

Center for Environmental Excellence AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS





U.S. Department of Transportation Federal Highway Administration

Stormwater BMP Maintenance and Operations

CEE by AASHTO Stormwater Community of Practice October 18, 2018

# Center for Environmental Excellence

- Promotes environmental stewardship and encourages innovative ways to streamline the transportation delivery process.
- Provides technical assistance, training, information exchange, partnership-building opportunities, and quick and easy access to environmental tools.
- Provides a variety of products and services to assist transportation agencies in achieving environmental excellence, including:
  - Peer Exchanges
  - Practitioner's Handbooks
  - Communities of Practice
  - Webinars
  - Databases

https://environment.transportation.org/





### **AASHTO and FHWA**



# Melissa Savage AASHTO Center for Environmental Excellence



### Susan Jones, P.E.

Federal Highway Administration

## **Community of Practice Presenters**



#### **William Fletcher**

Oregon Department of Transportation



#### **Andy McDaniel**

North Carolina Department of Transportation



#### **Richard Heineman**

Pennsylvania Department of Transportation



#### **Kiona Leah**

Maryland Department of Transportation



Scott McGowen (Moderator)

Michael Baker International

## **Community of Practice Forum Overview**

#### Overview: State of the Practice Report

- William Fletcher, Oregon DOT
- PennDOT Stormwater Control Measure Maintenance
  - Richard Heineman, Pennsylvania DOT
- NCDOT's BMP Inspection & Maintenance Program: Past, Present, and Future
  - Andy McDaniel, North Carolina DOT
- Managing Maryland's Stormwater –
  One Road at a Time
  - Kiona Leah, Maryland DOT
- Community of Practice Forum
  - Scott McGowen, Michael Baker International
- Closing



### **Overview: State of the Practice Report**



#### **William Fletcher**

Water Resources Program Coordinator Oregon Department of Transportation

### State of the Practice Stormwater BMP Maintenance and Operations

William Fletcher Oregon Department of Transportation



### **Purpose and Goals**

- Provide an overview of how DOTs manage and implement their programs for maintaining stormwater treatment facilities.
- Identify issues that deserve research and need additional information
- Develop recommendations and suggestions on actions to assist and improve stormwater BMP maintenance programs



### **The Survey and Analysis**

27 DOTs responded!

44 questions in 8 categories

- General Criteria, Training, Tracking, Inspection, BMP Design, BMP Maintenance, Funding, and Asset Management
- Analyzed in 4 groups: Basics, Training and Personnel, Tracking and Reporting, and Program Administration
  - Each group's answers were discussed, summarized, and recommendations developed.
- Conclude with Future Research Needs

### **BMP Maintenance Basics**

- Wide range in the number of maintained facilities:
  0 to 6000!
- Inspection results trigger maintenance
- Guidance or criteria for identifying maintenance triggers
- BMP inspection and maintenance usually separate workflows



## **Training and Personnel**

### **Common (but not universal) elements:**

- Dedicated staff for BMP inspection and maintenance
- Formal BMP maintenance training
- Design documentation provided to Maintenance
- Maintenance and designers communicate about failures
- Formal handoffs between inspection and maintenance



## **Tools for Tracking and Reporting**

- Use of software for tracking inspection and maintenance very common
- Asset management programs for stormwater infrastructure also common
- Cost tracking common, but not always used for budgeting
- The full strength of these tools for tracking and budgeting is not often fully utilized



### **Program Administration**

- Stormwater maintenance costs not separated out from the total operation and maintenance budget
- Rare to have dedicated stormwater maintenance funding, or specific appropriation requests for it
- Outsourcing some or all BMP inspection and maintenance is common



### **Selected Recommendations and Suggestions**

- Refine inspection frequency based on results
- Automate/streamline maintenance need identification and action implementation
- Internal audits to assure inspection and maintenance
- Break out BMP maintenance budget from the total Maintenance budget
- Track individual BMP maintenance costs and include in the asset management program



### **Selected Research and Information Needs**

- Inspections: Developing criteria to optimize inspection schedules
- Training: Developing metrics for tying BMP performance to maintenance training
- Program Admin and Asset Management: Determining cost estimates for long term maintenance of BMPs



## Summing Up

- BMP maintenance is important, but comes in second to maintaining the roadways, so
- Efficiencies are important to reduce the strain on maintenance resources
- Good use of information technology and asset management can support efficiency, improve budgeting, and provide information for better BMP selection and design and documenting regulatory compliance



### PennDOT Stormwater Control Measure Maintenance



#### **Richard Heineman**

**Stormwater Section Manager** 

Pennsylvania Department of Transportation

### **PennDOT's SCM Maintenance Program**

- Pennsylvania Department of Transportation (PennDOT) is responsible for maintaining over 40,000 miles of stateowned roadway
- PennDOT's MS4 Permit Stormwater Control Measure (SCM) Operation and Maintenance Requirement
  - PENNDOT shall take necessary steps to ensure proper operation and function of the post construction stormwater management BMPs (SCMs) pursuant to 25 Pa. Code §102.
- SCM maintenance program is taking shape to address current and future long-term Operation and Maintenance commitments
  - New manual for personnel responsible for SCM maintenance PennDOT Pub. 888 – Stormwater Control Measure Maintenance Manual

### **SCM Maintenance Program**

### Pub. 888 – SCM Maintenance Manual

- Inventory procedures
  - IDs, adding/modifying data
- Inspections
  - Types and frequencies
  - Forms, report templates
  - Submitting and viewing results
- Maintenance
  - SCM specific procedures
  - Common SCM components
- Charging, recording, reporting
  - Assemblies and charge codes
  - Creating work notifications



