

DESIGN THINKING



Focused on User
Outcomes



Multidiscipline
Teams



Restless
Reinvention

A photograph of a city street scene. In the foreground, there is a wide, light-colored concrete sidewalk. To the left of the sidewalk, there is a row of green bushes and a small tree. To the right, there is a concrete curb and more greenery. In the background, there are several modern buildings, including a tall, curved skyscraper and a building with a green facade. A CVS pharmacy sign is visible on the right side of the image. The sky is blue with some clouds.

Model for Urban Development



Multifunctional Design Thinking >

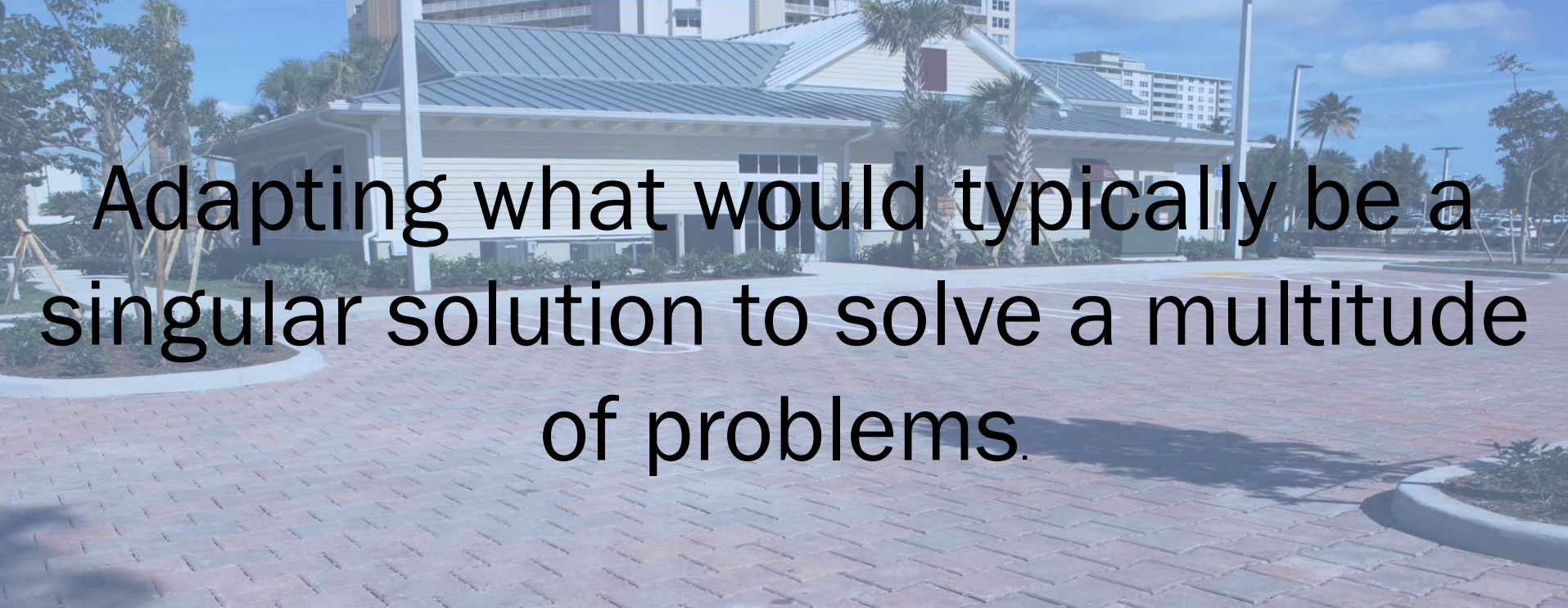
Why Multifunctional Design?

- **INCREASES LOT YIELD**
- **IMPROVES AESTHETICS**
- **LOWERS UPFRONT COSTS**
- **IMPROVE WATER QUALITY**
- **REDUCES FLASH FLOODING**
- **ALLOWS FOR CREATIVITY / THOUGHT / ENGINEERING**



What is Multifunctional Design?

Adapting what would typically be a singular solution to solve a multitude of problems.



What is Multifunctional Design?

Evolution of the Mobile Phone

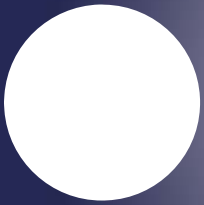








BIORETENTION DESIGN THINKING



Focused on User
Outcomes



Multidiscipline
Teams



Restless
Reinvention

What is Bioretention?



Focus on User Outcomes >



Begin with the End in Mind>Maintenance

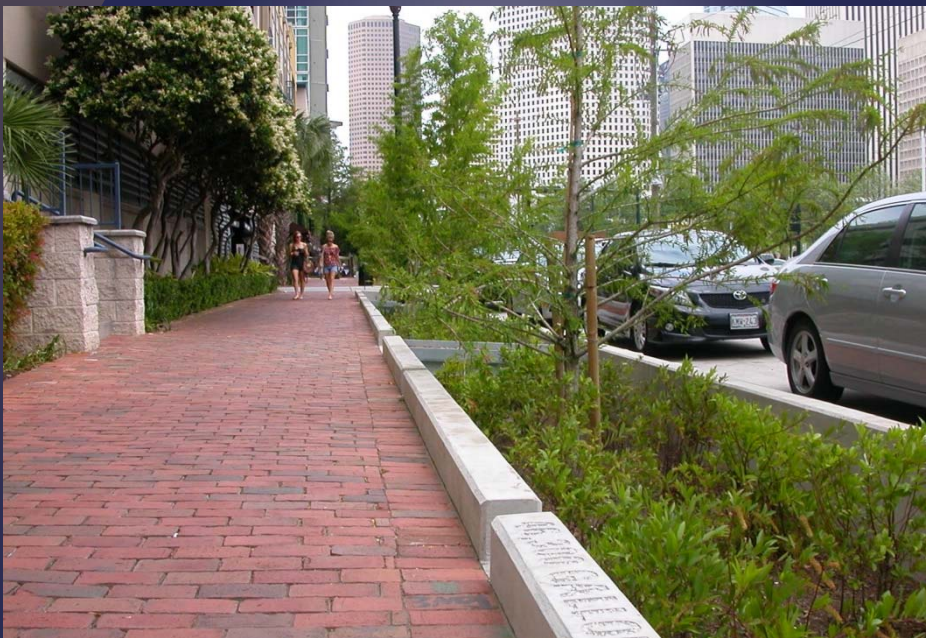


Maintenance > Engineered Soil Selection



108 SF of Biofiltration Bed Using 100\"HR Media

Maintenance > Planting Plan



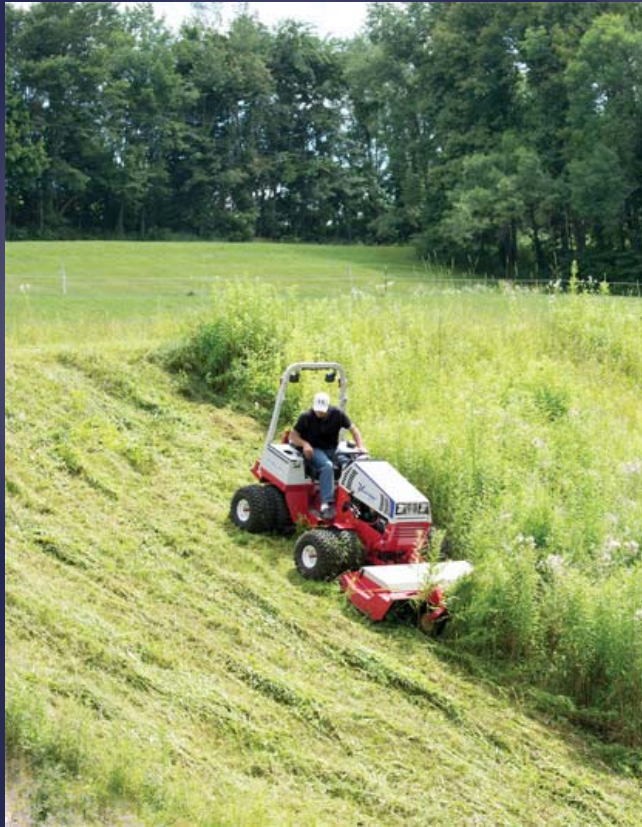
Maintenance > Identifying Engineered Soil



Maintenance > What's a Weed?



