



Designer and Reviewer Roles and Importance in Stormwater Management: A Case Study

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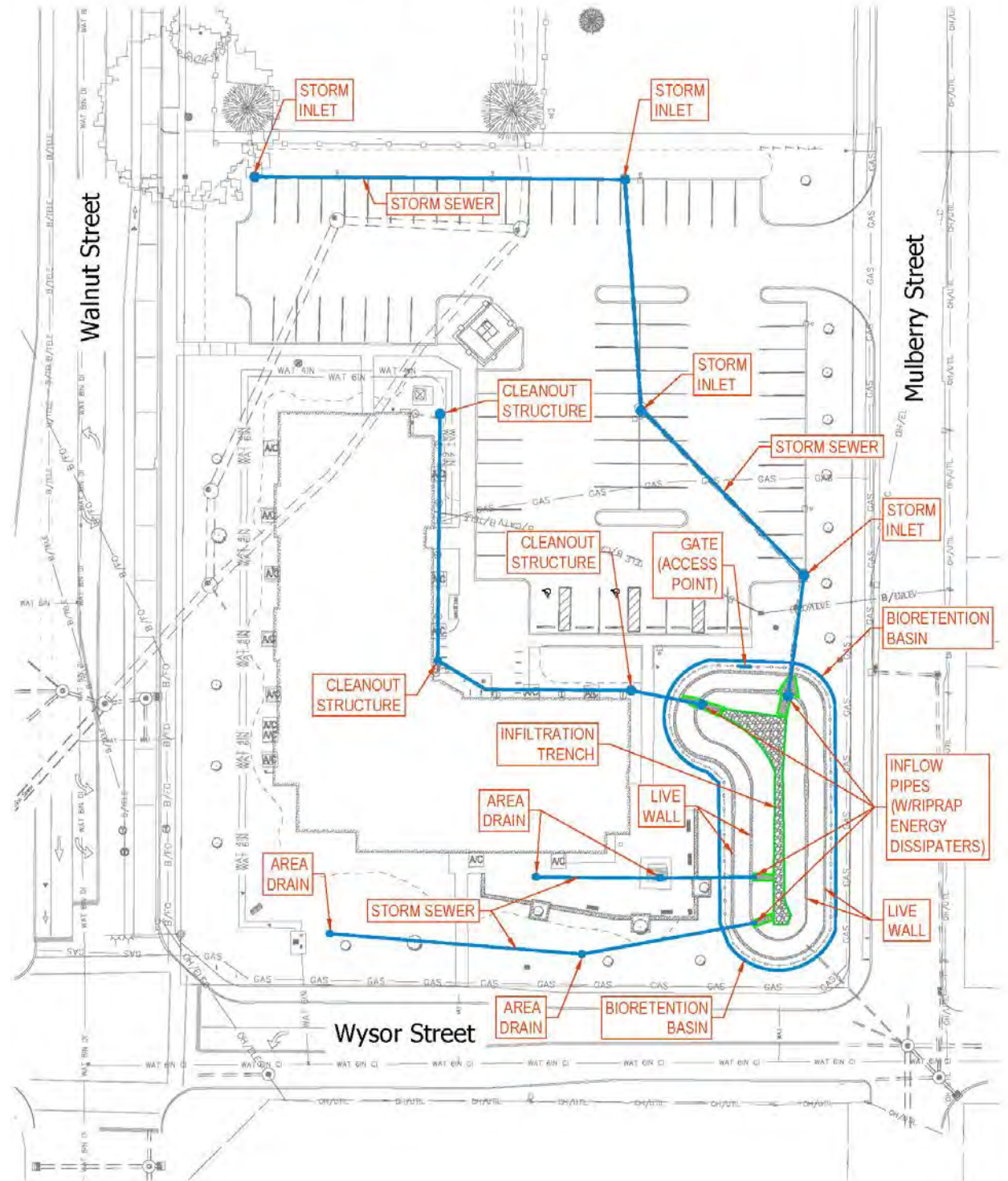
Walnut Commons

500 N. Walnut Street
Muncie, Indiana

- 2.16 Acre Site
- Existing 10-year Pre-developed Runoff = 5.65 cfs
- Design 50-year Post-developed Runoff = 1.78 cfs
- Design 50-year Total Retained Runoff = 8.68 cfs
- 77% of site's runoff detained in large bioretention basin