STORMWATER CONTROL MEASURE MAINTENANCE



## **Central Office Organizational Chart**



### **SCM Inventory**

### Stormwater Control Measure (SCM) Inventory

- Development
  - No statewide inventory pre-2012
  - Some basins in 2012
  - Other SCMs 2015-2016
  - Protocol for inventory after construction
- Inventory Access
  - Maintenance-IQ
  - PennDOT local area network



### **SCM Inventory**

SCM_ID	SCM_TYPE_CODE	LATITUDE	LONGITUDE	DISTRICT_NO	COUNTY_NAME	ST_RT_NO	SECTION
0110 IBE 001	IBE	41.65071	-79.65443	01	Crawford	0089	A02
0110 IBE 002	IBE	41.65116	-79.65465	01	Crawford	0089	A02

- The SCM inventory contains 40+ separate fields: type and location, discharge location, maintenance access, inspection frequencies, etc.
- Unique 10-digit SCM ID assigned by BOMO

**0110** county code Erie

**IBE** SCM type infiltration berm **001** sequential # first assigned

### **Maintenance-IQ**

○ – SCM LOCATION



### **Current SCM Inventory**

### SCMs in inventory as of Spring 2018



### **Current SCM Inventory**

#### Breakdown of most common SCM types

General SCM Type	SCM Type Codes	Number of SCMs
Dry Detention Basins	BDD, BED, BUD, BND, BOT	499
Infiltration Basins	BID	211
Wet Basins	BWD	103
Bioretention	BRE,BRU	211
Infiltration Trenches	SIT	194
Infiltration Berms	IBE	87
Vegetated Swales	VSW, VSC	589
Vegetated Filter Strips	VSF, VSS	21
Manuf. Treat. Devices	MTD	123
Media Filter Drains	MFD	13
Stormwater Wetlands	SWE	11

### **SCM Inspection Types**

#### Visual screening

- Every 3 years for most SCM types
- Walk-around observations
- Identify common problems
- Inspector training
- One form used for all SCM types
- Effort = 1-2 hours



- Condition assessment
  - Initial and every 10 years
  - Hands-on observations (e.g., opening manholes, soil sampling)
  - Measurements and sketches
  - Inspector training
  - Report certified by a licensed professional
  - Effort = 1-3 days

### **SCM Maintenance**

#### Routine

- Regularly scheduled
- Minimally invasive preventative tasks
- Categories: grass, vegetation, litter control, sediment

#### Corrective

- Scheduled as-needed
- Correct problems and restore functionality of SCM
- Tiers: 6-month, 4-week, immediate response

### **Preventative SCM Maintenance**

Table 4.2.1: Routine Maintenance Frequency by SCM Category

SCM	Grass Maint.	Vegetation Mgmt.	Litter Control	, Sediment Removal
Basin (BDD, BED, BUD, BOT, BND, BWD)	0	•	•	0
Bioretention (BRE, BRU)	•	0	•	0
Filter (CSF, MFD)	•	•	•	•
Infiltration (BID, IBE, SIT)	ο	•	•	0
Manuf. Treatment Device (MTD)	х	х	-	ο
Permeable Pavement (PPA, PPC, PPP)	-	Х	0	0
Riparian Buffer (RBE, RBO)	х	0	0	х
Stormwater Wetland (SWE)	•	•	•	0
Subsurface Detention (SDS)	х	Х	0	0
Vegetated Filter Strip (VFS, VSS)	•	0	•	0
Vegetated Swale (VSW, VSC)	ο	●	•	0
Key: X N/A	O As Needed	• Annual	<b>O</b> Semi-annual	Monthly

### **Visual Screening Inspection**

- Visual Screening Ratings SCM Component Condition
  - 0 = No Action
  - 1 = Routine (per maintenance schedule)
  - 2 = Corrective (6-month response)
  - 3 = Corrective (4-week response)
  - 4 = Emergency (immediate response)
  - 5 = Environmental/Engineering Evaluation
- Environmental/Engineering (E/E) Evaluation Used when SCM problems are difficult to rate or cannot be corrected through normal corrective maintenance

## **Visual Screening Inspection**

- ProblemCategories
  - Debris/Trash
  - Erosion
  - Ponding
  - Vegetation
  - Miscellaneous

Ca	tg.	Location/Type
- s/Trash		A. Anti-skid material accumulation
	-	B. Inflow channel(s)
	as!	C. Side slopes
	5/T	D. Sediment forebay or micropool
	bri	E. SCM floor/surface or within SCM
	De	F. Outlet/dewatering structure
		G. Other (describe)
		A. Inflow channel(s)
2	ion	B. SCM bottom or side slopes
2	ros	C. Outlet/outfall
	ш	D. Emergency spillway
1		A. Standing water
2	ling	B. Subsurface storage not draining
3	onc	C. Permanent pool water level very low or dry
	ď	D. Other signs of poor drainage (describe)
		A. Growth impeding inflow or outflow
	E	B. Significant plant mortality
	atic	C. Non-uniform grass coverage (bare areas)
4	get	D. Woody vegetation in embankment
	Ve	E. Presence of hydrophytic vegetation
	1	F. Vegetation impeding access to SCM