Maintenance > Who Do You Hire?



Maintenance > Controlling the Outcome

City of Austin
Thinking I
1. I
2. Le
4

SWQMP INSPECTION REPORT **MONTHLY CYCLE**

Project Name: _____ Date of Inspection: _____ Date of Inspection: _____
Project Address: _____ Owner & Address: PALT, Inc.
401 Studewood #312, Houston, 77007

Observations & Comments **Maintenance/Repairs Required?**

NON-STRUCTURAL CONTROLS

ARE LITTER CONTROL PRACTICES PRODUCING DESIRED RESULTS?	Y	N
ARE STREET SWEEPING PRACTICES PRODUCING DESIRED RESULTS?	Y	N
ARE LANDSCAPING PRACTICES EFFECTIVE?	Y	N
OTHER PRACTICES UTILIZED? IF SO DESCRIBE:	Y	N

STRUCTURAL CONTROLS

DRY DETENTION POND:

IS STANDING WATER EVIDENT?	Y	N
IF YES, HOW MUCH?		
EXCESSIVE SEDIMENT ACCUMULATION EVIDENT?	Y	N
IF YES, HOW MUCH?		
EXCESSIVE TRASH ACCUMULATION EVIDENT?	Y	N
ARE SLOPES STABLE AND VEGETATED?	Y	N
ARE THERE ANY OTHER STRUCTURAL ISSUES EVIDENT?	Y	N

BIORETENTION SYSTEMS:

IS STANDING WATER EVIDENT?	Y	N
IF YES, HOW MUCH? WHEN WAS LAST RAIN?		
EXCESSIVE SEDIMENT EVIDENT IN SLUMP OR ENGINEERED MEDIA?	Y	N
IF YES, HOW MUCH?		
EXCESSIVE TRASH ACCUMULATION EVIDENT?	Y	N
ARE SLOPES STABLE AND VEGETATED?	Y	N
ARE THERE ANY OTHER STRUCTURAL ISSUES EVIDENT?	Y	N
DO THE PLANTS LOOK HEALTHY? IF NOT, EXPLAIN:	Y	N

MAINTENANCE

REPAIRS/MAINTENANCE BEEN PERFORMED SINCE LAST INSPECTION?	Y	N
IF "YES" THEN WHAT AND WHEN? (MM-YY-XXXX)	Y	N

NOTES

INSPECTOR QUALIFICATIONS:

CONSTRUCTION ECOSYSTEMS INTERNAL TRAINING COURSE, ASSOCIATION OF GENERAL CONTRACTORS COURSE, "COMPLYING WITH STORM WATER REGULATIONS", INTERNATIONAL EROSION CONTROL ASSOCIATION "HOW TO SELECT, INSTALL AND INSPECT CONSTRUCTION SITE SEDIMENT CONTROL BASINS," FOUR-WEEK STORMWATER SITE INSPECTOR TRAINING APPRENTICESHIP PROGRAM.

STATIONARY: I CERTIFY UNDER THE PENALTY OF PERJURY THAT THIS DOCUMENT HAS BEEN PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND IN ACCORDANCE WITH A SYSTEM DESIGNED TO ENSURE THAT QUALIFIED PERSONNEL PROPERLY CAPTURED AND EVALUATED THE INFORMATION SUBMITTED. BASED ON MY KNOWLEDGE OF THE PERSON OR PERSONS WHO MANAGE THE SYSTEM, OR THOSE PERSONS DIRECTLY RESPONSIBLE FOR CAPTURING THE INFORMATION IN TO THE BEST OF MY KNOWLEDGE AND BELIEF, THIS DOCUMENT IS TRUE, ACCURATE, AND COMPLETE. I AM AWARE THAT FALSIFYING INFORMATION FOR SUBMITTAL IS A VIOLATION OF THE PROVISIONS OF THE STORMWATER ACT AND MAY BE SUBJECT TO PENALTY.

SIGNATURE: _____ **DATE:** _____

ORIGINAL ☐ COPY ☐ INITIAL INSPECTION ☐ © Construction Ecosystems 2011

Rehab > What Happens When It Fails?

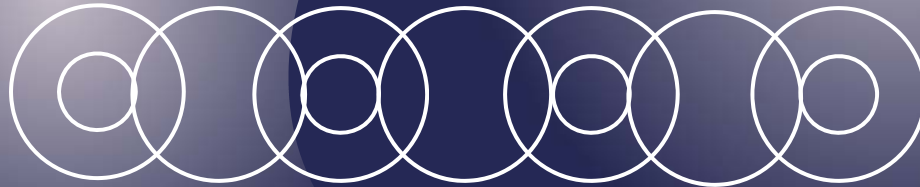
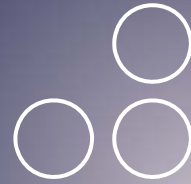


Rehab > What Happens When It Fails?



Multidiscipline Teams >

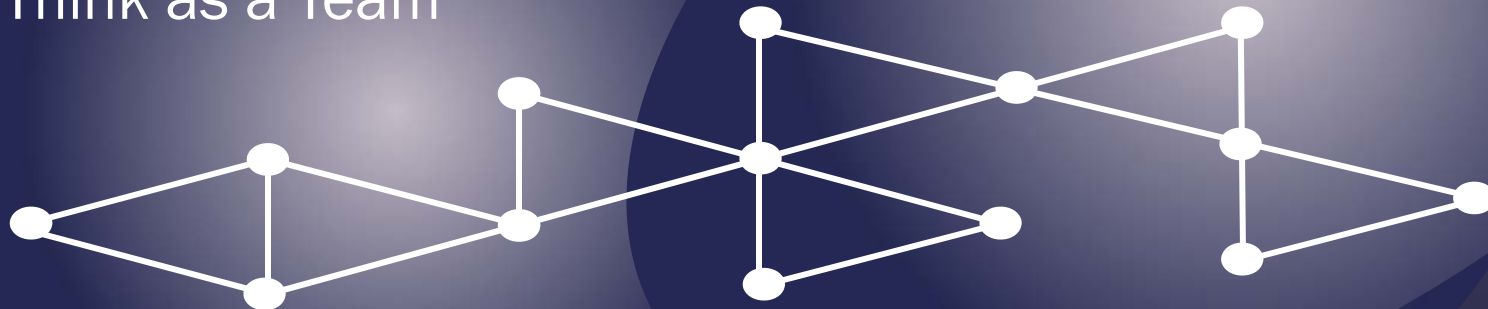
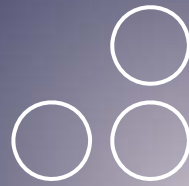
Collaborate as a Unit





