me with any questions or should additional information be required. Thank you for your consideration of this application.

Regards,

Phillip Taylor
Technical Product Manager
Hydro International®

(BLANK)

1.0 COVER LETTER

a. Product Name and General Description

Name: Hydro DryScreen®

The Hydro DryScreen® is a second baffle box designed to be used in-line for capturing and removing sediment as well as trash and debris from stormwater. The design of the Hydro DryScreen® incorporations a patented flow-diffuser as well as horizontal and vertical screens. The flow-diffuser improves pollutant capture and retention by directing incoming flow away from the center of the treatment chamber ensuring a dispersed flow path for the water and pollutants, maximizing the screen utilization prior to water exiting the Device. This eliminates short-circuiting of flow and increases pollutant removal.

The Hydro DryScreen® is equipped with an inclined screen at the entrance of the treatment chamber that serves to direct incoming flows but also begins the screening process. A secondary chevron shaped screen is placed in the vertical position at the exit of the vault. This vertical screen serves as the primary screening mechanism for the Device. A third screening mechanism is positioned wholly in the horizontal position above the sediment chambers and spanning the entire width of the treatment chambers. While this screen also serves to filter trash and debris, the primary function is to segregate the removed pollutants from the standing pool of water in the sediment sumps created by the baffles. The horizontal screen sits above the standing water level in the sump preventing captured gross organic solids from leaching dissolved nutrients between storm events. All screens utilized in the Hydro DryScreen® have an aperture that does not exceed 4.7mm in size and all flows under the listed maximum treatment capacity must pass through the screens ensuring removal and retention of all particles 5.0mm in size or larger.

b. Device Owner

Company:
Larry Abatiell
Hydro International®
General Manager - Americas Stormwater
94 Hutchins Drive
Portland, ME 04102
mdennis@hydro-int.com
P: +1 423-580-4629

Contact:
Phillip Taylor, CPSWQ
Technical Product Manager
Hydro International®
94 Hutchins Drive
Portland, Maine 04102
(207) 756-6200
ptaylor@hydro-int.com

Authorized Representative:
Phil O'Neill
Regional Sales Manager – Hydro International®
109 First Street
Solvang, California 93463
(805) 350-8163
poneill@hydro-int.com

c. Website

https://www.hydro-int.com/en/products/hydro-dryscreen

d. Manufacturing Locations

Hydro International® utilizes a combination of contract manufacturers and component suppliers to produce stormwater treatment systems. These partner facilities are located throughout the United States and Hydro International® selects the facility used based on proximity to the project as well as other factors. The facilities utilized for any specific project are selected to provide the most cost effective and convenient solution. Hydro International® currently retains over 60 partner manufacturing facilities.

Four facilities currently provide support for the California market, located in San Diego, Santa Maria, Simi Valley, and Pleasanton.

e. Testing

Hydro International® performed computational fluid dynamics (CFD) analyses as well as full-scale laboratory testing on the Hydro DryScreen® in 2016. The data from these analyses and experimental tests were utilized to determine system limitations with regards to hydraulics, sedimentation, and trash capture effectiveness. Additionally, Hydro International® utilized this data to scale geometrically proportional models of the Hydro DryScreen® considering equivalent surface loading rates and screen open areas.

With regards to screen blinding full scale testing with 80% screen blinding no significant increase in headloss was measured. Additionally, the hydraulic curve approximates a theoretical orifice equation for entrance loss into a pipe using a Cd of 0.65. This allows the engineer to easily estimate the influence on the drainage network's hydraulic performance.

The test report has been included in this Application in Appendix E.

f. Device Limitations, Operational, Sizing, and Maintenance Considerations

The Hydro DryScreen® is an engineered stormwater treatment system developed to meet a wide variety of applications and water quality objectives. Proper design, application, sizing, installation, operation and maintenance are critical to ensuring water quality objectives are met.

The Hydro DryScreen® is made from precast concrete and internal components are made from materials with long service lives. Adherence to Hydro International® design recommendations will ensure application within the design limits of the Hydro DryScreen®.

The Hydro DryScreen® is designed to remove sediment, trash, debris, and other gross pollutants. Sizing of the system is dependent on the targeted pollutants of concern and the federal, state, and local regulations that govern the water quality objectives. Recommended sizing guidelines have been provided in this Application.

Maintenance is a critical component of any Trash Control Program. The Hydro DryScreen® is an effective tool to help achieve Trash Control Program objectives but performance is dependent on routine maintenance. The Hydro DryScreen® design allows for increased trash capture capacities and extended maintenance cycles. No special equipment is needed to maintain the device. Trash removal can be achieved with no confined space entry. Period cleaning of the sump when required may require confined space entry permitted personal.

g. Existing Installations

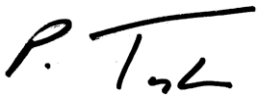
Project: Urban LID Retrofit at Meiners Oak. Swale Pre-treatment
David Kirby, PE, QSP/QSD, GISP
Water Quality Engineer
Watershed Protection District
(805)-662-6737
David.Kirby@ventura.org

Project: Ladera Park, LA County PW
5410 Wilshire Blvd Fl 10
Los Angeles 90036-4265
6’ x 12’ Hydro DryScreen®

Project: Citywide Surface Repair Phase II
Monterey, CA
Freemont Ave - 6’ x 12’ Hydro DryScreen®
Roberts Ave - 6’ x 12’ Hydro DryScreen®

h. The certification below:

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons that manage the system or those persons directly responsible for gathering the information, to the best of my knowledge and belief, the information submitted is, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.



4/20/2021

Phillip Taylor, CPSWQ, Technical Product Manager - Americas Stormwater Date

2.0 TABLE OF CONTENTS

Contents

3.0 PHYSICAL DESCRIPTION

a. Trash Capture

The Hydro DryScreen® is a rectangular vault system with a full coverage horizontal screen deck mounted approximately three (3) inches above the outlet invert and vertical outlet screen the also acts as a bypass weir for high flow conditions. All screens are 4.7 mm to capture all trash 5 mm and larger.

The horizontal screen has a ramped inlet section that directs trash upward onto the main screen deck where the trash held above the static water level. Towards the outlet end of the Hydro DryScreen® a full width vertical (bypass) screen prevents trash from existing the vault. The top of the vertical screen can be overtopped by extreme event flows to prevent upstream flooding should the screen become blinded and high headloss be generated. The top of the bypass screen generally set at an elevation matching a full pipe flow condition.

Mounted on the inlet screen is a flow splitting cone that distributes flow to both sides of the vault to evenly distribute the screen loading. See Diagram 1.

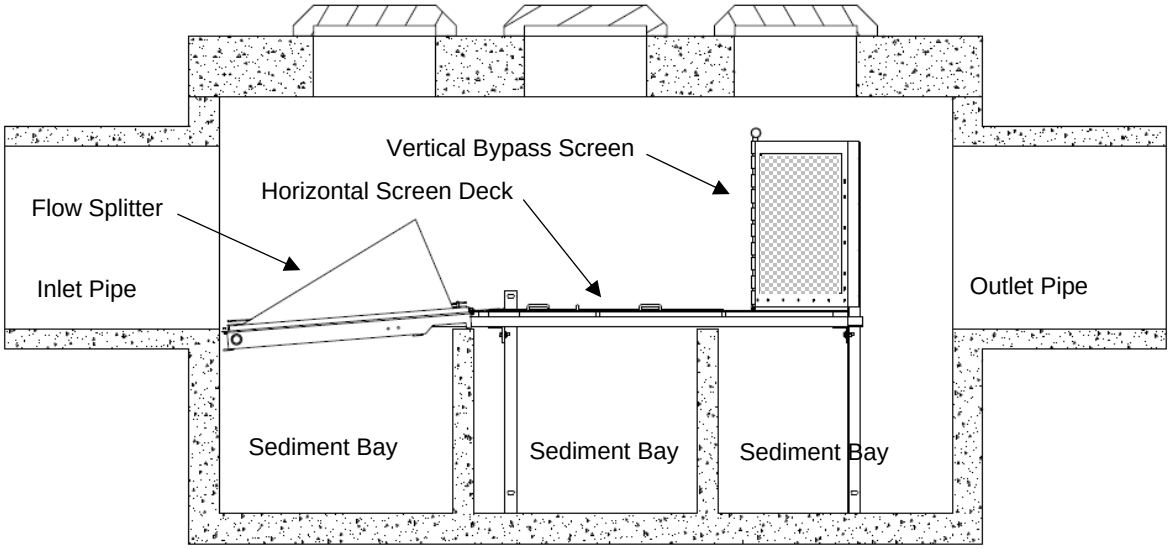


Diagram 1 – Standard Hydro DryScreen® Internal Components

(Vector Control Hatches not shown for clarity)

Operation of the Hydro DryScreen® begins when water enters the Device through the Inlet Pipe. The water is directed left and right by the flow splitter and passes down through the Horizontal Screen Deck to the outlet trash is left on top of the Horizontal Screen Deck. As flow increases the Vertical Bypass Screen collects trash also. As the flow stops the water level drops below the Horizontal Screen Deck keep the trash out of the water. Refer to Diagram 2.

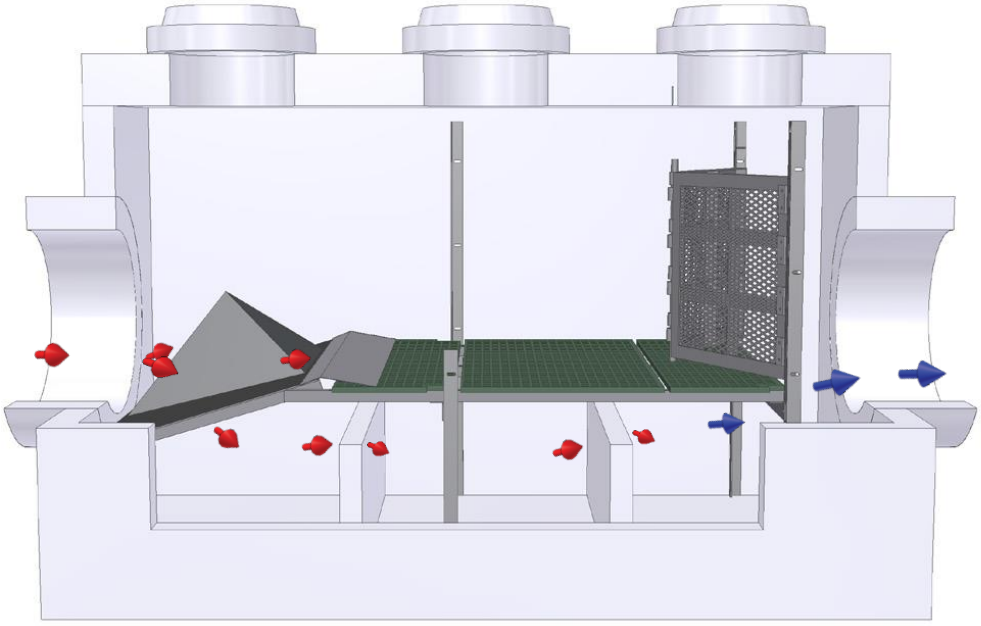


Diagram 2 - Hydro DryScreen® In Operation with Flows Less Than the Maximum Trash Hydraulic Capacity

(Vector Control Hatches not shown for clarity)

b. Peak Flows / Trash Volumes

In the event of a high intensity rainfall event or a blocked screen, the Bypass Screen can be overtopped to allow infrequent large flows to pass directly to outlet. At this stage, the outlet pipe will likely be submerged preventing some free-floating material from leaving the structure. As water levels return to normal some material downstream of the Bypass may be released.

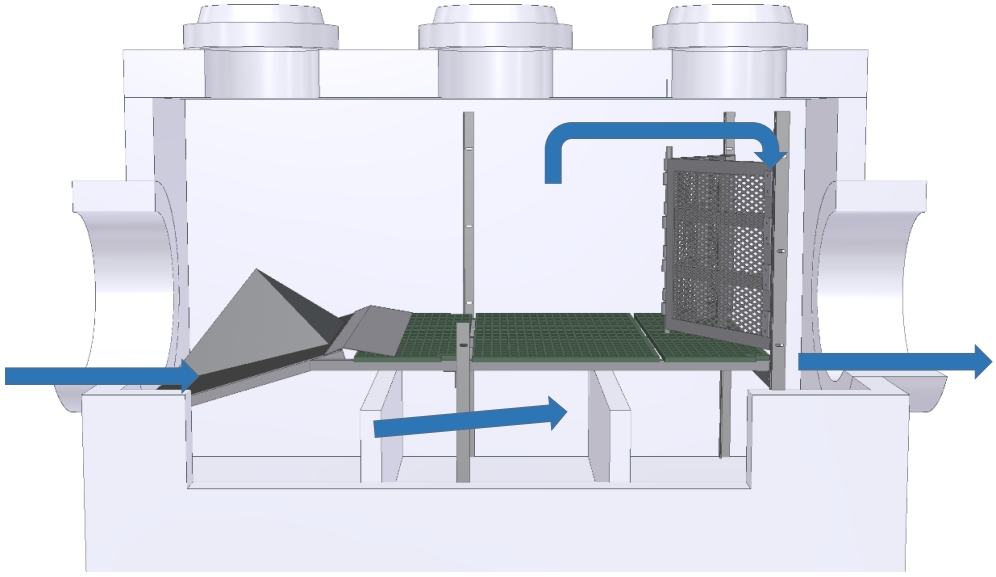


Diagram 3 - Hydro DryScreen® In Operation with Flows Greater Than the Maximum Trash Hydraulic Capacity

(Vector Control Hatches not shown for clarity)

Table 1 provides design flow rates for treating the 1 hour, 1 year storm assuming a 50% blinded screen.

Table 1 – Hydro DryScreen® – Flow Rates

Hydro DryScreen® Size	Design Flow for Trash 50% Blinded Screen	Hydraulic Capacity of Screen[1]
Model	(cfs)	(cfs)
4 x 8	20	28.6
6 x 12	47	66.4
8 x 14	65	92.7
10 x 16	87	124.0
12 x 24	113	162.0
Custom	Contact Hydro International	

(1) Flow rate at which water will crest the bypass weir screen assuming pipe sizes are those listed in Table 2.

The Hydro DryScreen® flow rates have been derived from controlled hydraulic testing. The main screen is a horizontal deck that has its full screen area in operation at all flow rates. The system was tested as various flow rates and headloss measured for two conditions,

- Unblinded
- 80% blinded

When plotted, both tests showed near identical headloss indicating the Hydro DryScreen has significant screen area available to maintain flow when significantly blinded without increasing the headloss.

In order to calculate a 50% blinded flow rate two factors of safety are applied:

- FOS of 1.4 has been applied to the peak hydraulic flow rate
- FOS of 1.6 has been applied to the screen for blinding

Example:

4 x 8 unit has a peak hydraulic capacity = 28.6 cfs

Applying a 1.4 factor of safety = 28.6 / 1.4 = 20 cfs (rounded)

Screen blinding testing was at 80% blinded however targeting 50% blinding for trash capture applies an 80 / 50 = 1.6 factor of safety on screen blinding.

