



## **The Solution to This Pollution is Bioswales Greater New Haven's Innovative Approach to CSO Abatement**

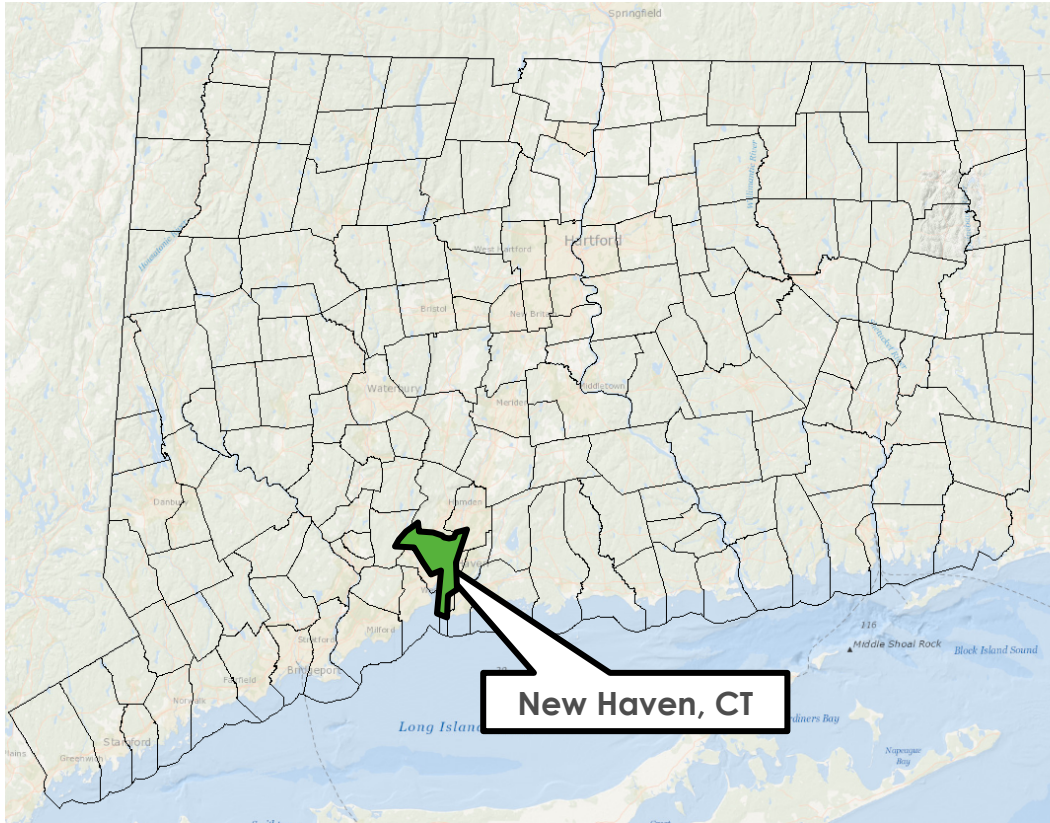
**Douglas Brisee, P.E.  
NEWEA Annual Conference 2019  
January 30, 2019**

# Presentation Outline

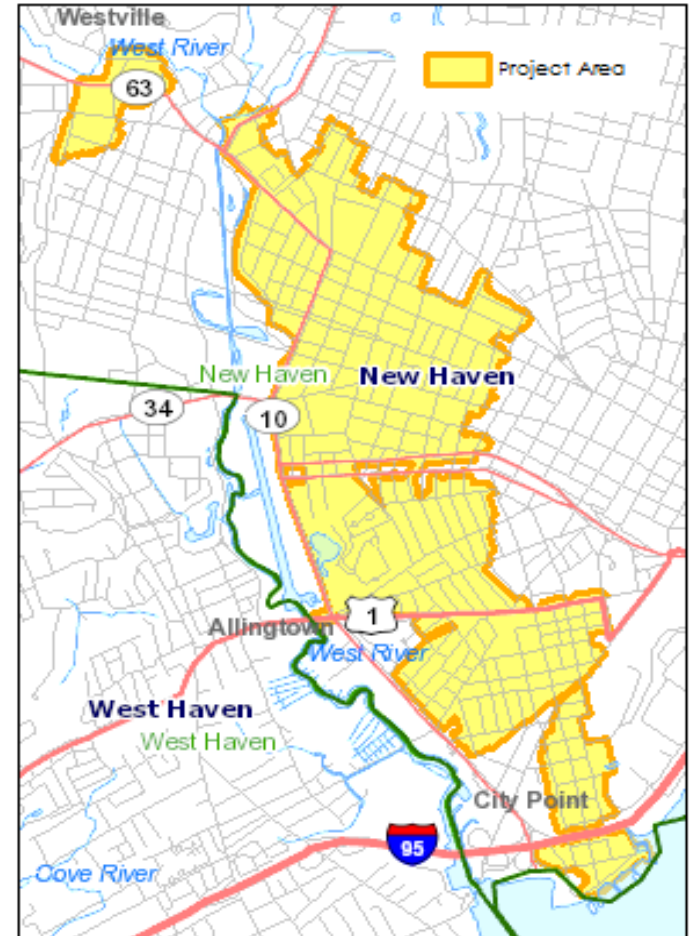
- **Project Background**
- **Bioswale Details**
- **Design Approach**
  - Soils investigation
  - Bioswale siting constraints
  - Field data collection
  - Public outreach
  - Development of design drawings
- **Bidding Phase**
- **Construction Phase**
- **Current Status**
- **Questions**