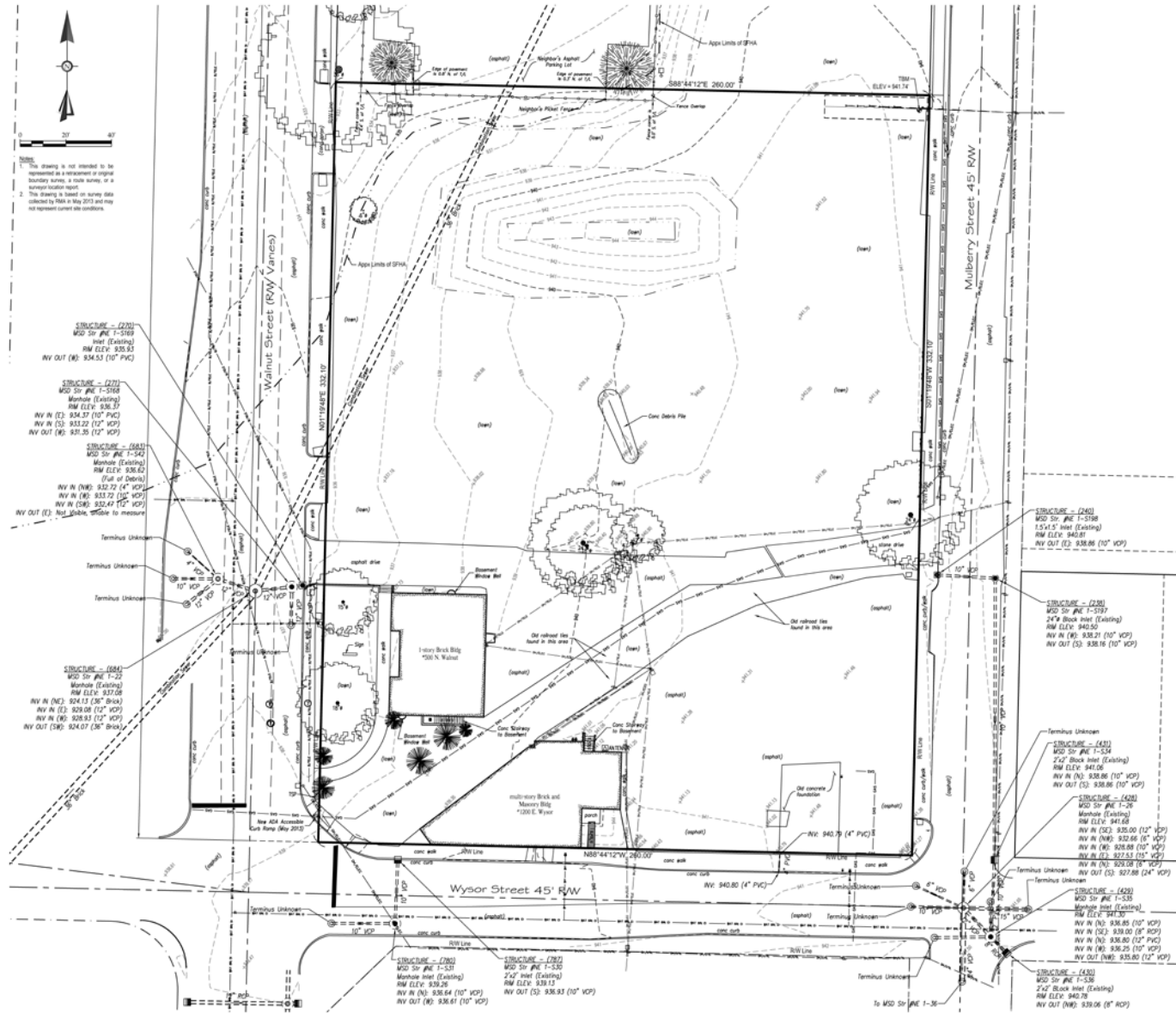
Appendix F

Stormwater Facilities Map



Design Challenges

- Proposed Detention Area on “High” side of the site
 - Reverse grading of site
 - Storm Sewer HGL
 - Retention/Detention basin must be deep
- Fill Site
 - Former Armory Building
 - Demolished and filled in on itself
 - Unsuitable subgrade (soils, materials)?
- No Stormwater Outlet
 - Site surrounded by CSO
 - No direct outlet after detention
- Conventional Detention Basin Not Feasible
 - At depth required for site HGL open space left for detention too small to accommodate conventional “pond” with 3:1 or 4:1 sloped banks to get required storage



