Urban Green Infrastructure:

What's Green Got to Do With It?

Chris Bogdan – Urban Green Infrastructure Business Development Manager

FERGUSON® WATERWORKS

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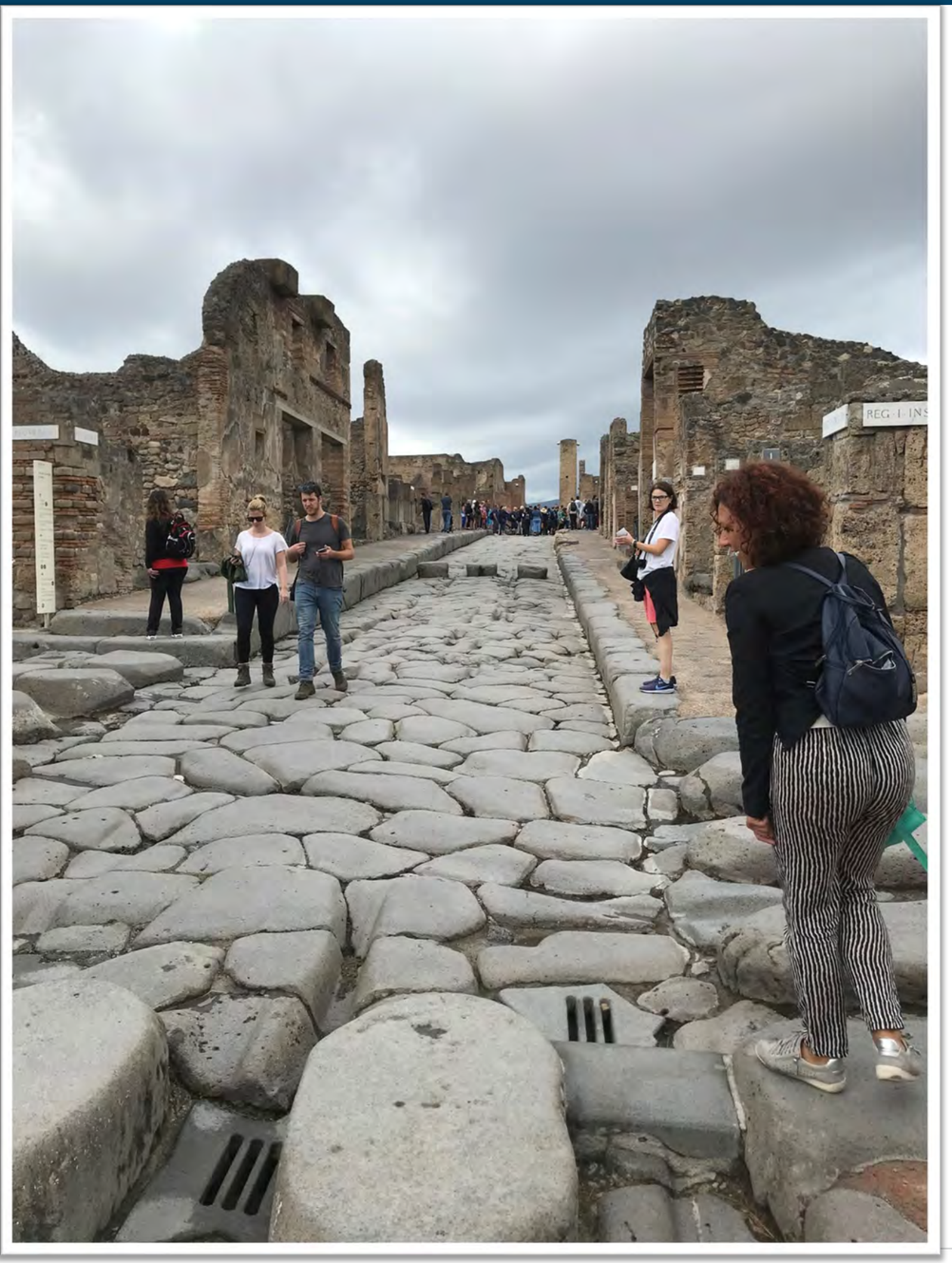
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154
STATIONERS
163

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412

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STOP

GSI: WHAT'S GREEN GOT TO DO WITH IT

GSI- THE WHY FOR MUNICIPALITIES

- Recharge Aquifers to Combat Sea Level Rise
- Reduce Pressure on Municipalities to Clean Other People's Runoff
- Mitigates Flash Flooding
- Solves Tough Engineering Problems
- Adds Tax Revenue for Municipalities

BUT

DO DEVELOPERS

CARE???

GSI: WHAT'S GREEN GOT TO DO WITH IT

GSI- THE WHY FOR DEVELOPERS

- Increased Lot Yield
- Lower Cost of Development
- Increase Project Revenue
- Maximize ROI
- Make More Money……The GREEN

GSI: WHAT'S GREEN GOT TO DO WITH IT

URBAN ADDED COMPLEXITIES- STREETSCAPE PROJECTS

- Tight spaces
- Working around existing infrastructure
- Poor Soils
- Steep Grades / Topography
- Need for function and feature / aesthetics
- Often research, design and maintenance are mutually exclusive. i.e. are we taking what we learn in the field back to the next design

GSI: WHAT'S GREEN GOT TO DO WITH IT

URBAN ADDED COMPLEXITIES

Design Challenges

- Developers Rush the Process
- Civil Engineers Product Knowledge
- Not Addressing Geotechnical Issues
- Civil Engineers and Landscape Architect Operate Independently
- Long-term Cost of Maintenance

Construction

- Poor Communication
- Unrealistic Expectations
- Inexperienced Contractors
- EOR is Often not Engaged During Construction
- Properly protect GSI assets during construction

Conventional Permeable Paver

Open-Joint Permeable Paver

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GSI: WHAT'S GREEN GOT TO DO WITH IT

GOALS FOR RAIN GARDENS AND BIOSWALES

- Look amazing (aesthetics)
- Filter Pollutants (water quality)
- Be Maintenance Free (good luck ☺)
- Be able to handle a layer of trash and sediment

That's pretty much impossible – but using pretreatment devices gets us much closer!

* Energy Dissipation

* Collection of sediment/debris

MAINTENANCE

GSI: WHAT'S GREEN GOT TO DO WITH IT

Rain Gardens on Private Projects

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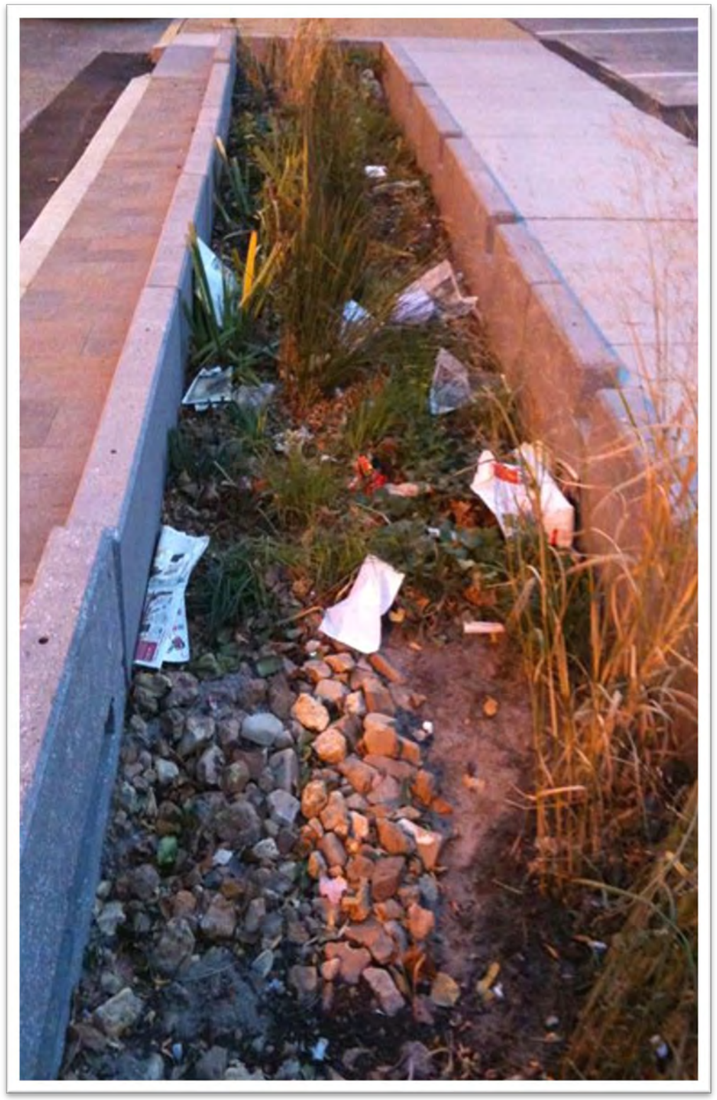