A. Temporary ESPC measures present B. Structural damage or deterioration C. Sediment build-up in or on SCM surface D. Signs of ground compaction/settlement E. Evidence of sinkhole activity F. Contamination (e.g. gas, oil, pet waste) G. Evidence of burrowing animals H. Other (describe)

### 650 inspections as of July 2018

Conoral SCM Type	# of SCMs	
General Scivi Type	Inspected	
Basin	309	
Bioretention	33	
Infiltration	125	
Restoration	8	
Riparian Buffer	1	
Stormwater Wetland	9	
Vegetated Filter Strip	7	
Vegetated Swale	127	
Filter	5	
Manuf. Treat. Device	16	
Other	10	



- Inspections have documented over 2,000 problems
- 55% of problems noted required corrective maintenance or an E/E evaluation

Problem	Any Problem	Corrective Maintenance	Engineering Evaluation	
Category	Action Code 0-5*	Action Code 2-4*	Action Code 5*	
Debris/Trash	433	157	5	
Erosion	232	152	21	
Ponding	246	25	149	
Vegetation	745	243	123	
Miscellaneous	349	159	59	
Total	2005	736	357	

\*Action Code: 0 = No Action, 1 = Routine Maintenance, 2-4 = Corrective Maintenance, 5 = Engineering Evaluation

### Most common problems

Problem	Most Common		Second Most Common		
Category	Problem Type	Number	Problem Type	Number	
Debris/Trash	Inflow Channels	118	SCM Floor/Surface or in SCM	104	
Erosion	SCM Bottom Side Slopes	87	Inflow Channels	84	
Ponding	Standing Water	167	Other Signs of Poor Drainage	59	
Vegetation	Hydrophytic Vegetation	257	Wood Vegetation in Embankment	199	
Miscellaneous	Sediment Build-Up	108	Other (Type Varied)	76	







#### **Basins**

- Every problem category represented
- Most E/E evaluation requests are for standing water in dry basins

#### **Bioretention**

Mostly minor problems noted (localized erosion and sediment/debris accumulations)

### Infiltration

Most problems symptomatic of poor infiltration

#### <u>Swales</u>

- Problems related to change in intended flow pattern (erosion and obstructions)
- Missing components (e.g., check dams) led to requests for engineering evaluations

### Conclusions

- Many facilities will need rehabilitation due to lack of upkeep and a formal SCM operation and maintenance
- Extent of corrective maintenance and E/E evaluations noted was expected as many existing SCMs were inspected for the first time





### Conclusions

- Bioretention has relatively few problems, which may be attributable to design parameters:
  - Shallow ponding depths
  - Native plants
  - Small drainage areas
- Ponding issues are prevalent in basins designed to dry cycle
- Standing water leads to other problems in SCMs
- Infiltration SCM problems are all related to poor dewatering, which could be traced to both design and construction
### Recommendations

- In-depth condition assessments are needed to determine cause of ponding issues (e.g., design, construction, lack of maintenance) in SCMs designed to dry cycle
- Provide training for construction inspectors to ensure critical stages of SCM construction are observed
- Department representative to perform QA/QC of as-built stormwater plan
- Improve design and construction guidelines for infiltration SCMs
- Facilitate coordination between Design, Construction, and Maintenance on SCM selection and implementation

### NCDOT's BMP Inspection & Maintenance Program: Past, Present, and Future



#### **Andrew McDaniel**

Manager, Highway Stormwater Program North Carolina Department of Transportation

### **NCDOT's BMP I&M Program**

- Past: Accomplishments and challenges
- Present: What we're working on today
- Future: What we hope to achieve moving forward



### **NPDES Permit Background**

- NPDES permit covers most all NCDOT activities across the state
- ~ 80,000 miles of state-maintained roads
- > 200 industrial facilities (maintenance yards, etc.)
- BMP Implementation and Maintenance requirements began in 2005



### **NPDES Permit Requirements**

- Maintain a BMP Inspection and Maintenance Manual
- Implement a BMP Inspection and Maintenance Program
- Evaluate Inspection and Maintenance needs for new BMP types
- Annual training

STATE OF NORTH CAROLINA DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES DIVISION OF ENERGY, MINERAL AND LAND RESOURCES PERMIT NO. NCS100250

TO DISCHARGE STORMWATER AND BORROW PIT WASTEWATER UNDER THE

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

In compliance with the provisions of North Carolina General Statute 143-215.1, other lawful standards and regularises generaligated and adopted by the North Carolina Environmental Maragement Commission, and the Federal Water Pollution Control Act, as amonded,

#### North Carolina Department of Transportation

is hardy authorized to discharge benowe pit seatements and stemwards from construction activities and the North Carolinos Department of Transportation (NCDDT) Transportation Separate Storm Severe System (TS4) located statewide in accordance with the discharge limitations, menitoring requirements, and other conditions set forth in Parts I, II, ID, IV, v, VI VII and VIII howeff.

This permit shall become effective October 1, 2015.

This permit and the authorization to discharge shall expire at midnight on September 30, 2020.

Signed this day September 11, 2015.

tor Mineral and Land Resources

### **Past Accomplishments and Challenges**

What kinds of BMPs do we have and where are they?