Multidiscipline Teams >

Think as a Team





LEGEND

-  SHADE TREE
-  EVERGREEN
-  LAWN
-  PAVEMENT

SITE IMPROVEMENTS

-  DINING TERRACE
-  CAFE TERRACE
-  ROOF TERRACE
-  LOADING DOCK
-  ENTRY COURT
-  TERRACE GARDENS

Restless Reinvention >



Solve Old Problems in a New Way



Everything's a Prototype >

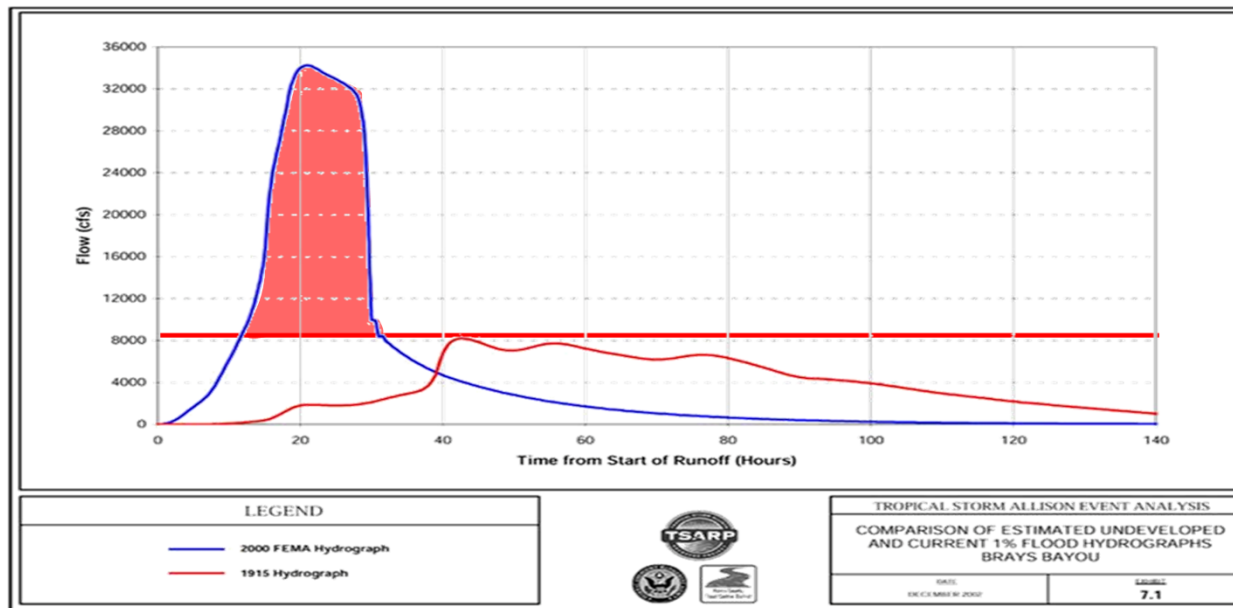
2001: 28.5" in 12-hr
288 North Bound



1913: 20" – 25"



IN THE SWIM
HOUSTON & MARSH ST



White Oak and Brays Hydrographs: 1915 & 2000

Blue line shows 2000 concentrated urban runoff; red line shows 1915 pre-urbanized runoff