Design Objectives

- Design for Total Retention
 - Green Infrastructure to allow for infiltration
 - No direct outlet available
 - Geotechnical Investigation for subsurface soils
- Design Basin Deep Enough for HGL and to fit in the provided open space
 - Walls
 - Tiered (ledges) for maintenance and safety
 - Aesthetics
- Grading Design for balanced site (earthwork volumes)
 - Site surrounded by CSO
 - No direct outlet after detention



RECORD OF SUBSURFACE EXPLORATION

Alt & Witzig Engineering, Inc.

CLIENT DDG Walnut, LP BORING # B-5
 PROJECT NAME Walnut Commons ALT & WITZIG FILE # 13IN0314
 PROJECT LOCATION Muncie, Indiana

DRILLING and SAMPLING INFORMATION

Date Started 6/24/13 Hammer Wt. 140 lbs.
 Date Completed 6/24/13 Hammer Drop 30 in.
 Boring Method HSA Spoon Sampler OD 2 in.
 Driller J. Livingston Rig Type _____

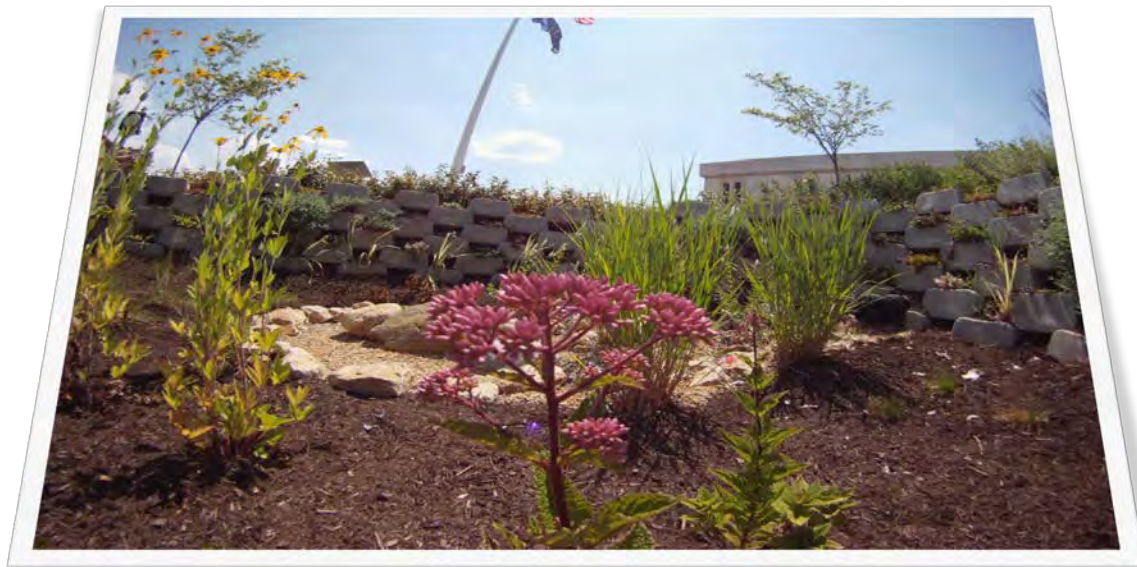
TEST DATA

STRATA ELEV.	SOIL CLASSIFICATION	Strata Depth	Depth Scale	Sample No.	Sample Type	Sampler Graphics Recovery Graphics	Ground Water	Standard Penetration Test, N - blows/foot	CU-1st Unconfined Compressive Strength	PP-1st Pocket Penetrometer	Moisture Content % Dry Unit Weigr (pcf)	Remarks
	2" Asphalt	0.1										
	8" Crushed Stone	0.9										
	Brown Silty CLAY with Sand and Gravel (FILL)		1	1	SS			10			21.4	
			5	2	SS			4	0.5	15.3		
	Brown, Dry Well Graded SAND		7.0	3	SS			18				
			10	4	SS			22				
	End of Boring at 11 feet	11.0										

Sample Type
 SS - Driven Split Spoon
 ST - Pressed Shelby Tube
 CA - Continuous Flight Auger
 RC - Rock Core
 CU - Cuttings
 CT - Continuous Tube

Groundwater
 ○ During Drilling Dry ft.
 ∇ At Completion Dry ft.
 ☒ Caved At Completion Dry ft.
 ▼ After 6 hours Dry ft.