This provides an overall FOS of 3 for both flow and screen blinding.

The system must be designed to treat the full flow from the 1hr, 1yr design storm intensity for the contributing area.

Design storm intensities can be obtained from NOAA Atlas 14 available here:
https://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html?bkmrk=ca

Obtain the rainfall intensity for the 1hr, 1yr rainfall event in inches per hour and use the Rational Method to calculate a treatment flow.

Q = CiA

Where:

Q = Peak runoff in cubic feet per second
C = Rainfall runoff coefficient
i = Rainfall intensity in inches per hour
A = Contributing area in acres

Example:

Monterey Fire Station: 1hr, 1 yr storm i = 0.519 in/hr

Assuming a 20 acre site with a C value of 0.85

Q = 0.85 x 0.519 x 20 = 8.8 cfs water quality flow (Select 4 x 8 Hydro DryScreen)

In some cases, such as retrofits to large pipes, steep sites, or sites taking off-site rainfall flow, an offline configuration is employed using an external bypass manhole with weir to manage the peak flow and protect the Device from extreme flow conditions. The top elevation of the external bypass weir can be set such that bypass initiates before the water level in the Hydro DryScreen® crests the Vertical Bypass Screens, ensuring no trash is lost.

c. Hydraulic Capacity

The Hydro DryScreen® is designed for in-line operation. While the Device may also be used in off-line applications, the hydraulics and internal bypass weir of the Device allow for maximized treatment and internal bypass at flows that typically well exceed the design storm and placement off-line is not usually necessary. The design engineer should calculate the water quality flow and peak flow and use Table 1 to select the correct size of Device.

d. Comparison Table

Table 2 – Hydro DryScreen® - Capacities Chart

Hydro DryScreen® Size	Maximum Pipe Diameter	Trash Storage Capacity
Model	(in)	(yd^3)
4 x 8	30	2.2
6 x 12	42	7.8
8 x 14	48	14.2
10 x 16	54	23.2
12 x 24	60	48.9
Custom	Contact Hydro International	

e. Design Drawings

Standard general arrangement drawings are included in Appendix A. Each project will have site specific drawings produced and Vector control compliant manhole access covers provided.

f. Alternative Configurations

No alternative configurations.

g. Internal Bypass

The internal bypass allows for extreme events to pass over the bypass screens preventing upstream flooding.

h. Previously Trapped Material

Under normal design and operating conditions, the Hydro DryScreen® will remove and retain all trash and debris 5.0mm in size or larger. Conditions under which the Device may re-introduce previously trapped trash are as follows:

- Extreme high flow condition where the water level exceeds the top bypass screen elevation.
- Unmaintained condition allowing the screen to become fully blinded.

i. Calibration Feature

No calibration features.

j. Photographs

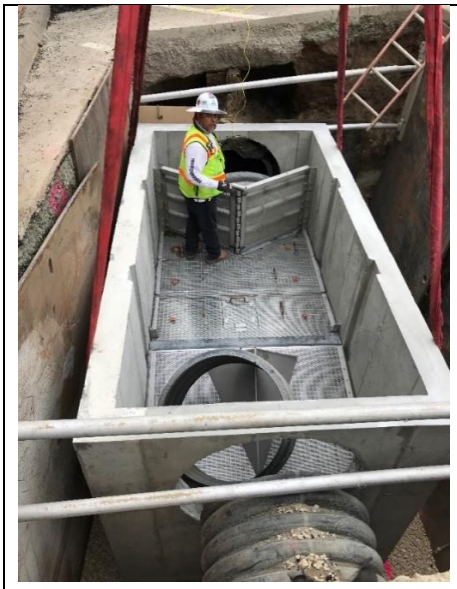


Figure 1 – Front view looking towards outlet

Figure 2 – Back view looking towards inlet

k. Materials

The Hydro DryScreen® is constructed of industry standard materials that are suitable for the harsh environment experienced by a subsurface stormwater treatment system.

- **Structure** – The Hydro DryScreen® main structure is made from a concrete vault conforming to ASTM C478. The walls, floor, ceiling, and baffles are all made from concrete with a minimum 28-day compressive strength of 4,000psi or greater with aggregate per ASTM C33 and reinforcing steel per ASTM A615, Grade 60. The structure is designed to support traffic loads per AASHTO HS-25.

- **Metal Frames and 5 mm Screens** – The main treatment screen and the bypass screen are made from perforated stainless steel conforming to ASTM A240, Grade 304 with perforations not greater than 4.7mm (0.185 in) in size.

- **Screen Deck** – Fiberglass grating

- **Inlet, Outlet, Bypass, Center Cone, and Mounting Ledge** – The internal components are rotationally molded from High Density Polyethylene (HDPE).

- **Securing Components** – Mounting hardware and securing fasteners are made from stainless steel conforming to ASTM F593 and F594, Grade 304.

- **Access Covers** – Manhole frames and covers are cast from iron in conformance with ASTM A48, CL358 and AASHTO M105. Hatches (if used) are made from aluminum. Either access system is designed to support traffic loads per AASHTO HS-25.

l. Design Life

The design service life for the Hydro DryScreen® is dependent on the materials, design, installation, and proper operation and maintenance. The Hydro DryScreen® is constructed from materials with a design service life of between 50 and 100 years. The metal and plastic components are rated for the shorter span of 50 years while the concrete structure is rated for 100 years. The Device does not utilize any consumable materials.

4.0 Installation Guide

a. Standard Installation

Prior to taking delivery the contractor should contact Hydro International® for pick weights to ensure the correctly sized lifting equipment is on site to handle the offload and placement of the concrete vault sections.

The Hydro DryScreen® is supplied with internal components pre-installed. In most situations the installation is the same as any precast stormwater structure. Pipe connections are made to local standards and are grouted using non shrink cement, or if required booted connects are provided.

The Hydro DryScreen® is intended to be a near turnkey Device that arrives at the construction site complete for installation. Assembly of vault sections and access structures as well as inlet and outlet connections are required to be performed in the field as these cannot be completed at the manufacturing facility. In all instances, Federal, State, and Local laws and regulations should be followed.

Excavations, grading, base preparation should follow the project specification for the site.

Internal components are pre-installed at the factory. At no time should a Contractor be tasked with installation of the internal components unless the Contractor has received appropriate training and instruction from Hydro International®.

Inspection is a critical component of the installation. Inspection should occur before, during, and after installation to ensure proper installation and function of the Device.

The Hydro DryScreen® is installs in the stormwater drainage systems with no special requirements or non-standard procedures, tools, or practices.

b. Methods for Diagnosing and Correcting Installation Errors.

The Hydro DryScreen® is supplied preassembled and the contractor should not be required to do anything other than complete the vault installation and pipe connections. Visual inspection and comparison to the design drawing will confirm the correct installation.

Installation errors of the Hydro DryScreen® are not common, provided installation is completed by a qualified Contractor. Hydro International® has procedures in place to prevent installation errors but in the event an error occurs, immediate diagnosis and corrective actions are required.

Prior to manufacture and delivery of the Hydro DryScreen®, the Contractor and Owner or Owner's Representative is provided with a full submittal with design drawings and instructions. These drawings provide specific details of the design and construction of the Device. A Hydro International® representative can also be available for delivery, installation, and maintenance of the Device. The drawings should be utilized to help diagnose errors.

Should an error be encountered, Hydro International® should be consulted for any necessary corrective action.

5.0 Operation and Maintenance

a. Inspection Procedures & Frequency Considerations

The Hydro DryScreen® design allows for quick inspection from surface level and requires no entry into the manhole.

Inspection Procedures

- Set up any necessary safety equipment around the access hatches and/or manhole covers of the Hydro DryScreen® as required by local ordinances. Safety equipment should notify pedestrians and vehicle traffic of work in the area.
- Remove the manhole covers or access hatches.
- Without entering the structure, visually inspect the annular space around top of the Device for trash, debris, and other gross pollutants.
- Use a pick to lift the inspection hatches in the screen deck and using a sediment probe, measure the depth of sediment in each sump bay.
- Visually inspect for signs of abnormal operation such as indications of long term elevated water levels, broken or damaged internal components, or absence of any pollutants.
- Record the date, Device location, trash and debris volumes estimates, and sediment levels measured.
- If screens are clogged full maintenance should be scheduled.
- Securely replace the access cover/hatches.
- Remove safety equipment.
- Contact the local Mosquito and Vector Control District should mosquito or vector be present in the vault.

Inspection Frequency

- During the first year of operation, the Hydro DryScreen® should be inspected every three to six months. This initial inspection schedule is needed to determine the site-specific pollutant loading and is utilized to determine ongoing maintenance frequency.
- Inspection may be conducted during any season but is typically conducted prior to the start of the rainy season.
- Typically, most sites will benefit from inspection every 6 months, however trash loads may require more frequent inspections.

b. Maintenance Frequency and Hydraulic Capacity

The Hydro DryScreen® may experience some reduction in hydraulic capacity depending on the type and amount of trash entering the systems. During the initial inspection period after installation the characteristics of the trash load coming from the source area should be noted and considered when determining the maintenance frequency for any specific site.

c. Maintenance Procedures

The Hydro DryScreen® Operation and Maintenance Manual is included with this submittal in Appendix C. The manual provides detailed information for Hydro DryScreen® Maintenance procedures and frequency considerations. Visual inspection will usually be sufficient to indicate the need for trash removal.

Maintenance of the Hydro DryScreen® should occur as determined during inspection of the Device. If no inspection records have been used to determine a maintenance frequency, then maintenance should occur annually or when inspection indicates the screen are blinded, or trash levels exceed 75% of the capacity listed in the Operation and Maintenance Manual.

A summary of requirements maintenance procedures is listed below:

- Set up any necessary safety equipment around the access ports as stipulated by local ordinances. Safety equipment should notify passing pedestrian and road traffic that work is being done. Follow all confined space entry permit conditions and procedures if entering the vault for sediment removal.
- Remove access lids and visually inspect the inside of the vault. Document observations and take pictures. Estimate and record the screenings and sediment depths. Update the maintenance log.
- Using a vacuum removal system, vacuum pollutants trapped around the top of the Device.
- Insert the vacuum tube in the central opening and vacuum sediment and liquid from the central sump.
- Screen can be inspected and cleaned from above using a water jet. No entry is required.
- Document the cleaning with photographs and by completing the maintenance log included with the Hydro DryScreen® Operation and Maintenance Manual.
- Replace the access covers/hatches and remove the safety equipment.

d. Recommended Maintenance Equipment and Materials

The following equipment is the minimum recommended equipment for routine maintenance of the Hydro DryScreen®. Additional equipment may be necessary based on unique site or installation conditions.

- PPE (Personal Protective Equipment)
- Safety and Traffic control equipment (cones, barricades, signage, flagging, etc.)
- Manhole hook or pry bar
- Flashlight
- Tape measure
- Measuring stick or sludge sampler
- Long-handled net and brush
- Confined space entry equipment
- Vacuum truck
- Digital Camera
- Inspection/Maintenance Report

e. Deferred Maintenance

For full trash capture deferred maintenance may result in blinded screens, early bypass, Trash loss, and upstream flooding. Organic material may decompose resulting in odors and release of secondary pollutants such as bacteria, nitrogen, etc.

Sediment in the sump may become compacted and more difficult to remove.

f. Repair of Screens and Internal Parts

Minor repairs may be required and Hydro International® should be contacted in the event of a minor repair for specific repair instructions. Major repairs are not anticipated but should be evaluated by a Hydro International® representative on a case-by-case basis.

Screens and structural components can be accessed and repaired or replaced in-situ if repair is required. It may be necessary to remove the concrete flattop for the larger Devices as the screens will not fit through a standard manhole cover. All internal parts are replaceable without removal of the concrete manhole structure.

6.0 Vector Control Accessibility

a. Vector Control Accessibility Letter Application Date

April 19, 2021

b. Vector Control Accessibility

The Hydro DryScreen® is a subsurface stormwater treatment Device that maintains an accommodating environment for Mosquito and Vector. Conscious of this, Hydro International® designed the Hydro DryScreen® for quick and convenient access to inspect and abate for Mosquito and Vector. The orange arrows in Diagram 4 represent unobstructed visual and physical access to the wet sump areas of the Device. Mosquito and Vector personnel can use these access points to visually inspect for Mosquito and Vector activity as well as mitigate by way application of larvicide pellets, briquettes or liquid spray.