### **2006 BMP Inventory Survey**

- Written survey:
  - Division staff
  - Central office design staff
- Field investigations
- Initial inventory yielded ~ 410 BMPs



### **BMP I&M Manual**

#### I&M Manual

- Fifteen Chapters
  - General I&M Chapters (1-4)
  - Bioretention basin
  - Filtration basin
  - Infiltration basin
  - Detention basins-Dry and Wet
  - Hazardous Spill Basin
  - 🔨 Stormwater wetland
  - Swale
  - Level Spreader
  - Permeable Pavement
  - Preformed Scour Hole
- Individual BMP Chapter Contents
  - BMP Overview
  - BMP Components Description
  - I&M Procedures
- Inspection Checklists
- BMP Naming Convention

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

STORMWATER CONTROL INSPECTION AND MAINTENANCE MANUAL (LAST UPDATED: MAY 2015)





North Carolina Department of Transportation



### **Illustrations Depicting Major Components**



above diagram may depict, but rely on water conveyances such as ditches, swales, and buffers to transport treated runoff to the nearest river, lake, or stream.

### **Illustrations Depicting How It Works**



### **Level of Service Ratings**

### Level of Service (LOS)

- A No maintenance needs
- B Minor maintenance needs
- C Moderate maintenance needs
- D Major maintenance needs
- F BMP not functional

STOR BMP I DIVIS COUN DATE LOCA	MWATE D#: ION: TY: INSTAL TION:	R BMP: LED:	BIORETENTION BASIN       Inspector(s):         Inspection Date:       Inspection Date:
			Structural Components
Y	N	N/A	
			Inlet/outlet drainage systems are structurally sound and functional.
			Forebay and transition berm are structurally sound and functional.
			Basin, embankment, and emergency spillway are structurally sound and functional.
			(Sediment must be removed from the basin when it exceeds 50% or more of the
			forebay's storage capacity.) Filter models and endering including characteristic and the structure like sound and
			Futer media and underdrain, including cleanouts, appear to be structurally sound and functional.
			Outlet control structure and components are structurally sound and functional.
			A mark of Maintenance
v	N	N/A	Areas of Mannenance
ċ.			Inlet and outlet ditches/pipes are free of sediment, leaves, trash, and other debris.
_	_	_	Forebay is clean and free of sediment, leaves, trash, and other debris. (Sediment must
			be removed when it exceeds 50% or more of the forebay's storage capacity.)
			Grass has been mowed and undesirable vegetation removed.
			Plants are healthy and mulch layer is adequate (at least 3 inches).
			Basin is free of standing water.
			Areas of erosion have been repaired.
			Trash rack is unobstructed and free of sediment, leaves, trash, and other debris.
Y	N		
			Are structural repairs needed at this site? (If yes, describe in Comments.)
			Is any maintenance necessary at this site? (If yes, describe in Comments.)
			Were maintenance activities conducted at the time of inspection?
			(II ves, describe in Comments.)

Comments/Recommendations/Actions Taken:

LOS Category	LOS Description
A	Some aging and wear has occurred, but no structural deterioration or maintenance needs were found. Device is functioning properly.
В	Minor structural deterioration and/or maintenance needs were found, but function of the device has not been affected.
С	Moderate structural deterioration and/or maintenance needs were found, but function of the device has not been significantly affected.
D	Serious deterioration in at least one structural component and/or major maintenance needs were found. Function of the device is inadequate.
F	Device is no longer functional due to the general or complete failure of a major structural component and/or the lack of adequate maintenance.