# Project Location

## State of Connecticut

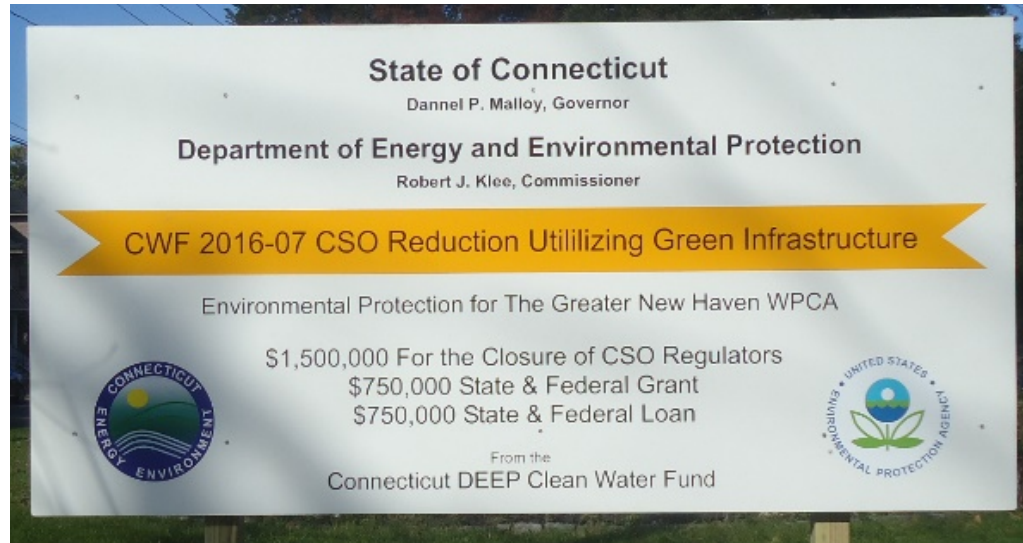


## City of New Haven



# Project Details

- Project completed for the **Greater New Haven Water Pollution Control Authority (GNHWPCA)**
- Project goal: Site, design and install 70 bioswales within the combined sewer area of the West River watershed
- Project funded by **Connecticut Department of Energy and Environmental Protection**



# Greater New Haven WPCA

- **Regional sewer authority serving four member communities**
- **550 miles of sewers and 30 pump stations**
- **East Shore Treatment Plant – ADF: 30 MGD**
- **15 active CSO regulators and 12 active CSO outfalls**
  - **New Haven Harbor (3)**
  - **Quinnipiac River (3)**
  - **Mill River (2)**
  - **West River (4)**