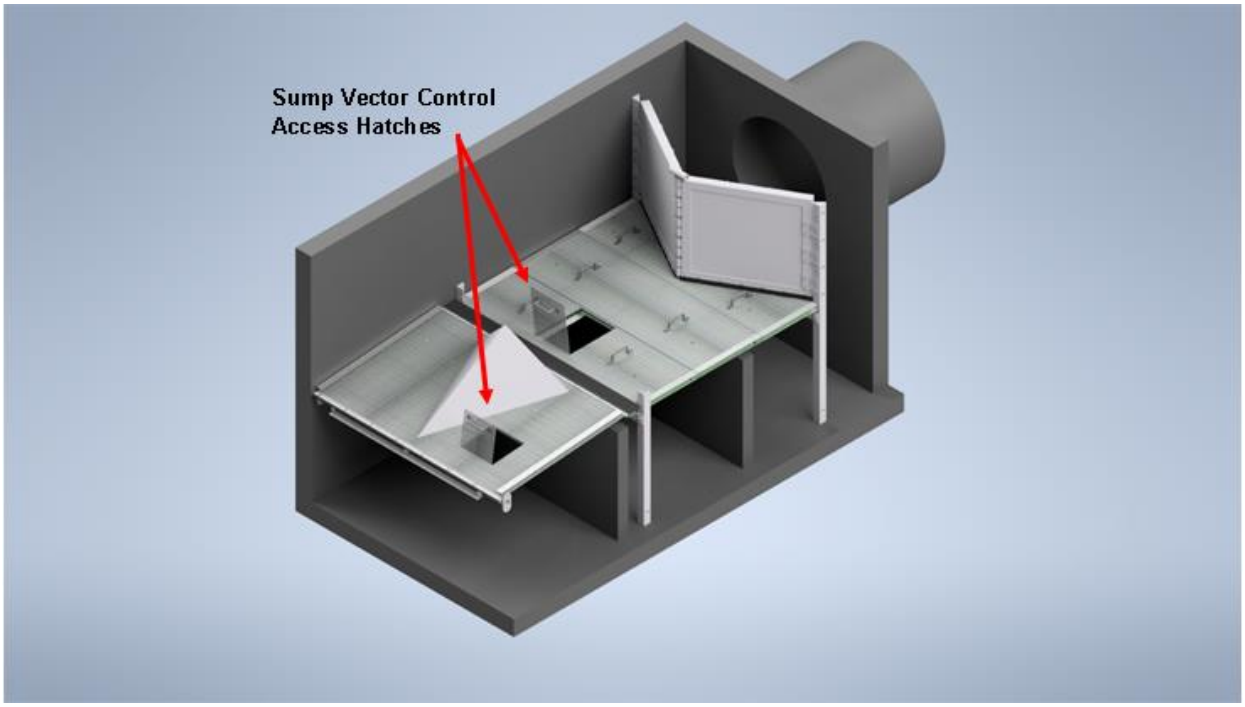


Diagram 4 – Hydro DryScreen® Sump Vector Control Access Hatches in Screen Deck

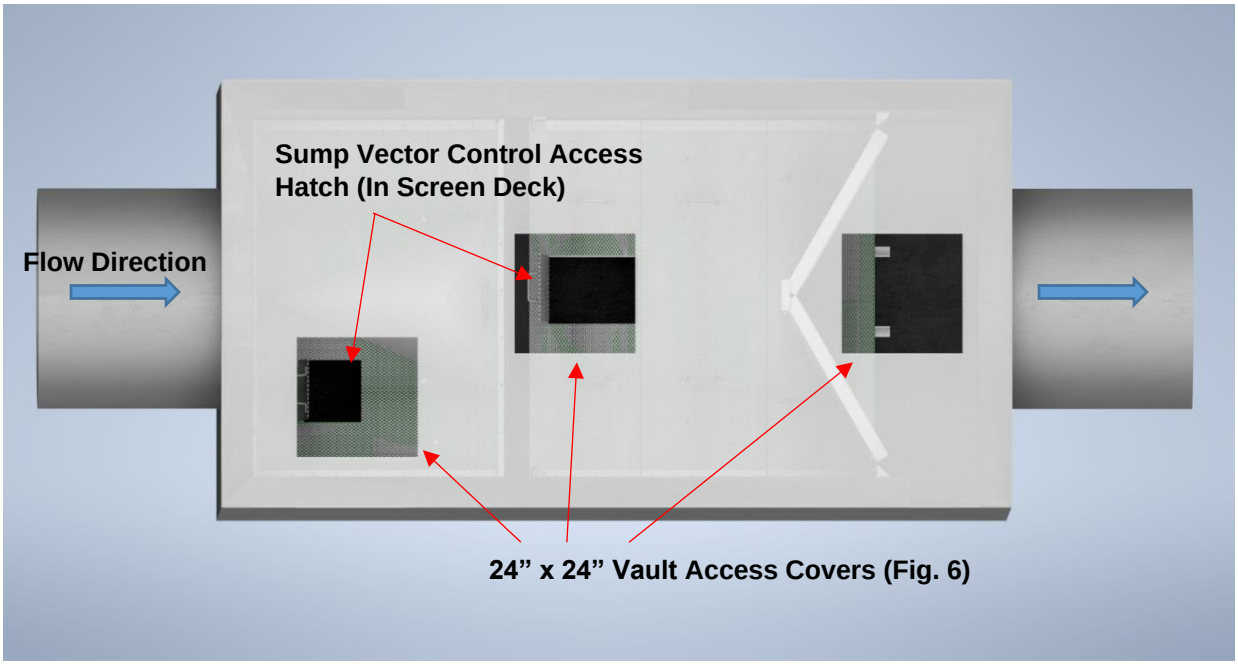


Diagram 5 – Hydro DryScreen® - *Top Down View Illustrating Internal Access and Vector Control*

Diagram 5 is a top-down view of a typical Hydro DryScreen® vault. The vault access covers shown in Figure 6 are located over the Vector Control Access Hatches, two provided, and a third vault access cover over the rear outlet bay, which can be accessed directly as it is not covered by a

screen. Physical access is large enough for a vactor truck nozzle as well as manned entry. Should liquid or solid forms of larvicide need to be applied for Mosquito control visual and physical access is available.

Hydro International supplies all Hydro DryScreen® devices with solid covers to prevent Mosquito and Vector entry. Diagram 6 illustrates the vault covers used with the Hydro DryScreen®.

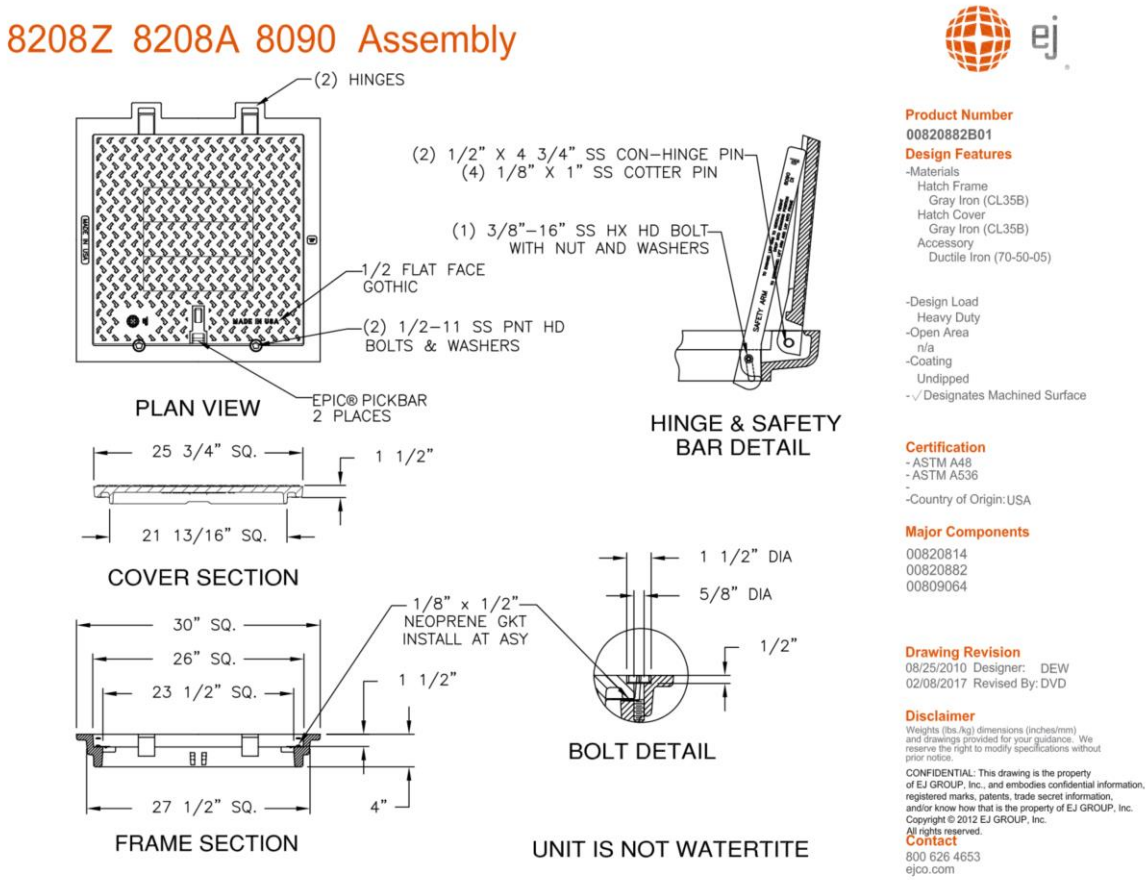


Figure 6 – Access Covers

Inlet and outlet pipes are another possible entry points to the Device for Mosquito and Vector. Figure 7 and Figure 8 are examples of potential third party exclusion devices that may be utilized to prevent mosquito and vector from entering the manhole through the inlet and outlet pipes. Both devices are considered to be check valves and function by allowing water to pass through the device in one direction. When water is not moving the valves are closed thus preventing passage of Mosquito and vector. The devices operate with low head pressure but confirmation of function within the storm drain system should be confirmed prior to application.

Figure 7 - Example Third Party Exclusion Device - Duckbill Valve

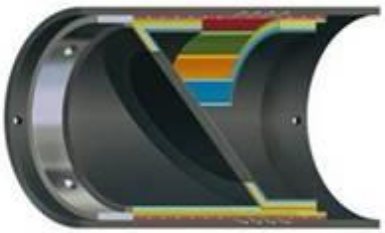


Figure 8 - Example Third Party Exclusion Device – Internal Rubber Boot Check Valve

Hydro International® should be contacted in the design phase should any third-party exclusion device be a consideration for review and evaluation of compatibility.

c. Vector Control Accessibility Letter

MVCAC Letter of Verification is attached in Appendix F

7.0 RELIABILITY INFORMATION

a. Estimate Design Life of Device Components Before Major Overhaul

As per Section 3.I., the design service life for the Hydro DryScreen® is dependent on the materials, design, installation, and proper operation and maintenance. The Hydro DryScreen® is constructed from materials with a design service life of between 50 and 100 years. The metal and fiberglass components are rated for the shorter span of 50 years while the concrete structure is rated for 100 years. The Device does not utilize any consumable materials. A major overhaul would not be anticipated prior to 50 years of operation.

b. Warranty

The warranty for the Hydro DryScreen® is a two (2) year limited warranty. A copy of the warranty is included in Appendix D.

c. Customer Support Information.

Hydro International® Stormwater has a corporate office located in Portland, Maine and representatives throughout the country.

Hydro International® Americas Stormwater Headquarters
94 Hutchins Drive
Portland, Maine 04102
Phone: (207) 756-6200

Fax: (207) 756-6212
inquiries@hydro-int.com

8.0 Field/Lab Testing Information and Analysis

The Hydro DryScreen® has been lab verified specifically for screen blinding and hydraulic head loss. Lab testing was carried out for both unblinded and 80% blinded screen and headloss measured and compared. Chart 1.

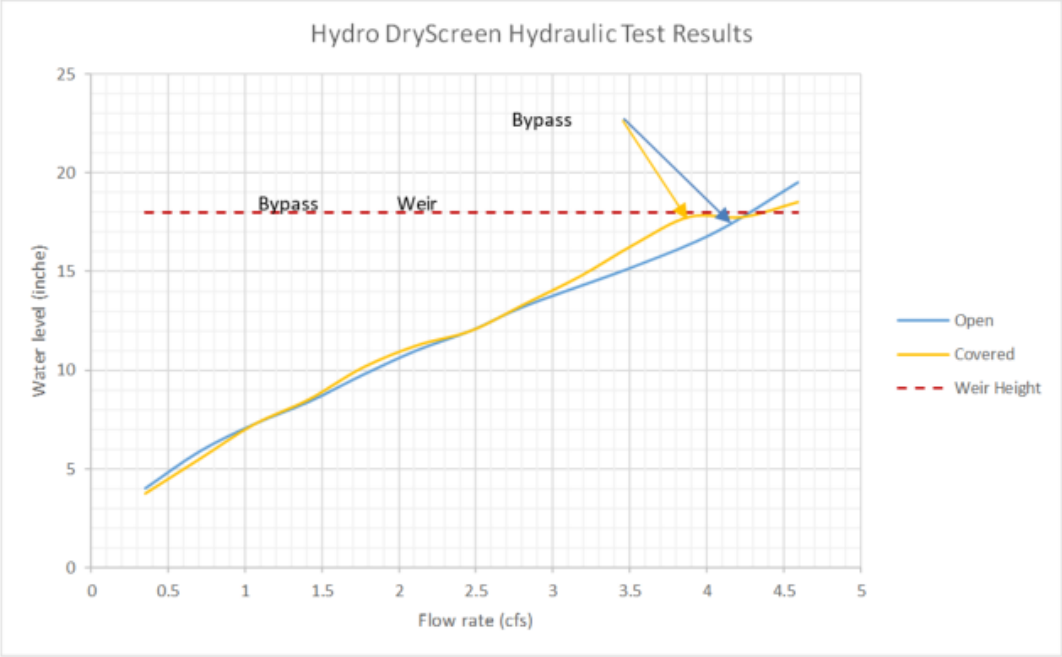


Chart 1 - Hydro DryScreen® Hydraulic Capacity Test 3 x 6 ft Device, Open Screen vs. 80% Covered Screen

APPENDIX A – GA Drawings

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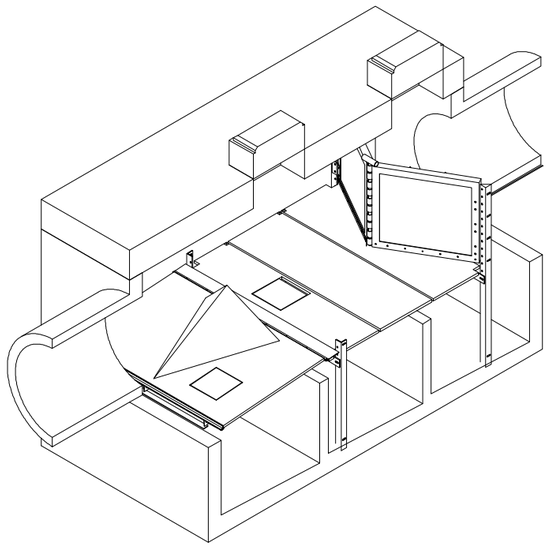
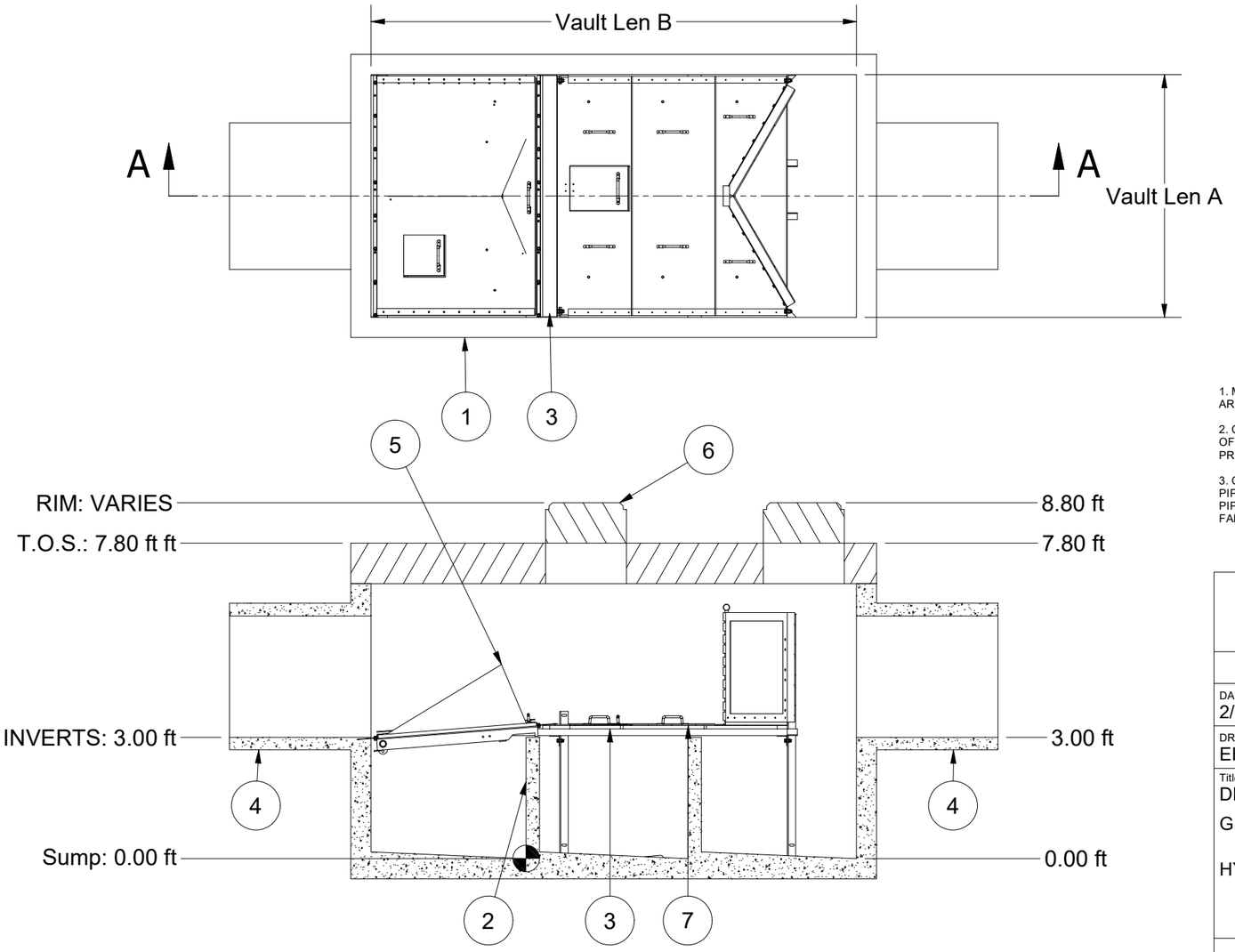