### **Stormwater Control Management System**

#### SCMS – authenticated web based application



## ~ 1,900 BMPs in the SCMS Database

	RTH CAROLINA DEPARTMENT	OF TRANSPOR	RTATION						
Connecting people an to enhance the econo	d places safely and efficiently, v my, health and well-being of No	with accountabi orth Carolina.	lity and en	vironmental sensitivity			() <b>m</b>	eholman :	logout
Bi	isiness DMV	Newsroo	m	Programs P	rojects	Travel	& Maps		
SCMS									
Search Controls	Search Results						Rec	ently Constru	icted =
Maps									
Control Map	Control ID	Division	County	ПР	Retrofit	Route	Town	Phase	SMP
Control LOS Map	1 IM-5-32-DDB-212	1 5	Durham	I-306C(DDB1)	No		Durham	Maintenance	No
Inspection and	2 IM-5-32-DDB-239	9 5	Durham	B-2552(DDB1)	No		Bahama	Maintenance	No
Maintenance	3 IM-5-32-DDB-240	0 5	Durham	B-2552(DDB2)	No		Bahama	Maintenance	No
Add New Control	4 IM-5-32-WDB-212	25 5	Durham	1-306(WDP1)	No		Durham	Maintenance	No
Add New	5 IM-5-32-SW-1631	5	Durham	I-306DB(SWWL)	No		Durham	Maintenance	No
Nonstructural Control	6 IM-5-32-SW-3053	1 5	Durham	1-0306DB	No		Durham	Maintenance	No
Inspections Overdue	7 IM-5-32-SW-3054						Durham		
Maintenance Needed	8 IM-5-32-SW-3055								
I & M Manual	9 IM-5-32-SW-3056								
BMP Toobox	10 IM-5-32-5-2398	5	Durham	B-3528(GS1)	No		Bethesda	Maintenance	No
19 M Ouldk Guide	11 IM-5-32-5-2691	5	Durham	U-4009(GS1)	No		Durham	Maintenance	No
	12 IM-5-32-5-2692	5	Durham	U-4009(GS2)	No		Durham	Maintenance	No
Design Quick Guide	13 IM-5-32-S-2123	5	Durham	I-306C(GS3)	No		Durham	Maintenance	No
SC Inventory	14 IM-5-32-5-2124	5	Durham	I-306(GS1)	No		Durham	Maintenance	No
LOS Report	15 IM-5-32-S-2128	5	Durham	I-306C(GS2)	No		Durham	Maintenance	No
LOS Assessment	16 IM-5-32-5-2129	5	Durham	I-306C(GS5)	No		Durham	Maintenance	No
Report	17 IM-5-32-S-2186	5	Durham	R-2000AC(GS9)	No		Morrisville	Maintenance	No
Retrofit Credits	18 IM-5-32-S-2187	5	Durham	R-2000AC(GS8)	No		Morrisville	Maintenance	No
Retrofit Listing	19 IM-5-32-5-2189	5	Durham	R-2000AC(GS7)	No		Morrisville	Maintenance	No
SC Summary	20 IM-5-32-S-2190	5	Durham	R-2000AC(GS6)	No		Morrisville	Maintenance	No
SC Location	21 IM-5-32-S-2191	5	Durham	R-2000AC(GS5)	No		Morrisville	Maintenance	No
SC Funding	22 IM-5-32-S-2192	5	Durham	R-2000AC(GS3)	No		Morrisville	Maintenance	No
SC Permitted	23 IM-5-32-S-2193	5	Durham	R-2000AC(GS4)	No		Morrisville	Maintenance	No
SC Construction	24 IM-5-32-S-2194	5	Durham	R-2000AC(GS1)	No		Morrisville	Maintenance	No
SC Not Manad	25 IM-5-32-S-2195	5	Durham	R-2000AC(GS11)	No		Morrisville	Maintenance	No
Sc Not Happed	26 IM-5-32-S-2196	5	Durham	R-2000AC(GS10)	No		Morrisville	Maintenance	No
Research Summary	27 IM-5-32-S-2197	5	Durham	R-2000AC(GS12)	No		Morrisville	Maintenance	No
Admin	28 IM-5-92-S-2200	5	Durham	R-2000AC(GS2)	No		Morrisville	Maintenance	No No
Manual Credits	29 IM-5-32-S-2120	5	Durham	1-306C(GS4)	No		Durham	Maintenance	No
User Management	30 IM-5-32-LS-2126	5	Durham	I-306C(LS3)	No		Durham	Maintenance	No No
Control Types	31 IM-5-32-LS-2656	5	Durham	I-306C(LS1)	No		Durham	Maintenance	No
Inspection Report	32 IM-5-32-LS-2657	5	Durham	I-306C(LS2)	No		Durham	Maintenance	No
Questions	33 IM-5-32-PSH-267	3 5	Durham	B-3450(PSH1)	No		Durham	Maintenance	e No
	34 IM-5-32-PSH-267	4 5	Durham	B-3450(PSH2)	No		Durham	Maintenance	No
	35 IM-5-32-PSH-267	5 5	Durham	B-3450(PSH3)	No		Durham	Maintenance	No
	36 IM-5-32-PSH-267	6 5	Durham	B-3450(PSH4)	No		Durham	Maintenance	No
	37 IM-5-32-PSH-267	<u>Z</u> 5	Durham	B-3450(PSH5)	No		Durham	Maintenance	No
	38 IM-5-32-PSH-268	4 5	Durham	R-2904(PSH1)	No		Durham	Maintenance	No
	39 IM-5-32-PSH-268	5 5	Durham	R-2904(PSH2)	No		Durham	Maintenance	No
	40 IM-5-32-PSH-268	6 5	Durham	R-2904(PSH3)	No		Durham	Maintenance	No
	41 IM-5-32-PSH-268	Z 5	Durham	R-2904(PSH4)	No		Durham	Maintenance	No
	42 IM-5-32-PSH-268	8 5	Durham	R-2904(PSH5AandPSH	15B) No		Durham	Maintenance	No
	43 IM-5-32-PSH-268	2 5	Durham	R-2904(PSH6)	No		Durham	Maintenance	No
	44 IM-5-32-PSH-269	0 5	Durham	R-2904(PSH7)	No		Durham	Maintenance	No
	45 IM-5-32-PSH-270	0 5	Durham	11-4026(PSH4)	No		Durham	Maintenance	No

### **SCMS Stores Data For Individual BMPs**

	Cont	trol ID: I	4-10-60	-IB-256	i9 Pha	se: Maint	enanc	е Тур	e: Infi	tration	Basin (I	(B)
General	Hydrologic	Design	Construe	tion D	etails	Document	s Im	ages /	Admin			
Ouick	Links											
Quick	LIIKS											
Inspec	tion and M	aintenan	ce									
View C	Control Map	)										
Back t	o Search											
Gene	ral Infor	matio	n									
		macro	-									
			County:	Meckle	enburg	•						
		Contro	ol Type:	Infiltra	ition B	asin (IB)				•		
		Con	trol ID:	IM-10-	60-IB-	2569						
		Hy	dro ID:	D10_C	060_00	011						
		F	Retrofit:	<ul> <li>✓</li> </ul>								
			TIP:	SC-256	9							
		Roa	ad Tier:	Secon	dary 🔻							
		Tie	r Type:	-Selec	t-	•						
		*Rout	e Type:	SR	T							
			*Route:	1784 (F	Rozzel	les Ferry	Rd)					
		Ro	moved:					Contro	l has l	been rei	moved	from the
		Re	moveu.	ground.								
		Neares	t Town:	Charlot	te							
		L	atitude:	35.283	1900							
		Lor	ngitude:	-80.92	13700							

Location Description: Paw Creek Maintenance Yard 6820 Rozzelles Ferry Rd Charlotte, NC 28214

