National Disaster Resilience Regional Stormwater Infrastructure Toolkit Public Workshop

January 9, 2019

Agenda

Room	Time Slot	Activity	Learning Objectives
Civil Air Patrol Room	8:30 AM to 8:45 AM	**Introduction NDR Toolkit Team & Overarching Goals of the Workshop** ***Presenters: Dennis Reinknecht and Taylor Forster (DEP)***	▪ Introduction to the National Disaster Regional Resilience Stormwater Infrastructure Toolkit. ▪ New upcoming projects for the region including resilient grey and green stormwater infrastructure that will help improve current stormwater management. ▪ Learn about green and grey stormwater infrastructure techniques and applications. Why some techniques are preferred in different environments and settings and how they can be implemented (e.g., rain gardens vs. porous pavements).
	8:45 AM to 9:30 AM	**Introductory Stormwater Infrastructure Presentation** ***Presenters: Alexis Taylor (DEP), Jonathan Carey, AICP (Louis Berger), David Ksyniak, PE (CDM Smith)***	
	9:30 AM to 9:40 AM	**Q&A/Open Forum**	
	9:40 AM to 9:55 AM	**Green Infrastructure Design With Maintenance in Mind** ***Presenter: Virginia Roach, PE (CDM Smith)***	
	9:55 AM to 10:00 AM	**Q&A/Open Forum**	
	10:00 AM to 10:15 AM	**Break**	
	Module 1: Operation & Maintenance (O&M)		
	10:15 AM to 10:35 AM	**Utility Asset Management** ***Presenter: Ed Carpenetti, PE (Louis Berger)***	▪ Introduction to asset and utility management and best practices for regional communities, including asset registry and interactive field maps. Bringing documentation and tracking of utilities and assets into the 21st century. ▪ Learn about the current status of stormwater management O&M in New Jersey and how New Jersey can benefit from expanded, more regional O&M organizational structures. A review of different types of regional entities that might improve stormwater management O&M. ▪ Learn about native plant use for green infrastructure design and O&M.
	10:35 AM to 10:50 AM	**Asset Management Software Assessment Tool (AMSAT)** ***Presenter: Brian Porter (CDM Smith)***	
	10:50 AM to 11:10 AM	**Institutional Options for Improved Stormwater O&M** ***Presenter: Bill Cesanek, AICP (CDM Smith)***	
	11:10 AM to 11:20 AM	**Q&A/Open Forum**	
	11:20 AM to 12:05 PM	**Breakout Session: Obtain feedback on successful components, challenges, and recommendations for implementation of asset management/O&M planning process for stormwater infrastructure**	
	12:05 PM to 12:20 PM	**Restoring Native Plants in the Meadowlands** ***Presenter: Don Torino (Bergen County Audubon Society)***	
	12:20 PM to 12:25 PM	**Q&A/Open Forum**	
Port Authority Executive Conference Room		**Lunch: 30 minutes (12:25 to 12:55 PM)**	

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Room	Time Slot	Activity	Learning Objectives
Port Authority Executive Conference Room	**Module 2: Job Training**		
	12:55 PM to 1:25 PM	**Case Studies: Green Stormwater Infrastructure Projects and Lessons Learned** ***Presenter: Chris Perez (Rutgers University New Jersey Agricultural Experiment Station)*** ***Presenter: Fran Lawn (The Sustainable Business Network of Greater Philadelphia)***	▪ Learn about green infrastructure projects and lessons learned. ▪ Responsibility charting as a management tool to determine roles and relationships among public stakeholders and municipal personnel in maintaining stormwater infrastructure. ▪ Community involvement in training programs and establishing stormwater management program goals at a municipal level. ▪ Overview of training programs to facilitate growth and expansion of skill sets for stormwater career professionals to develop long-term capacity for stormwater infrastructure O&M.
	1:25 PM to 1:35 PM	**Q&A/Open Forum**	
	1:35 PM to 1:50 PM	**RACI Table as an Asset Management Tool** ***Presenter: Melissa Harclerode, PhD, BCES (CDMS)***	
	1:50 PM to 2:30 PM	**Job Training, Career Development, and the National Green Infrastructure Certification Program (NGICP)** ***Presenter: Margaret Stewart (LBG) and Adriana Caldarelli (NGICP)***	
	2:30 PM to 2:50 PM	**Q&A/Open Forum**	
	Closing Thoughts/Recap **2:50 PM to 3:15 PM** **Please complete workshop evaluation forms, required to obtain CEUs**		


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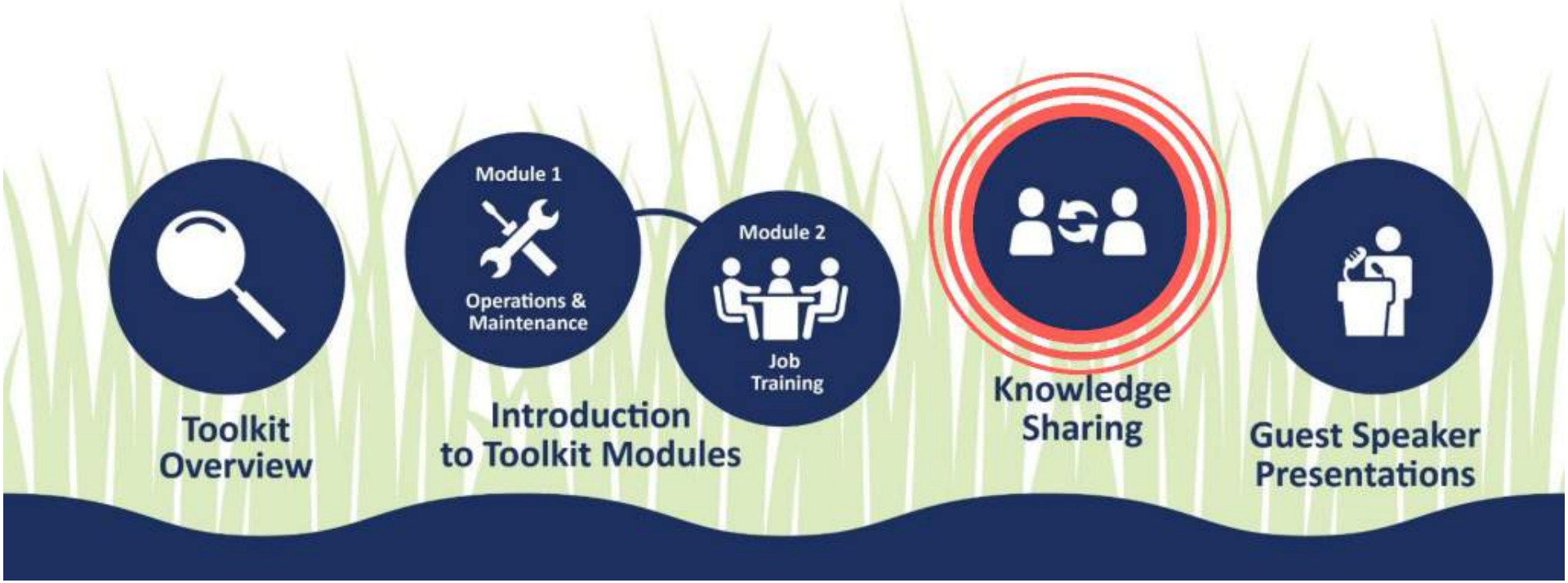
8:30 a.m. - 8:45 a.m.	Introductions/Overarching Goals of the Workshop
8:45 a.m. - 9:30 a.m.	**Introductory Stormwater Infrastructure Presentation**
9:30 a.m. - 9:40 a.m.	Q &A/Open Forum
9:40 a.m. - 10:00 a.m.	Design with Maintenance in Mind & O&A/Open Forum
10:00 a.m. - 10:15 a.m.	Break
10:15 a.m. - 12:25 p.m.	Module 1 O&M Learning Session with Guest Speakers
12:25 p.m. - 12:55 p.m.	Lunch
12:55 p.m. - 2:50 p.m.	Module 2 Job Training Learning Session with Guest Speakers
2:50 p.m. - 3:15 p.m.	Recap/Lessons Learned