1. MANHOLE WALL AND SLAB THICKNESSES ARE NOT TO SCALE.

2. CONTACT HYDRO INTERNATIONAL FOR A BOTTOM OF STRUCTURE ELEVATION PRIOR TO SETTING HYDRO DRYSCREEN SYSTEMS.

3. CONTRACTOR TO CONFIRM RIM, PIPE INVERTS, PIPE DIA.AND PIPE ORIENTATION PRIOR TO RELEASE OF UNIT TO FABRICATION.

Parts List			
ITEM	QTY	SIZE	DESCRIPTION
1	1		VAULT
2	2		BAFFLES
3	3		HORZ. SCREEN PANELS
4	1		INLET/OUTLET PIPES (BY OTHERS)
5	1		FLOW SPLITTER
6	3	24 in	FRAME AND COVER
7	1		PANEL, CENTER

DryScreen Sizing			
Vauilt Len A	Vault Len B	Max Treatment Flow (cfs)	Max Pipe Diam (in)
4	6	28.62	30
5	10	28.62	30
6	12	45.16	42
8	14	92.7	48
10	16	124.44	50
12	20	161.94	60

PROJECTION

IF IN DOUBT ASK

DATE:	SCALE:
2/10/2021	1:40

DRAWN BY:	CHECKED BY:	APPROVED BY
EHR		

Title

DRY SCREEN GA

GENERAL ARRANGEMENT

HYDRO DRYSCREEN

Hydro International®

hydro-int.com

HYDRO INTERNATIONAL

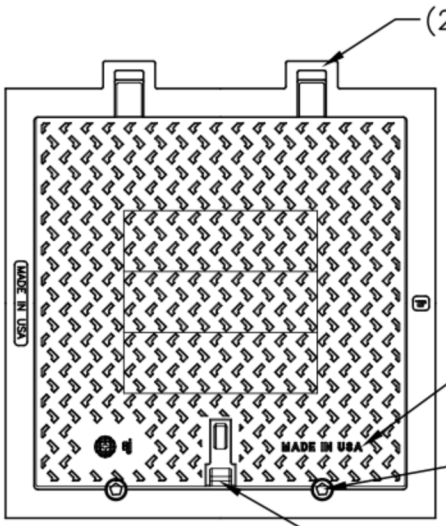
WEIGHT:	MATERIAL:
N/A	

STOCK NUMBER: 1

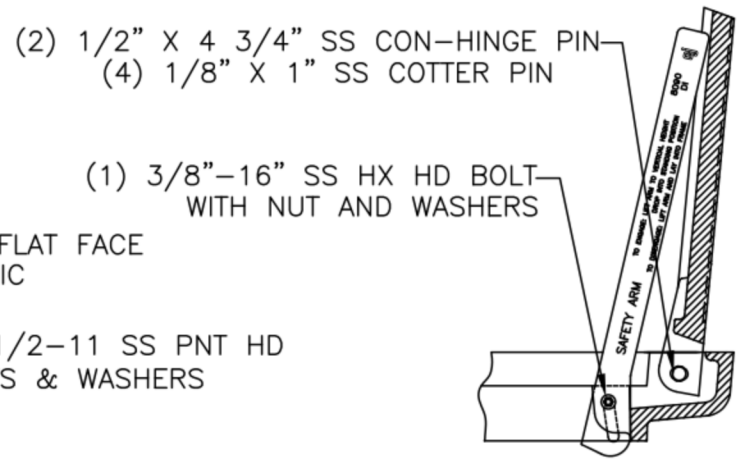
DRAWING NO.: GA-Dry Screen

SHEET SIZE:	SHEET:	Rev:
B	1 OF 2	-

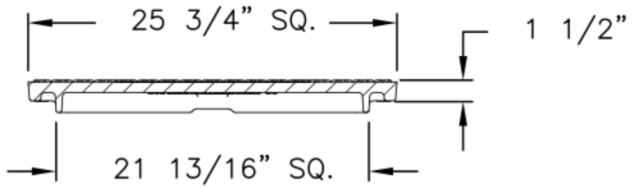
8208Z 8208A 8090 Assembly



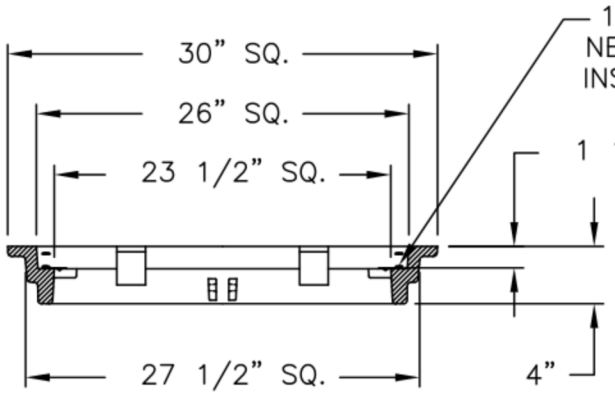
PLAN VIEW



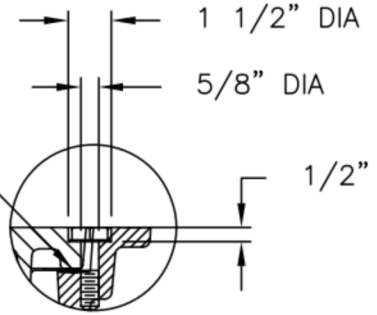
HINGE & SAFETY BAR DETAIL



COVER SECTION



FRAME SECTION



BOLT DETAIL

UNIT IS NOT WATERTITE

Product Number

00820882B01

Design Features

-Materials
  Hatch Frame
    Gray Iron (CL35B)
  Hatch Cover
    Gray Iron (CL35B)
  Accessory
    Ductile Iron (70-50-05)

-Design Load
  Heavy Duty
-Open Area
  n/a
-Coating
  Undipped
- √ Designates Machined Surface

Certification

- ASTM A48
- ASTM A536
-
-Country of Origin: USA

Major Components

00820814
00820882
00809064

Drawing Revision

08/25/2010 Designer: DEW
02/08/2017 Revised By: DVD

Disclaimer

Weights (lbs./kg) dimensions (inches/mm) and drawings provided for your guidance. We reserve the right to modify specifications without prior notice.

Contact

800 626 4653
ejco.com

APPENDIX B - Specification

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PART 1 - GENERAL

1.01 SCOPE

A. Work described in this section includes furnishing all labor, equipment, materials, tools and incidentals required for a complete and operable installation of the Hydro DryScreen stormwater treatment system (treatment system, system, BaffleBox, or 1st/2nd Generation Baffle Box) as shown on the drawings and specified herein.

B. The manufacturer shall design and supply the equipment listed herein and the Contractor shall install the equipment in accordance with the manufacturer's Handling, Storage, and Installation Instructions.

1.02 GENERAL REQUIREMENTS

A. The treatment system shall use an elevated screen to separate pollutants that can be screened from stormwater runoff and kept above the static water elevation in the system. Flow modifying components are required and shall reduce turbulence and enhance capture of settling pollutants that pass through the screen. The system shall be self-activating (with no mechanical operated parts) or external power requirements.

B. The treatment system shall be supplied by a manufacturer regularly engaged in such work who has furnished similar installations that have been in successful and continuous operation for a minimum period of fifteen years.

C. Upon request, independently certified performance data and references shall be made available to the Engineer of Record for use in determining that the treatment system meets the design criteria and performance requirements stated herein.

1.03 SUBMITTALS

A. Submittals shall be provided and shall include the following:

1. General arrangement and dimensional drawings of the treatment system.

2. Plan and elevation drawings of the treatment system as it shall be incorporated into the stormwater drainage system. The elevation drawing shall indicate the top of water level both upstream and downstream of the treatment system at the flow conditions specified herein.

3. Handling, Storage and Installation Instructions.

4. Operation and Maintenance Instructions.

1.04 QUALITY ASSURANCE

A. The stormwater treatment system shall be manufactured under the direction of an ISO 9001 Certified Company.

B. Inspection

The stormwater treatment system shall be subject to inspection by the Engineer of Record or the owner's representative at either the place of manufacture or the project site. Any and all observed defects shall be repaired to the satisfaction of the owner or owner's representative or replacement shall be made available.

C. Warranty

The manufacturer shall guarantee the treatment system from defects in materials and workmanship for a period of two years following installation. If during the warranty period defects in materials or workmanship are noted, then the manufacturer shall be promptly notified. The decision to repair or replace affected units shall be made at the discretion of the manufacturer.

D. Patent Indemnity

Upon request, the manufacturer shall warrant that the treatment system does not infringe upon or violate any patent, copyright, trade secret or any other proprietary right of any third party and shall indemnify the Owner against any loss, cost, expense or liability arising out of such claim whether or not such claim is successful.

E. Certificate of Compliance

Upon request, the manufacturer shall provide a "Letter of Certification" to certify that the stormwater treatment system adheres to the specifications required herein and complies with the project's stormwater management permit.

1.05 MANUFACTURER

A. The stormwater treatment system shall be the Hydro DryScreen as designed by Hydro International located at 94 Hutchins Drive, Portland, Maine 04102. Telephone (207) 756-6200. Fax (207) 756-6212.

B. Alternate stormwater treatment systems must demonstrate compliance with the specifications herein and be approved by the Engineer of Record. Request for alternative systems shall include:

i. Revised site plan showing location and orientation of proposed alternative, pipe sizes, connections and excavation limits.

ii. Product installation drawings showing plan and elevation views with water elevations for the flow conditions specified herein.

iii. Performance data as required in Part 2.

iv. Maintenance manual including inspection (and clean out costs and three references for verifying successful completion of the procedures and associated costs).

C. Costs for reviewing submittals for alternative treatment system shall be the Contractor's or Manufacturer's responsibility.

PART 2 – STORMWATER TREATMENT SYSTEM

2.01 General

A. The stormwater treatment system shall be a second generation baffle box with elevated and adjustable screen that prevents screenings from being stored below the static water elevation within the baffle box.

B. A flow spreader at the inlet shall be used to distribute flow and utilize the entire area of the treatment system. All polluted flow entering the treatment system shall follow a controlled three-dimensional flow path. Internal baffles will prevent flow entering the baffle box from discharging directly to the outlet pipe.

C. The treatment system shall fit within the limits of excavation (area and depth) as shown in the project plans and will not exceed the dimensions for the design flow rates specified herein.

D. The treatment system shall provide separate and protected storage regions for captured pollutants that float and for those that settle. The treatment system shall not release captured floating pollutants.

E. The storage capacities for pollutants that settle (sediment) and float (screenings) shall not be less than the volumes listed in Table 1. The treatment system shall operate as intended and perform as specified herein as pollutants accumulate.

F. Minimum 24-inch openings shall provide access to the pollutant storage regions from the surface for inspection and maintenance. Internal components will allow for access to the sump region during maintenance.

2.02 Performance

A. Performance of the treatment shall be based on full-scale laboratory and/or field testing and shall adhere to the Performance Specifications listed in Table 1. The laboratory testing used as the basis of product performance shall be undertaken in accordance with testing protocols approved or endorsed by the Stormwater Equipment Manufacturers Association (SWEMA) or acceptable State agency, such as a State Department of Environmental Protection (DEP) or recognized verification agency (e.g: ETV, NJCAT, NETE).

B. Performance of the treatment system shall be based on conveying the Maximum Treatment Capacity without internally bypassing or without releasing screened pollutants. The system's Typical Treatment Flow Rate shall be greater than or equal to the water quality flow rate. The treatment system shall remove greater than or equal to 80% of coarse sand for all flows less than the Typical Treatment Flow Rate.

Table 1.

Hydro DryScreen® Size	Design Flow for Trash[1]	Bypass[2]
(ft)	(cfs)	(cfs)
4 x 8	20	28.6
6 x 12	47	66.4
8 x 14	65	92.7
10 x 16	87	124.0
12 x 24	113	162.0
Custom	Contact Hydro International	

Notes:

(1) Maximum online flow for no trash loss, 80% blinded screen, 1.4 safety factor. If flows exceed this some trash may be lost in bypass. Based on lab testing of full sized unit.
(2) Flow rate at which water will crest the bypass weir screen and internal bypass begins.

PART 3 – EQUIPMENT

A. The Hydro DryScreen shall consist of a baffled rectangular precast vault with internal components.

(i) The internal components to be supplied by Hydro International shall include an inlet flow spreader, mounting brackets, weir and all screens.

Materials of construction for the above components excluding the support frame shall be cross-linked polyethylene (XLPE). The component support frame members and all metal parts shall be Type 304 stainless steel or carbon steel powder coated in accordance with ASTM 775/ ASTM A775M with a resulting thickness of 8-12 mils. All components shall be designed to withstand all normal loadings associated with fabrication, shipping, site installation, and normal operation of the equipment. The component support frame shall withstand a live load of 500 pounds.

(ii) The rectangular precast vessel shall be manufactured with concrete that has attained a compressive strength of 4,000 psi after 28 days. The structure shall be reinforced to withstand an HS20-44 loading. Shiplap joints shall be sealed with butyl rubber mastic sealant conforming to ASTM C990. Slab tops shall be suitably reinforced and provided with manhole openings and covers as required. The cast iron manhole frames and covers shall be sized as per the manufacturer's drawings and shall be in accordance with ASTM A48, CL.35B and AASHTO M105. The masonry fixing bolts shall be Type 304 stainless steel.

(iii) All piping connections and ancillary items not listed herein shall be provided by the Contractor.

PART 4 - EQUIPMENT DELIVERY

A. The Hydro DryScreen components shall be delivered within six weeks of date of approved technical submittal.

B. The Hydro DryScreen components shall be delivered to the site fully fabricated or shall be ready for the final assembly of the support frames within the host manhole structure.

C. Off-loading, storage, and installation shall be by the Contractor.

D. The Contractor shall inspect and provide signed acceptance of equipment prior to unloading, or notify Hydro International of any damage to equipment to effect proper remedial action. Failure to notify Hydro International of damage to equipment prior to unloading will void all warranties pertaining to subject equipment.