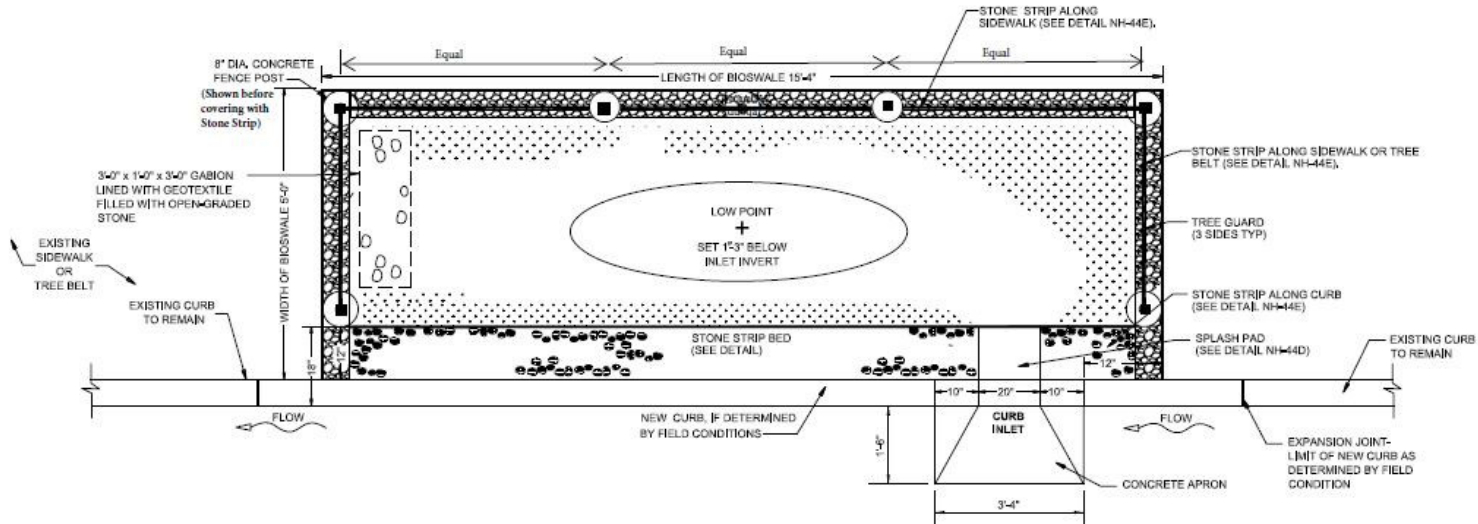


# What is a bioswale?

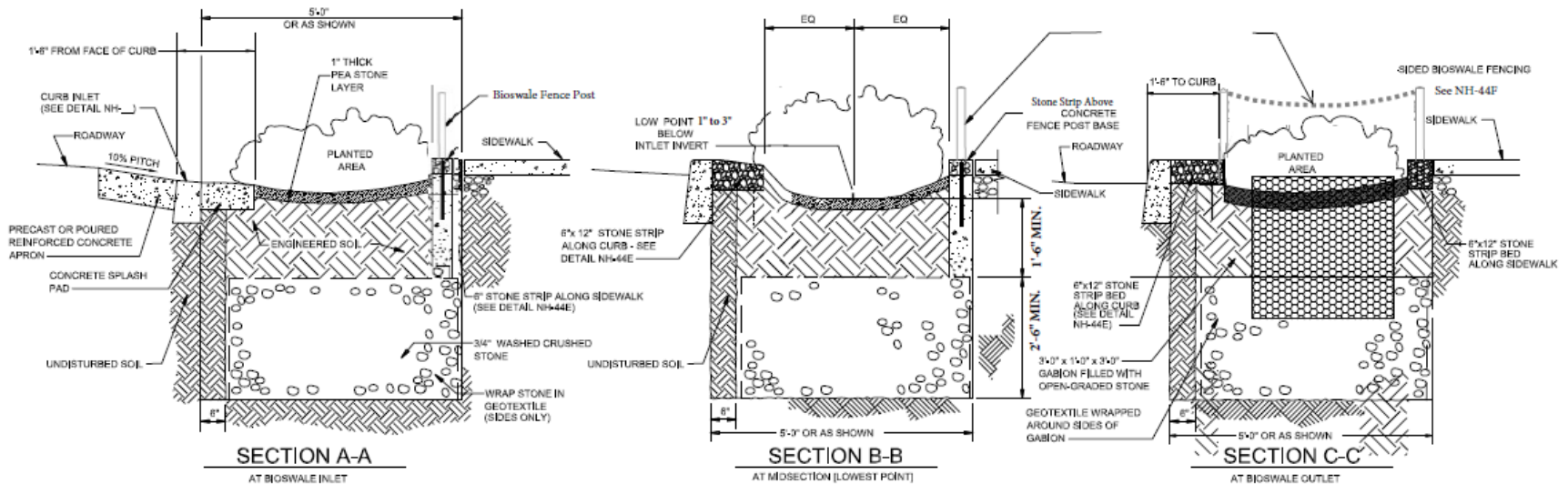


- Simple landscape feature
- Used to collect and infiltrate stormwater runoff
- Bioswale construction details:
  - Size: 15' x 5' rectangle
  - Fill material:  $\frac{3}{4}$ " crust stone and engineered soil
  - Curb cut inlet
  - Planting Plan
  - Bioswale fencing