Boring Method
 HSA - Hollow Stem Augers
 CFA - Continuous Flight Augers
 DC - Driving Casing
 MD - Mud Drilling



Bioretention Design

- *Aesthetics*

SWPPP Elements

• Demolition

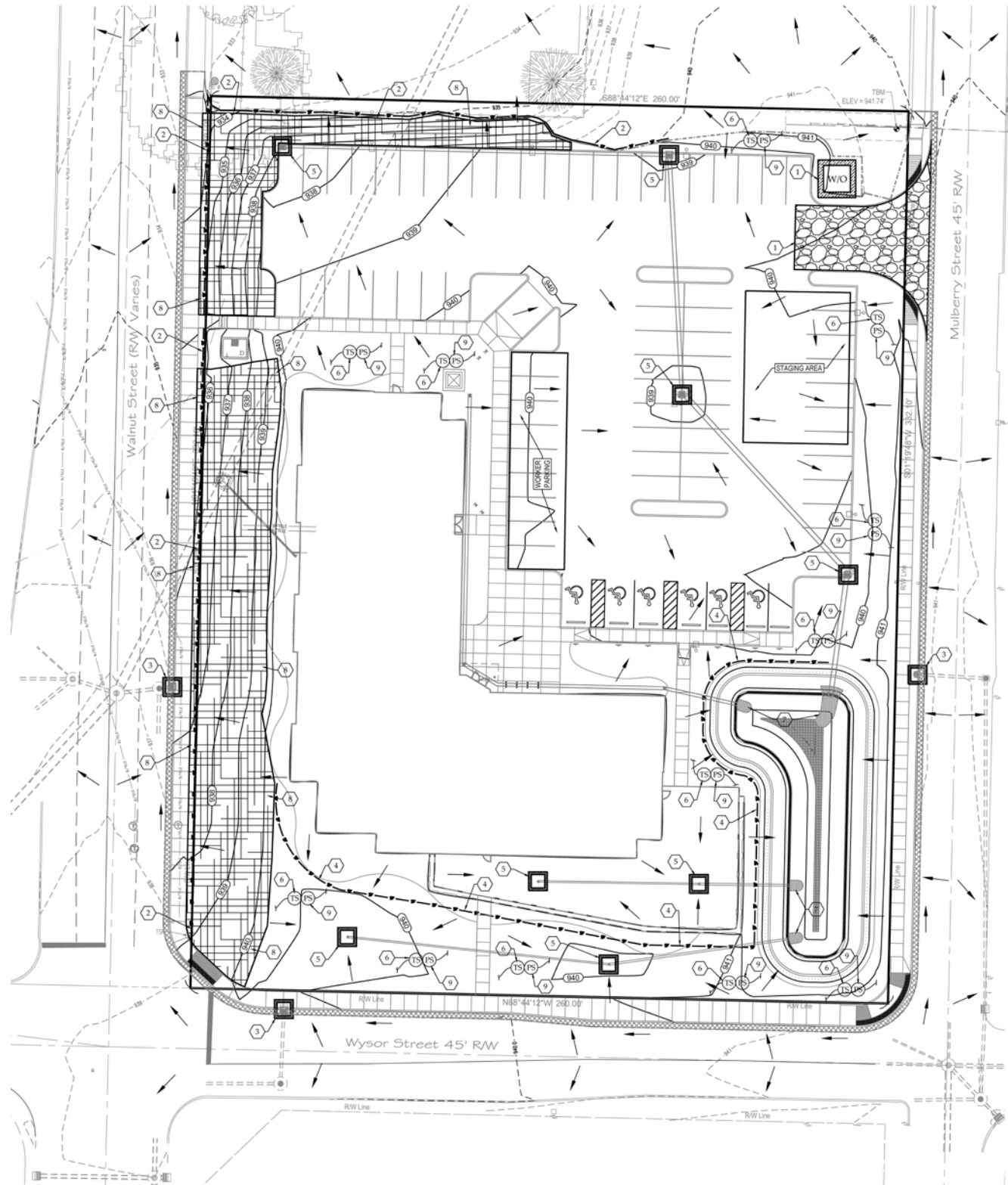
- Initial Construction Entrance
- Existing stone drive
- Perimeter Protection