PART 5 - EQUIPMENT INSTALLATION

A. The system shall be installed in strict accordance with the site plans, and the manufacturer's general arrangement drawings and Handling, Storage and Installation Instructions. The Contractor shall be responsible for installing the equipment and all necessary site connections.

B. The Manufacturer shall be notified immediately of any equipment which is damaged during unloading, storage, or installation. The damaged equipment shall be repaired or replaced at the discretion of Hydro International and entirely at the Contractor's expense.

C. The precast concrete structure shall be set on a granular or compacted sand sub-base in accordance with local requirements for standard manhole installation. In no instances shall the compacted sub-base material have a thickness of less than 12 inches.

D. The precast concrete structure shall be set level and plumb to within 0.5%.

E. Non-shrink grout or hydraulic cement conforming to ASTM C 595 shall be used to provide a water tight seal in the lift holes, any drain holes and around the concrete knock-outs for the inlet and outlet pipes.

F. The Contractor shall, at the discretion of the owner or owner's representative, test the concrete structure for water tightness before backfilling.

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APPENDIX C – Operation and Maintenance

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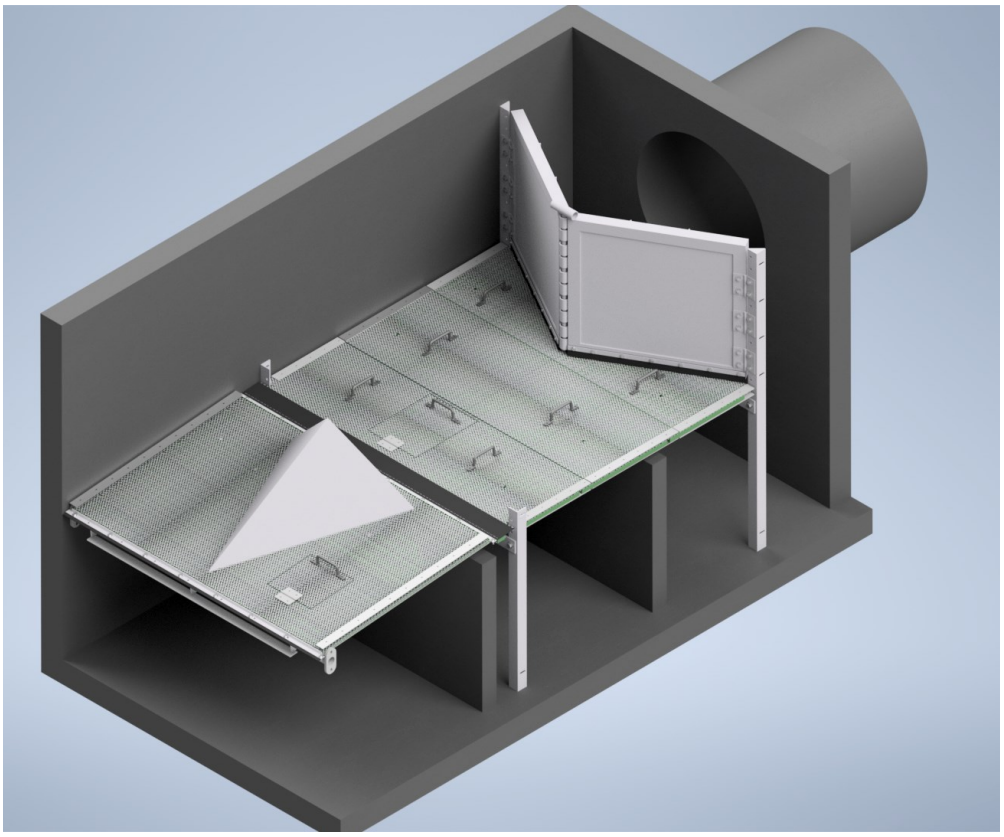
Hydro International®



Operation and Maintenance Manual

Hydro DryScreen®

Screened Baffle Box for Sediment and Trash Control

Stormwater Solutions

Turning Water Around ...®

BLANK

Hydro Maintenance Services

Hydro International has been engineering stormwater treatment systems for over 30 years. We understand the mechanics of removing pollutants from stormwater and how to keep systems running at an optimal level.

Nobody Knows our Systems Better than we do

Avoid Service Negligence

Sanitation services providers not intimately familiar with stormwater treatment systems are at risk of the following:

- Inadvertently breaking parts or failing to clean/replace system components appropriately.
- Charging you for more frequent maintenance because they lacked the tools to service your system properly in the first place.
- Billing you for replacement parts that might have been covered under your Hydro warranty plan .
- Charging for maintenance that may not yet have been required.

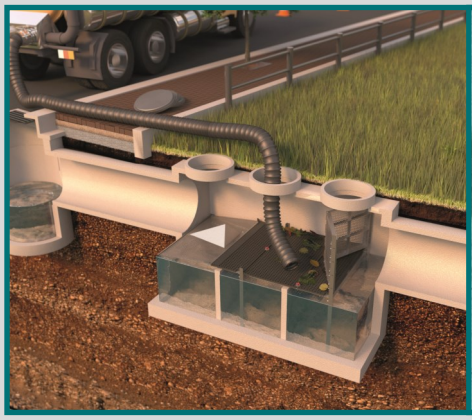
Leave the Dirty Work to us

Trash, sediment and polluted water is stored inside treatment systems until they are removed by our team with a vactor truck. Sometimes teams must physically enter the system chambers in order to prepare the system for maintenance and install any replacement parts. Services include but are not limited to:

- Solids removal
- Removal of liquid pollutants
- Replacement media installation (when applicable)

Better Tools, Better Results

Not all vactor trucks are created equal. Appropriate tools and suction power are needed to service stormwater systems appropriately. Companies who don't specialize in stormwater treatment won't have the tools to properly clean systems or install new parts.



Service Warranty

Make sure you're not paying for service that is covered under your warranty plan. Only Hydro International's service teams can identify tune-ups that should be on us, not you.

Treatment Systems Serviced by Hydro:

- Stormwwater filters
- Stormwater separators
- Baffle boxes
- Biofilters/biorention systems
- Storage structures
- Catch basins
- Stormwater ponds
- Permeable pavement

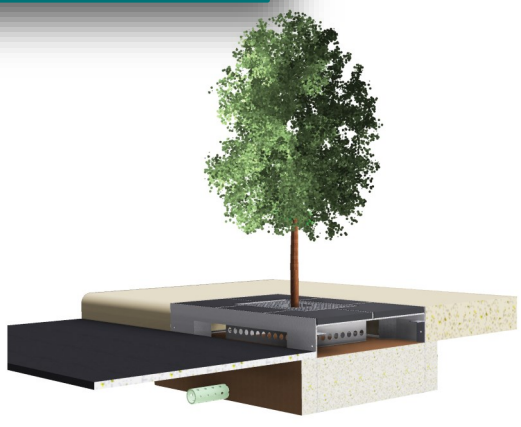


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Table of Contents

Hydro International (Stormwater), 94 Hutchins Drive, Portland ME 04102
Tel: (207) 756-6200 Fax: (207) 756-6212 Web: www.hydro-int.com

I. Hydro DryScreen® by Hydro International

Introduction

The Hydro DryScreen® is a gravity separation system that couples pretreated screening with enhanced Baffle Box sedimentation. There are five standard precast model sizes ranging from the smallest 4-ft. by 8-ft. footprint to the largest having a footprint of 12-ft. by 20-ft.

Each model has both a screening and sediment storage capacity that must be periodically inspected and cleaned to ensure proper operation and efficient separation. Figure 1 shows the key components of each Hydro DryScreen® and its operation is briefly described

Operation

Baffle box sedimentation is a relatively simple pollutant removal process based on the principle of slowing the velocity of flow through a pipe in order to allow solids to settle out of the flow stream. As stormwater enters the Hydro DryScreen® chamber, the flow is diffused and slowed by the Flow Spreader. Gross solids are conveyed around the spreader and captured on the horizontal screen (Fig.1).

As the flow encounters the first baffle wall, the velocity slows again allowing particles to settle. Oher solids in the flow stream strike the baffle wall and settle to the sump where their further movement is impeded by the presence of the baffle. Flow continues through the next two baffle chambers, where smaller particles settle.

Pollutant Capture and Retention

The internal components of the Hydro DryScreen® have been designed to capture and retain floating pollutants, like trash and organic matter as well as particulate matter that will settle.

A horizontal screen is positioned above the system's sump which allows them to dry out and makes it easier to view during inspections and remove when it's time to clean out. In general, the vertical screened weir traps and prevents floating pollutants on the horizontal adjustable dry screen from being carried downstream. The storage capacity of each DryScreen® model is determined by the height of the vertical screen.

Pollutants that settle during separation and fall into the sump are trapped between two baffle walls. Most of the pollutants that cannot be screened will settle into the first chamber and the adjacent two chambers will capture what does not have time to settle in the first chamber. The sump depth on standard models is 3-ft which is the maximum sediment storage depth.

Wet Sump

The sump of the Hydro DryScreen® retains a standing water level between storm events. The water in the sump prevents stored sediment from solidifying in the base of the unit. (The cleanout procedure becomes more difficult and labor intensive if the system allows fine sediment to dry-out and consolidate. Dried sediment must be manually removed by maintenance crews. This is a labor intensive operation in a hazardous environment.)

Blockage Protection

Hydraulic testing of the Hydro DryScreen® has shown that there is no hydraulic impact even with 75% of the total open area of the screen blinded. While this is an important hydraulic consideration it is still recommended to remove pollutants as they accumulate to prevent them from being lost during the larger less frequent storm events.

II. Model Sizes and Configurations

Hydro DryScreen® models include the internal components that are designed to remove and retain total suspended solids (TSS), gross solids, floatable trash and hydrocarbons. Hydro DryScreen® model parameters and design criteria are shown in Table 1.

Hydro DryScreen® Components

1. Screened Bypass Weir
2. Inlet Pipe
3. Outlet Pipe
4. Screen Deck
5. Splitter Cone
6. Sediment Storage
7. Access Hatch (3) one not shown

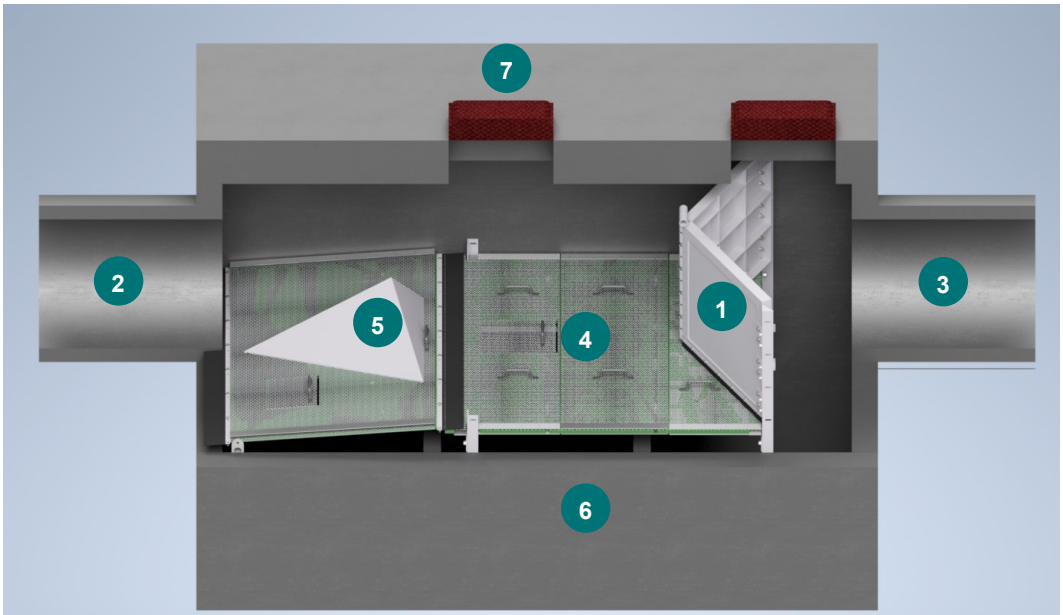


Fig.1 Hydro DryScreen® Components

Table 1. Hydro DryScreen® Capacities

Hdyro DryScreen® Models	Screen Storage Capacity	Standard Sump Depth	Sediment Capacity
(ft x ft)	(yd^3)	(ft)	(yd^3)
4 x 8	2.5	3.0	3.6
6 x 12	8.0	3.0	8.0
8 x 14	14.2	3.3	13.8
10 x 16	22.9	3.8	22.7
12 x 20	38.9	4	35.6

III. Maintenance

Overview

The Hydro DryScreen® protects the environment by removing a wide range of pollutants from stormwater runoff. Periodic removal of these captured pollutants is essential to the continuous, long-term operation of the device. The Hydro DryScreen® will capture and retain pollutants that float and settle until the storage volumes are full to capacity. When these capacities are reached, the system will no longer perform as intended which may violate the regulations requiring its use. Maximum pollutant storage capacities are provided in Table 1.

The Hydro DryScreen® provides surface access for easy and safe inspection, monitoring and clean-out procedures. A commercially or municipally owned sump-vac is used to remove screenings and any pollutants that have settled into the wet sump. Three access ports are located in the top of the precast vault. Each system will have different heights above the horizontal screen but it is intended for walking on. Once access is gained, the vertical screened weir and sections of the horizontal screen can be opened. Once opened, vactor hose access into each sump chamber is possible. The sump liquid and particulate matter is easily removed to proper disposal.

Ideally, the Hydro DryScreen® is regularly inspected to determine the frequency of a maintenance event and what is required. Maintenance events may only need to address screenings, or only sediment or both. Maintenance events will require entry into the underground vault or confined space entry. Components have been designed to open for access to the sump chambers and do not require removal. In the case of inspection and floatables removal, a vactor truck may not be required. However, a vactor truck is required if the maintenance event is to include removal of the sump liquid and pollutants.

Determining Your Maintenance Schedule

The frequency of cleanout is determined in the field after installation. During the first year of operation, the unit should be inspected every three to six months to determine the rate of sediment and screenings accumulation. A simple probe such as a Sludge Judge® can be used to determine the level of accumulated solids stored in the sump. This information can be recorded in the maintenance log (attached) to establish a routine maintenance schedule.

Inspection Procedures

Inspection is a simple process that may not have to involve entry into the vault. Maintenance crews should be familiar with the internal components prior to inspection.

Scheduling

- It is important to inspect your Hydro DryScreen® every three to six months during the first year of operation to determine your site-specific rate of pollutant accumulation.
- Typically, inspection may be conducted during any season of the year if the winter months do not prevent access to the surface openings.
- Sediment removal is not required unless sediment depths exceed the maximum clean-out depths stated in Table 1.