# Bioswale Details

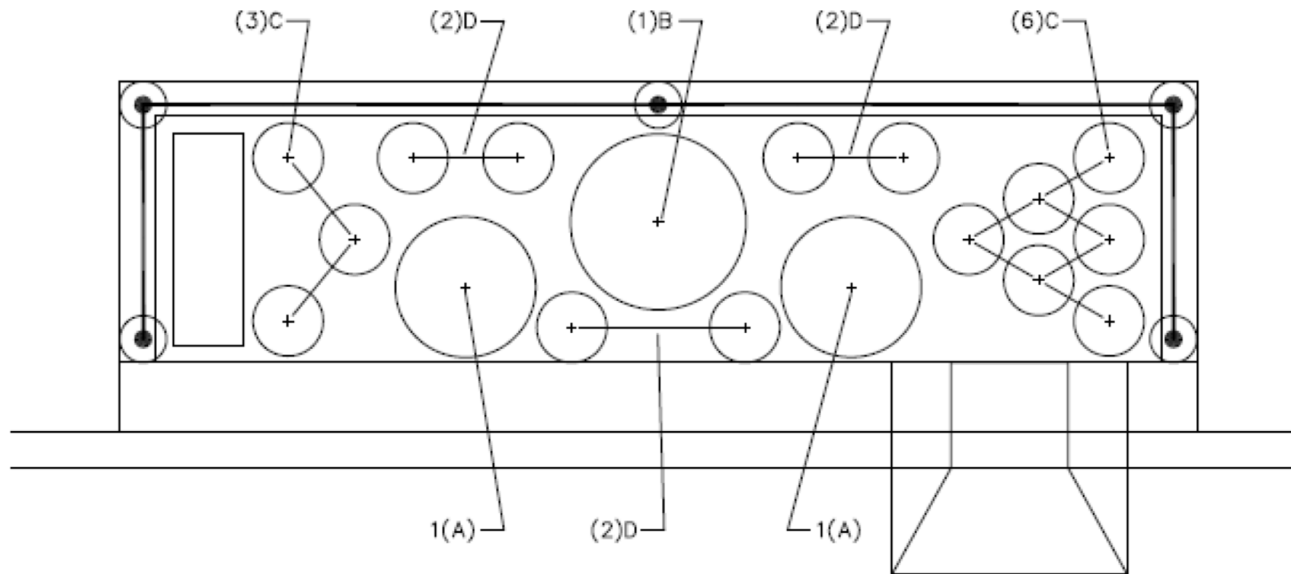


**Plan View**



**Sections**

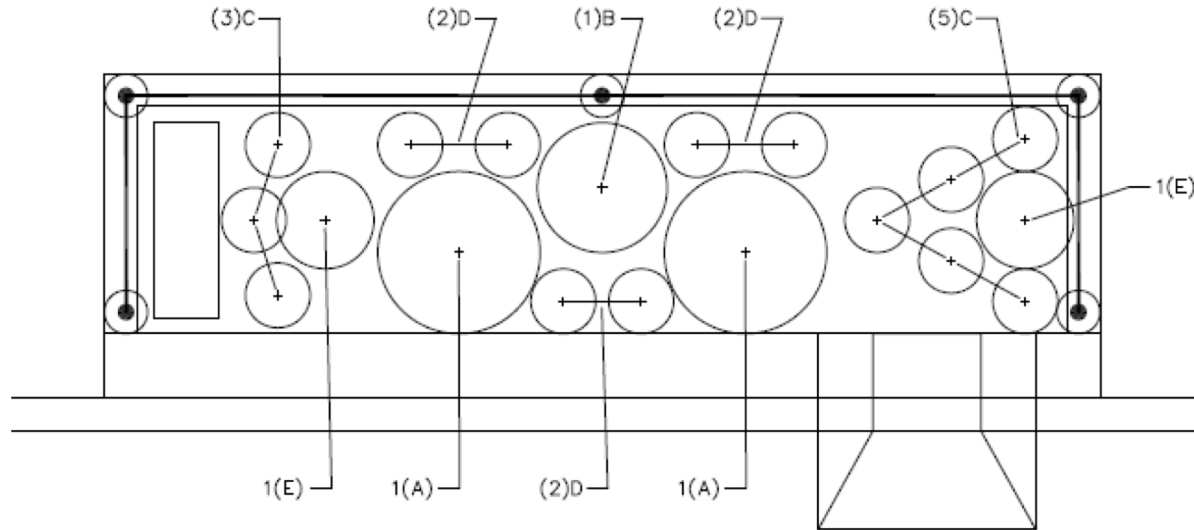
# Bioswale Planting Plan – Shade Planting Plan



KEY	QTY	TYPE	BOTANICAL NAME	COMMON NAME	SIZE	SPACING
A	2	SHRUB	ILEX GLABRA COMPACTA	INKBERRY	18"–24" HT.	2' O.C.
		SHRUB	PIERIS JAPONICA	LITTLE HEATH JAPANESE PIERIS	18"–24" HT.	2' O.C.
		SHRUB	PRUNUS LAUROCERASUS "OTTO LUYKEN"	DWARF CHERRY LAUREL	24"–30"	2.5 O.C.
B	1	SHRUB	CORNUS SERICEA	RED TWIG DOGWOOD	18"–24" HT.	1' O.C.
		SHRUB	KERRIA JAPONICA	JAPANESE KERRIA	18"–24" HT.	1' O.C.
		SHRUB	CLETHRA AINIFOLJA	SWEET PEPPERBUSH	18"–24" HT.	1' O.C.
C	9	GROUNDCOVER	LIRIOPE SPICATA OR MUSCARI	LILYTURF	1 GAL.	1' O.C.
		GRASS	CAREX "ICE DANCE"	SEDGE	1 GAL.	1' O.C.
		PERENNIAL	TIARELLA WHERRYI	FOAM FLOWER	1 GAL. (8"–10" HT.)	1' O.C.
D	6	PERENNIAL	HOSTA	HOSTA	1 GAL.	1' O.C.
		PERENNIAL	ALCHEMILLA MOLLIS	LADY'S MANTLE	1 GAL.	1' O.C.
		PERENNIAL	HEUCHERA (SP.)	ALUMROOT	1 GAL.	1' O.C.