• Construction and Staging

- Maintain Perimeter Protection
- Temporarily seed disturbed areas idle for more than 14 days
- Perimeter Protection around bioretention basin
- Inlet Protection

• Post Construction

- Maintain BMPs until NOT
- Permanently Seed all areas
- O&M Manual



Erosion and Sediment Control Staging Chart

Project Stage		Plan Ref. #	BMP Description	Anticipated Beg. Date	Remove after Stage	Notes
A	Prior to Land Disturbance	1	Constr. Entrance & Staging Area	Apr. 2014	D	Utilize existing entrance for initial site access. Construct new entrance according to specification/detail.
		2	Perimeter protection (silt fence)	Apr. 2014	F	Place near construction limits, remove after grading and installation of blankets or mats
B	Demolition & Rough Grading	3	Inlet Protection	Apr. 2014	E	Maintain Erosion Control Measures weekly and within 24 hours after each rain of 0.5 inch or more
				Apr. 2014	N/A	
C	Bldg Pad and Utility Install			May - June 2014	N/A	Maintain Erosion Control Measures weekly and within 24 hours after each rain of 0.5 inch or more
D	Bioretention Basin construction and Storm Sewer Install	4	Perimeter protection (silt fence)	July 2014	F	Place near top of basin, ±4' behind wall
		5	Inlet Protection	July 2014	E	Seed all disturbed areas, blankets or mats must be used on slopes 4:1 or steeper with upland flow > 100 ft.
		6	Temporary Seeding	July 2014	N/A	
		7	Outlet Energy Dissipator	July 2014	N/A	Permanent Erosion Control measure
E	Pavement Installation, Site Lighting Installation			Aug. 2014	N/A	Maintain Erosion Control Measures weekly and within 24 hours after each rain of 0.5 inch or more
				Aug. 2014	N/A	
F	Final Grading, Landscaping	8	Erosion Control Blankets or Mats	Aug. 2014	N/A	Seed all disturbed areas, blankets or mats must be used on slopes 4:1 or steeper with upland flow > 100 ft.
		9	Permanent Seeding	Aug. 2014	N/A	
G	After major construction activities, until closure of Land Disturbance permit			Sept. 2014	N/A	Sufficient quantities of mulch and tackifier must be used to promote germination and control erosion until vegetation is established.

SWPPP Elements

- *Construction Staging*

SWPPP Elements

- Series of small independent failures
 - Change in PM between demolition and next phase
 - Interruption in compliance flow
 - Failure to revisit the actual SWPPP to verify practices
 - Specified inlet protection type
 - Grading of a proposed swale on the western side of the building
 - Failure to communicate concerns
 - Failure to communicate that drilling would occur
 - Assumption that the other was watching
 - Overlooking BMP issues due to dry weather
 - Improper inlet protection
 - Failure to properly re-install inlet protection after paving
 - Lack of Bioretention perimeter protection
 - Tolerance of slow corrections on the part of the contractor



SWPPP Elements

- Solutions

- Continuously revisit the SWPPP to verify BMPs
- Communicate concerns when they occur
- Communicate concerns in advance if a problem is foreseen
- Be consistent, require immediate response to any and all violations





May 28, 2014

Demolition

- *Perimeter Protection*



June 18, 2014

Construction & Staging

- *Maintain Perimeter Protection*
- *Temporarily Seed disturbed areas*
- *Perimeter Protection (bioretention)*
- *Inlet Protection*



July 22, 2014

Construction & Staging

- *Maintain Perimeter Protection*
- *Temporarily Seed disturbed areas*
- *Perimeter Protection (bioretention)*
- *Inlet Protection*



Sept. 16, 2014

Construction & Staging

- *Maintain Perimeter Protection*
- *Temporarily Seed disturbed areas*
- *Perimeter Protection (bioretention)*
- *Inlet Protection*



Oct. 2, 2014

Construction & Staging

- *Maintain Perimeter Protection*
- *Temporarily Seed disturbed areas*
- *Perimeter Protection (bioretention)*
- *Inlet Protection*



Nov. 7, 2014

Construction & Staging

- *Maintain Perimeter Protection*
- *Temporarily Seed disturbed areas*
- *Perimeter Protection (bioretention)*
- *Inlet Protection*