Equipment

- Safety Equipment and Personal Protective Equipment (traffic cones, work gloves, etc.)
- Crow bar or other tool to remove grate or lid
- Pole with skimmer or net
- Sediment probe (such as a Sludge Judge®)
- Trash bag for removed floatables
- Maintenance Log

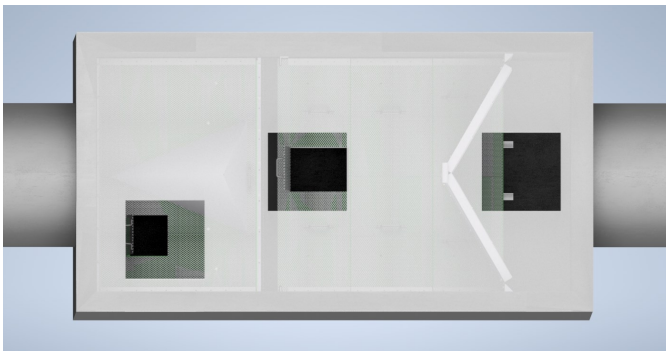


Fig.2 - Access to the Hydro DryScreen® is provided via Three, 2 ft Square Hatches.

Access and Entry

Each Hydro DryScreen® has three (3) 2 ft square access hatches in locations similar to the detail in Fig 2. The two hatches near the inlet pipe sit over liftable screen hatches for access to the sump bays for vector control and sediment depth measuring.

The access next to the outlet pipe has direct access to the sump downstream of the bypass screen weir.

No entry is required for inspection or trash removal. Full sump cleaning may require confined space entry.

Inspection Procedures

1. Set up any necessary safety equipment around the access port or grate of the FDHC FTC as stipulated by local ordinances. Safety equipment should notify passing pedestrian and road traffic that work is being done.
2. Remove the lids to the structure.
3. Without entering the vessel, look down into the chamber to inspect the inside. Make note of any irregularities.
4. Note the amount of trash contained and estimate the volume.
5. Using a sediment probe such as a Sludge Judge®, measure the depth of sediment that has collected in the sump of the vessel.
6. On the Maintenance Log (see page 7), record the date, unit location, estimated volume of floatables and gross debris, and the depth of sediment measured. Also note any apparent irregularities such as damaged components or blockages.
7. Securely replace the grate or lid.
8. Take down safety equipment.
9. Notify Hydro International of any irregularities noted during inspection.

Scheduling

- Floatables and sump clean out are typically done once or twice a year.
- The device should be cleaned following an oil or other contamination spill in the contributing area.
- Cold climates may require a early summer clean to remove winter grit loads.

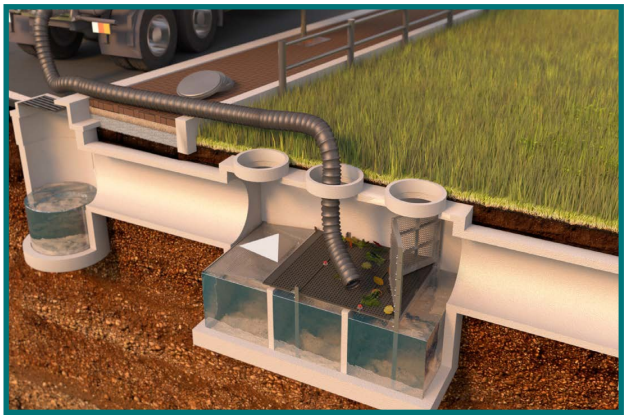
Recommended Equipment

- Safety Equipment (traffic cones, etc.)
- Crow bar or other tool to remove grate or lid
- Pole with skimmer or net (if only floatables are being removed)
- Sediment probe (such as a Sludge Judge®)
- Vactor truck (flexible hose recommended)
- FDHC FTC Maintenance Log

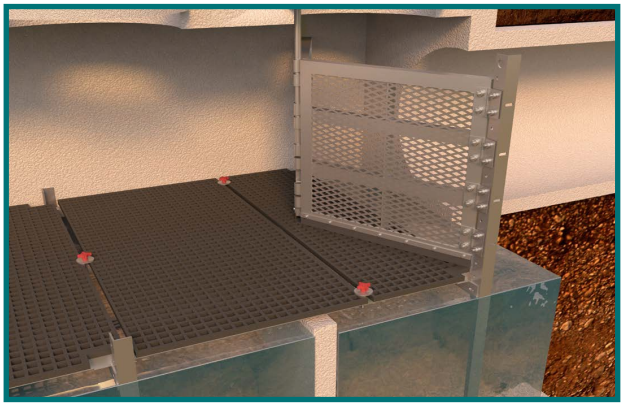
Screenings and Sediment Clean Out

The access openings or ports located at the top of the precast vault provide unobstructed access for a vactor hose and skimmer pole to be lowered onto the horizontal screens and sump. Screenings may also be removed by hand or by vacuuming and can typically be scheduled with sediment removal. A commercially or municipally owned sump-vac is used to remove captured screenings and sediment.

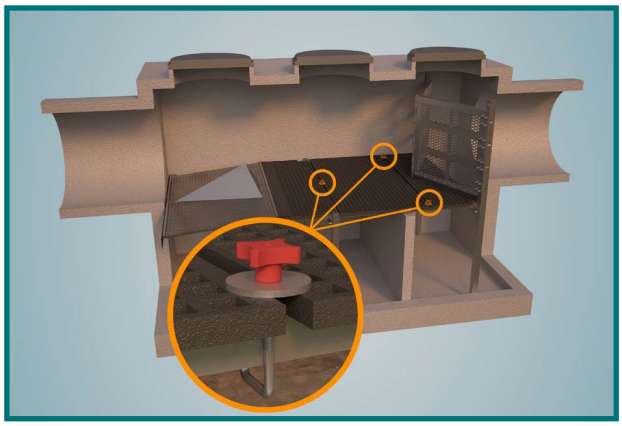
1. Set up any necessary safety equipment around the access ports as stipulated by local ordinances. Safety equipment should notify passing pedestrian and road traffic that work is being done.
2. Remove access lids and visually inspect the inside of the vault. Document observations and take pictures. Estimate and record the screenings and sediment depths. Update the maintenance log.
3. Using a vactor removal system, vacuum pollutants trapped on the screen above the horizontal baffle walls and behind the vertical weir.



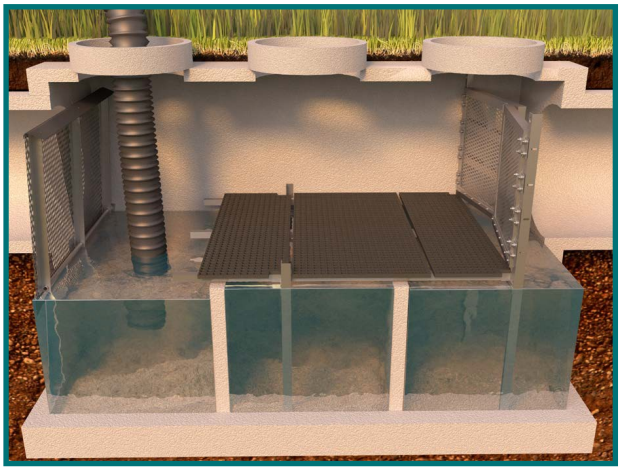
4. Using confined space entry procedures, enter the Hydro DryScreen.
5. Remove the hinge pin from the weir wall. Push weirwall.



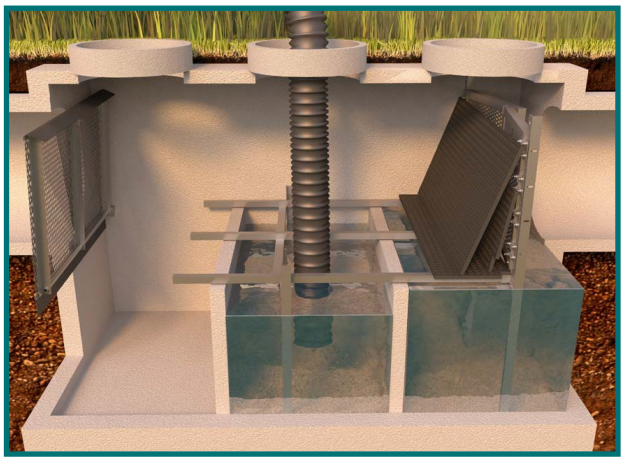
6. Remove the red hold down clamps.



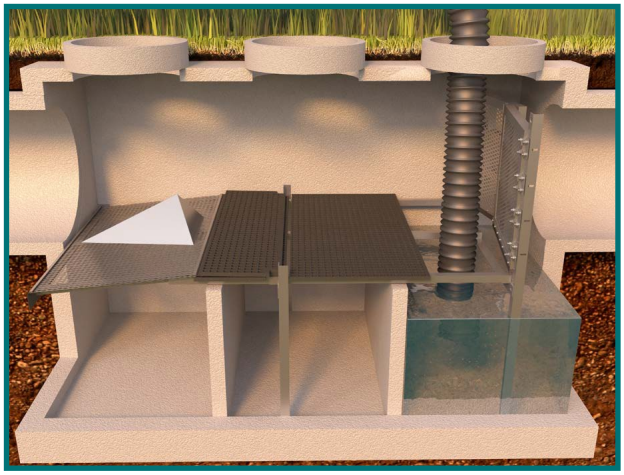
7. Vacuum sediment and liquid from the first section of the sump. Return the inlet screen back into position, resting on the central screen.



8. Vacuum sediment and liquid from the second section, replace the screen and re-attach the hold-downs.



9. Vacuum sediment and liquid from the third section, under the closed weir walls. Move the doors of the weir wall back into position and replace the hinge pin.



10. Pull all sections back as you found them and reapply the red hold down clamps.

11. Take pictures of cleaned system, exit the Hydro Dry-Screen and replace the access.

Action	Timing
Inspection	• Regular (recommended 2 - 4 times a year in the first year depending on expected pollutant load) • Every 6 (six) months after first year of operation or more frequently if pollutant loads indicate a need
Screenings Removal	• Remove as part of regular cleaning schedule • Remove following a spill event
Sediment Removal	• Once a year or more frequently if inspections indicate • Never more then 2 years apart to avoid sediment compaction in the sump • Following spill event

Hdyro DryScreen® High Capacity FTC Installation Log

REFERENCE NUMBER:	
SITE NAME:	SITE ADDRESS:
OWNER:	CONTRACTOR:
CONTACT NAME:	CONTACT NAME:
COMPANY:	COMPANY:
ADDRESS:	ADDRESS:
PHONE:	PHONE:
EMAIL:	EMAIL:

INSTALLATION DATE: / /

SIZE (CIRCLE): **3 x 8 ft** **6 x 12 ft** **8 x 14 ft** **10 x 16 ft** **12 x 24 ft**

NOTES:

Hdyro DryScreen® High Capacity FTC Inspection and Maintenance Log

DATE	INITIALS	DEPTH OF SCREENINGS	DEPTH OF SEDIMENT	COMMENTS

Notes

DO IT RIGHT THE FIRST TIME

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CALL **1 (888) 382-7808** TO SCHEDULE AN APPOINTMENT

Stormwater Solutions

94 Hutchins Drive
Portland, ME 04102

Tel: (207)756-6200
Fax: (207) 756-6212
StormwaterInquiry@hydro-int.com

www.hydro-int.com

Turning Water Around…®

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APPENDIX D – Warranty

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Turning Water Around…®

Stormwater Equipment Limited Product Warranty

Hydro International's equipment, including the DOWNSTREAM DEFENDER®, FIRST DEFENSE®, UP-FLO® FILTER, HYDRO DRYSCREEN®, HYDRO STORMSCAPE™, HYDRO-BRAKE® or REG-U-FLO® Vortex Flow Control, is backed by the following warranty:

Hydro International warrants all of its products to be free from defects in materials and workmanship; and will replace, repair, or reimburse at its discretion any part or parts which, after Hydro's examination, Hydro shall have determined to have failed under normal use and service by the original user within two years following initial installation. Such repair or replacement shall be free of charge for all items except for (i) those items that are consumable and normally replaced during maintenance, (ii) labor costs incurred by Hydro to obtain access to the part or unit for repair or replacement, (iii) any costs to repair or replace any surface treatment / cover after repair or replacement or (iv) other charges that Hydro may incur incident to such repair or replacement. Repair or replacement of such consumable items shall be subject to assessment of a pro-rated charge based upon Hydro International's estimate of the percentage of normal service life realized by the item. Hydro International's obligation under this Warranty is conditioned upon (a) its receiving prompt notice of claimed defects which shall in no event be later than thirty (30) days following expiration of the above warranty period and (b) owner of the product properly operating, inspecting, maintaining and caring for the product and is limited to repair or replacement as aforesaid. Purchaser agrees that the foregoing warranty is Purchaser's sole remedy under any legal theory whether pleaded in contract, tort, or otherwise.

THIS WARRANTY IS EXPRESSLY MADE BY HYDRO INTERNATIONAL AND ACCEPTED BY PURCHASER IN LIEU OF ALL OTHER WARRANTIES, INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS FOR PARTICULAR PURPOSE, WHETHER WRITTEN, ORAL, EXPRESS, IMPLIED, OR STATUTORY. HYDRO INTERNATIONAL NEITHER ASSUMES, NOR AUTHORIZES ANY OTHER PERSON TO ASSUME FOR IT, ANY OTHER LIABILITIES WITH RESPECT TO ITS EQUIPMENT INCLUDING NEGLIGENCE IN DESIGN OR MANUFACTURE AND PURCHASER AGREES THAT THIS WARRANTY AND THE OBLIGATIONS OF HYDRO INTERNATIONAL SET FORTH HEREIN ARE THE SOLE REMEDIES AVAILABLE TO PURCHASER FOR THE FAILURE OF ANY PRODUCT TO PERFORM AS WARRANTED. HYDRO INTERNATIONAL SHALL NEITHER BE LIABLE FOR NORMAL WEAR AND TEAR NOR FOR INCIDENTAL OR CONSEQUENTIAL DAMAGE DUE TO USE OR INOPERABILITY OF ITS EQUIPMENT FOR ANY REASON WHATSOEVER.

This Warranty shall not apply to equipment or parts thereof which have been altered or repaired outside of an authorized Hydro International facility or fabricator, or damaged by improper handling, installation, or application, or subject to misuse, abuse, neglect, accident or improper or inadequate maintenance. The Contractor shall inspect and provide signed acceptance of equipment prior to unloading, or notify Hydro International of any damage to equipment to effect proper remedial action.
Failure to notify Hydro International of damage to equipment prior to unloading will void all warranties pertaining to subject equipment.

Hydro International (Stormwater), 94 Hutchins Drive, Portland ME 04102
Tel: (207) 756-6200 Fax: (207) 756-6212 Web: www.hydro-int.com

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APPENDIX E – Test Report

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Hydro DryScreen® Performance Testing

January 2017

Hydro International (Stormwater), 94 Hutchins Drive, Portland ME 04102
Tel: (207) 756-6200 Fax: (207) 756-6212 Web: www.hydro-int.com

Contents

1 Executive Summary

Baffle boxes are horizontal settling tanks that are used for removing pollutants from waste streams, like stormwater runoff. The original Type I Baffle Box primarily targets settleable solids but more recent designs, referred to as Type II Baffle Boxes, include screens that are used to capture floating pollutants. While research has shown Type I Baffle boxes to have high removals of sandy clay sediment, the initial laboratory work showed the efficiency to be very sensitive to loading rates. Hydro International has developed a Type II Baffle Box (Hydro DryScreen®)that not only increases the loading rate range but includes a screen that ensures buoyant organic matter is captured and retained above the static water level in between rainfall events. Leaching of nutrients is prevented by keeping organic particulate matter exposed to oxygen or out of the sump where it degrades and becomes anoxic.