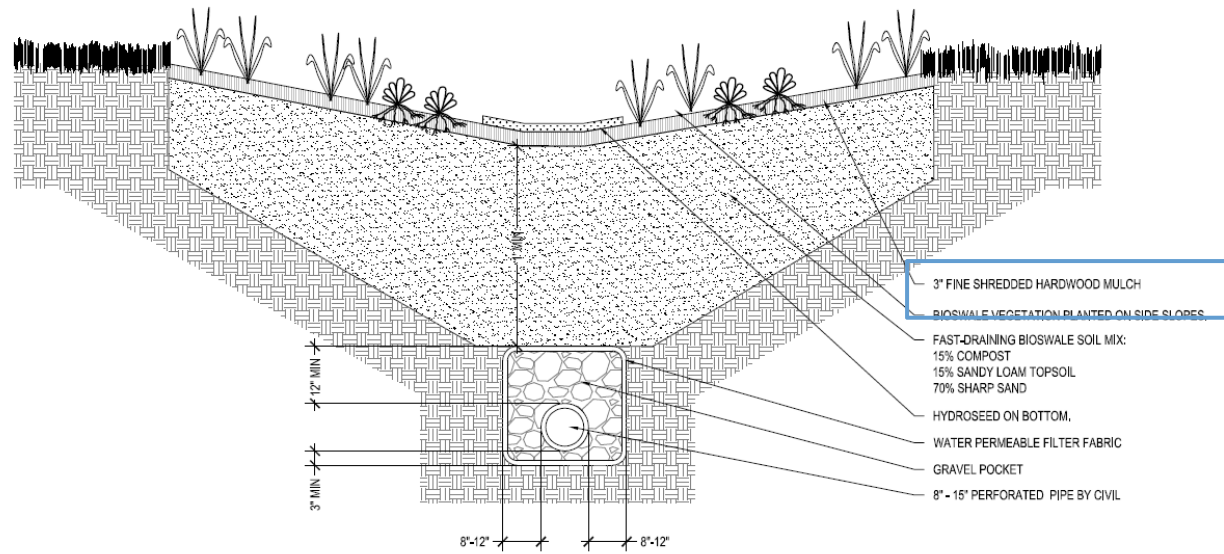


2016: 16.5" in 12-Hr

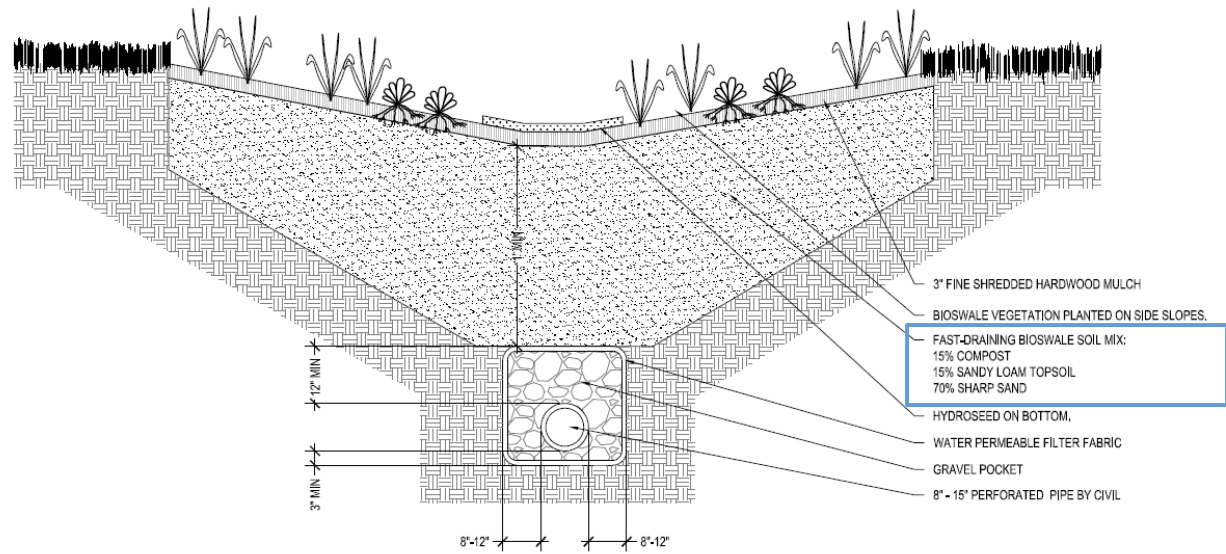
Allen Parkway Eastbound

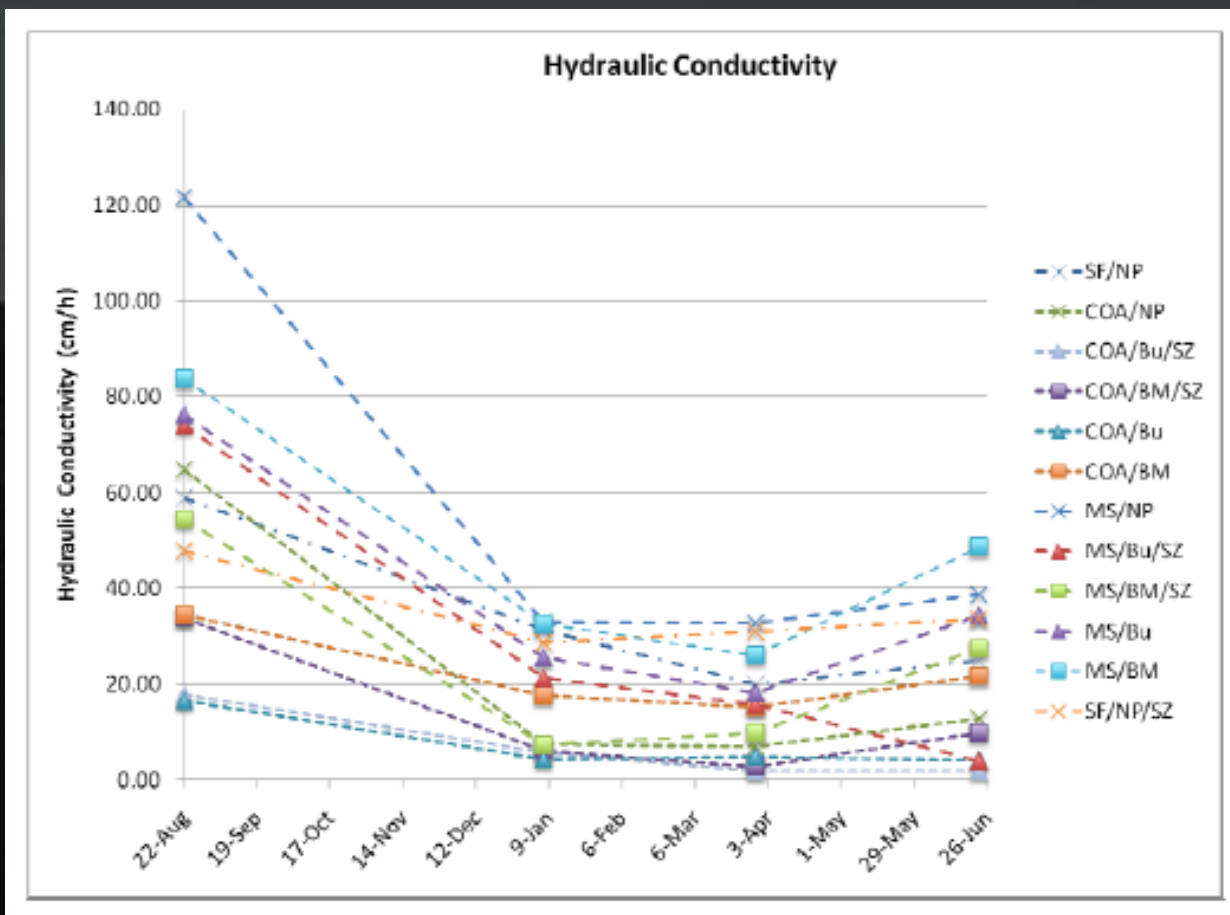














Quality



Assurance

Report Number: LR13-52

MATERIALS ANALYSIS REPORT

Company Name: Convergent Water Tech
Customer Contact: Bob Adair
Customer Address: 1930 Aldine Western Road
City, State, Zip Code: Houston, TX 77038
Customer Telephone: 281 414-4719 (cell)

Date Sample Received: 4/1/2013 afternoon
Sample Description: Sand samples (Eagle Lake)
Sample Condition: Low moisture for all samples.

Project: Filter Media

Sample Description	Lab Number	Ksat ⁽¹⁾ (n/hr)	Porosity ⁽¹⁾			Bulk Density ⁽¹⁾ (g/cm ³)	Particle Density ⁽¹⁾ (g/cm ³)	% Organic Matter ⁽²⁾ (LOI)	Conductivity ⁽³⁾ (mmhos)	pH ⁽⁴⁾ (CaCl2 1:1)
			% Total	% Capillary ^(a)	% Air ^(a)					
#1 Eagle Lake Sand Light Compaction	13-52	169.0						0.20		6.06
#2 Eagle Lake Sand Light Compaction	13-52	159.2						0.14		6.25
#3 Eagle Lake Sand Light Compaction	13-52	126.0						0.11		6.40

Lab Number	Particle Size Analysis ⁽⁵⁾				Sand Size Distribution ^{(5), (6)}					Gradation Index D90/D10	Coefficient of Uniformity D60/D10
	% Sand	% Silt	% Clay	% Gravel (#10 sieve)	% Very Coarse (#15 sieve)	% Coarse (#35 sieve)	% Medium (#60 sieve)	% Fine (#100 sieve)	% Very Fine ⁽⁵⁾ (#270 sieve)		
USGA Recommendation	>92 %	≤ 5%	≤ 3%	≤ 3% gravel ≤ 10% combined		≥ 60 %	≤ 20%	≤ 20%	≤ 5%	---	---
13-52 (#1 Sand)	77.26	0.49		22.24	71.35	5.34	0.41	0.09	0.14		
13-52 (#2 Sand)	79.22	0.67		20.11	53.57	20.63	4.73	0.27	0.13		
13-52 (#3 Sand)	99.13	0.87		0.00	12.56	64.77	20.52	1.20	0.08		

Particle Shape ⁽⁷⁾			(1) ASTM F1815, (2) Soil EC 1:2 soil H ₂ O ratio method (3) ASTM F1647, (4) ASTM D4972, (5) ASTM 1632, (6) ASTM D2974, (7) ASTM D2976, (8) ASTM C136, (a) determined at 30 cm tension, (b) % retained on or (c) as defined by USGA specifications This report applies only to the sample(s) listed. Samples are not before disposal. This test report contains confidential information except in full, and with the express written approval of DAWGTA. DAGTA guidelines and ASTM methods. DAGTA is not responsible for the accuracy of these test methods and makes no claim about their ability to predict performance in actual use.
#1 Sand @ 15x	#2 Sand @ 15x	#3 Sand @ 30x	
Angularity: Rounded	Angularity: Sub-Rounded	Angularity: Sub-Rounded	
Sphericity: Medium	Sphericity: Medium	Sphericity: Medium	
ALL IN-HOUSE REFERENCE MATERIALS TESTED WITHIN LIMITS: <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO - EXPLAIN			
ASTM Methods: C136, D421, D2974, D2976, D4972, F1632, F1647, F1815			
Ksat adjusted to 8%M. *This test result is not covered by our current A2LA accreditation.			