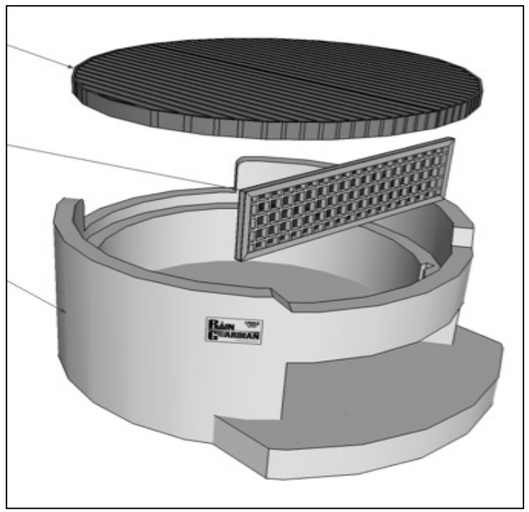
GSI: WHAT'S GREEN GOT TO DO WITH IT

RAIN GARDEN AND BIOSWALE PRETREATMENT

TWO OPTIONS

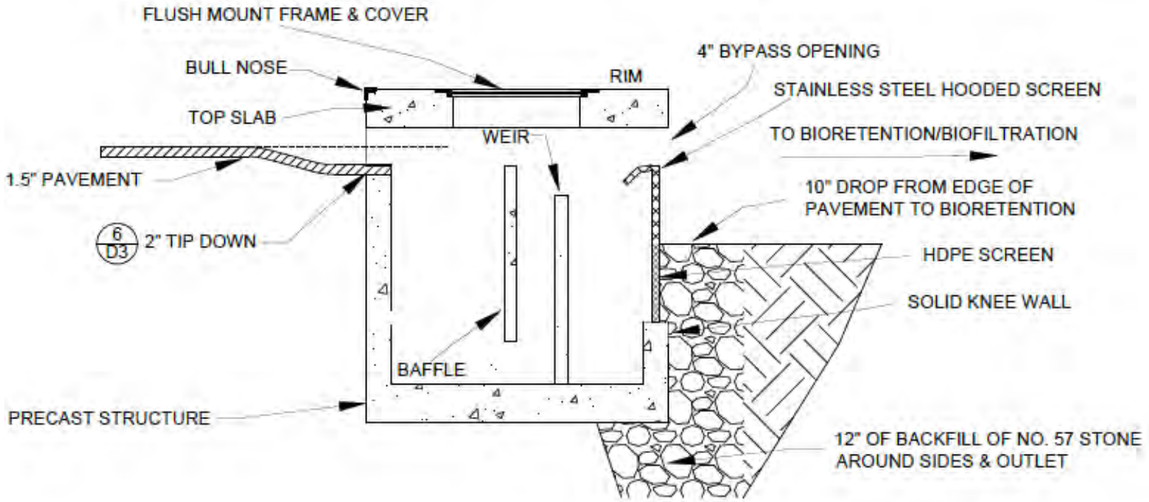
Watershed Area < 0.25 acres

Rain Guardian



Watershed Area > 0.25 acres

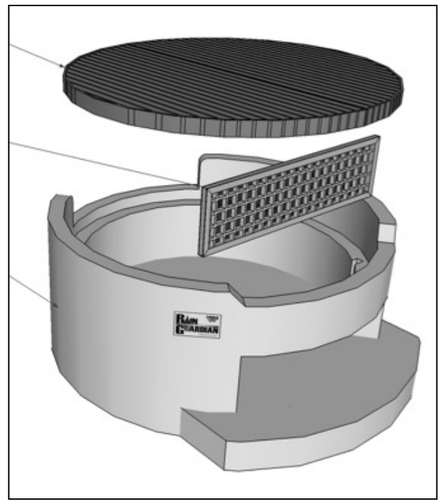
PreTx

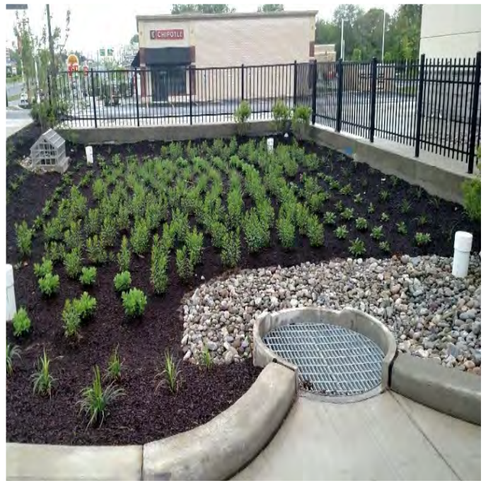


GSI: WHAT'S GREEN GOT TO DO WITH IT

CURBLINE PRETREATMENT

- Extend Effective Bioretention Cell Life
- Maximize Capacity
- Easy Installation
- Simplify Maintenance

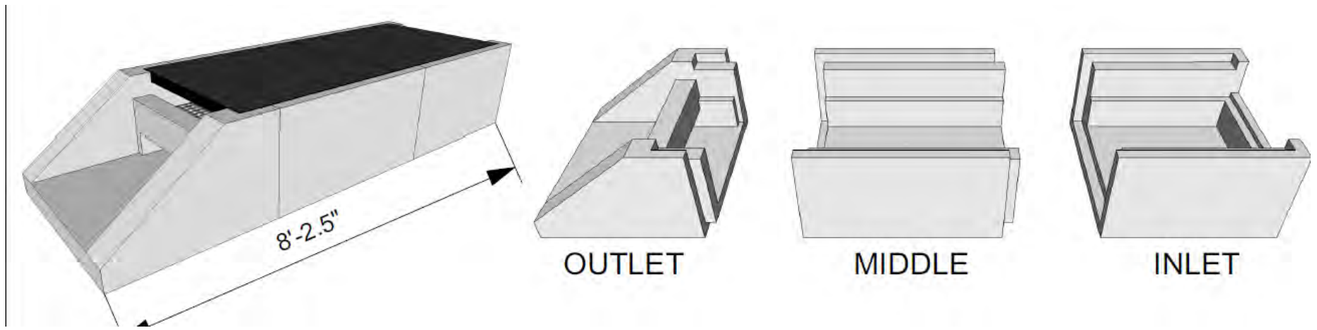


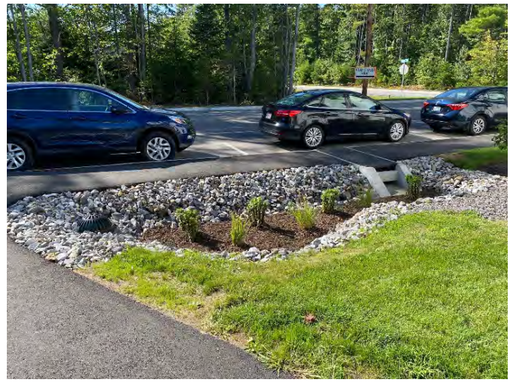


GSI: WHAT'S GREEN GOT TO DO WITH IT

CURBLINE PRETREATMENT

- When BMP is behind sidewalk
- Modular based on sidewalk width
- Solid cover on top

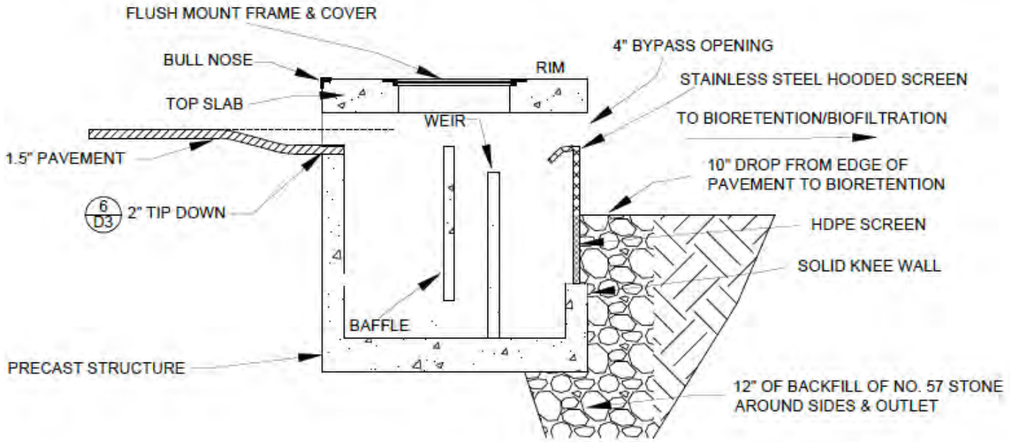




GSI: WHAT'S GREEN GOT TO DO WITH IT

CURBLINE PRETREATMENT

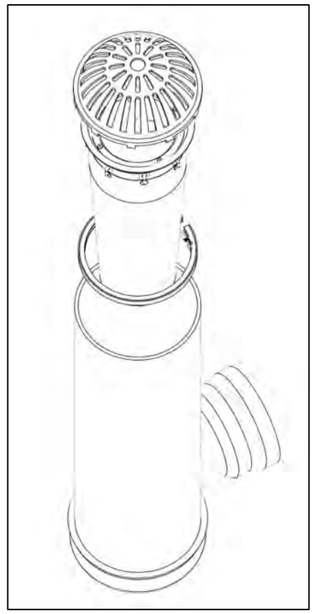
- Larger watersheds
- Higher volumes of sediment
- Formal sump and storage
- Baffles, weirs and screens