# Bioswale Planting Plan – Sun Planting Plan

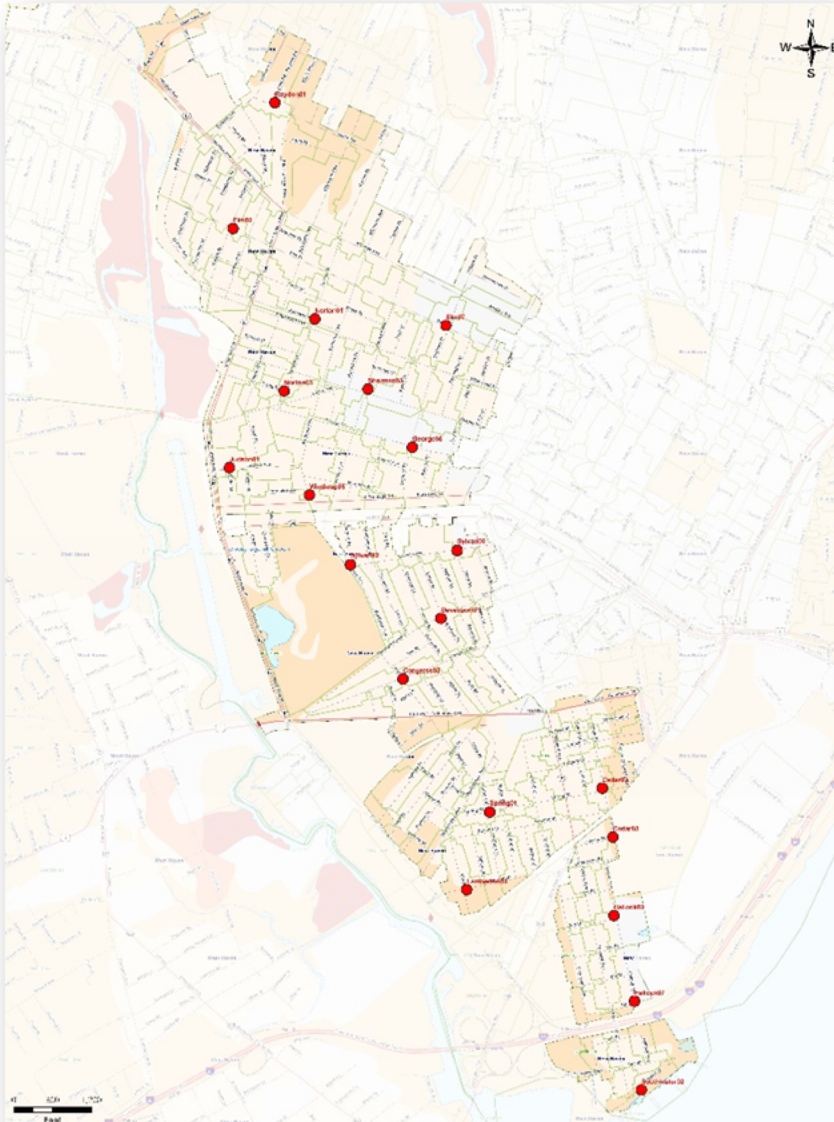


KEY	QTY	TYPE	BOTANICAL NAME	COMMON NAME	SIZE	SPACING
A	2	SHRUB	CORNUS SERICEA	RED TWIG DOGWOOD	18"-24" HT.	2.5' O.C.
		SHRUB	PJM RHODODENDRON	RHODODENDRON	18"-24" HT.	2.5' O.C.
B	1	SHRUB	ILEX GLABRA SHAMROCK OR COMPACTA	INKBERRY	24"-30" HT.	2' O.C.
		SHRUB	ILEX VERTICILLATA	WINTERBERRY	24"-30" HT.	2' O.C.
C	8	GROUNDCOVER	LIRIOPE SPICATA OR MUSCARI	LILYTURF	1 GAL.	1' O.C.
		GROUNDCOVER	COREOPSIS GOLDFINK OR ROSEA	TICKSEED	1 GAL., 16" HT.	1' O.C.
		GROUNDCOVER	COREOPSIS STERNATALER	TICKSEED	1 GAL., 8"-10" HT.	1' O.C.
D	6	PERENNIAL	RUDBECKIA FULGIDA "GOLDSTRUM"	BLACK EYED SUSAN	1 GAL.	1' O.C.
		PERENNIAL	ECHINACEA SIMULATA	CORNFLOWER	1 GAL.	1' O.C.
E	2	PERENNIAL	ROSA RADRAZZ KNOCKOUT	KNOCKOUT ROSES	18"-24" HT.	1.5' O.C.
		PERENNIAL	SPIREA (SP.) "DWARF"	SPIREA	18"-24" HT.	1.5' O.C.

# Design Approach

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# Soil Investigation



- **Goal: To confirm soil suitability for stormwater infiltration**
- **Performed 17 soil borings using a GeoPrope**
- **Depth of 8 feet**



# Soil Investigation

- Primarily “Silty Sand” and “Gravelly Sand / Sand”
- No evidence of mottling or groundwater
- Results: Excellent for stormwater infiltration!



BORING LOG		SITE ID: 2 Auburn St								
PROJECT: New Haven Green Infrastructure		SHEET: 1 of 1								
LOCATION: New Haven, CT		PROJECT NO.: 20140991-320								
		WEATHER: p. cloudy 80s								
CONTRACTOR: Fuss & O'Neill Inc.		BORING LOCATION: see map								
OPERATOR: D. Levesque		DATE STARTED: 8/20/14								
P&C REFERRED TO: D. Levesque		DATE & TIME COMPLETED: 8/20/14 0832								
DRILLING METHOD: Geoprobe		DEPTH TO SATURATED ZONES: n/a								
SAMPLING METHOD: none										
HAMMER WT: n/a		HAMMER FALL (ft): n/a								
BORING DATA		SAMPLING DATA		ANALYTICAL DATA						
START DEPTH (ft)	ALLOW (ft)	REC. DEPTH (ft)	DEPTH RANGE (ft)	DESCRIPTION	MO	UFGC LOGIC CODE	USDA NO. & TYPE	DEPTH (ft)	LAB #	PREPARED BY
0	n/a	36/48	0-0.5	Top soil (SAND & SILT) some grass roots, light brown, dry, poorly sorted, no odor		SM				
			0.5-4	SAND, med; reddish brown, loose, poorly sorted, dry, no odor		SP				
4	n/a	40/48	4-4	SAND, med, reddish brown, loose, poorly sorted, dry, no odor		SP				
End of Boring @ 8' No Groundwater!										
BORING DIAMETER		BORING METHOD		BORING DEPTH		REMARKS				
2.5"		Geoprobe		8'		Field instrument = PED/OTM  If data is encountered, describe all efforts used to obtain.  Field Desc. Yes / No / Dedicated Device				
REMARKS:		FROM 0-0.5'		TO 0-0.5'		BAGGELL				
EXAMPLE DESCRIPTION:		SAND, SILT, etc. Fine-grained, silty, clayey, (10R, 5/4), wet at 7 ft.		Loose: No odor		Original / Contents _____ To _____ See Monitoring Well Remnants / Gooch / Chips _____ To _____ Completion Report Cuttings / (Native Material) _____ To _____ 2.5 Other: SAND _____ 2.5 To _____				
Reviewed by: SUE										

# Bioswale Siting Constraints

- **Project area: 70 miles of roadway**
- **Preferred area: Streets with sidewalk and tree belt**
- **Maintain separation distances (fire hydrant, signs, etc.)**
- **Site bioswale such that bioswale inlet is up gradient of existing catch basin.**



# Bioswale Siting – Water Quality Volume Treated

- **Project Area Soils – NRCS identified as primarily sandy**
- **Assumptions:**
  - Capture runoff from half width of road ~ 15 feet wide
  - Soils infiltrate at a rate of 3.5 feet/day
  - Bioswale size: 5' wide x 15' long x 5' deep
- **Water quality volume treated approximately a 200 foot length of crowned roadway**
- **Bioswales likely to infiltrate much greater than the WQV, due to higher local infiltration rates**
- **Site bioswale on longer roadways; not short streets or mid block locations**