The Value of Participation

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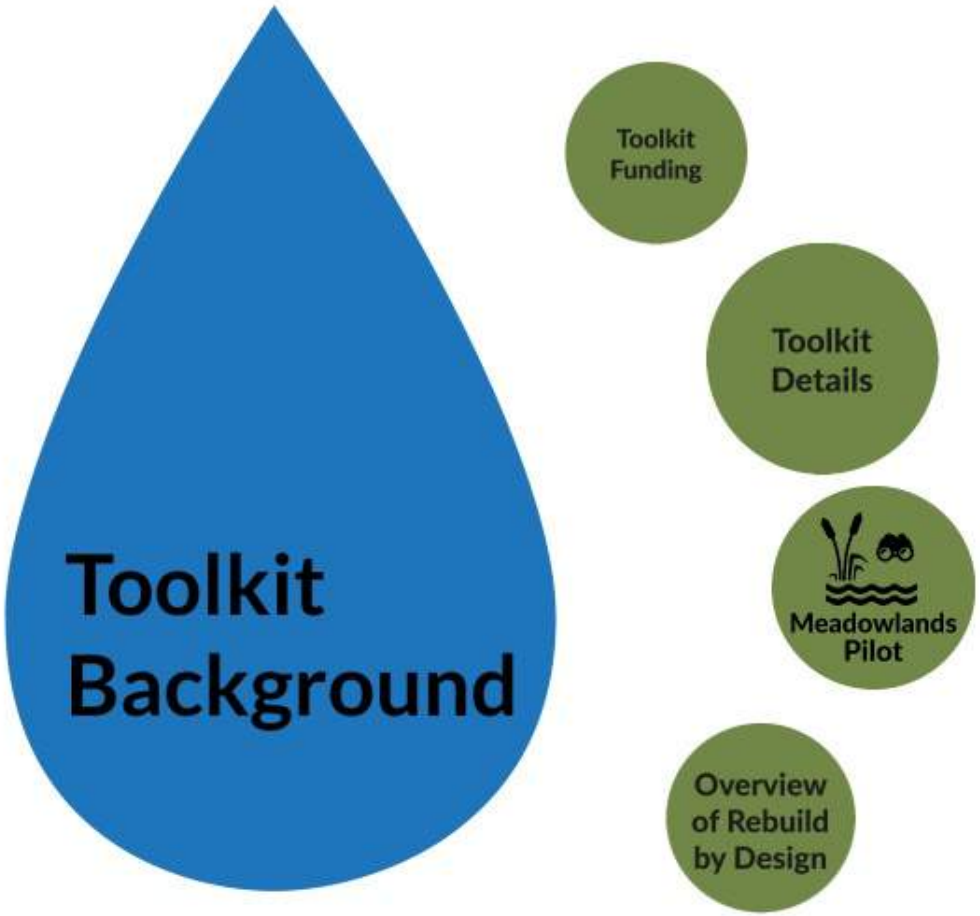
Toolkit Overview
What is a toolkit?
Toolkit Background
Tools
Stormwater Infrastructure
Toolkit Goals

What is a toolkit?

A set of **voluntary best practices** that serve as a resource for:

- Local jurisdictions
- Regional entities
- Policy-makers


Toolkit Background
Toolkit Funding
Toolkit Details
Meadowlands Pilot
Overview of Rebuild by Design

NDR Regional Stormwater Infrastructure Toolkit

NDR Competition

Launched by HUD to provide funding for resilience projects to states and communities that were impacted by major disasters between 2011 and 2013,including Hurricane Sandy.

NDR Submission

Regional Resilience Planning Grant Program concept submitted to the NDR Competition.

NDR Award

New Jersey is selected as 1 of 13 awardees to fund and develop a Regional Resiliency Grant Program and develop a Resilience Toolkit.