Member of the Putting Greens Materials Testing Technical
Member of USGA Proficiency Testing Program

Report Number: LR13-55

MATERIALS ANALYSIS REPORT

Company Name: Convergent Water Tech
Customer Contact: Bob Adair
Customer Address: 1930 Aldine Western Road
City, State, Zip Code: Houston, TX 77038
Customer Telephone: 281 414-4719 (cell)

Date Sample Received: work request rec 4/4/13
Sample Description: Sand sample #2 (Eagle Lake)
Sample Condition: Dry (1.21% moisture)
Project: Filter Media

Sample Description	Lab Number	Ksat ⁽¹⁾ (n/hr)	Porosity ⁽¹⁾			Bulk Density ⁽¹⁾ (g/cm ³)	Particle Density ⁽¹⁾ (g/cm ³)	% Organic Matter ⁽²⁾ (LOI)	Conductivity ⁽³⁾ (mmhos)	pH ⁽⁴⁾ (CaCl2 1:1)
			% Total	% Capillary ^(a)	% Air ^(a)					
#2 Eagle Lake Sand Light Compaction	13-52	159.2						0.14		6.25
90/10 #2 Sand/Dakota Light Compaction	13-55	137.6	39.5	7.6	31.9	1.59	2.621	0.84		6.34

Lab Number	Particle Size Analysis ⁽⁵⁾				Sand Size Distribution ^{(5), (6)}					Gradation Index D90/D10	Coefficient of Uniformity D60/D10
	% Sand	% Silt	% Clay	% Gravel (#10 sieve)	% Very Coarse (#15 sieve)	% Coarse (#35 sieve)	% Medium (#60 sieve)	% Fine (#100 sieve)	% Very Fine ⁽⁵⁾ (#270 sieve)		
USGA Recommendation	>92 %	≤ 5%	≤ 3%	≤ 3% gravel ≤ 10% combined		≥ 60 %	≤ 20%	≤ 20%	≤ 5%	---	---
13-52 (#2 Sand)	79.22	0.67		20.11	53.57	20.63	4.73	0.27	0.13		2.61

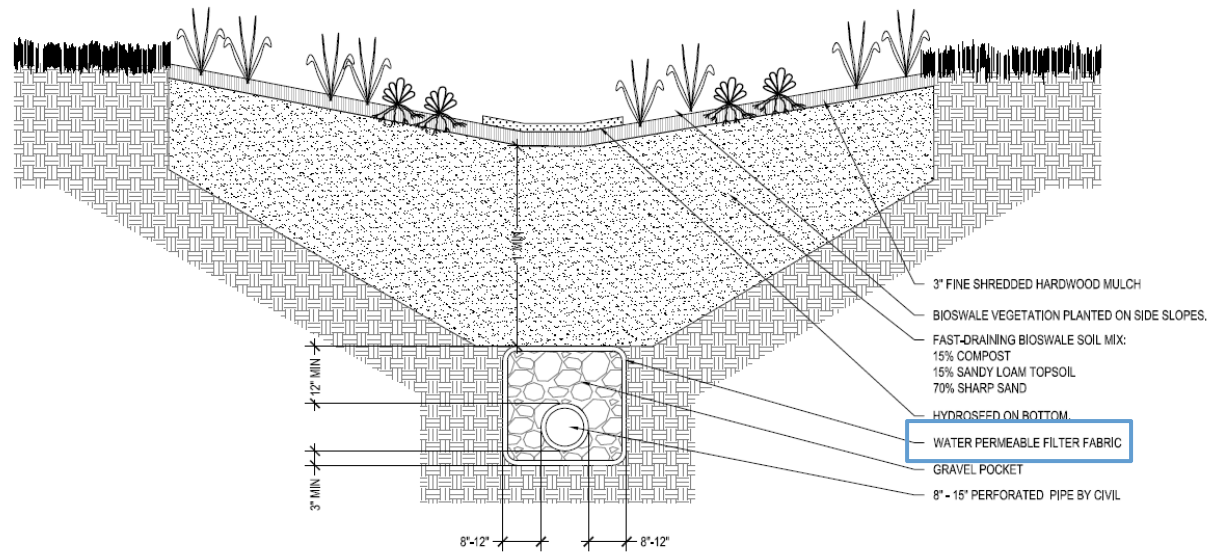
Particle Shape ⁽⁷⁾		(1) ASTM F1815, (2) Soil EC 1:2 soil H ₂ O ratio method, (3) ASTM F1647, (4) ASTM D4972, (5) ASTM 1632, (6) ASTM D2974, (7) ASTM D2976, (8) ASTM C136, (a) determined at 30 cm tension, (b) % retained on sieve, (c) as defined by USGA specifications This report applies only to the sample(s) listed. Samples are maintained a maximum of thirty days before disposal. This test report contains confidential information and shall not be reproduced except in full, and with the express written approval of DAWGTA. DAGTA is not responsible for the accuracy of these test methods and makes no claim about their ability to predict performance in actual use.
#2 Sand @ 15x	90/10 #2 Sand/Dakota @ 15x	
Angularity: Sub-Rounded		
Sphericity: Medium		
ALL IN-HOUSE REFERENCE MATERIALS TESTED WITHIN LIMITS: <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO - EXPLAIN		
ASTM Methods: C136, D421, D2974, D2976, D4972, F1632, F1647, F1815		
Ksat adjusted to 8%M. *This test result is not covered by our current A2LA accreditation.		

Member of the Putting Greens Materials Testing Technical Advisory Committee
Member of USGA Proficiency Testing Program



SIDENOTE







~~Fabric Can Will~~
Clog Over Time



Bridging

Prevents Clogging

Report Number: LR14-27

BRIDGING FACTOR REPORT*

Date Sample Received: 5/10/2015

Customer Name: Bob Adair

Customer Address: 1930 Aldine Western

City, State, Zip Code: Houston, TX 77038

Customer Telephone: 832-456-1000

Customer Fax:

Sample Description: Bioswale Mix & Drainage Gravel for use with gravel matching.

Gravel Sieve Analysis	12.5mm (1/2" sieve)	9.5mm (3/8" sieve)	6.3mm (1/4" sieve)	4.0mm (#5 sieve)	2.0mm (#10 sieve)	1.0mm (#18 sieve)	Pan
% Gravel Retained	4.75	12.08	33.51	39.66	8.61	0.54	0.65

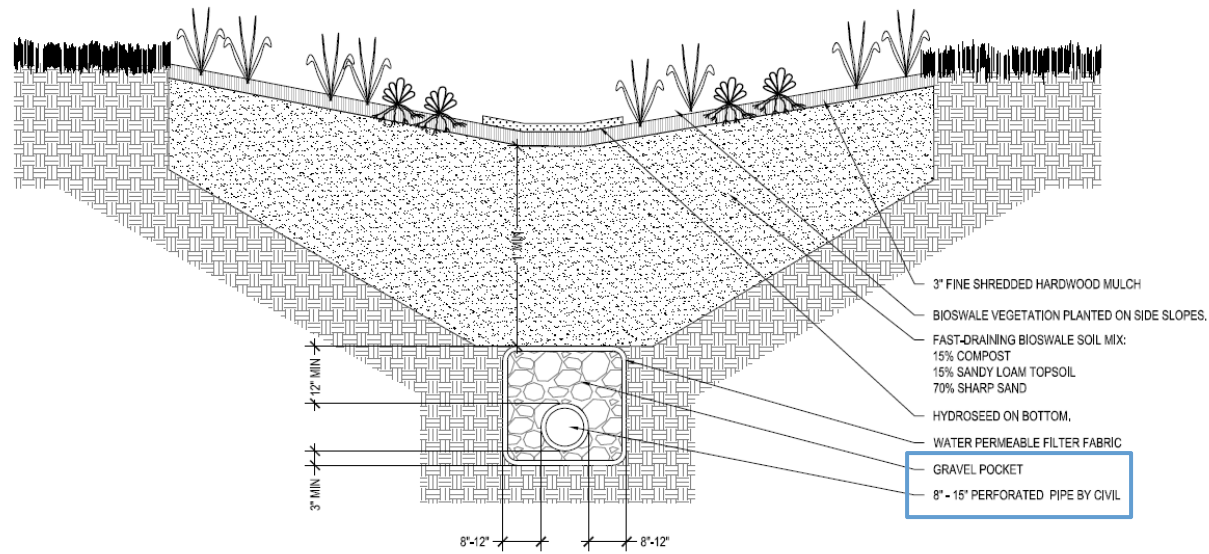
Particle Size Analysis (a)				Sand Size Distribution (a), (b)				
% Sand	% Silt	% Clay	% Gravel (#10 sieve)	% Very Coarse (#18 sieve)	% Coarse (#35 sieve)	% Medium (#60 sieve)	% Fine (#100 sieve)	% Very Fine (c)
>92%	≤ 5%	≤ 3%	≤ 3% gravel ≤ 10% combined		≥ 60 %		≤ 20%	≤ 5%
26.07	2.89	0.25	70.79	9.57	7.63	6.26	4.09	0.86