# Field Data Collection

- Visually inspected all streets in project area
- Trimble GPS unit used to locate features including:
  - Trees
  - Parking meters
  - Sign posts
  - Telephone/light poles
  - Fire hydrants
  - Edge of driveway/curb cut



Final Design Services CSO Reduction Utilizing Green Infrastructure  
West River Watershed  
Project Number CWF 2016-07  
Greater New Haven Water Pollution Control Authority

## Bioswale Field Data Sheet

Date: \_\_\_\_\_ Time: \_\_\_\_\_

BMP ID [Street\_#]: \_\_\_\_\_ Photo Numbers: \_\_\_\_\_

Street: \_\_\_\_\_

1. Unique BMP ID Road crown? Yes No
2. General flow direction to inlet: N E W S Low Point
3. Adjacent land use: Residential Commercial Industrial
4. Property address(es) [### Street]: \_\_\_\_\_
5. Tree belt width (ft): \_\_\_\_\_ft. Sidewalk width (ft): \_\_\_\_\_ft.
6. Curb composition: Concrete Granite Bituminous Other
7. Bumpout potential? On street parking? How utilized?

8. Detail with or without trees? i.e. site distance, overhead lines

9. Associated site sketch? Yes No

10. Structures within 5 ft of bioswale footprint? (circle all that apply)

Trees (including the dimensions of any tree pits) Parking Meters Sign Posts

Telephone poles Light poles Underground access vaults Fire Hydrants

Utility mains or laterals (with type) Driveway/curb cut

11. Structures to be relocated? Trash Can Bicycle Rack Street or Traffic Sign Other:
12. Other Concerns? (Neighbor talks, high trash generation, traffic too heavy)

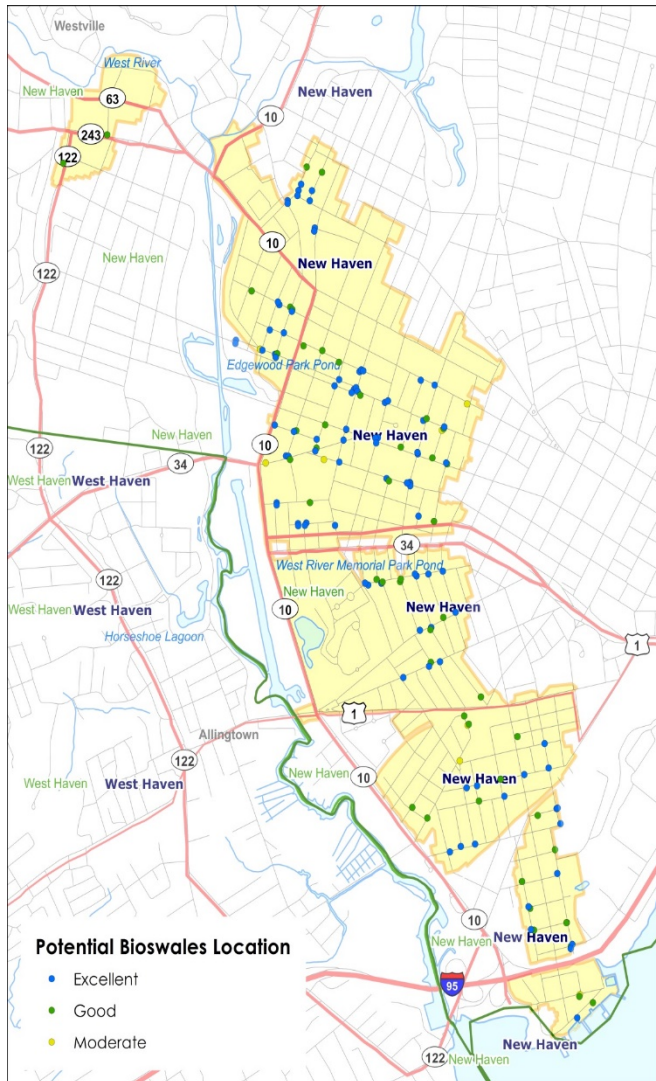
13. Overall Site Rating? (to be determined in the field) Excellent Good Moderate

14. Final Bioswale Size: 5x15 Other: \_\_\_\_\_

F:\P2314\0391\A20\Field\New Haven GI Field BMP Data Sheet.Docx

# Potential Locations

- 154 potential bioswale locations identified



Bioswale Site Rating Factors and Criteria

Rating Factors	Rating Criteria		
	Excellent	Good	Moderate
Tree belt and Sidewalk Widths	5-foot or greater tree belt width OR 10-foot or greater sidewalk width with no tree belt	Less than 5-foot tree belt width BUT greater than 9-foot combined sidewalk and tree belt width	Not applicable
Utility Laterals	Utility laterals are not present or believed not to be present within proposed bioswale footprint	One utility lateral is present or believed to be present within proposed bioswale footprint	More than one utility lateral is present or believed to be present within proposed bioswale footprint
Other Factors	There are no other factors making the site unfavorable	There are no other factors making the site unfavorable	Other factors make the location less favorable due to high trash generation area, a potential conflict with adjacent land uses, or other concern or issue



# Public Outreach

- **Public Outreach conducted by the GNHWPCA**
- **Meeting with the West River Watershed Coalition**
- **Those that didn't want a bioswale, didn't get a bioswale**