For more information on the NJ Regional Resilience Grant Program, please contact Nick Angarone at nick.angarone@dep.nj.gov

NDR Regional Stormwater Infrastructure Toolkit

Administered by: DEP Bureau of Flood Resilience

Pilot: 5 Meadowlands municipalities

Scope: developed with local jurisidictions

Output: a series of user-friendly DEP webpages

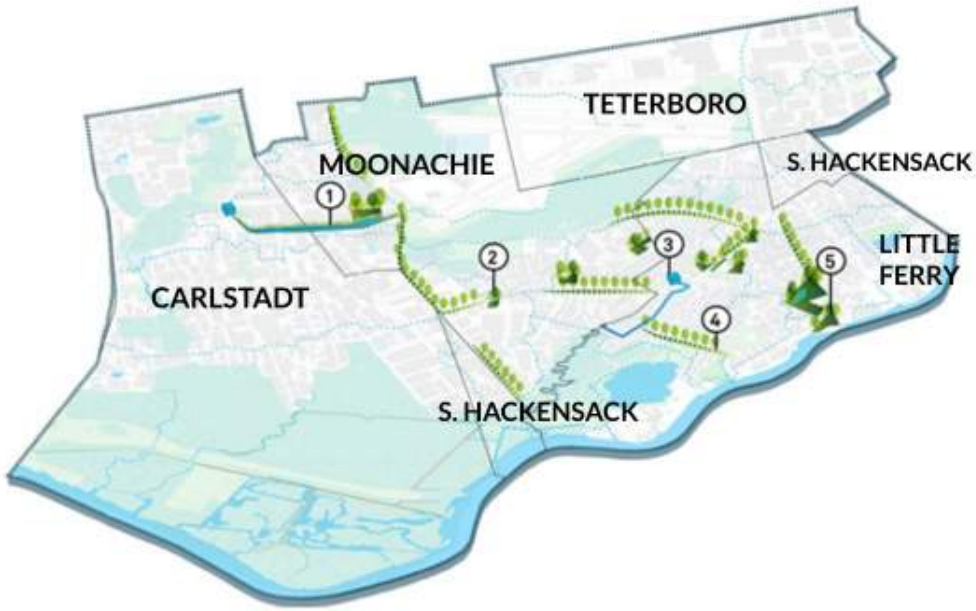
Pilot will occur alongside Meadowlands Rebuild by Design Project

Why was the Meadowlands region selected as the pilot?

- Region is prone to **chronic flooding** and tidal storm surges
- Area is vulnerable to impacts from **sea level rise**
- significant **unmet stormwater control** and drainage needs
- Concurrent Meadowlands Rebuild By Design project will result in **new stormwater** infrastructure

Meadowlands Rebuild By Design
Improvements Overview

1. Pump Station, Channel Improvements, New Park
2. Green Infrastructure and New Park
3. Pump Station, Force Main, Public Facility Improvements
4. Green Infrastructure
5. Park Improvements, New Park, Green Infrastructure



The toolkit

can be used by...

The toolkit

can be used by...

Meadowlands Communities

The toolkit

can be used by...

Meadowlands Communities

The general public

The toolkit

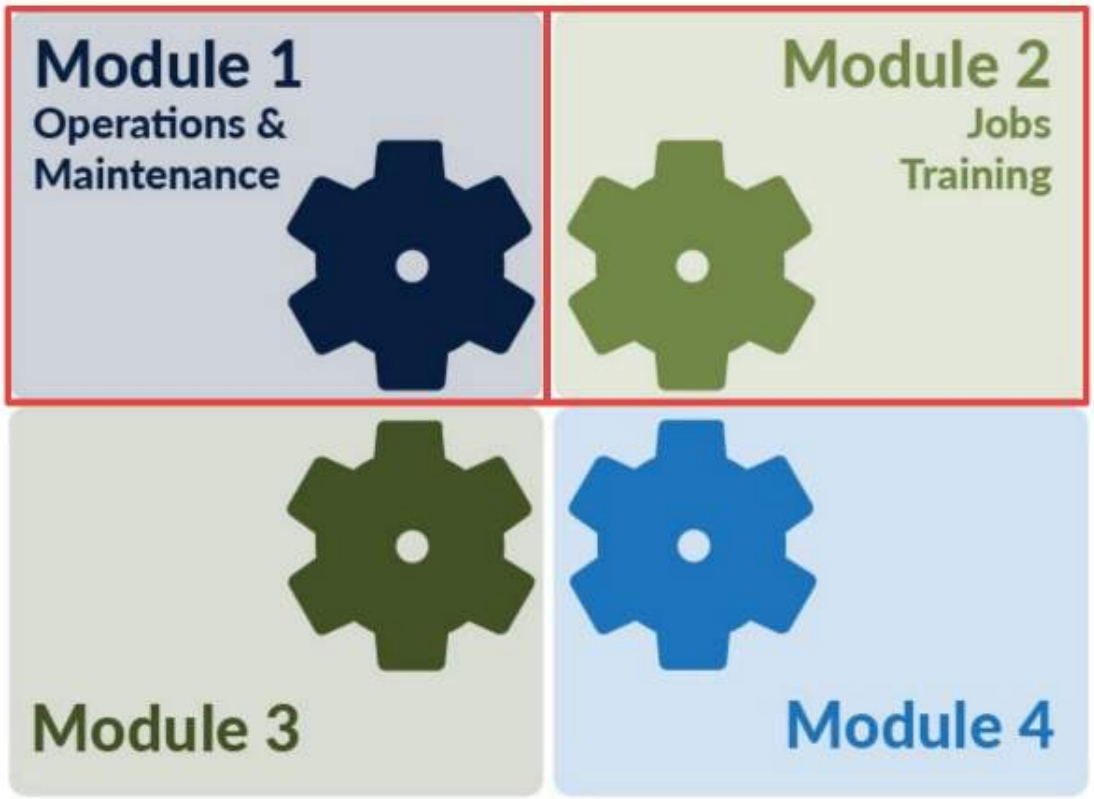
can be used by...

Meadowlands Communities

Communities throughout NJ

The general public

Toolkit Modules



Stormwater Infrastructure

Immediate Toolkit Goals

Asset Management

Explore options for a **shared asset management** program and O&M organizational structure

Workforce Development

Research opportunities for stormwater O&M **workforce development**

Benefit-Cost Analysis

Create template to assess **financial benefits** of regionally coordinated O&M program and training opportunities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Project Status

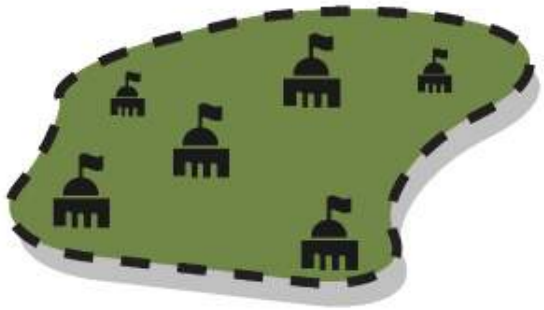
Continued jurisdictional and stakeholder outreach