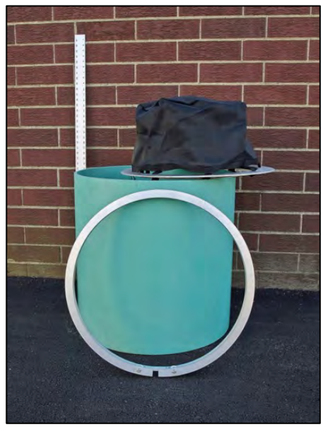


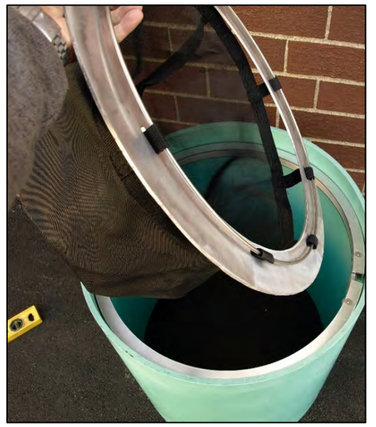
GSI: WHAT'S GREEN GOT TO DO WITH IT

DOMED OVERFLOW WITH FILTER INSERT

- Conveyance of larger storms
- Collection of floatables, mulch, debris
- Expanding ring mount
- No screws or fasteners
- Low cost
- Easy to clean







GSI: WHAT'S GREEN GOT TO DO WITH IT

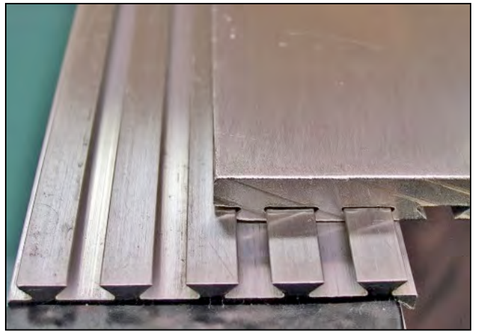
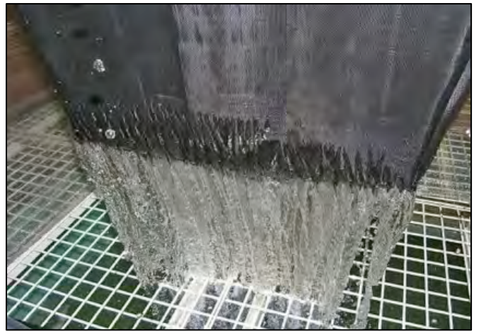
PRETREATMENT DEVICE FOR TRASH, SEDIMENT AND DEBRIS

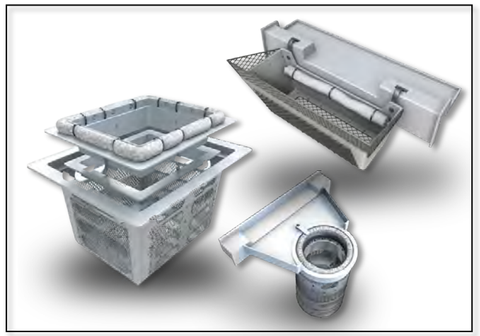
- Simple to Retrofit to Existing Catch basins.
- Installs Without Heavy Equipment.
- Adjusts to Irregular Catch basin Bottoms and/or Walls.
- Available in several different sizes.

GSI: WHAT'S GREEN GOT TO DO WITH IT

PRETREATMENT FILTER FOR TRASH AND SEDIMENT

- Post construction inlet protection
- Adjustable frame options
- Geotextile Options
- Rigid Basket Options
- Built in bypass
- Scour protection deflector
- Integral oil boom

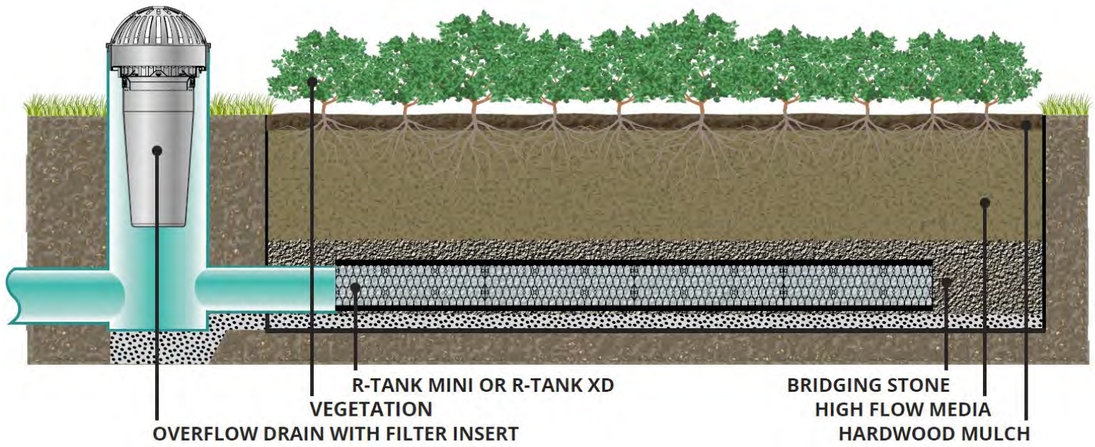




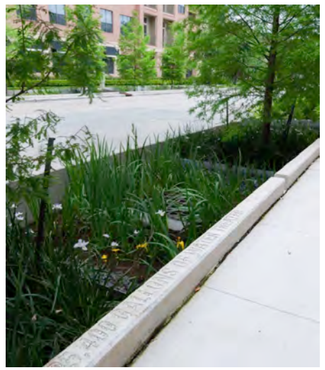



GSI: WHAT'S GREEN GOT TO DO WITH IT

MODULAR BIOFILTRATON SYSTEM

- Space efficient
- 100 in/hr innovative media
- Provides treatment for a variety of pollutants
- Engineered system





- Smaller footprint = less disturbance
- Smaller footprint = smaller maintenance footprint
- Smaller footprint = feasibility in tight spaces previously overlooked

GSI: WHAT'S GREEN GOT TO DO WITH IT

MODULAR BIOFILTRATION SYSTEM

Vegetated System:
Plants process pollutants removed from run-off and root system maintains drainage and aeration of media.

3" Layer of Shredded Hardwood Mulch:

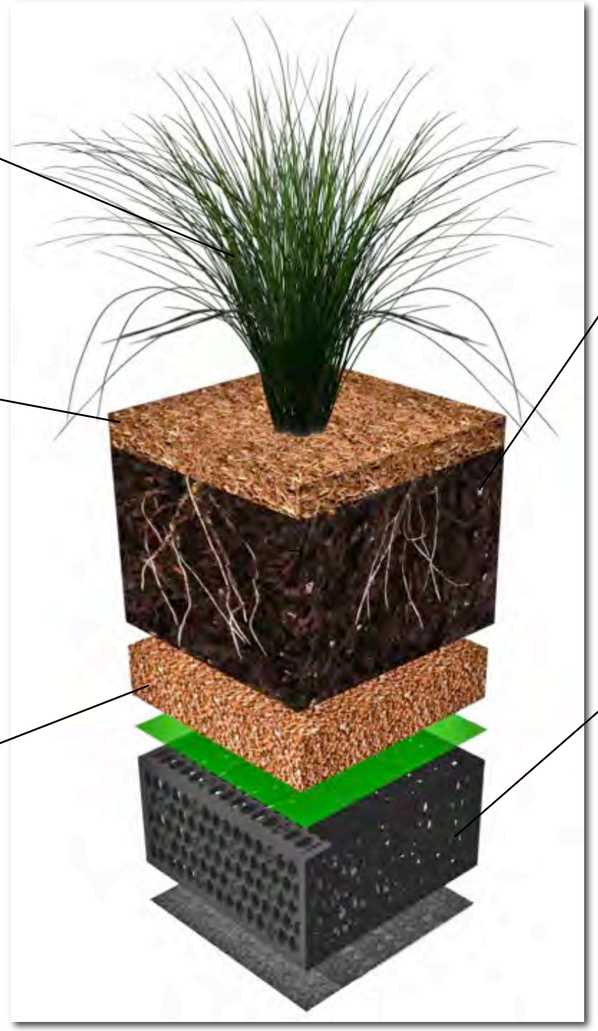
Pre-treatment mechanism.