Location Type: County Maintenance Yard (CMY) 🔻

Notes Keywords: Located in SW portion of yard behind bulk storage bins

### SCMS Stores Both Inspection and Maintenance Data

Control ID: IM-10-60-IB-2569 Phase: Maintenance Type: Infiltration	on Basin (IB)			
General Hydrologic Design Construction Details Documents Images Admin				
Images				
Photo Date: 11/5/2012 States: Post-Construction • Image Type: Construction • Description:	Photo Date: 1/28/2013 Status: Post-Construction V Image Type: Maintenance V Description:			
Photo Date: [J/28/2013 Status: [Pot <construction th="" •]<=""><th>Und Photo Date: 2/11/2016 Status: Inspection</th><th><u>fate Delete</u></th><th></th><th></th></construction>	Und Photo Date: 2/11/2016 Status: Inspection	<u>fate Delete</u>		
Description:	Image Type: Maintenance • Description:	Location Type Date Inspectior Performed Reporter LOS Ranking	County Maintenance Yard (CMY) 09/04/2016 sujit_ekka B - Minor maintenance needs found but funct	ioning properly.
Update Delate		Report Type Questions:	Inspection V Y N N/A	
			<ul> <li>Inlet and outlet drainage systems a and functional.</li> </ul>	and flow bypass structure are structurally sound
			Pretreatment BMP and filter strip/s	wale are structurally sound and functional.
			and functional.	cy spillway (if present) are structurally sound
		C	<ul> <li>Emergency outlet control structure,</li> </ul>	, sluice gate, and trash rack are structurally
			<ul> <li>All components are free of sediment</li> </ul>	nt, leaves, trash, and other debris.
			Sediment was removed from foreba	ay if capacity was reduced to 50% or less.
			<ul> <li>Basin sidewalls and surrounding are grass maintained at a height of 6–1</li> </ul>	eas are stabilized with a dense cover of turt 15 inches.
			Basin bottom has adequate cover (	4" of sand or dense turf grass 6-15" in height).
			Sediment was removed from basin Areas of erosion have been repaired	if soil media appeared to be clogged.
			<ul> <li>Are structural repairs needed at this</li> </ul>	is site? (If yes, describe in Comments section)
			Are there maintenance needs at thi	is site? (If yes, describe in Comments section)
			<ul> <li>were maintenance activities conduct describe in Comments section)</li> </ul>	cted during the time of inspection? (If yes,
		Inspection		
	Ob	oservations/Comments		

### **Present Accomplishments and Challenges**

- Inspection and maintenance optimization
- Training and recordkeeping
- Inspection and Maintenance manual upkeep

## **I&M Optimization**

- Preformed Scour holes (PSH)
- Swales

Dry detention basins



Preformed Scour Hole





**Dry Detention Basin** 

Swale

### **Preformed Scour Holes**

- The Problem: Difficult to access often located at the bottom of a fill slope
- The Question: Do preformed scour holes need to be inspected and maintained every year?



### **PSH Condition Assessment**

#### Initial study conducted in 2013

- Findings: For properly sited and constructed PSHs, failure does not increase with age of BMP. Almost all PSH failures were attributable to improper siting and/or construction.
- Result: Optimized I&M frequency
  - Inspect after construction
  - Inspect after 1 year, and if good,
  - ✓ No further I&M requirements
- Follow-up study conducted in 2017
  - Findings: Same as in 2013
  - Result: Retain optimized PSH I&M frequency



PSH failure due to improper siting and construction

### **Swale Condition Assessment**

- Currently under study...
- The Problem: Resource intensive to inspect due to large number of swales across the state; not all swales sited within routine roadside mowing pattern.
- Goal:
  - Develop an optimized I&M policy for swales
  - Siting guidance to take advantage of routine roadside mowing



### **Dry Detention Basin Assessment**

- Currently being researched by NC State University
- The Problem: Regular vegetation management required, not typically performed by routine roadside mowing operations
- Goal:
  - If appropriate, develop an optimized I&M policy





### **Future Goals and Challenges**

- Improve cost tracking common issue identified in the State-of-the-Practice report
- Pilot I&M outsourcing model
  - Initially inspections only
  - Ultimately maintenance too
- Increase training options
  - Leverage university I&M certification programs
  - On-demand video training



## **Thank You!**

Google (	ncdot stormwater	۹
	All News Images Shopping Maps More Settings	Tools
	About 58,100 results (0.43 seconds)	
	Highway Stormwater Program (HSP) - Connect NCDOT https://connect.ncdot.gov → Connect NCDOT → Resources → Hydraulics ▼ The Highway Stormwater Program (HSP) was established in 1998 as an NCDOT-wide initiative to protect and improve water quality while fulfilling NCDOT's You've visited this page 5 times. Last visit: 9/20/18	
	People also search for	×
	ncdot smp ncdot rainfall intensity	
	ncdot pcsp guidelines for drainage studies ncdot	
	ncdot infiltration basin ncdot permit drawings	



### Managing Maryland's Stormwater – One Road at a Time An Overview of the MDOT SHA Drainage and Stormwater Assets Management Program



#### Kiona Leah, P.E.

Drainage and SWM Assets Manager Maryland Department of Transportation

## Managing Maryland's Stormwater – One Road at a Time Kiona Leah, P.E.



An Overview of the MDOT SHA Drainage and Stormwater Assets Management Program October 18, 2018

### **Maryland in a Snapshot**



## **Maryland NPDES in a Snapshot**

Howard

é Geor

Frederick 15

Montgome ry County Harford County

- As of June 30, 2018, MDOT SHA, within the MS4 coverage area, includes
- over 7,800 permanent stormwater management facilities and ESD practices;
- nearly 123,000 hydraulic structures; and
- almost 100,000 conveyances (nearly 7 million linear feet).