Step 1 — Step 2 — Step 3 — Step 4 — Step 5

Completed Step 1

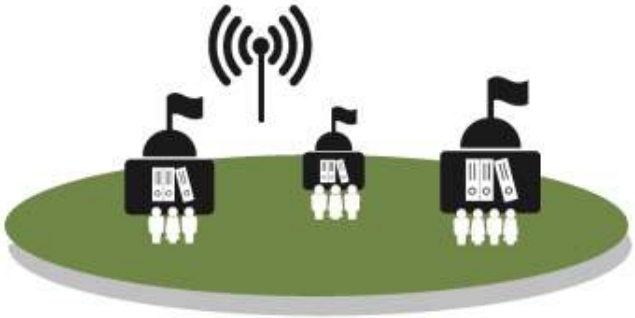
- Develop **scope of work** for modules 1 and 2
- Collect **baseline data**
- **Garner input** from municipalities and regional entities
- Undertake **literature review**

Examples of Step 1 Findings



Regional Entity

The lack of a **regional entity** in the project area to regulate stormwater use makes maintenance responsibilities among jurisdictions difficult and unclear



Institutional Knowledge

Institutional knowledge about stormwater operations is **not always written down at the local level**, a need exists for a formal transfer of knowledge

Completed Step 2

- Identify **best practices** for:
  - Stormwater infrastructure O&M and
  - Job training
- Based on research and local coordination, complete **benefit-cost analysis baseline**

Benefit Cost Analysis Baseline

1. Meadowlands Expertise & Municipal Budgets
2. Data from Other Municipalities
3. Estimates of Stormwater Flows
4. Outside Annual Cost Knowledge and Data

...to make the case!

Step 1 Step 2 **Step 3** Step 4 Step 5

Completed Step 3

- Created **O & M** tools
- Drafted **jobs training** module

In Progress

- Continued outreach
- Incorporate feedback, revise, finalize, publish and implement **O & M** and **jobs training** modules
- Complete **Benefit-Cost Analysis**; set up as template for other jurisdictions

Continued jurisdictional and stakeholder outreach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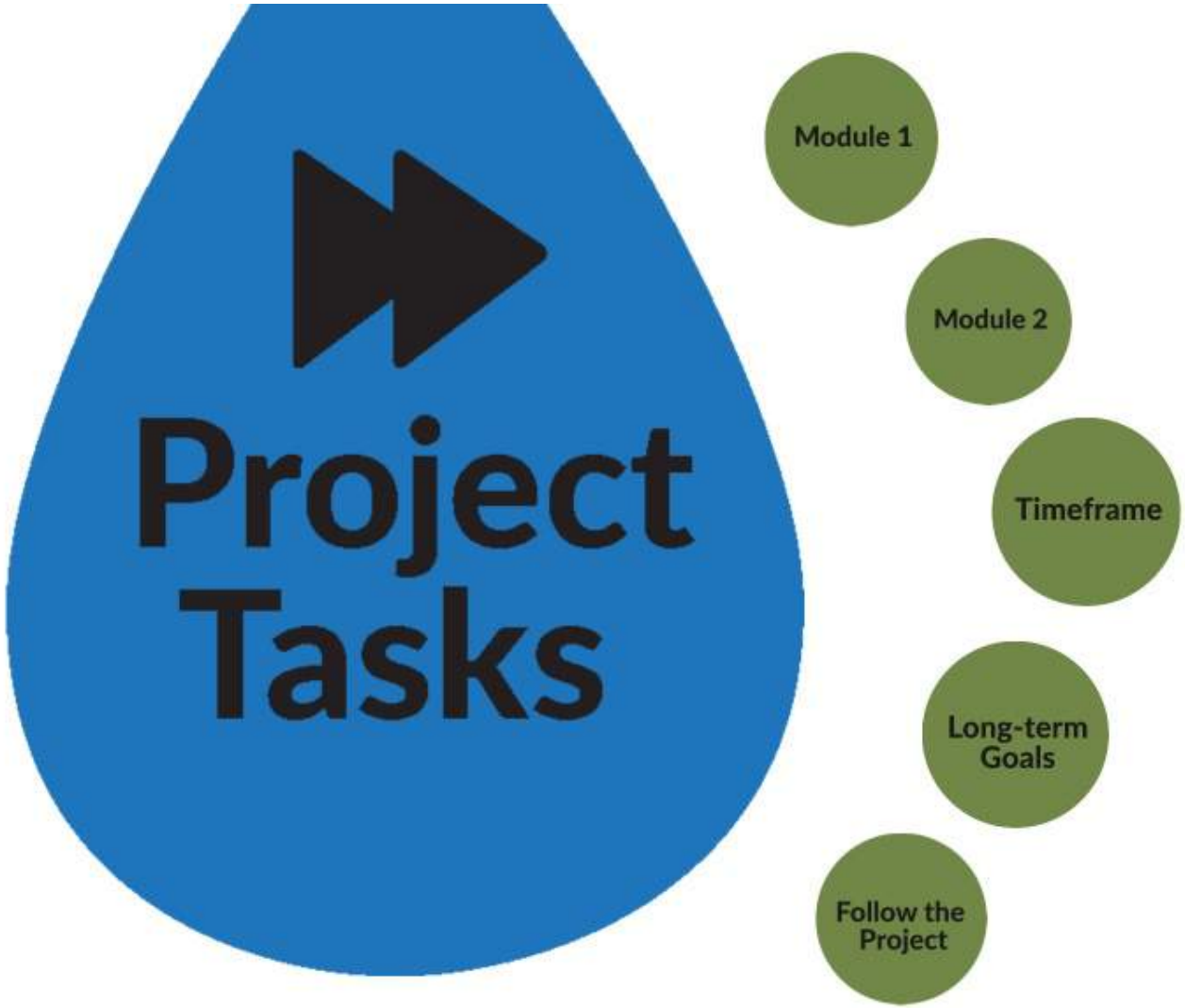
Project Tasks
Module 1
Module 2
Timeframe
Long-term Goals
Follow the Project

Module 1 - Operations and Maintenance

	Regional Stormwater Entity	O&M/Asset Management Best Practices	Documentation and Track Systems
Toolkit	- Characterization of entity types - Examples in current operation	- Explanations and examples of best practices	- Comparison of existing systems - Guide to selecting a system based on user identified needs
Meadowlands Pilot	- Options for a regional storm water entity, including strengths and weaknesses of each	- Applicable O&M Plan best practices	- Options for documentation and tracking systems based on the needs identified in project area