Removal and Replacement of Mulch Represents the Bulk of System Maintenance!

6" Bridging Stone & Separation Layer:

Clog-Proof Clean Stone & Micro-Grid Replace Traditional Geotextile Layer

No geotextile = no clogging



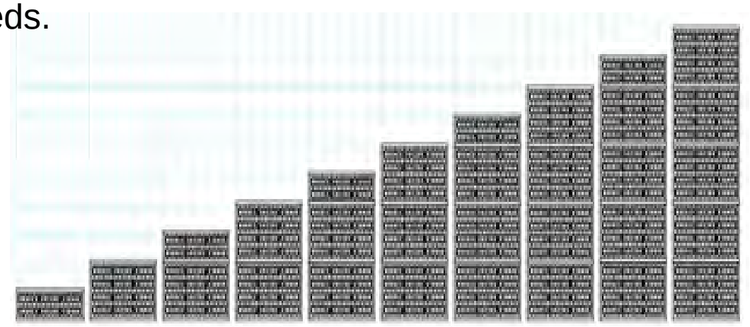
18" High Performance Media:

Flows at 100" Per Hour / 200 ft per day
Resistant to Clogging

High Performance Underdrain:
9.45" Modular Tank, or "Flat Pipe" w/95% Open Surface Collects Water Efficiently.

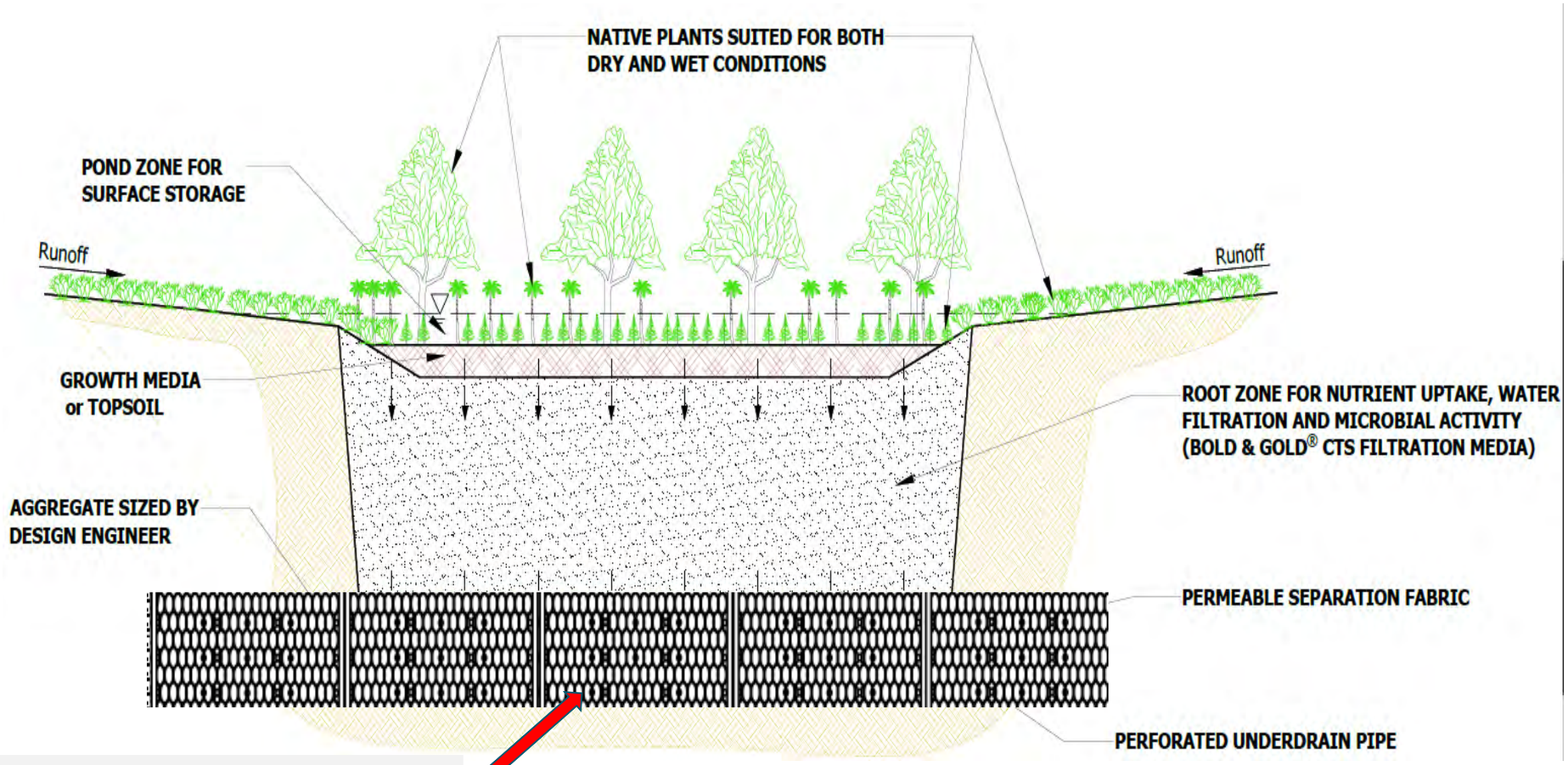
Optional 2" Low-Profile Panel Addresses Shallow Applications.

Expand into Modular Tanks for Larger Storage Needs.



GSI: WHAT'S GREEN GOT TO DO WITH IT

NUTRIENT REDUCTION WITH INNOVATIVE MEDIA



Include Underground Storage

GSI: WHAT'S GREEN GOT TO DO WITH IT

TIGHT URBAN SITES

GSI: WHAT'S GREEN GOT TO DO WITH IT

GREEN ROADWAY PROJECTS









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GSI: WHAT'S GREEN GOT TO DO WITH IT

ALTERNATIVE SURFACES

- Formal Surfaces
  - Permeable Pavers
  - Porous Concrete/Asphalt
- Informal Surfaces
  - Grass Surface
  - Gravel Surface

GSI: WHAT'S GREEN GOT TO DO WITH IT

TRADITIONAL PERMEABLE PAVERS

GSI: WHAT'S GREEN GOT TO DO WITH IT

TRADITIONAL PERMEABLE PAVERS

PROBLEM:

- Traditional Permeable Pavers Require a Filler Between Blocks
- Provides Stability Under Loads
- Accurately Called "Choker Stone" in Most Regulations
- Choker Stone Filters Sediments at the Surface

GSI: WHAT'S GREEN GOT TO DO WITH IT

TRADITIONAL PERMEABLE PAVERS

PROBLEM:

- Traditional Permeable Pavers Require a Filler Between Blocks
- Provides Stability Under Loads
- Accurately Called "Choker Stone" in Most Regulations
- Choker Stone Filters Sediments at the Surface
- Requires Frequent Maintenance

Open-Joint Pavers Help Maximize Infiltration Rates and Reduce Maintenance.