### **Program Operation Snapshot**

**E. Future Focus** Business Process Improvements Additional Program Support

**D. Operations** Minor Maintenance Routine Maintenance Procedures

**C.** Construction

Area Wide Contracts, Bid -Build Contracts Design Build Contracts, MOUs, Immediate Response

> **B. Engineering** Remediation Rating

Work Order Generation, Retrofit Design

#### **A. Planning**

Inspections & Inventory, Performance Rating, Data Management

#### Inspections and Inventory

- Triennial in NPDES Counties
- Regularly in all others
- Evolving Technology and Efficiency



#### **Inspections and Inventory**

- BMP Inventory
  - BMP ID Number
  - In Stream
  - Location
  - Road Name
  - Fence
  - Dam

- BMP Inspection
  - BMP ID Number
- 33 Inspection
   Parameters for
   Triennial
  - Road Name
  - Fence
  - Dam
  - Debris
  - Inflow Conditions
  - Vegetation
  - Ponding
  - Access
  - Mowability
  - Emergency Spillway
  - Orifice
  - Riser
  - Outfall
  - Other inspection protocols for annual, as built and emergency inspections

### Performance Ratings

• A <u>No Issues</u> – The SWM facility is functioning as designed with no adverse conditions identified.





- B <u>Minor Problems</u> The SWM facility is functioning as designed but minor issues are observed that may worsen to the next rating level if not repaired.
- C <u>Moderate Problems</u> The SWM facility is functioning as designed but efficiency, performance, and function are at risk.





- **D** <u>Major Problems</u> The SWM facility no longer functions as designed, and efficiency has been compromised.
- **E** <u>Severe Problems</u> The SWM facility no longer functions as designed and efficiency as well as several critical parameters have been significantly compromised.

### Data Management

- Extensive and Complex SQL database that is viewed primarily through Esri tools, both internal and external.
- Collector and Survey 1-2-3 are used for inventory and inspections
  - SWM Facilities
  - Video Pipe Inspection
  - Outfall Inspection



#### Data Management

- ArcGIS Online tools often create the interface from field tools to office planning tools.
  - HHD Web Research App
  - NPDES Field Data App
- Enterprise GIS (eGIS) internal operations and interface with data.
  - Inspections and Ratings Tab
  - Maintenance and Permit Tracking Tab

SWM Fac	cilities					
Selection	Results	Reports	Reserve	SWMFAC	Adm	
Selected :	SWM Facilities	1				
SWMF A	Subcategory	County	/	Watershed	Contrac	
020809	werroo		e Aruna	02130900	99-	
SWMFAC	Sheet Er	able Editing	Add	Delete	Edi	
Gen Solor	thy Pating Dat	LOC	Detine D	Cont		
<ul> <li>Select</li> </ul>	ct by Inspection	Date	Inspectio	n Date: 0	8/10/20	
<	BMP Mainte	nance 1 of:	2 >	Ade	d	
Field			Value			
EPD Cor	mments		Possit	le JPA requir	ed; Mair	
Wetland	Wtrwy. Permit					
JPA Sent	to Agency					
JPA Appr	oval					
EPLD Er	iviro. Coord.		True			

# **Program Engineering**

### Remediation (Action) Rating

I <u>No Action</u>— schedule for annual maintenance in next cycle





- II <u>Routine Maintenance</u> *attention needed* to sustain BMP performance- vegetation management, mowing, trash removal, minor sediment removal, wildlife control (beaver issues)
- III <u>Remediation Work Order</u> is needed to return the site to original functionality within the existing footprint of the facility. Structural defects include excess brush and trees, excess sediment dredging, infiltration media replacement, outfall failure or blockage. Historically also slope erosion, structural damage





IV <u>Retrofit/Enhancement Design</u> – is required on-site or at another location, since BMP cannot be returned to its original functionality by maintenance or remediation activities; typically BMP type is changed and functionality upgraded to meet current standards

### **Program Engineering**

#### Work Order Generation

#### Traditional Reporting and Needs

- BMP Maintenance Report
  - Based on additional field assessment once assigned
  - Location Map
  - Maintenance Work Order
  - Maintenance Plan
  - Cost Estimate
  - As Built Plans and Details
- Developed in approximately 16 manhours

#### Traditional Permit Requirements

- MDOT SHA General Permit Allowed
  - Clearing and Grubbing
  - Sediment Removal
  - Slope and Structural Repairs
  - Pipe Cleaning
  - Facility Dredging

#### **Average Number of Facilities Maintained Annually ~ 100**

D LOCATION OF RECOMMENDED WORK MP 15271

BMP ID # 15218

BMP Type Retention Fond Contract # M-528-501-371

Inspector: G. Islew / J. Smith retion Rating: Il SHA Rating: II

Action enove lock and chain from access gat

NOT TO SCALL

MP # 15218

County Montgomery Read: MD-07 Location: MD 124 near ADC Ond: 18, H12, 2003

sded Rating: III sert Contact: Groug Jakes

ce lock and chain when work is do

and to a level where the cattails

over the trush of the inflow.