This report reviews results from laboratory tests on a Type I Baffle Box, compares these results to estimates using settling equations in horizontal tanks and provides efficiency estimates for the Hydro DryScreen® Type II Baffle Box using Computerized Fluid Dynamics (CFD). Full-scale laboratory testing was also completed to compare to both the CFD model and results of the original Type I Baffle Box laboratory tests.

Researchers studying a Type I Baffle Box (Pandit and Gopatakrishnan) determined that the average removal efficiency for a "sandy clay" test sand having 80% of the particle sizes between 200 and 600 µm was close to 90% for loading rates in the range of 6 to 8 gpm per square-foot of surface area. Ideal settling calculations predict Type I baffle Boxes would be challenged to remove the finer portion of the test sand gradation (D_{50}=350µm) used by Pandit and Gopatakrishnan when the hydraulic loading rate is in excess of about 50 gpm per square foot of settling.

CFD simulations with the same sandy clay particle size distribution described in Pandit's work was used to evaluate the performance of a Type I (no screen) and Hydro DryScreen® Type II Baffle Boxes. The model was used to design flow modifying components and additional CFD simulations were run with the internal components used in the Hydro DryScreen Type II Baffle Box to demonstrate a 26% increase in efficiency. To verify the CFD results, testing was completed on a full-scale 3-ft × 6-ft test unit.

Hydraulic test results showed that there would be less than a 10% reduction in flow even if pollutants blind the screens so that there is only 20% of open screen area remaining (i.e.: 80% blinded). Additionally, hydraulic data was shown to approximate a theoretical orifice equation for entrance loss into a pipe using a Cd of 0.65, which simplifies modeling impacts to the hydraulic grade line when placed into a drainage network.

Removal efficiency testing correlated well with theoretical settling calculations for 80% removal of all particles down to 100-microns at about 30 gpm/sq-ft. However, at high loading rates of 150 gpm/sq-ft 80% removals of particles down to 400 microns was measured compared to settling calculations that predicted removals down to the 700 micron range. These higher loading rates observed in the lab test results are attributed to the flow modifying internals used in the Hydro DryScreen®. Compared to the lab test results of Pandit and Gopatakrishnan, similar removals were observed but at loading rates 3-4 times higher.

2 Overview

Hydro International has traditionally focused on products that harness the energy from rotational flow to create innovative products for the control and treatment of waste streams, like stormwater runoff. While vortex separation for treatment of urban stormwater runoff has been proven to capture and retain a wide range of pollutants that float and settle, conventional baffle box separators ("Stormwater Technology Fact Sheet", United States Environmental Protection Agency, Spetember 2001.) also have a history and are an acceptable stormwater treatment technology.

The original Type I Baffle Box (Figure 1) was similar in design to septic tanks used for removing solids prior to pumping or flowing to leach fields. These designs included one or two baffle walls installed perpendicular to the flow direction within a rectangular precast structure. The baffle walls function to: reduce the flow velocity and allow particles with a settling velocity greater than the horizontal flow velocity to settle into the sump; and minimize particle movement. Heavier or larger particles tend to settle and accumulate in the first chamber while smaller particles usually settle out in subsequent chambers. The sediment removal efficiency of a typical Type 1 Baffle Box has been investigated in the laboratory to take advantage of being able to control loading rates and test sand particles sizes and concentrations ("Physical Modeling of a Stormwater Sediment Removal Box", Pandit and Gopatakrishnan, June 1996). The study defined the overall efficiency as the ratio of total mass of sediment captured to the total mass of sediment injected during the experiment, which is conservative but arguably more accurate than efficiency determined by influent and effluent concentrations. The average removal efficiency for a "sandy clay" test sand having 80% of the particle sizes between 200 and 600 µm was close to 90% and found not to be dependent on concentration. Removal efficiency of "silty clay" test sand was lower at about 30% but the particle sizes were mostly less than 50µm and almost 60% less than 20µm. The tested loading rates were about 6 and 8 gpm per square-foot of surface area. Since the decrease in efficiency of these fine particles was believed to be caused by resuspension within the chamber, researchers speculated that modifications to the baffles to reduce turbulence and minimize resuspension could increase retention of particles less than 50µm or allow for higher loading rates without significant decrease in capture.

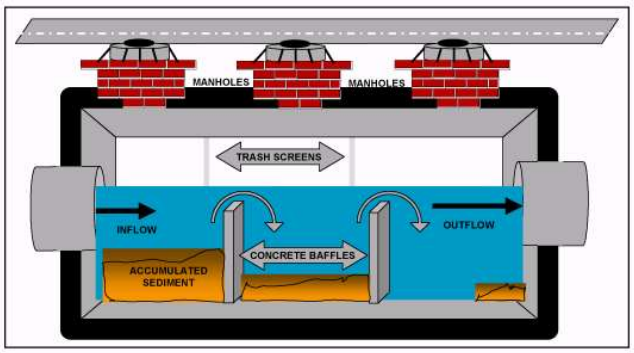

Figure 1. Type I Baffle Box

Type 2 baffle boxes (Figure 2) include horizontal screens above pipe inverts that trap floating organic matter and suspended sediments above the static water elevation. By suspending organic matter above the water filled sump, it is kept dry or exposed to oxygen, which is needed to keep them from decaying and leaching nutrients. Additionally, material that is captured and retained can form a mat on the screen surface, reducing the effective size of openings, which captures particles that are smaller than the screen openings. The horizontal screen used in Type 2 baffle boxes has been proven to be more effective than

Type I baffle boxes for removing Total Nitrogen (TN) and Total Phosphorus (TP) *(*"Final Report – Baffle Box Effectiveness Monitoring Project", *FL DEP and GPI Southeast. Jan. 7, 2010).*

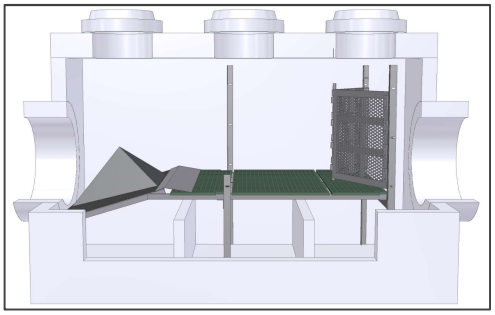

Figure 2. Type II Baffle Box – Hydro DryScreen®

The Type II Baffle Box shown in Figure 2 is a rendering of the Hydro DryScreen® by Hydro International. It is a second-generation baffle box that augments the typical baffle box design with a patented flow-diffusing deflector to improve sediment capture. The horizontal screens not only vertically adjust to keep screenings dry if tailwater conditions exist but they are sectionalized for ease of access to the separate storage chambers in the sump. A vertical screened weir is positioned at the outlet to retain all screened material for the full design flow rate. The screens are sized to capture 100% of all material greater than 0.75-inches.

Settling of discrete particles in a horizontal settling tank has been mathematically defined for some time now, Hazen(1904) and Camp(1946). The idea that a particle will settle depending on its settling velocity before it leaves a tank and that it is dependent on the surface loading rate of the tank is often used to estimate how large the settling tank needs to be for a given flow rate. Using an ideal or theoretical settling equation ("A Simple Universal Equation for Grain Settling Velocity", Ferguson and Church, 2006.), a hydraulic loading rate greater than about 150gpm per square-foot of settling area would not capture particles smaller than about 750µm (Figure 3). For more typical loading rates of 25 gpm per square foot of settling area, particles smaller than about 160µm would not have enough time to settle. Given the test sand gradation used by Pandit and Gopatakrishnan that had a D_{50}=350µm, a hydraulic loading rate in excess of about 50 gpm per square foot of settling area would not capture the finer portion of the distribution.

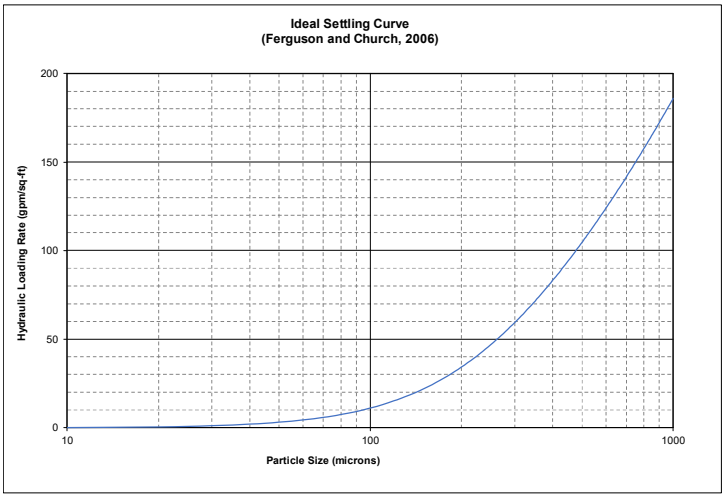

Figure 3. Hydraulic Loading Rates for Settling Different Particle Sizes

To benchmark the actual efficiency at these loading rates with the Hydro DryScreen® Type II baffle box, a 3-ft × 6-ft full scale model was tested. This report summarizes these tests and the results.

3 Product Description and Operation

The Hydro DryScreen® product components are shown below in Figure 4. The inlet pipe (1) conveys flow into the structure from the left. A screened inlet ramp (6) with integral prismatic flow splitter directs any screenable material up onto the horizontal screened platform (4). Additionally, the flow splitter directs flow to the sides of the vessel, interrupting a "short-circuit" between the inlet and outlet. The smooth, sloped shape of the flow splitter deflects and prevents accumulation of buoyant material likely to collect on the surface.

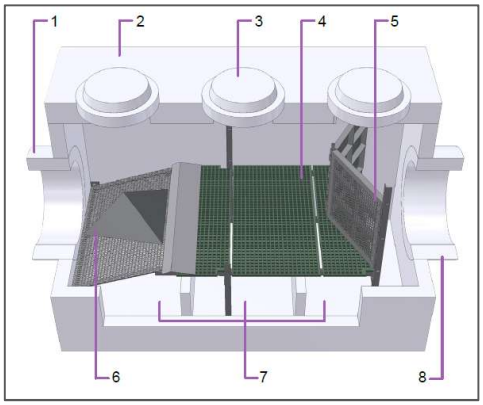

Figure 4: Component diagram of Hydro's dry screen product

Figure 5 and Figure 6 show the flow path when the system is operating below and above the design treatment flow rate. When the runoff flow rate is less than the design treatment flow rate (Figure 5), incoming flow, floating debris and sediment pass through the sump region and across the horizontal screen. Flow unscreened by the inlet ramp or screened platform is treated by the vertical screened weir (5) positioned over the outlet pipe (8).

Energy from the inflow continues to deposit any floating debris on the horizontal platform. Settleable solids are collected in the three sump areas (7) located under the horizontal screen. Treated flow then exits the system from the overflow pipe located on the right (8).

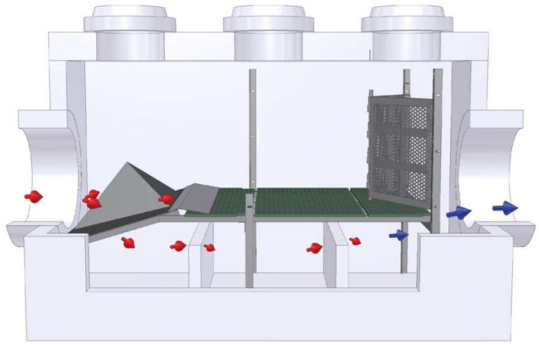

Figure 5: Flow Path with runoff less than peak treatment flow rate

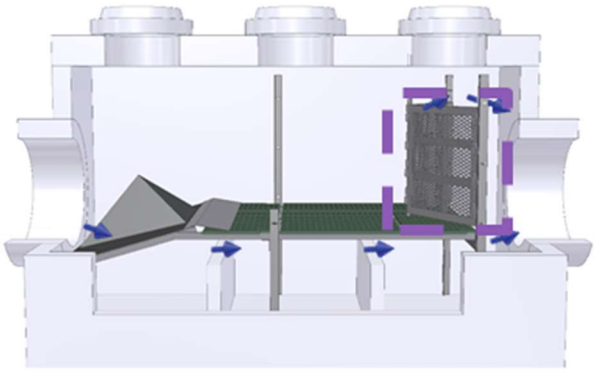

Figure 6: Flow Path with runoff greater than peak treatment flow rate

As shown in Figure 6, once the peak treatment flow rate is exceeded, high water elevations that could cause upstream flooding are managed by diverting flows over the screened vertical weir. In general, the vertical weir is the same height as the pipe diameter to allow full pipe flow prior to bypassing. This ensures that 100% of the flows are screened with no bypass up to the peak treatment flow rate, such as the 25-year return frequency.

4 Performance Testing Overview

A two-phase test plan that used Computerized Fluid Dynamics (CFD) simulations and controlled testing was completed. CFD was used to understand the limitations of a standard Type I Baffle Box with no flow modifying components and predict the benefits of the prismatic flow splitter. Controlled sediment tests with known particle size distribution, concentration and flows or loading rates were assessed.

CFD simulations with the same "Sandy Clay" particle size distribution described in Pandit's work was used to evaluate the performance of a Type I (no screen) and Hydro DryScreen® Type II Baffle Boxes. The CFD simulation was first calibrated against Pandit's lab work using a Type I Baffle Box to gain confidence in the model. Removal efficiencies at surface loading rates of 6 and 8 gpm/sq.ft. were simulated within 1% of results reported by Pandit using second order momentum equations and Lagrangian Particle tracking methods. Velocity contour plots of the baseline vessel showed significant short circuiting between the inlet and outlet pipes at higher velocities (Figure 7-top). The model was used to design flow modifying components that interrupt the "short circuit" and increase residence time and the particle retention rate. Additional CFD simulations were run with the internal components used in the Hydro DryScreen Type II Baffle Box (Figure 7-bottom) to demonstrate a 26% increase in efficiency.

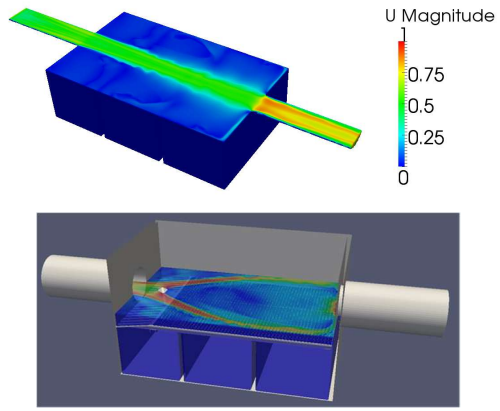

Figure 7: CFD Models of Type I and II Baffle Boxes

Following the CFD simulations, a full-scale 3-ft × 6-ft Hydro DryScreen separator was tested to confirm the modeling efficiency results reported by Pandit. In general, the test procedures used were designed to mimic those used by Pandit with the addition of recording water elevations to determine headlosses with and without the screen being partially blinded. The controlled efficiency tests were also completed with and without internal components to quantify the benefits of the prismatic flow splitter.