GSI: WHAT'S GREEN GOT TO DO WITH IT

INFILL vs OPEN JOINT PAVER

100" / Hour vs **1,000" / Hour**

50% Clogged – 50"/hr
75% Clogged – 25"/hr
90% Clogged – 10"/hr

50% Clogged – 500"/hr
75% Clogged – 250"/hr
90% Clogged – 100"/hr

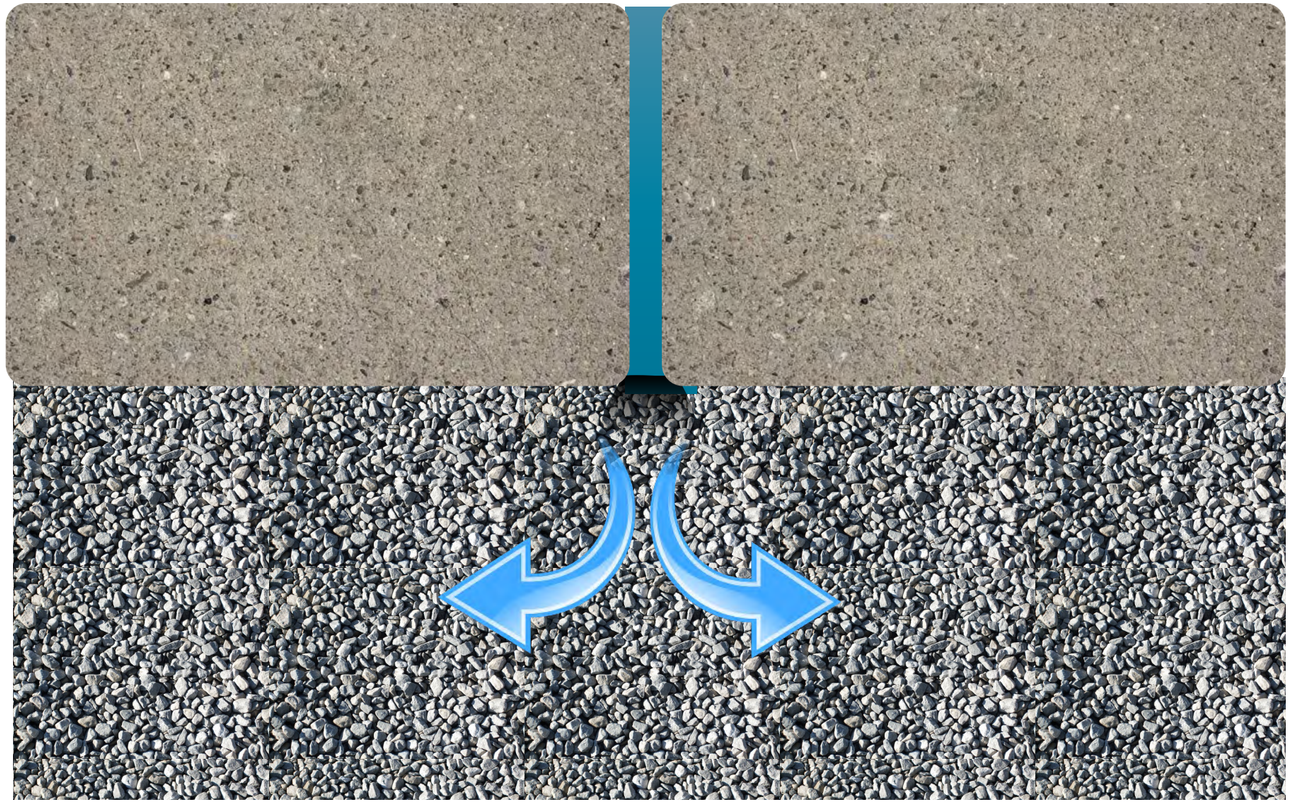
Higher Conveyance Rates (> 1000 inches/hour) Can Minimize Owner Pain By Extending Maintenance Cycles

GSI: WHAT'S GREEN GOT TO DO WITH IT

TRADITIONAL PERMEABLE PAVERS

Typical Paver

Open-Joint Paver



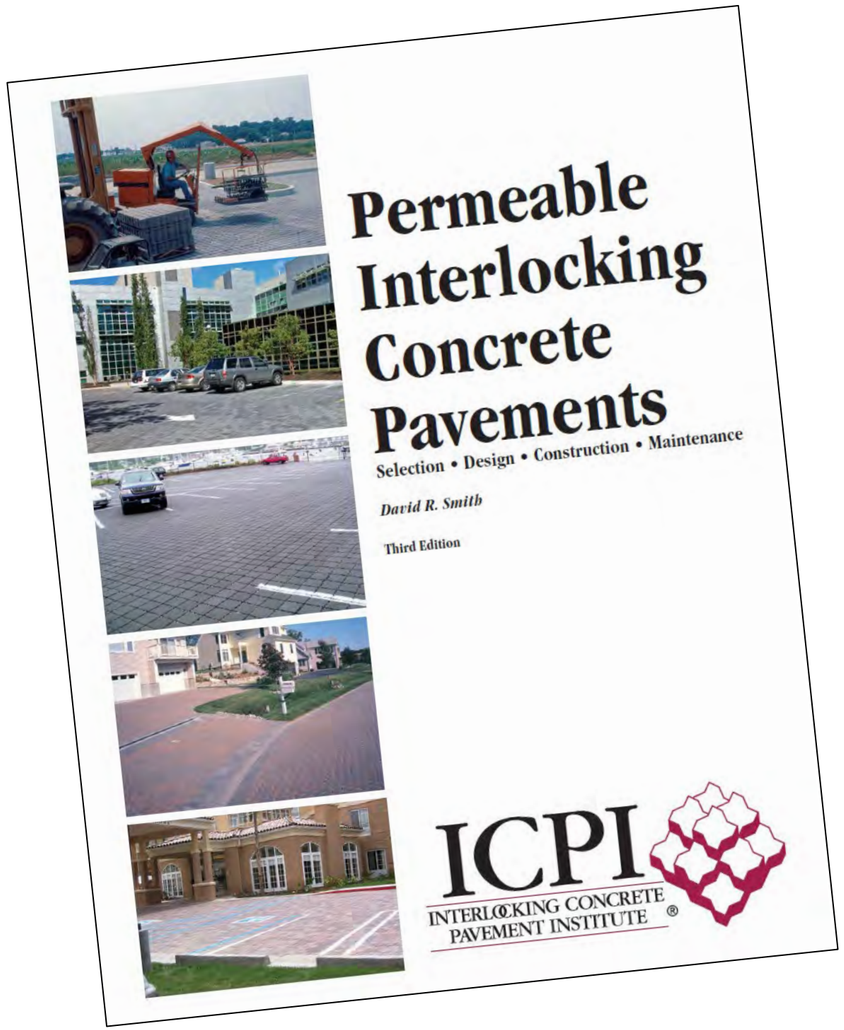
Where Does Clogging Occur?

Initiating clogging at the BOTTOM of the joint creates several inches of head pressure to drive water into the base.

…of course, that's only good if you can still remove the sediment!

GSI: WHAT'S GREEN GOT TO DO WITH IT

MAINTENANCE



In-service Inspection Checklist

- ❑ Vacuum surface openings in dry weather to remove dry, encrusted sediment. These appear as small, curled "potato chips." Vacuum settings may require adjustment to prevent uptake of aggregate in the pavement openings and joints.
- ❑ Inspect after at least one major storm per year.
- ❑ Maintained vegetation around pavement to filter runoff and minimize sediment deposition on the pavement.
- ❑ No standing water on the surface after storms.
- ❑ Repair ruts or deformations in pavement exceeding ½ in. or 13 mm.
- ❑ Repair pavers more than ¼ in. or 6 mm above/below adjacent units.
- ❑ Replace broken units that impair the structural integrity of the surface.
- ❑ Replenish aggregate joint materials as needed.
- ❑ Check drain outfalls for free flow of water.
- ❑ Check outflow from observation well annually.

"Vacuuming should be done <u>at least</u> once or twice annually"

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JOINTS BETWEEN BLOCKS

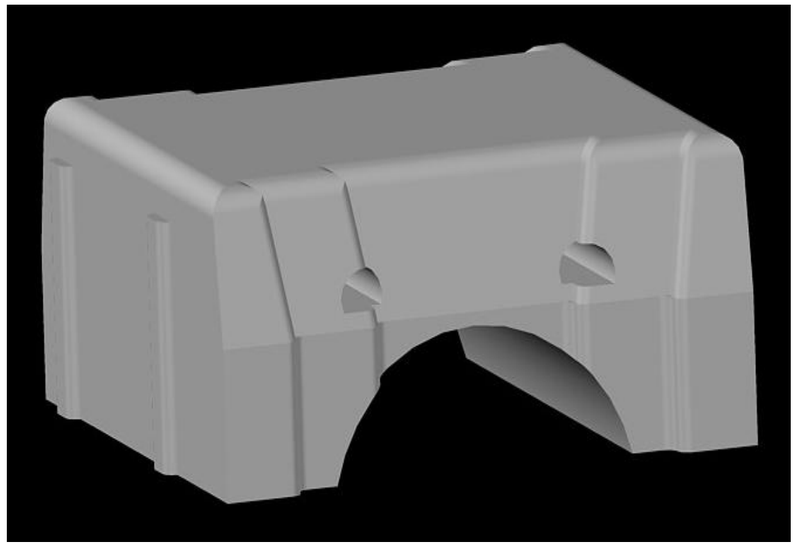
MAINTENANCE

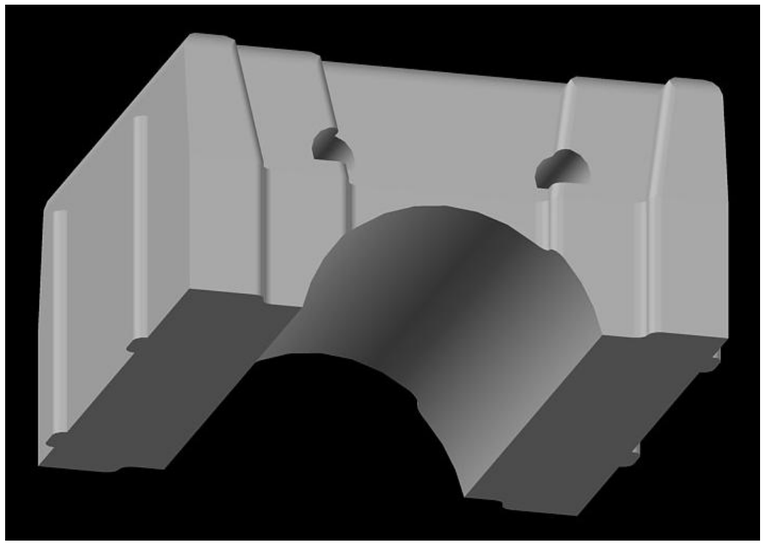
- Cost to Vacuum
- Cost of Replacement Rock
- Labor to Install
- Loss of Lot During Maintenance
- When Can Lot be Closed and How Long Must it Be Closed?
- What is the Maintenance Schedule?