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Module 2 - Jobs Training

	Training Program	Career Opportunities	Professional Certification
Toolkit	- Explanations of job training program best practices - Examples of implementation in other jurisdictions	- Explanations and examples of career opportunity best practices	- Explanations of available professional O&M certifications
Meadowlands Pilot	- Options for job training programs specific to the needs and objectives of the project area	- Applicable options for promoting career opportunities within the project area	- Appropriate O&M certifications for the project area

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Timeframe

Continued jurisdictional and stakeholder outreach

Long-term Toolkit Goals

Resilience

Establish long-term **sustainable flood resilience** O&M techniques and strategies

Regional Applicability

Develop an **adaptive framework** so the toolkit can be replicable for other regions

Promote Resilience Projects

Increase the number of **regional flood risk reduction plans** and projects

Follow the Project

Project Contact

Alexis Taylor
NJDEP Bureau of Flood Resilience

Project E-mail

Toolkit@dep.nj.gov

Project Website

www.resiliencetoolkit.nj.gov


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Green Infrastructure Design With Maintenance in Mind

Presented by:
Virginia Roach, PE
CDM Smith
Boston, MA

Overview

- Green infrastructure techniques
- Design with maintenance in mind
- Construction lessons learned

Green Infrastructure Techniques – Areas With Limited Space

Green Roof

Subsurface Storage and Infiltration

Blue Roof

Porous Pavements

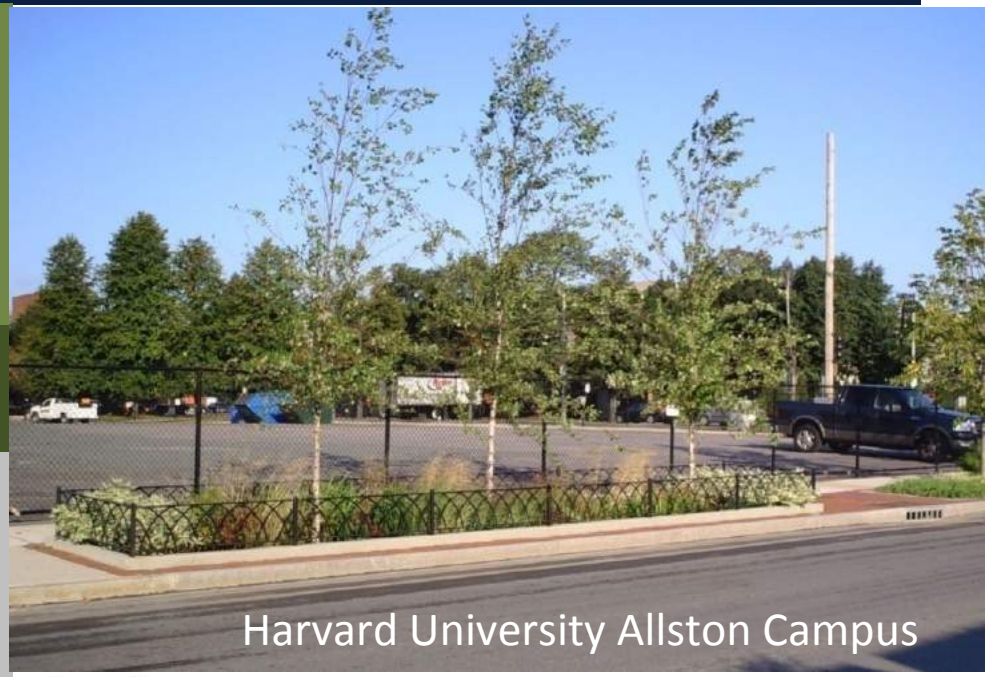
Bioretention/Rain Gardens/Street Planters

Green Infrastructure Techniques – Large Open Spaces

Design with Maintenance in Mind

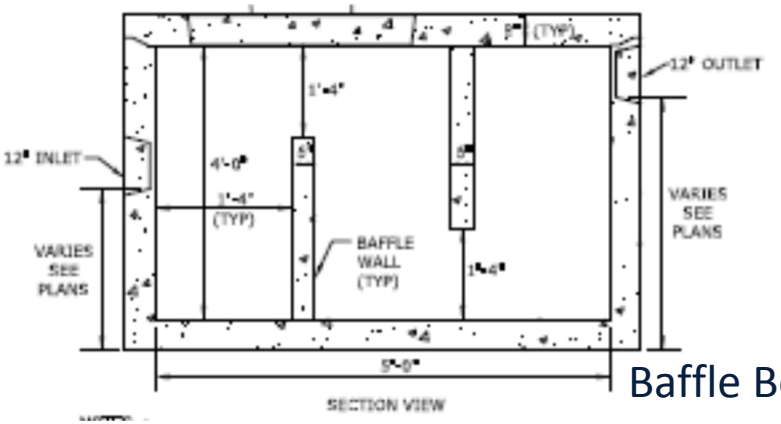
- Install hardscapes instead of planted areas if trash is an issue
- Install grasses instead of plantings
  - *Easier to maintain*
  - *Found to have better infiltration over time (UNH Stormwater Center)*
- Provide ready access
  - *Sufficient manholes on structures*
  - *Ramp for bobcat/mower in basins*
  - *Access to forebay*

Pre-Treatment to Reduce Sediment and Debris in Street Planters



Harvard University Allston Campus

- Catch basin
- Baffle box
- Particle separator



Baffle Box

Bioretention / Rain Garden Maintenance

- Highest maintenance first two years
- Seasonal weeding, raking and pruning
- Infiltration improves over time as roots establish

Porous Pavement Maintenance

- Winter maintenance
  - Do not use sand
- Porous asphalt and pervious concrete
  - Vacuum sweep
  - Power wash if needed
- Permeable pavers
  - Regenerative air or traditional sweeper
  - Replenish joint material

Construction Lessons Learned

- Experienced contractors for this type of work are limited, but a must
- Properly stage and plan construction of bioretention areas
- Maximize use of precast pervious concrete panels to save time and money
- Allocate sufficient funds for hazardous and regulated materials disposal