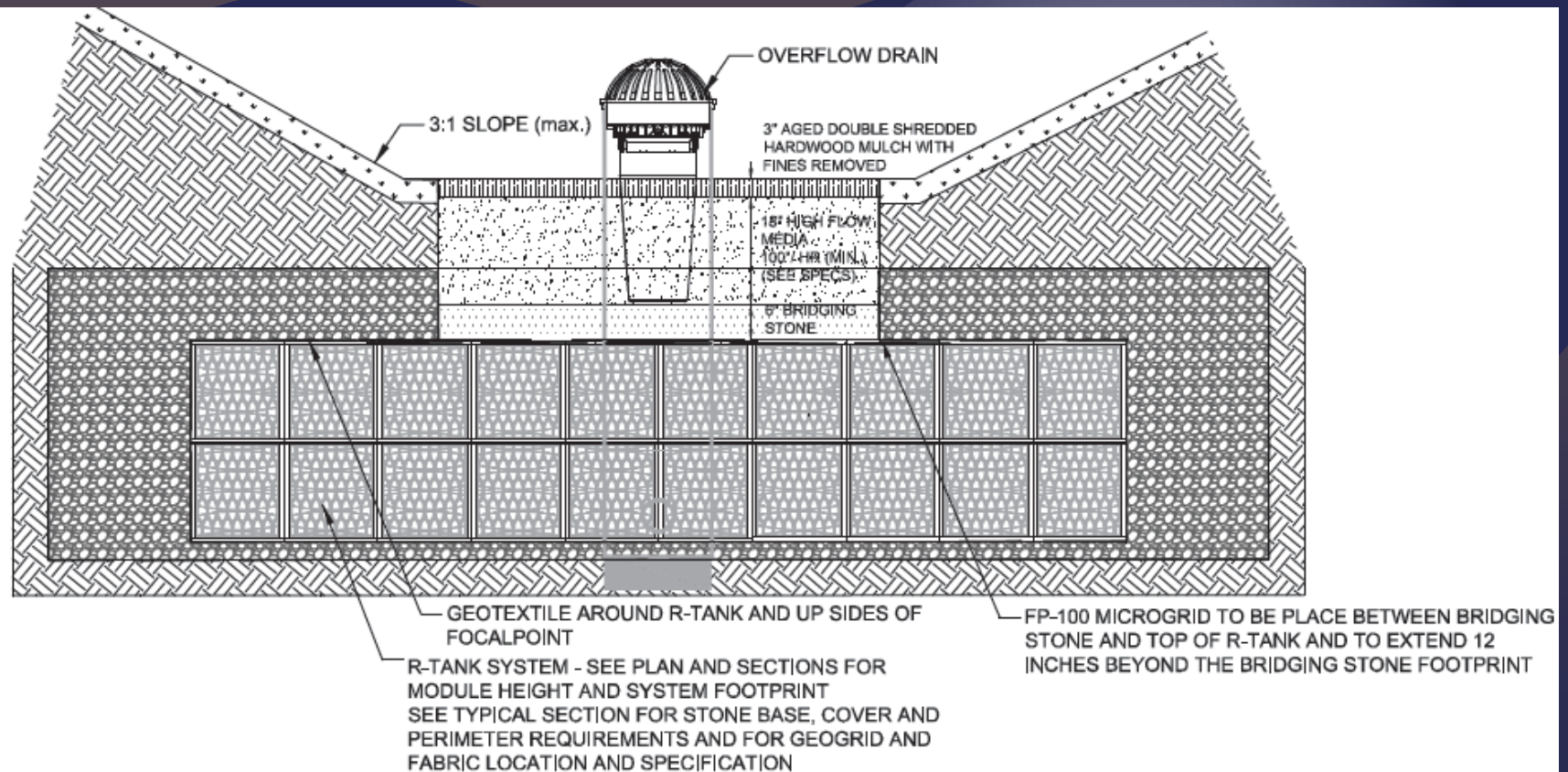
Sample	D ₁₅ Gravel	D ₃₀ Gravel	D ₅₀ /D ₁₅ Gravel	D ₁₅ Rootzone	D ₃₅ Rootzone	D ₁₅ X 5 Rootzone	D ₃₅ X 8 Rootzone
Drainage Gravel	4	10.59	2.650				
Bioswale Sand				0.650	0	3.25	0

Performance Factors	Recommendation	Within Specs?
Bridging Factor	D ₁₅ (gravel) less than or equal to D ₃₅ (rootzone) X 8	
Permeability Factor	D ₁₅ (gravel) greater than or equal to D ₁₅ (rootzone) X 5	OK
Uniformity Factors	D ₃₀ (gravel)/D ₁₅ (gravel) is less than or equal to 3	OK
	No particles greater than 12 mm	
	Particles smaller than 2 mm ≤ 10%	OK

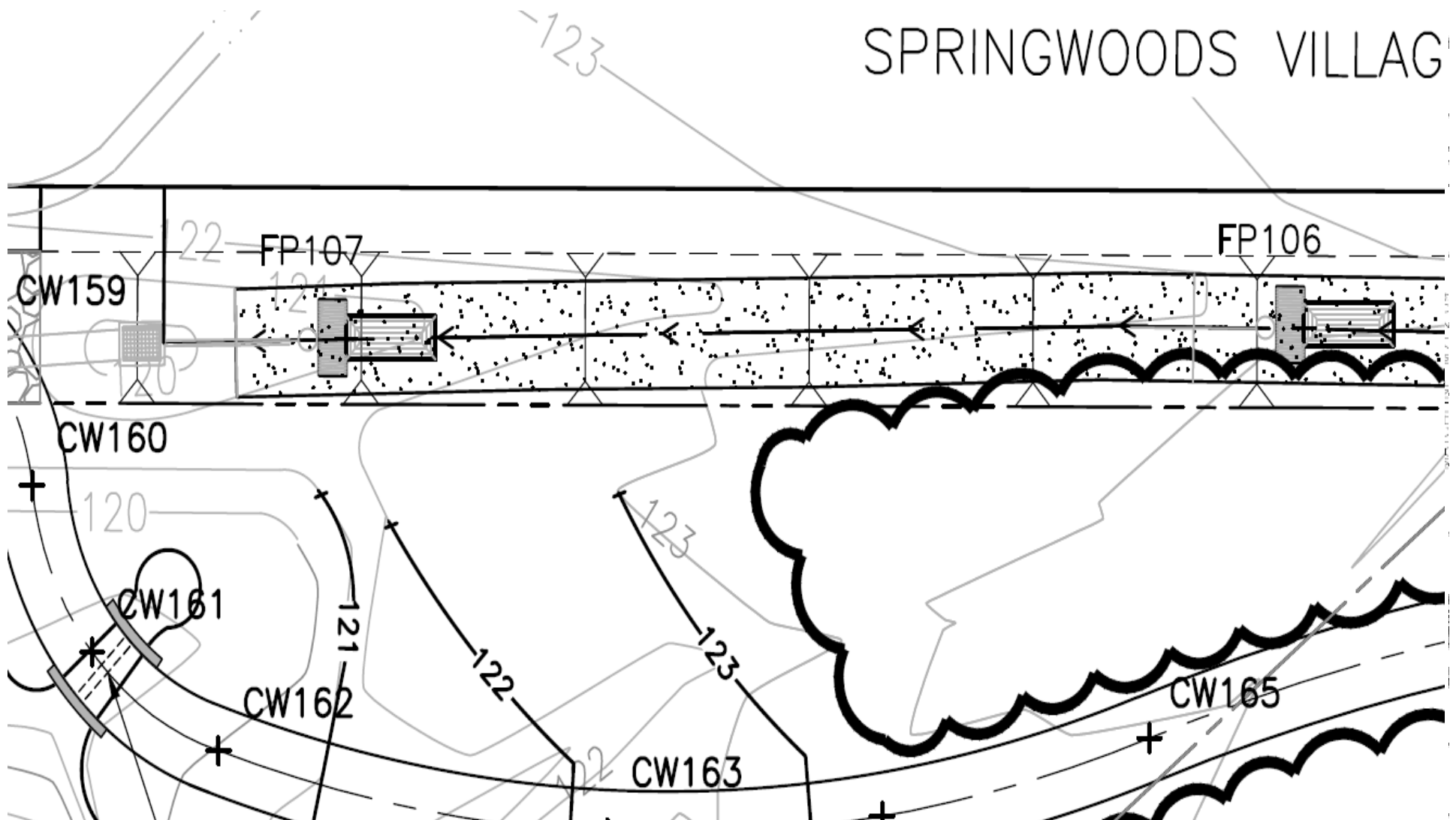
*This test result is not covered by our current A2LA accreditation.