GSI: WHAT'S GREEN GOT TO DO WITH IT

OPEN JOINT PERMEABLE PAVER SYSTEM

- Concrete Open-Joint Permeable Paver with 3 Functions

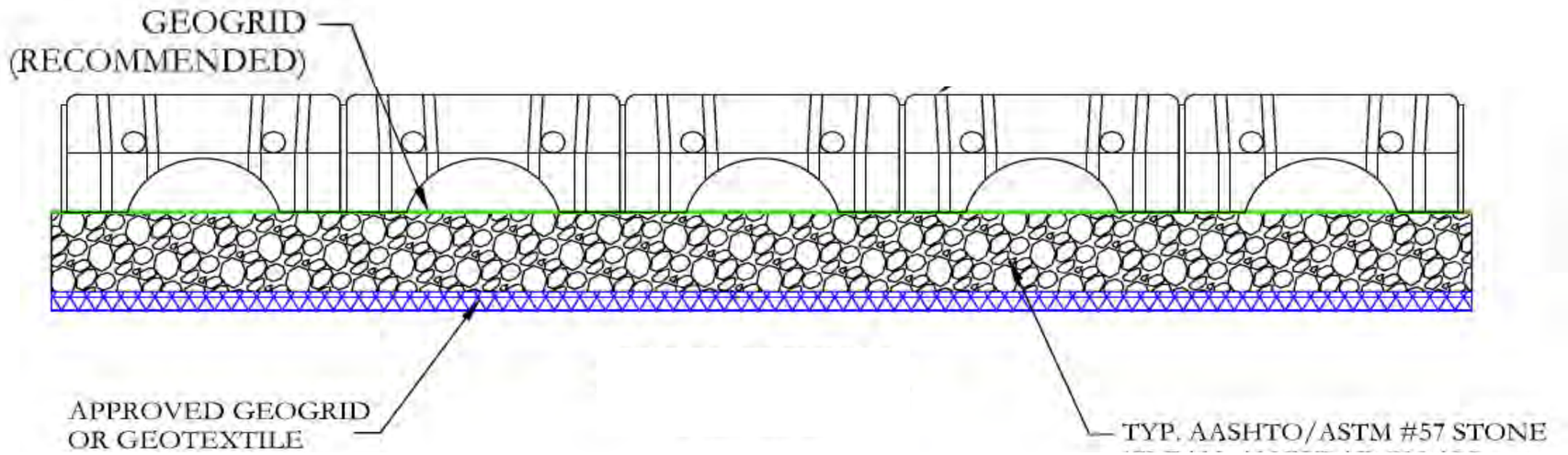




- Pavement – Handles Traffic Loads with 6000 psi Concrete
- Drains – Open Joints Move Water Without Inlets
- Stores & Infiltrates – Stores 1" of Water

GSI: WHAT'S GREEN GOT TO DO WITH IT

OPEN JOINT PERMEABLE PAVER SYSTEM



Storage above base

Open Gap
~1/4"

Increase rock base or add void space for additional water storage

GSI: WHAT'S GREEN GOT TO DO WITH IT

PAVERS, GRASS, AND GRAVEL- MODULAR OPTIONS

GSI: WHAT'S GREEN GOT TO DO WITH IT

TRADITIONAL POUR IN PLACE CHALLENGES

- **Durability**
- **Labor Intensive**
- **Quality Control Issues**
- **Difficult to Produce**
- **Weather Dependent (can't install when too cold or hot)**
- **Difficult to Maintain and Repair**

HIGH RISK!!!

GSI: WHAT'S GREEN GOT TO DO WITH IT

TRADITIONAL POUR IN PLACE CHALLENGES

Project Conditions

A. Weather Restrictions

1. The Contractor shall not place pervious concrete pavement when the ambient temperature is predicted by the National Weather Service Point Forecast for the jobsite to be 40°F (4.4°C) or lower during the seven days following placement, unless otherwise permitted in writing by the Architect/Engineer.

2. The Contractor shall not place pervious concrete pavement later in the year than November 1 or earlier in the year than April 1 unless otherwise permitted in writing by the Architect/Engineer.

3. The Contractor shall not place pervious concrete pavement when the ambient temperature is predicted by the National Weather Service Point Forecast for the jobsite to rise above 90°F (32.2°C) during the seven days following placement, unless otherwise permitted in writing by the Architect/Engineer.

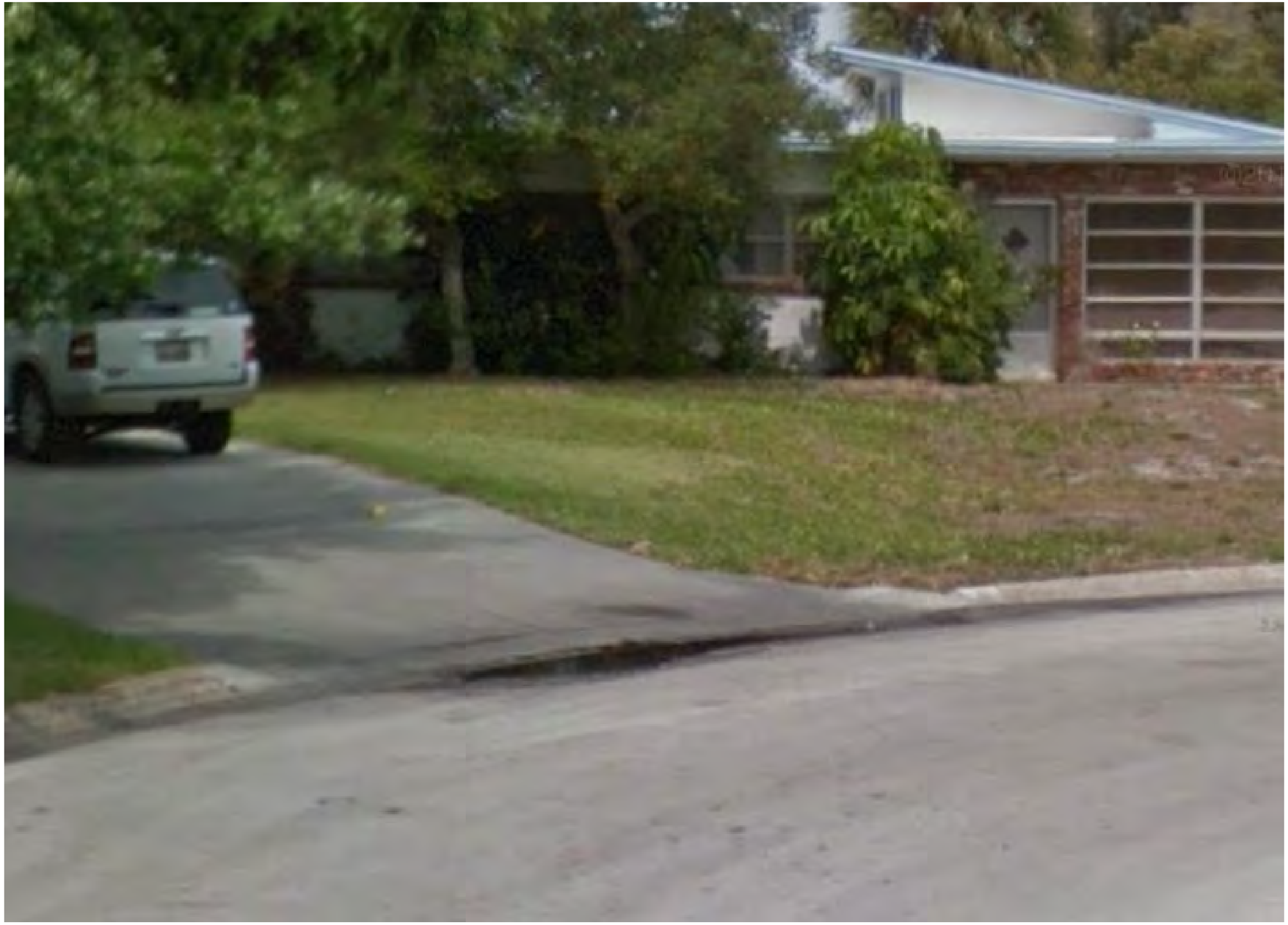
4. The curing cover shall remain securely in place, uninterrupted, until the concrete has reached a maturity equivalent to 14 days of curing at 70°F (21°C) at 95% relative humidity. Maturity shall be determined by an independent testing laboratory. No vehicular traffic shall be permitted on the pavement until curing is complete without written permission from the Architect/Engineer.