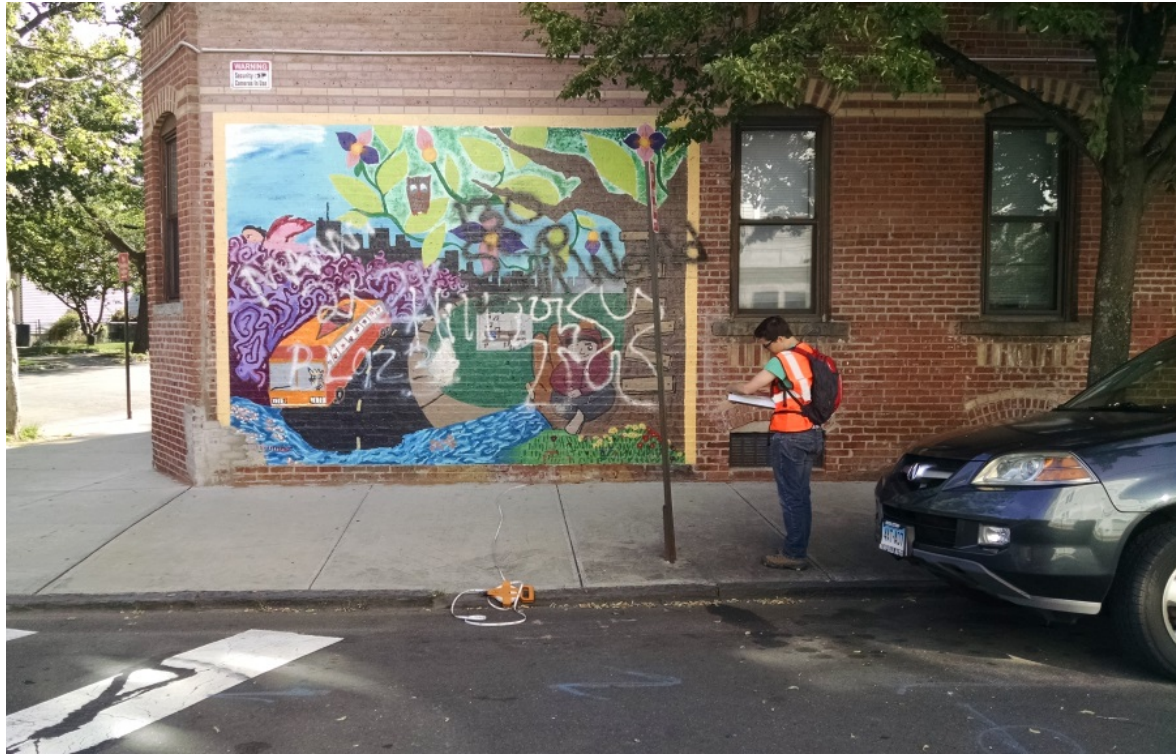
# “Excellent” Bioswale Location



## Rated “Excellent” due to:

- A total tree belt width of 7.6 feet
- No observed utility markings on the street
- No utility meters on the adjacent house to suggest the presence of underground utility laterals within the bioswale footprint

# “Good” Bioswale Location



Rated “Good” due to:

- Total existing sidewalk width of 9.7 feet. Only leaves final sidewalk width of 4.7 feet
- There is a sign within the proposed bioswale footprint