Open Forum
Questions and Answers

BREAK



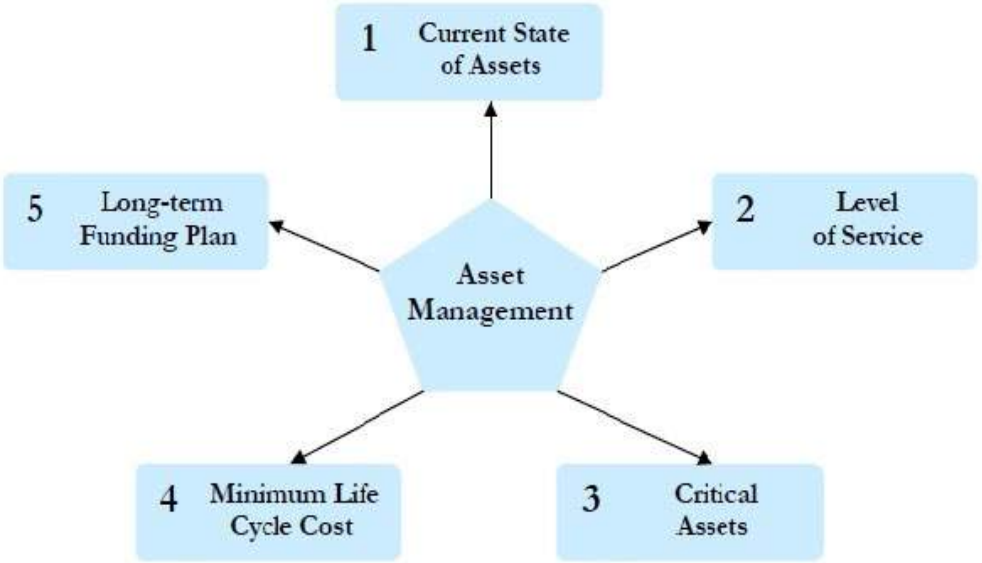
Module 1 O&M

Utility Asset Management

Presented by:
Ed Carpenetti, PE
Louis Berger

Utility Asset Management

- Utility Asset Management
- What is Asset Management
- Why Asset Management
- Asset Management Schematic
- Getting Started
- Enterprise Asset Management



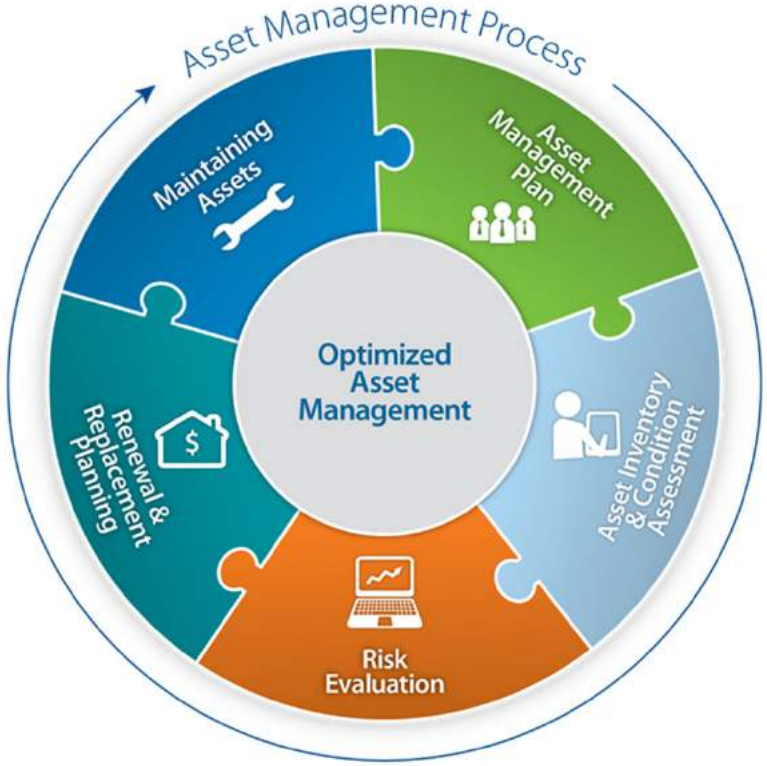
What is Asset Management?

"A Way of doing business that allows **Utilities** to achieve the desired
Level of Service and
Acceptable Level of Risk at the
Lowest Lifecycle Cost"

Why Asset Management

- Prolonging asset life
- Meeting consumer demands with a focus on system sustainability
- Optimizing structural and maintenance activities
- Meeting service expectations and regulatory requirements
- Improving responses to emergencies
- Improving security and safety of assets

EPA – Asset Managemet: A Best Practices Guide

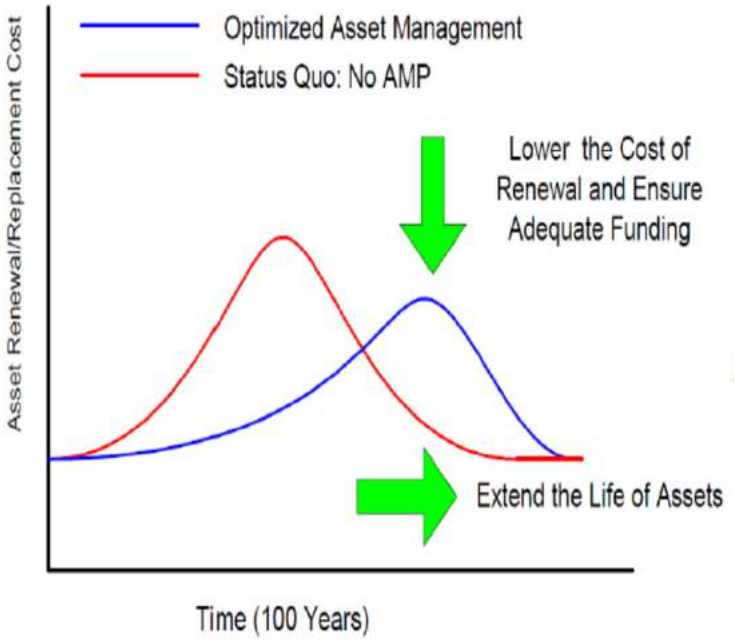


Why Asset Management

"Asset management is maintaining a desired level of service (LOS) for what you want your assets to provide at the lowest life cycle cost.

Lowest life cycle cost refers to the best appropriate cost for rehabilitation, repairing or replacing an asset."