GSI: WHAT'S GREEN GOT TO DO WITH IT

PRECAST POROUS PANELS

- **Porous concrete is manufactured, cured and stored in controlled environment**
- **Ease of Installation**
- **Porous Section is Removable and Replaceable**
- **Can be Installed Year-Round in any Weather Condition**
- **Lower Life Cycle Costs**

Low RISK!!!



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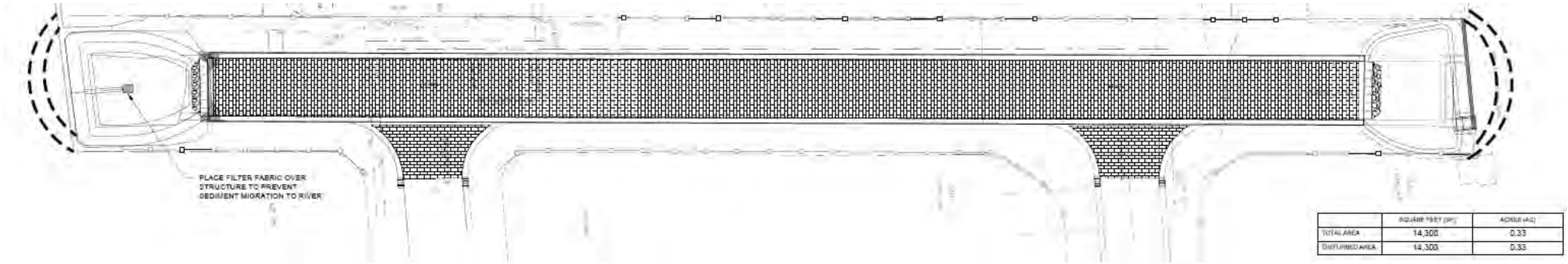
STOP


DEERING OAKS
TIQA Café & Bakery

GSI: WHAT'S GREEN GOT TO DO WITH IT

Combining GSI Technologies

CANAL



CANAL

PAVE DRAIN
STORMWATER'S ARCH ENEMY

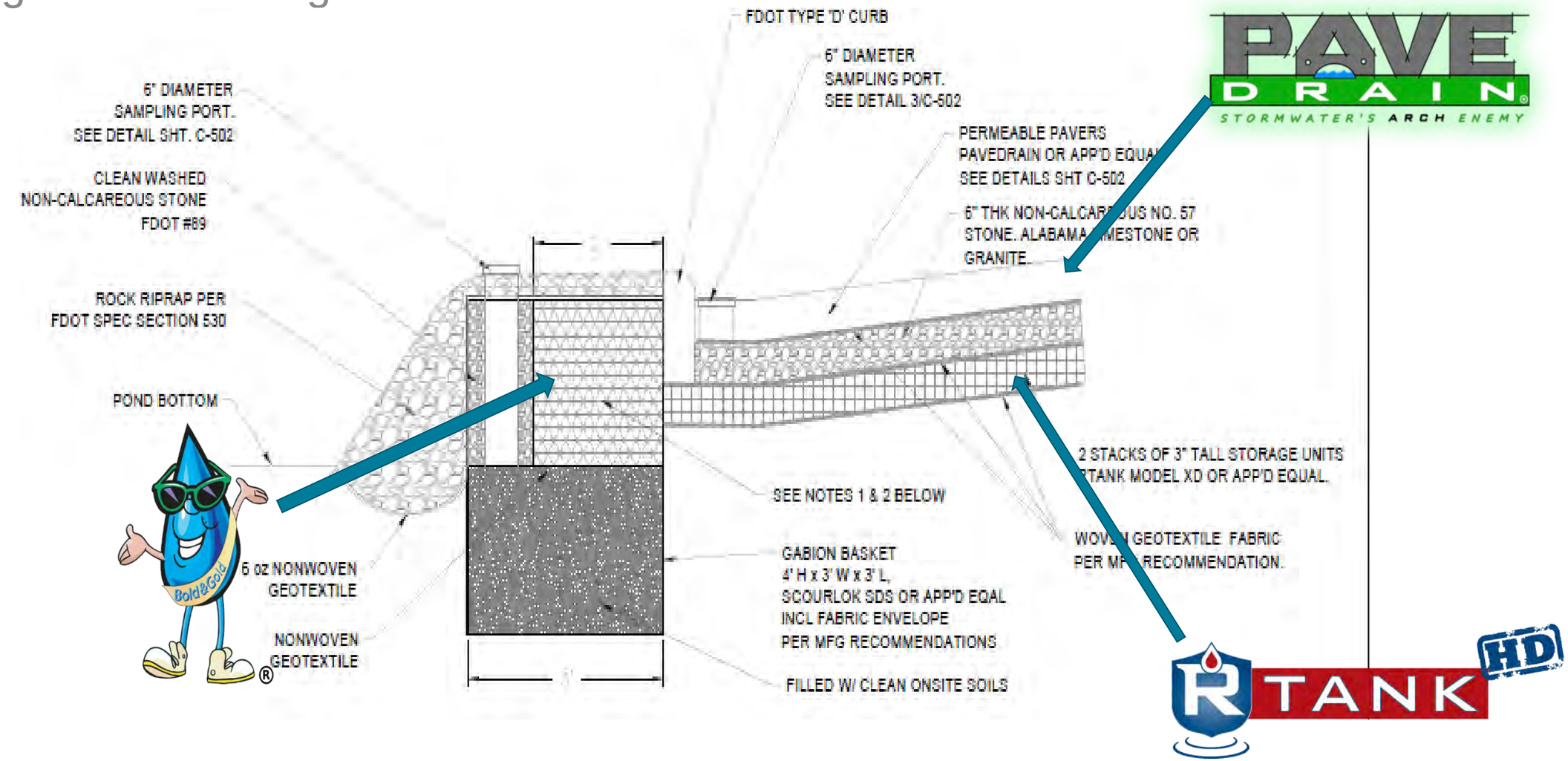
+

TANK HD

+

GSI: WHAT'S GREEN GOT TO DO WITH IT

Combining GSI Technologies



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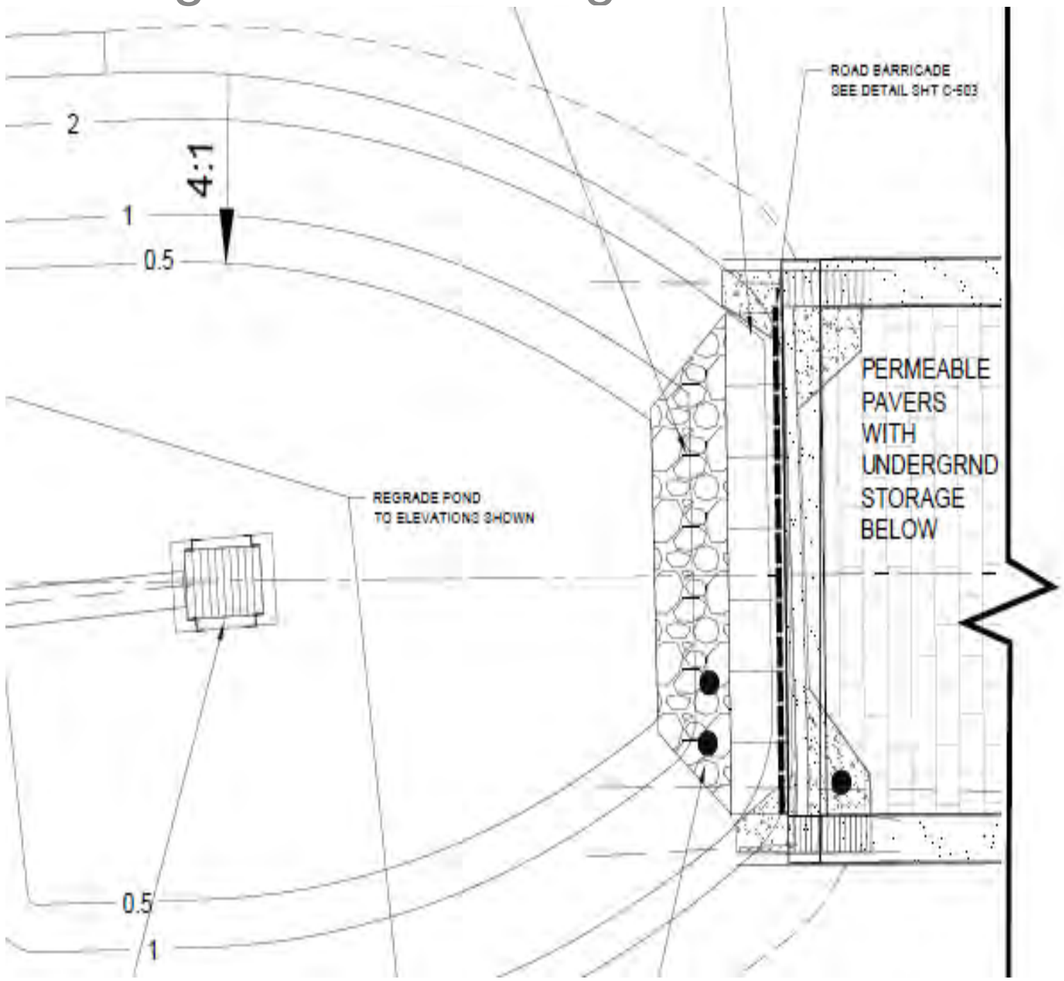