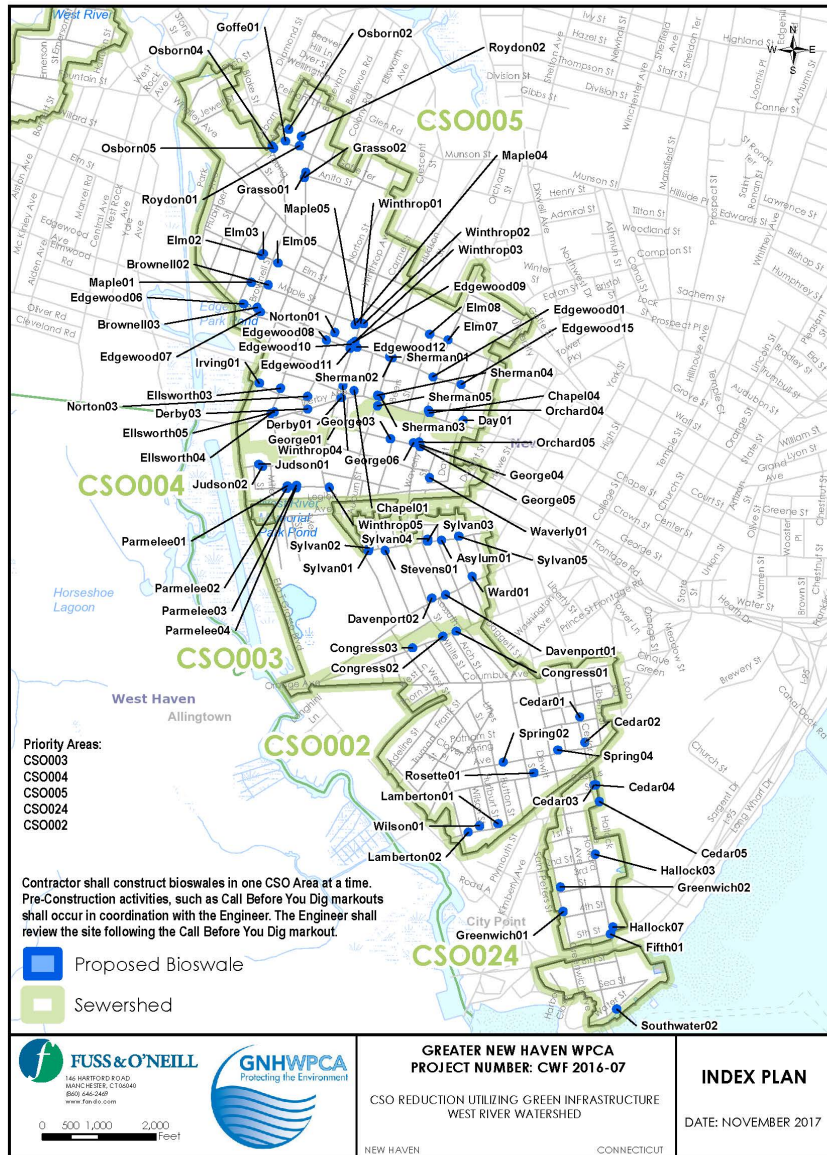
# “Moderate” Bioswale Location



## Rated “Moderate” due to:

- Total existing sidewalk width of 9.4 feet. Only leaves final sidewalk width of 4.4 feet.
- Multiple utility laterals within the proposed bioswale footprint
- High traffic area making maintenance more difficult

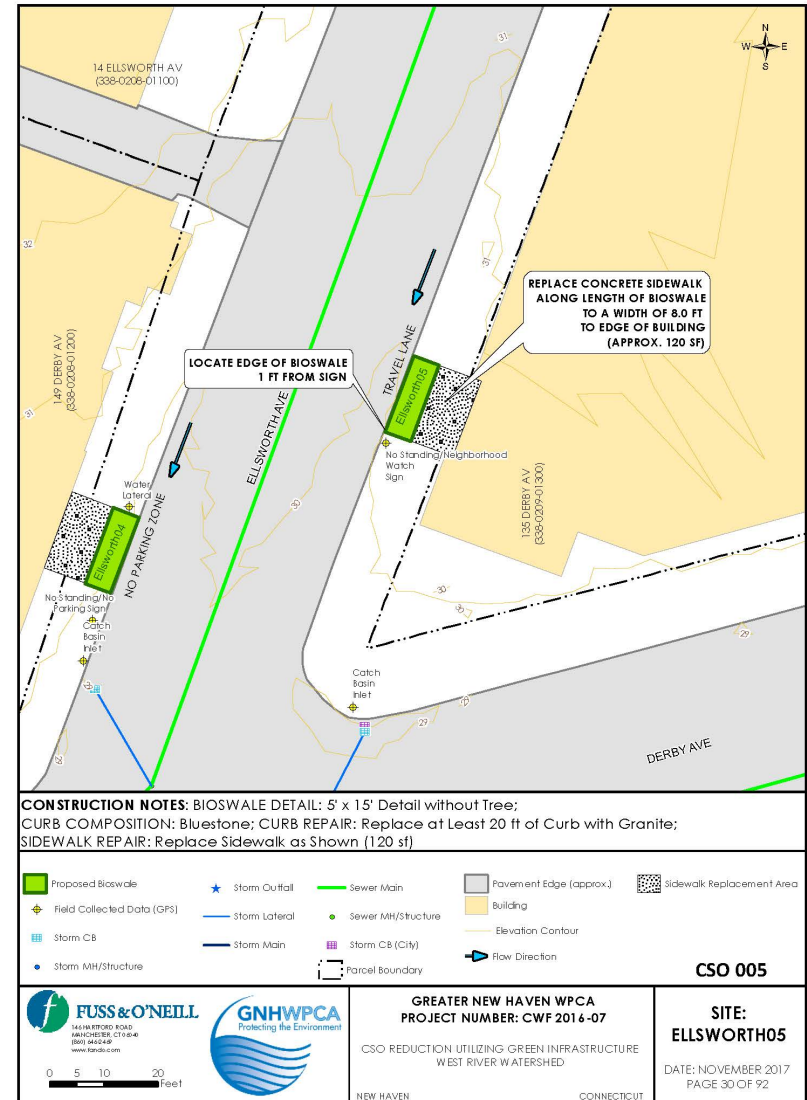
# Drawing Development



- 92 proposed bioswales included in Contract Documents
- Bioswales sited in 5 different CSO Areas
- Bioswales prioritized based on CSO Areas that contribute largest volume of overflow

# Drawing Development – Individual Site Plans

- Individual bioswale site plan
- Placed upstream of existing catch basin – Gutter flow line provided
- Identification of site features:
  - Location of signs, hydrants, etc.
  - Sidewalk replacement
  - Where bioswale should be sited



# Bidding Phase

- **Contract Bid – Based on constructing up to 92 bioswales**
  - Bid Range: \$1,322,688 to \$4,566,000
- **Contract award based on constructing 70 bioswales**
  - Actual Contract Award: \$1,092,393.00
- **Contractor: Schumack Engineered Construction, LLC**
- **Notice to Proceed Date: September 17, 2018**
- **Construction Start Date: October 30, 2018**

# Construction Phase

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# Bioswale Mark Out – CBYD



# Bioswale Excavation



# Backfill and Placement of Fence Posts/Gabion



# Stone Curb Cut Inlet



# Stone Curb Cut Inlet



# Placement of Stone Strip



# Bioswale with Peastone and Shrubs Installed



# Current Status

- To date: Approximately 25 bioswales have been constructed
- Contractor continuing through the winter (weather permitting) with partial plantings
- Install remaining plants in Spring 2019
- Post construction continue to monitor effectiveness





# Acknowledgments

- **Tom Sgroi – GNHWPCA Director of Engineering**
- **Gary Zrelak – GNHWPCA Director of Operations**
- **Mario Ricozzi – GNHWPCA Manager of Design**
- **Luigi DiMonaco – GNHWPCA Construction Administrator**
- **Dawn Henning – City of New Haven**

# Contact Information

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