Clean water was pumped via an 8-inch variable speed Flygt pump from a 23,000 gallon reservoir, through a 12-inch pipe network to the inlet of the 3-ft × 6-ft full-scale Hydro DryScreen® test unit. Figure 8 shows the laboratory at Hydro International with, reservoir, piping and test unit. Test sand was manually feed into a standpipe cored into the crown of the inlet pipe. The feed rate was calibrated to have an inlet concentration of 200 mg/L. Like the tests completed by Pandit, the efficiency was determined by removing and measuring the mass of the captured sediment from the sump at the end of each test run. The sediment removed from the sump was also sieved to quantify the removal efficiency of different particle size ranges.

Figure 8: Hydro International Test Facility

Figure 9 is a photograph taken during hydraulic testing with view looking down into the test unit from above. The 12-inch inlet pipe is on the left, followed by prismatic flow diverter, horizontal platform screen and 18-inch screened vertical weir covering the outlet pipe on the far right. Flow rates and water elevations were measured with a static pressure tap in the inlet pipe, a rule in the upstream section of the vessel and a rule installed downstream of the vertical screens. To determine the hydraulic impact of screen blinding, a fully open-screen system was compared to a system with 80% of the open screen area blocked or covered as shown in Figure 10. The flow/water elevation plots (Figure 11) showed that the water level overflowed the bypass weir height at 3.9 cfs with screens 80% blocked compared to 4.2 cfs when left open. The translation of these results to actual field installations suggest that there would be less than a 10% reduction in flow even if pollutants blind the screens so that there is only 20% of open screen area remaining (i.e.: 80% blinded). Additionally, the hydraulic curve approximates a theoretical orifice equation for entrance loss into a pipe using a Cd of 0.65. This allows designers to easily estimate the influence to the drainage network's hydraulic grade at various flow rates.

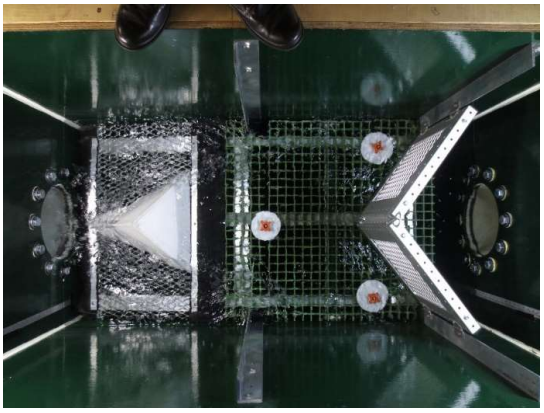
Figure 9: Top View of 3-ft × 6-ft Test Unit

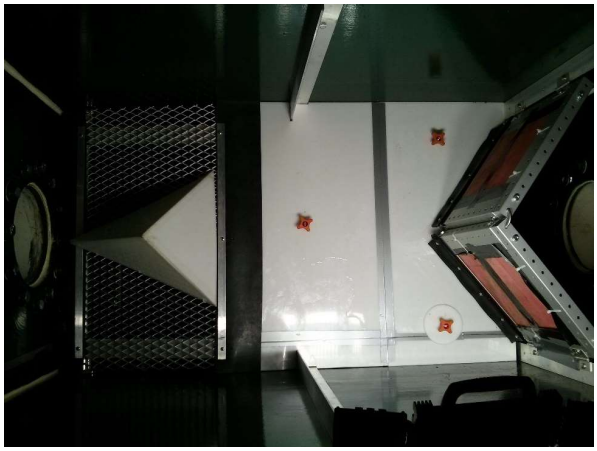
Figure 10: Hydraulic Testing with 80% Open Area Blocked

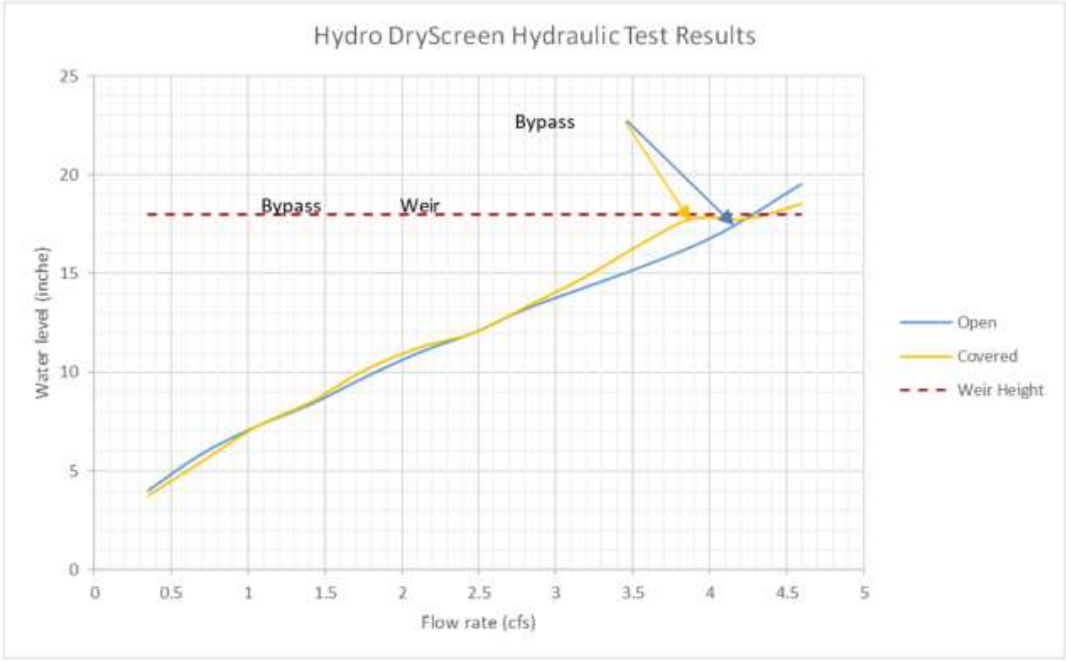

Figure 11: Comparison of water elevations and flow rates – Open Screen Vs. 80% Covered Screen.

4.1 Removal Efficiency Testing

To quantify removal efficiency, test sand was introduced into a standpipe approximately eighteen inches upstream of the vessel. The test sand chosen was similar to the "Sandy Clay" gradation used in the research completed by Pandit. The target and measured PSD of the blended mix were very similar as shown in Figure 12. Removal efficiencies for a range of surface loading rates and particle sizes are reported in Figure 13. As shown, the efficiency for particles "down to" five different sizes were analyzed. For example, greater than 80% efficiency was measured for all particles down to 106 microns at a surface loading rate of about 30 gpm/sq-ft and at 150 gpm/sq-ft, all particles down

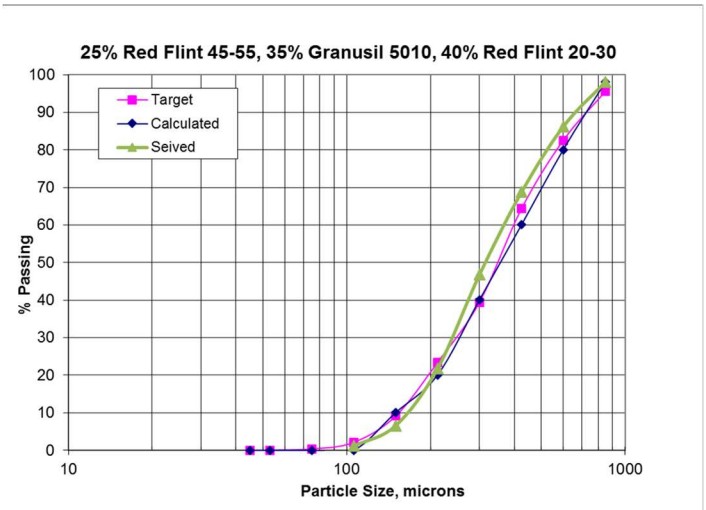

Figure 12: Target, Calculated and Sieved particle size distributions of Pandit's "Sandy Clay".

to 400 microns was measured. This correlates well with the theoretical hydraulic loading rates used to predict removals of the 100 micron particle size range. However, the theoretical settling calculations

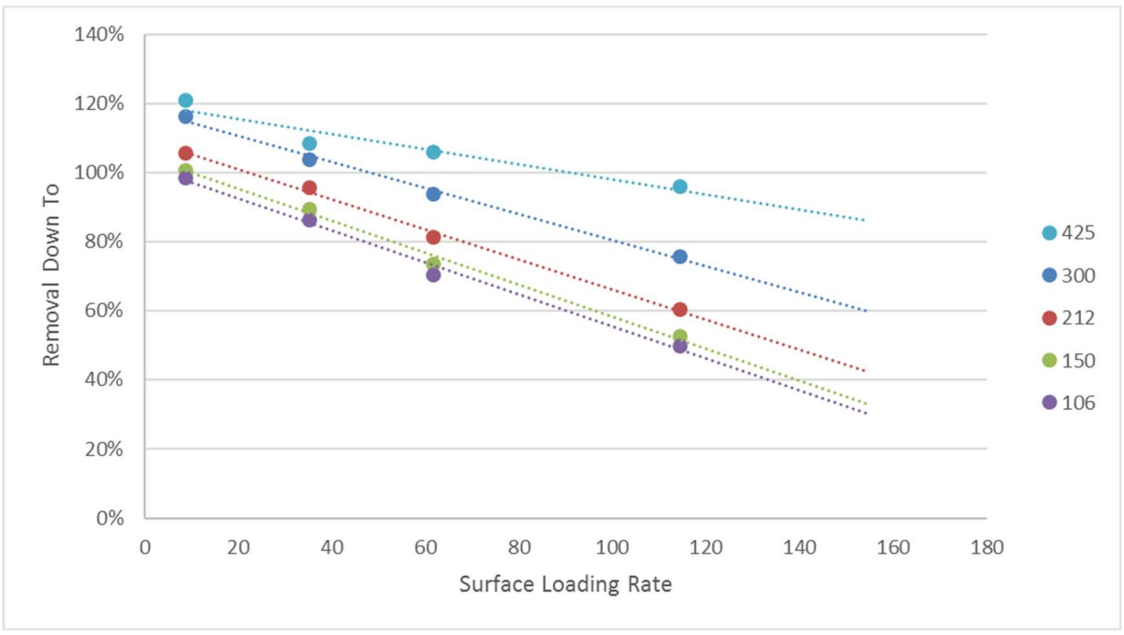

Figure 13: Removals Down to Particle Size using Pandit's "Sandy Clay" blend

estimate 80% removals of particles in the 700 micron range. Given the test results show removal of 400 micron particles, the results indicate that at higher loading rates, the flow modifying internals improve the settling capability. Compared to the lab test results of Pandit and Gopatakrishnan, similar removals were observed but at loading rates 3-4 times higher.

5 Standard Model Sizes

Using the hydraulic data, screen open area, maximum pipe size and efficiency data, five Hydro DryScreen models are standardized for commercial availability. Custom sizes are also available and some changes to the key dimensions shown may be necessary depending on local precast supply. Table 5 includes the key design requirements for each model size.

For on-line installations, the maximum pipe size, Peak Online Flow Rate and either Typical Treatment flow rate or 80% TSS flow rate can be used to correctly size a system based on specific site and catchment area criteria. For off-line installations that allow for control of the peak runoff flow, the pipe size, Bypass Flow Rate and either Typical Treatment or 80% flow rates can be used to select the appropriate size system.

Table 5: Sizing table

Unit Dims (feet)			Pipe Dia.	Pipe Area	Bypass[1]	Peak Online[2]	Typ. Treat.[3]	80% TSS[4]
W	L	A	(feet)	(sq.ft)	(cfs)	(cfs)	(cfs)	(cfs)
4	8	32	2.5	4.91	28.6	20	11	1.8
6	12	72	3.5	9.62	66.4	47	24	4.0
8	14	112	4	12.57	92.7	65	37	6.2
10	16	160	4.5	15.90	124	87	53	8.9
12	24	288	5	19.63	162	113	96	16.0

1. ***Bypass Flow:*** The flow rate at which the water level will crest the vertical screened bypass weir. Can be used for offline installations that use an external bypass to control the peak runoff flow rates. Runoff rates exceeding the Bypass Flow Rate can release captured pollutants.
2. ***Peak Online Flow:*** The Maximum Bypass flow less a safety factor of at least 1.4. Can be used for online installations having peak runoff flow rates pass through the treatment system. No release of captured pollutants for runoff flow rates that are less than the Peak Online Flows.
3. ***Typical Treatment Flow Rate:*** This is the flow rate at which the device would remove 80% of a "Sandy Clay" particle size distribution down to 425 microns. This flow rate is based on 150 gpm/sq.ft.. Compare to a common "wet-season" storm event (example: 1-2 year return frequency).
4. ***80% TSS Flow Rate:*** This is the flow rate at which the device would remove 80% of "Sandy Clay" particle size distribution down to its minimum particle size. This flow rate is based on 25 gpm/sq.ft. Compare to a frequent but low intensity storm event (example: captures the first 0.5-1 inches of rainfall or 70-80% of the annual runoff volume).

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APPENDIX F – MVCAC Letter

MVCAC
Mosquito and Vector Control Association of California
One Capitol Mall, Suite 800 • Sacramento, CA 95814 • p: (916) 440-0826 • f: (916) 444-7462 • e: mvcac@mvcac.org

Hydro International
94 Hutchins Drive
Portland, ME 04102

April 29, 2021

Dear Mr. Taylor,

Thank you for the submission of the Hyro International Hydro DryScreen full trash capture device for review by the Mosquito and Vector Control Association of California pursuant to the SWRCB Trash Treatment Control Device Application Requirements. The Association has reviewed the conceptual drawings for the Hydro DryScreen and verifies that provisions have been included in the designs that allow for full visual access to all areas for presence of standing water, and when necessary, allows for treatments of mosquitoes.

While this verification letter confirms that inspection and treatment for the purpose of minimizing mosquito production should be possible with the Hydro DryScreen as presented, it does not affect the local mosquito control agency's rights and remedies under the State Mosquito Abatement and Vector Control District Law. For example, if the installed device or the associated stormwater system infrastructure becomes a mosquito breeding source, it may be determined by a local mosquito control agency to be a public nuisance in accordance with California Health and Safety Code sections 2060-2067.

"Public nuisance" means any of the following:

1. Any property, excluding water that has been artificially altered from its natural condition so that it now supports the development, attraction, or harborage of vectors. The presence of vectors in their developmental stages on a property is prima facie evidence that the property is a public nuisance.
2. Any water that is a breeding place for vectors. The presence of vectors in their developmental stages in the water is prima facie evidence that the water is a public nuisance.
3. Any activity that supports the development, attraction, or harborage of vectors, or that facilitates the introduction or spread of vectors. (Heal. & Saf. Code § 2002 (j).)

Declaration of a facility or property as a public nuisance may result in penalties as provided under the Health and Safety Code. Municipalities and the vendors they work with are encouraged to discuss the design, installation, and maintenance of stormwater trash capture devices with their local mosquito control agency to reduce the potential for disease transmission and public nuisance associated with mosquito production.

Sincerely,

Bob Achermann,
MVCAC Executive Director