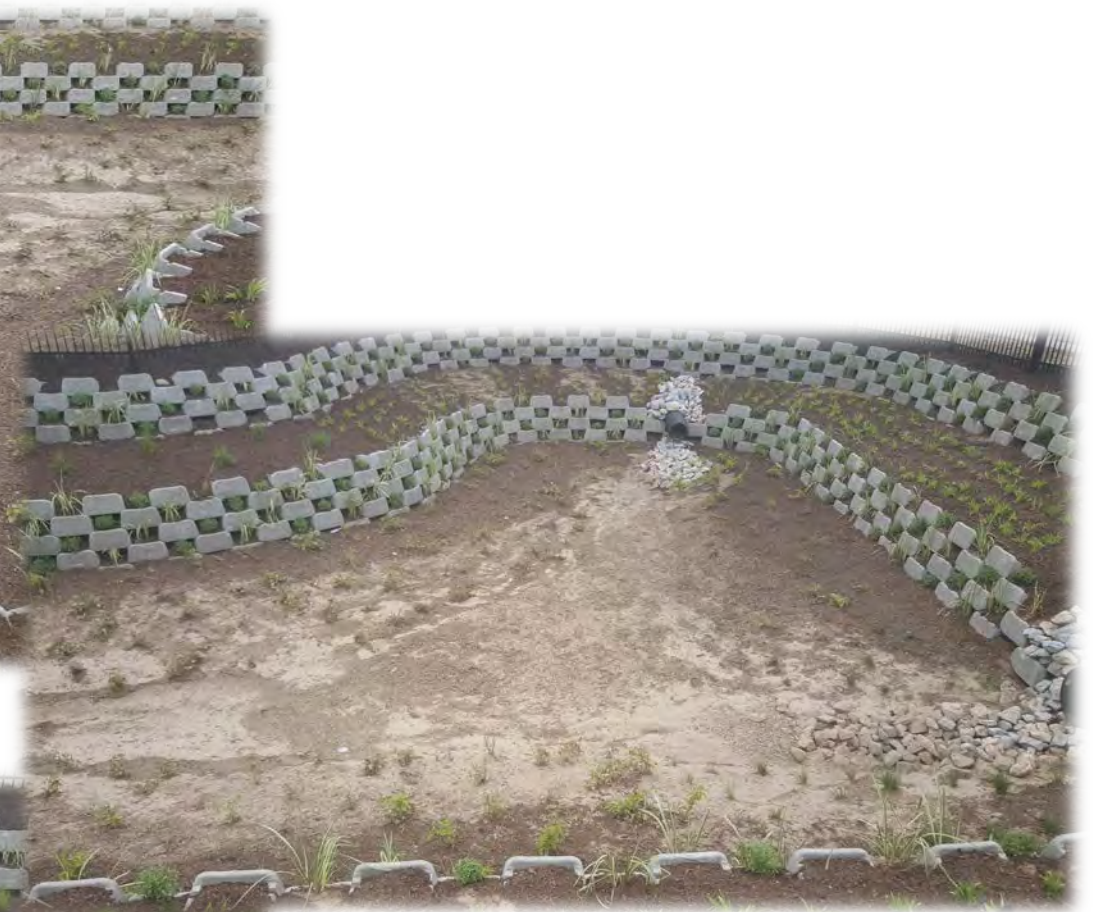
May 8, 2015



May 14, 2015

Post-Construction

- *Maintain BMPs until NOT*



May 14, 2015

Post-Construction

- *Maintain BMPs until NOT*



June 24, 2015

Post-Construction

- *Drilling of Well for Irrigation*
- ***STOP WORK ORDER ISSUED!***



June 24, 2015

Post-Construction

- *Drilling of Well for Irrigation*
- ***STOP WORK ORDER ISSUED!***



Remediation

1. Remove accumulated sediment from around inlets and haul offsite
2. Clean debris from storm sewer, structures and pipes
3. Seed/Sod all disturbed areas to be lawn
4. Removal of all sediment, stone, and dead plants from bioretention basin
5. Replace stone in infiltration trench
6. Place new plants and mulch in bioretention basin

Remediation took approximately 2 weeks and cost in excess of \$20K!

Sept. 24, 2015







Questions/Comments?



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