This report applies only to the sample(s) tested. Samples are maintained a minimum of thirty days before disposal. This test report contains confidential information and shall not be reproduced except in full, and with the express written approval of BAKO TAA Analytical. All tests are performed





SPRINGWOODS VILLAGE





SIDENOTE

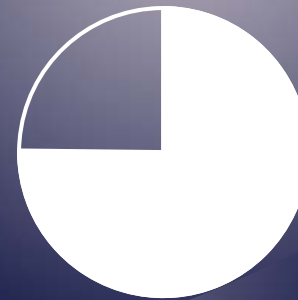
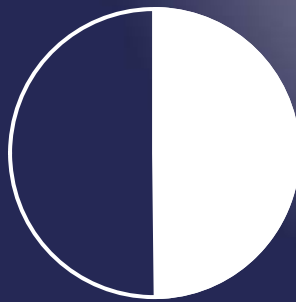




Restless Reinvention>



Bias Toward Action

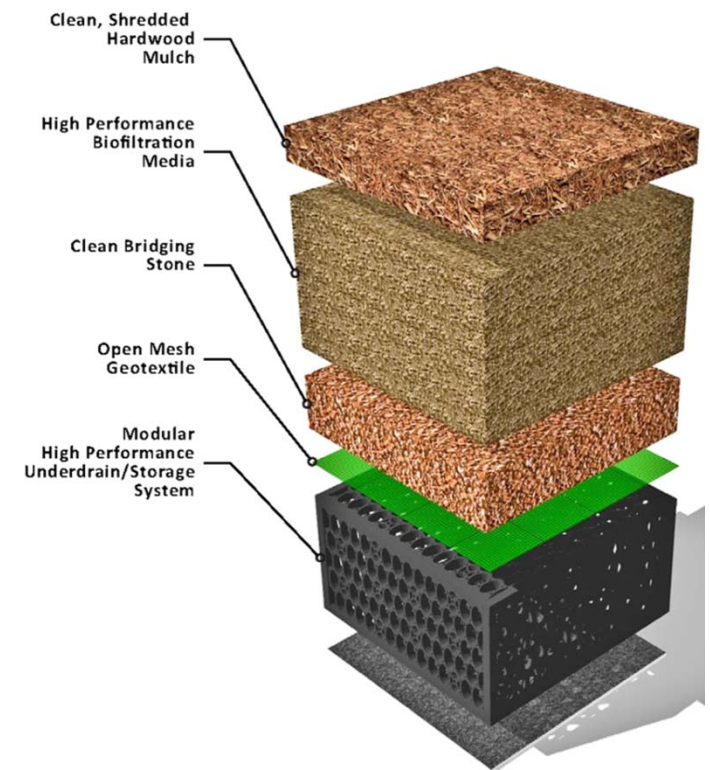
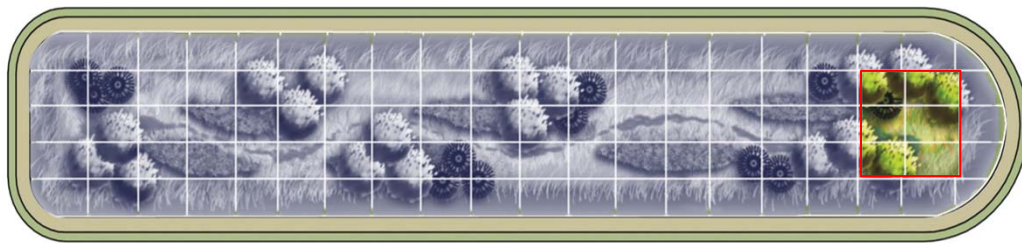


THERE IS A WAY TO DO IT BETTER - FIND IT
~ THOMAS EDISON

FocalPoint

BIOFILTRATION SYSTEMS

- 20X Smaller Footprint
- Scalable
- Easily Maintained (First Year Included)
- Inexpensively Rehabilitated
- Performance is Field Measurable (Included)



Cameillia - RainGarden H

Drainage Area – 143,715 SF (3.29 Acres)

Water Stored – 85,813 CF (642,000 Gallons)

Water Treated – 78,400 CF (586,432 CF)