Maintenance Perfor

nkmeet according to the Special Proice Removal and Vegetation Manage outside of SHA right-of-way. Use p to determine limits of right-of-way, smally the right-of-way limit. DO N as this may demand the emberitment

FROKE

## **Program Engineering**

### Work Order Generation

#### Current Reporting and Needs

- BMP Remediation Work Order
  - Based on additional field assessment once assigned
  - Location Map
  - Erosion/Sediment Control General Notes, Details, Sequence of Construction
  - Remediation Action List
  - Erosion Sediment Control Exhibits
  - Detailed Design Plan Blowup
  - Remediation Figures and As Built Plans
  - Remediation Verification Form
  - Maintenance of Traffic
  - Inspection Report
- Development Time 64–240 hours
- BMP Remediation Design Report
  - Site and Computation Summary
  - MD Pond Code 378 Flow Chart
  - SWM Design Report and Mapping Excerpts


# **Program Engineering**

#### Work Order Generation

- MDE Environmental Permitting
  - Joint Permit Applications
  - Delineation and permitting for wetlands



- MDE Pilot Program
  - Tree Removal Standards vary
  - Dam Classification
  - 5-Phase Joint coordination should benefit all



3. CONTRACTOR DATA NOT READED THESE LEADER THAN A EXEMPTION AT READE VALUE THEORY OF A CULTANOISM ANY CONTRACT AS IT ADDRESS THE DATA TOUCHNOT THE THEORYTH AND POLYTHE ZONG MATCHING AND A POLYTH AND POLYTH ZONG MATCHING AND A POLYTH AND POLYTH AND ANY THE MATCHING ACCEPTOR IN COMPACTING AND ANY THE CONTRACT.

A DEWARDE SWE FROLETY AS INDEXED TO FROME ACCOUNT ACCESS TO FERVIORE STEPS IN THE ACTION INTO LET SHOW THE WORK OPERACEDERING, DETERS ACQUIRES IN THE WOR REMARKED ACTION FROMEWORK SHOWS OF CONSINCTION 1997.

INVERSION SET OF



# **Program Engineering**

#### Retrofit Design

- DBOM (Design/Build/Operations and Maintenance Contracts)
- TMDL adds to the retrofit list, so double bonus
- Contractor feedback indicates this is easier for them







Before

During

#### **Program Construction**

- Area Wide Contracts
- Bid Build Contracts
- Design Build Contracts
- Memorandum of Understanding (MOU)
- Immediate Response



# **Program Operations**

#### Coordination with other Offices

- Outreach thru the MDOT SHA website
- Development of location Apps
- Minor Maintenance
- Routine Maintenance
- Manuals







### **Program Future Focus**

- Maintenance Location Apps
- **File Scans Search Function** 
  - Quick search for file management
  - Available to all inside MDOT SHA

File Scans			
≡ Search Log	)		
130228	SWMFAC	File Name	Contract
Search found 8 files. Search within rt	<u>130228</u>	MD 100\HO 661-504-770\BMP_130228 \130228 - Facility Map.pdf	<u>H0661504770</u>
	<u>130228</u>	MD 100\HO 661-504-770\BMP_130228 \130228 - Pe Calculation Result.pdf	<u>H0661504770</u>
	<u>130228</u>	MD 100\HO 661-504-770\BMP_130228 \130228 Plan 24.tif	<u>H0661504770</u>
	<u>130228</u>	MD 100\HO 661-504-770\BMP_130228 \130228 SM Grading.tif	<u>H0661504770</u>
	<u>130228</u>	MD 100\HO 661-504-770\BMP_130228 \130228_plans.pdf	<u>H0661504770</u>
	<u>130228</u>	MD 100\HO 661-504-770\BMP_130228 \130228_RS_Volume_Signoff_Sheet.pdf	<u>H0661504770</u>
	<u>130228</u>	MD 100\HO 661-504-770\BMP_130228 \HO661-504-770.1413.pdf	H0661504770
	<u>130228</u>	MD 100\HO 661-504-770\BMP_130228 \HO661-504-770.1414.pdf	<u>H0661504770</u>

#### **Program Future Trends**



## Questions



Presented by: Kiona Leah, P.E Program Manager 410-545-8044 kleah@sha.state.md.us



# Stormwater Community of Practice Forum Collaboration

- Submit your questions
  Type in the Q&A box on the panel on your screen.
  - Select 'Host & Presenter' in the drop down.
  - Click 'Send'



# **CoP Questions/Discussions**



#### William Fletcher

- Oregon DOT
- William.B.Fletcher@odot.state.or.us



Kiona Leah, PE
Maryland DOT
Kleah@sha.state.md.us



#### **Richard Heineman**

- Pennsylvania DOT
- rheineman@pa.gov



#### Melissa Savage

- AASHTO CEE
- msavage@aashto.org



#### Andy McDaniel, PE

- North Carolina DOT
- ahmcdaniel@ncdot.gov



#### Scott McGowen, PE

- Michael Baker International
- scott.mcgowen@mbakerintl.com

## **CLOSING**

A recording of this webinar will be available on the Center for Environmental Excellence by AASHTO Website.



Individual Community of Practice discussions are facilitated and moderated by Center technical experts. Typically, the communities participate in regular conference calls, Transportation Systems Technical

Assistance Program

http://environment.transportation.org Products & Programs > Communities of Practice > Stormwater Management



Center for Environmental Excellence AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS





U.S. Department of Transportation Federal Highway Administration

**Stormwater BMP** Maintenance and **Operations THANK YOU FOR ATTENDING CEE by AASHTO Stormwater Community of Practice October 18, 2018**