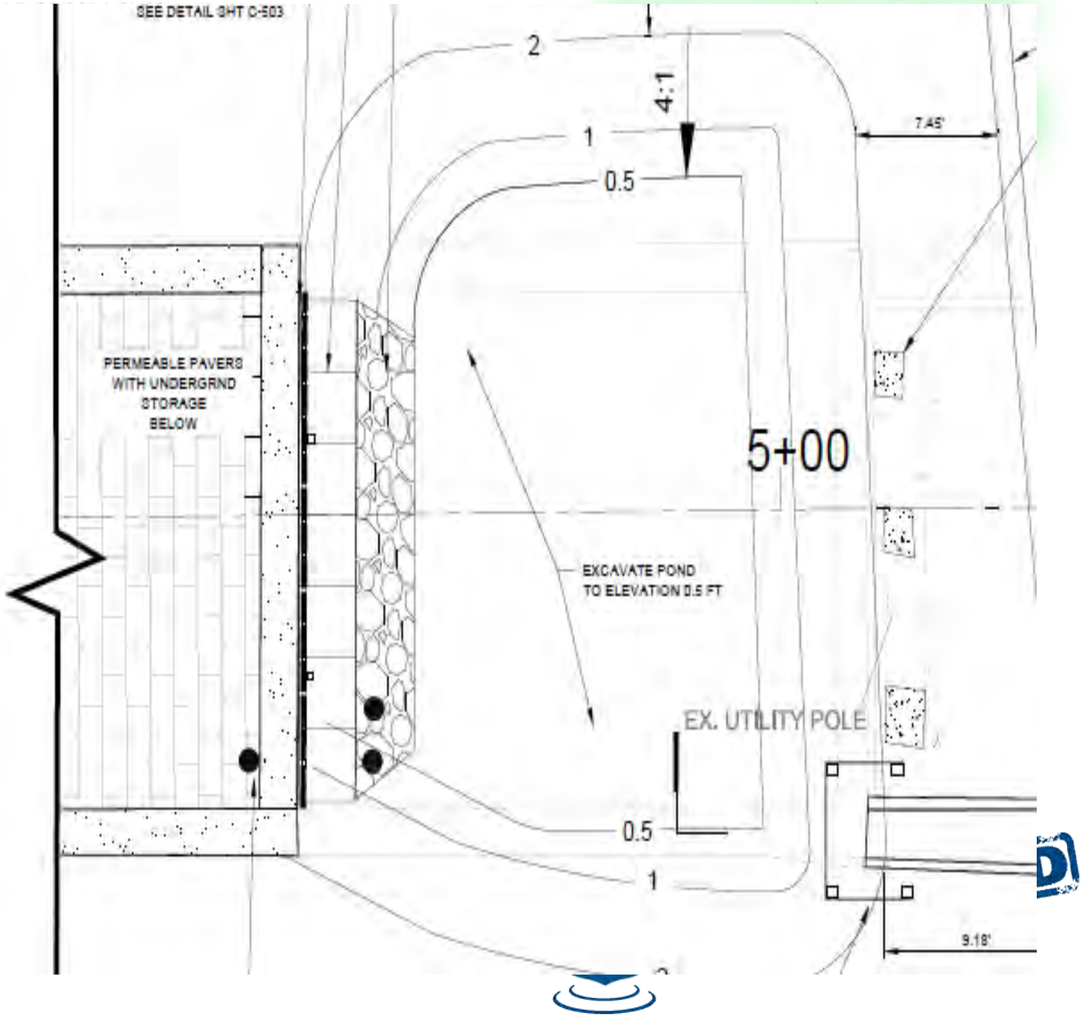

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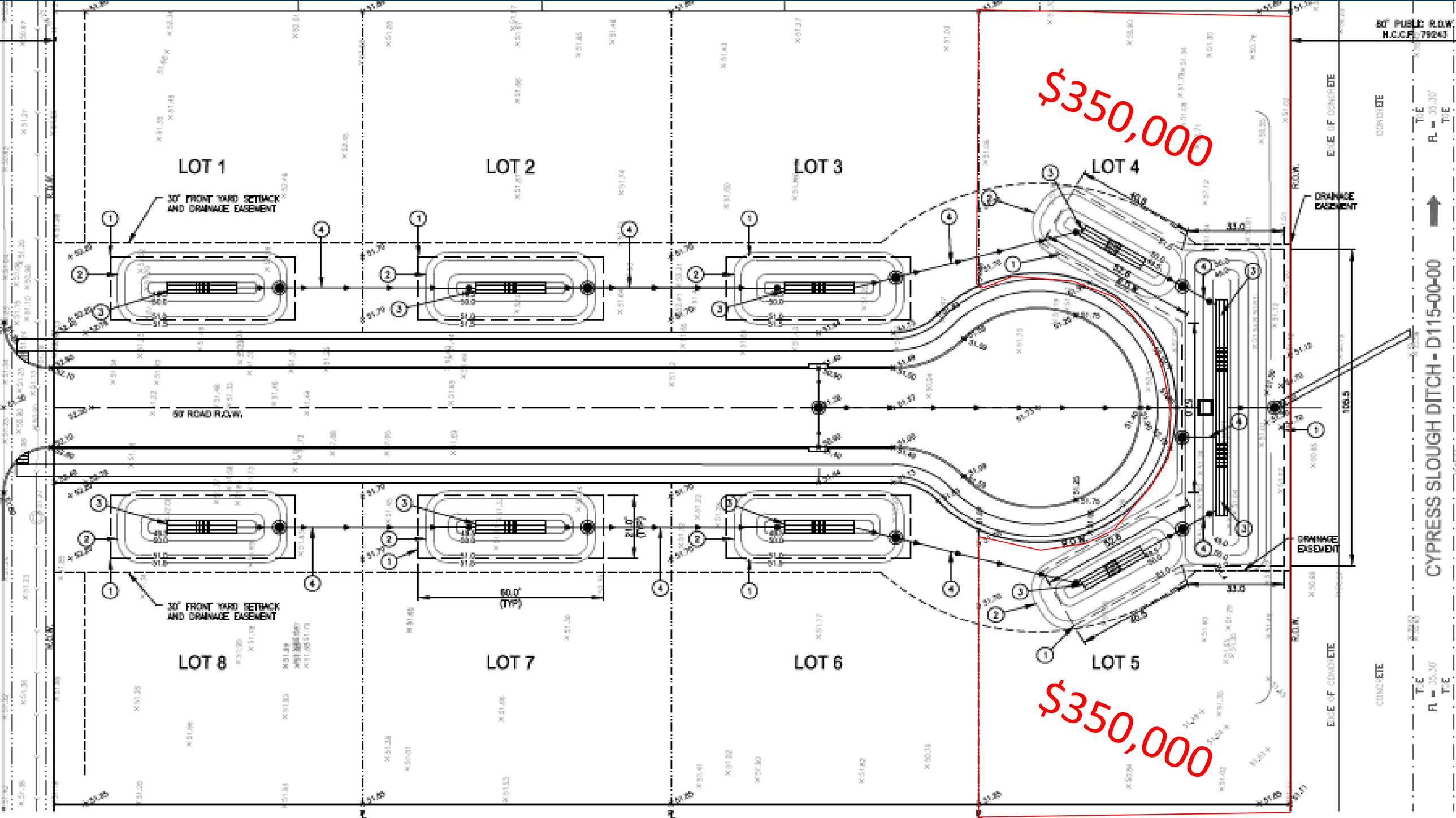
Combining GSI Technologies


$350,000
$350,000
LOT 1
LOT 2
LOT 3
LOT 4
LOT 5
LOT 6
LOT 7
LOT 8
30' FRONT YARD SETBACK AND DRAINAGE EASEMENT
30' FRONT YARD SETBACK AND DRAINAGE EASEMENT
50' ROAD R.O.W.
60.0' (TYP)
21.0' (TYP)
DRAINAGE EASEMENT
DRAINAGE EASEMENT
80' PUBLIC R.O.W. H.C.C.F. 79243
EDGE OF CONCRETE
CONCRETE
CYPRESS SLOUGH DITCH - D115-00-00
R.O.W.
T.E.
R. = 35.30'

Questions ?

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ACF ENVIRONMENTAL

LET'S GET IT DONE®

Thank you!!

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