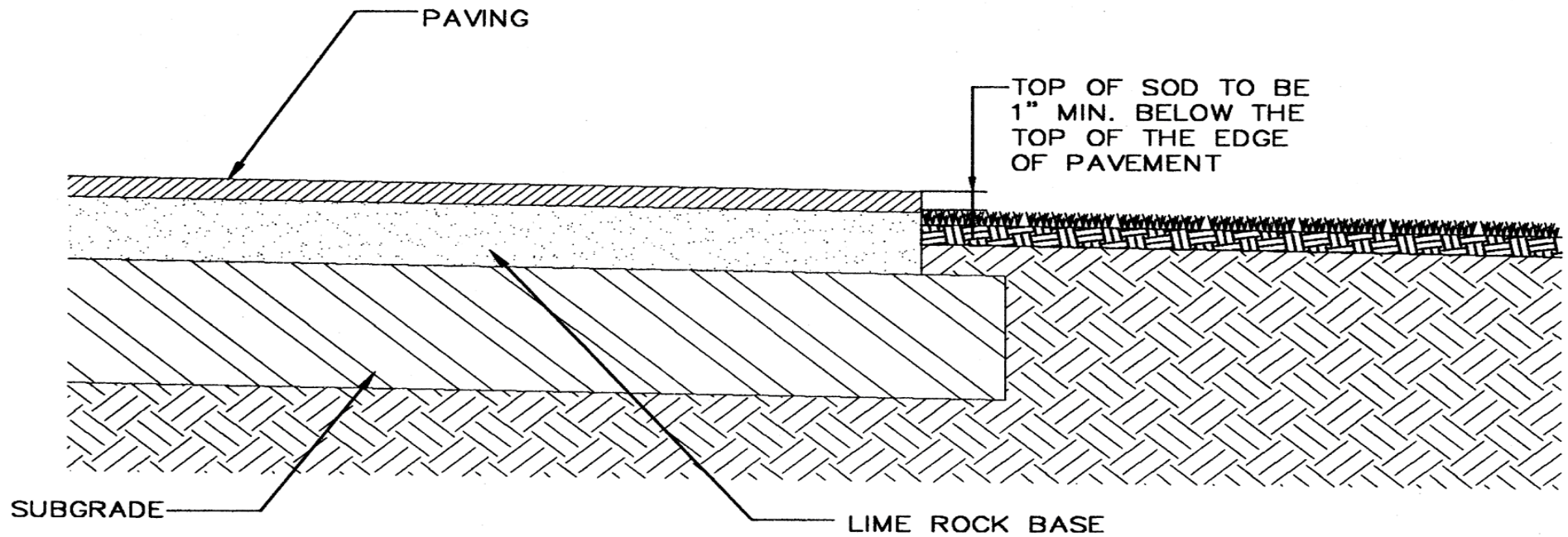
FocalPoint Size – 196 SF → \$29,400

Traditional RainGarden Equivalent – 7,840 SF → \$156,800









SOD PLANTING

NOT TO SCALE





PM12-25 JUN/12/2012

SIDENOTE



CAUTION: BIOFILTRATION SYSTEM

DO NOT REMOVE GEOTEXTILE COVER

No quite la cubierta geotextil

DO NOT PLACE SOIL ON TOP OF ENGINEERED MEDIA OR COVER

No coloque tierra en la parte superior de la cubierta protectora

DO NOT STOCKPILE DIRT OR HAZARDOUS MATERIAL UPSTREAM

No acumular tierra o materiales peligrosos en el canal de drenaje

CAUTION: This FocalPoint Biofiltration System is an engineered stormwater treatment system. It must not be compromised prior to activation by Construction EcoServices. Do not remove the protective geotextile.

PRECAUCIÓN: FocalPoint Biofiltration System es un sistema de tratamiento de agua de lluvias. La cubierta protectora no debe ser removida o abierta, antes de ser activado solamente por Construction EcoServices.

ACTIVATION PREREQUISITES

Requisitos de activación

70% OF THE DRAINAGE AREA MUST BE STABILIZED

El 70% del área que rodea el drenaje debe ser estabilizada

STREET/PARKING MUST BE SWEEPED

La calle / estacionamiento debe ser barrido

90% OF THE SWALE MUST BE

VEGETATED OR MULCHED

El 90% del canal de drenaje debe tener por obligacion vegetación o mulch

CONTACT CONSTRUCTION ECOSERVICES FOR ACTIVATION

Contacta con Construction EcoServices para la activación

832.456.1000



WWW.ECOSVS.COM









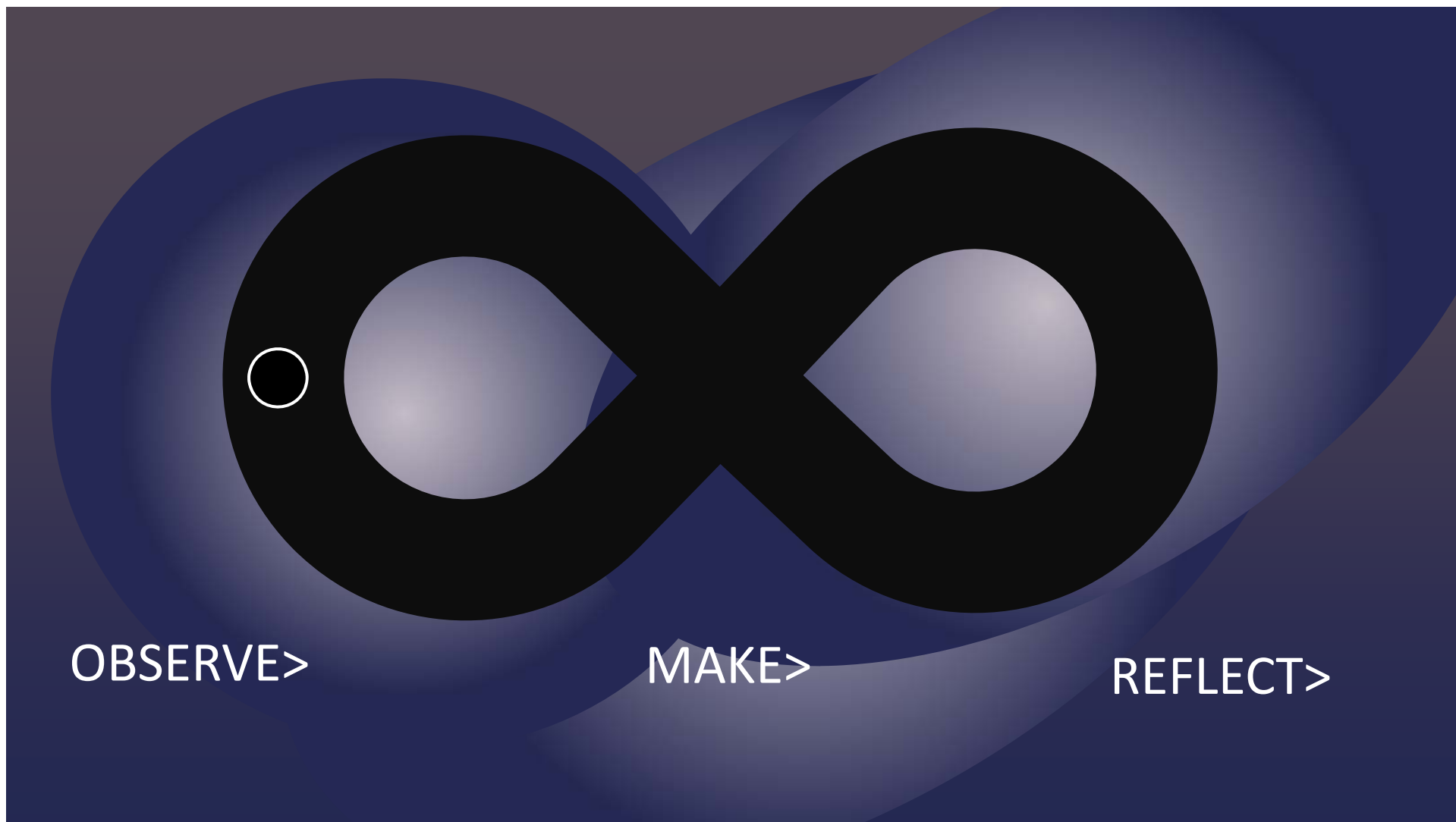
Keys to Success

- **Verify Maintainability**
- **Design with Emergency Overflow**
- **Protect System During Construction**
- **Push for Turn-Key Installation**
- **Require Performance Verification in Specification**
- **Require Maintenance in Specification**

Why Construction EcoServices

- **NEXT GENERATION GREEN INFRASTRUCTURE SOLUTIONS**
- **CRADLE TO GRAVE BUSINESS MODEL**
- **TURN-KEY INSTALLATION AVAILABLE ON ALL GI BMP TYPES**
- **MAINTENANCE AVAILABLE ON ALL GI BMP TYPES**







QUESTIONS?

THANK YOU!

DAVID BATTS, LEED AP
Director, Stormwater Systems
Construction EcoServices
832.456.1000
ecosvs.com