EPA – Asset Managemet: A Best Practices Guide



Benefits of Asset Management

Figure 3

Why Asset Management

Current Maintenance Plans

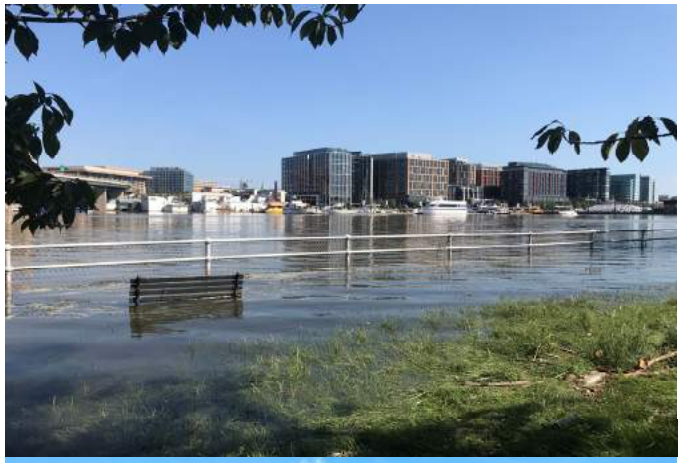
- **Reactive**
- **Preventative (time based or usage based)**

Asset Management Based Plans

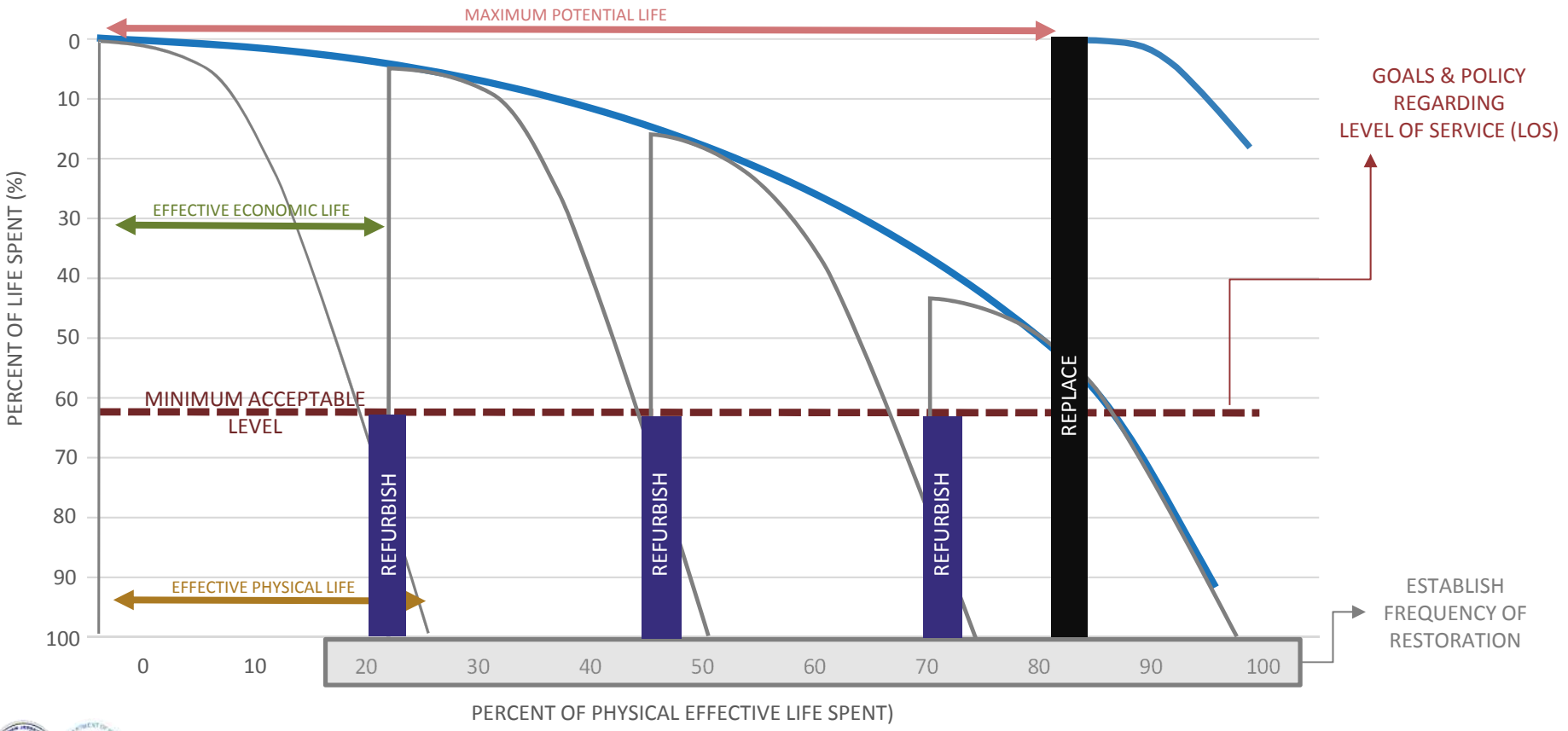
- **Predictive (Real-time Monitoring)**
- **Prescriptive / Prognostic (Modeling)**
  - **Real-time, statistical & numerical modeling**
  - **Machine Learning / Artificial**

Advanced Asset Management Based Plans include:

- **Sustainability**
- **Resiliency**



Asset Management Schematic



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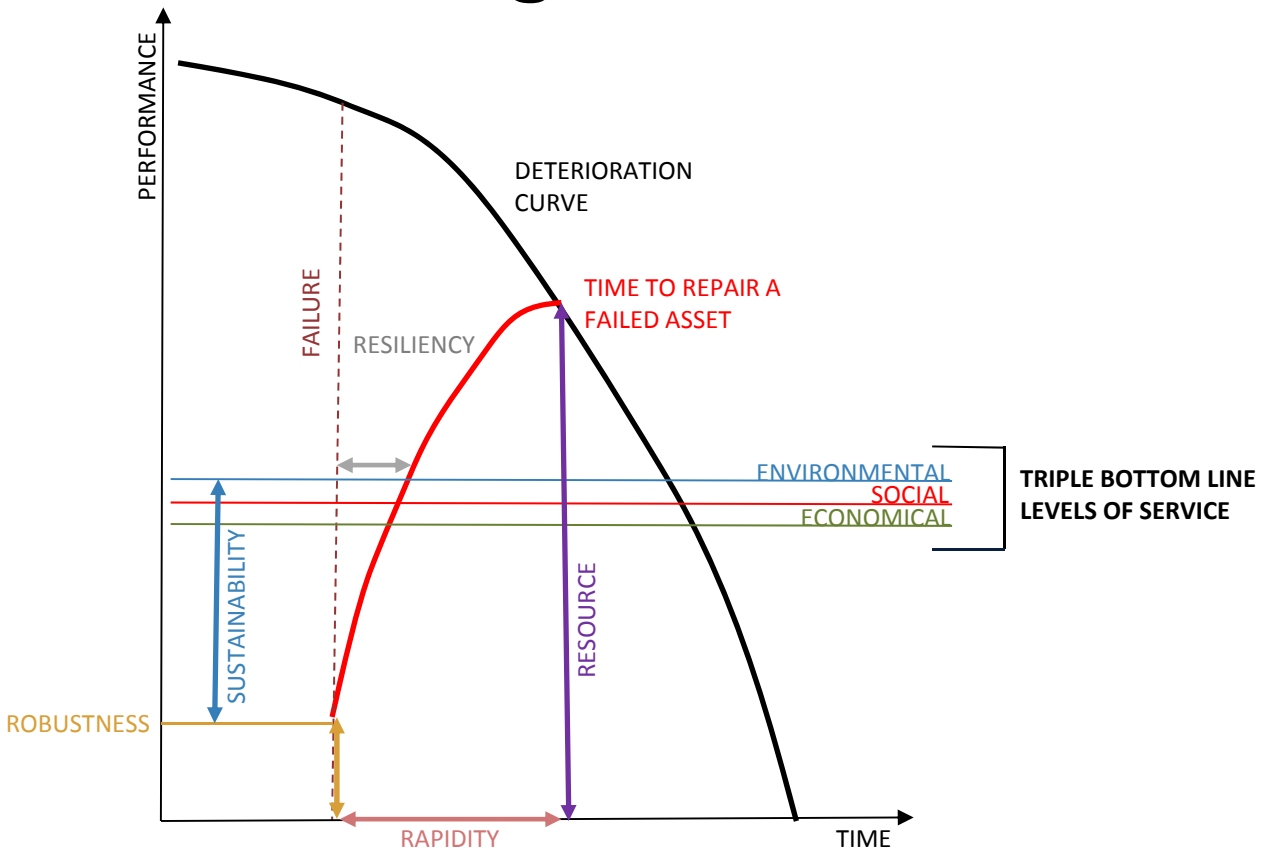
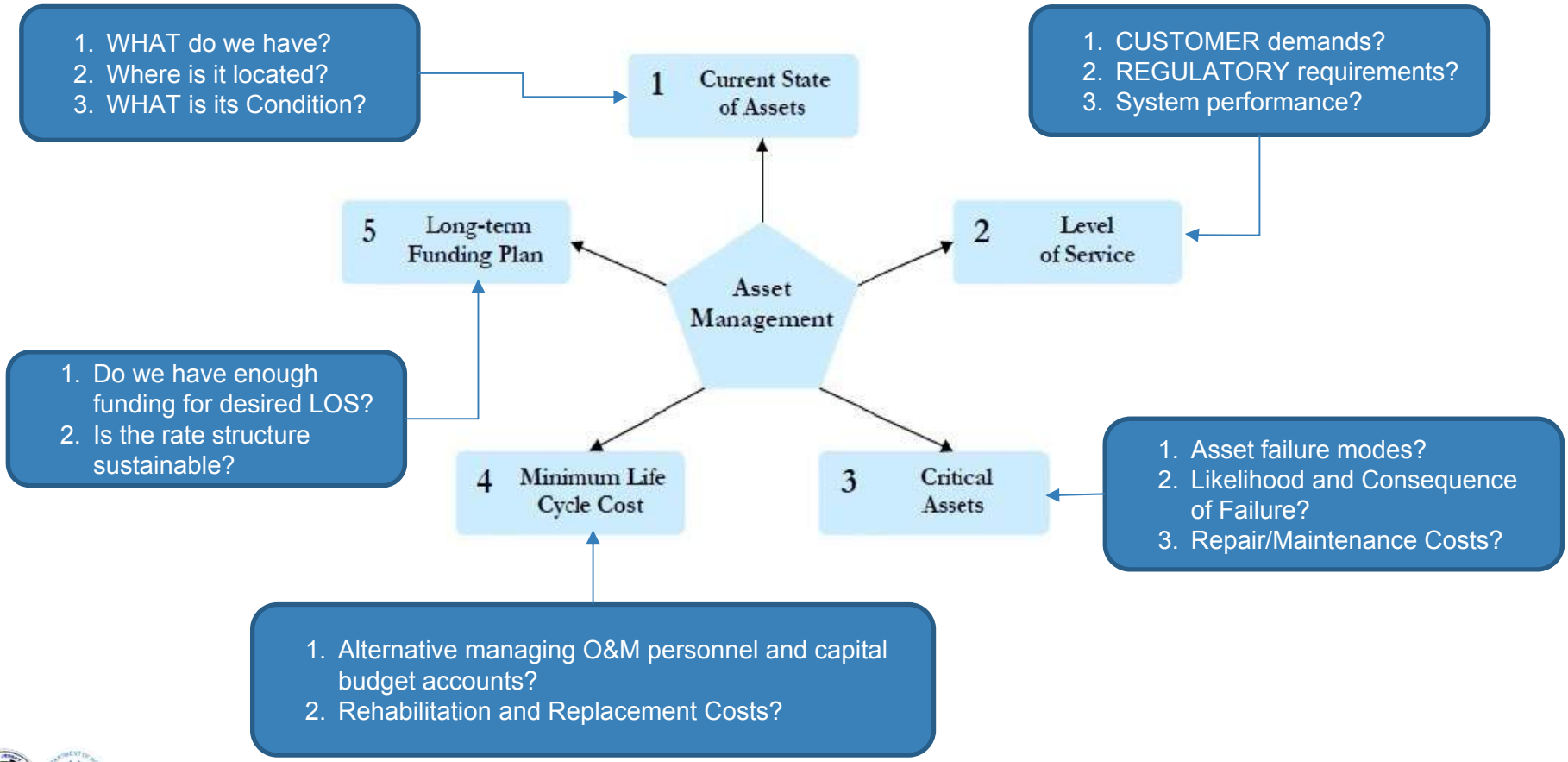
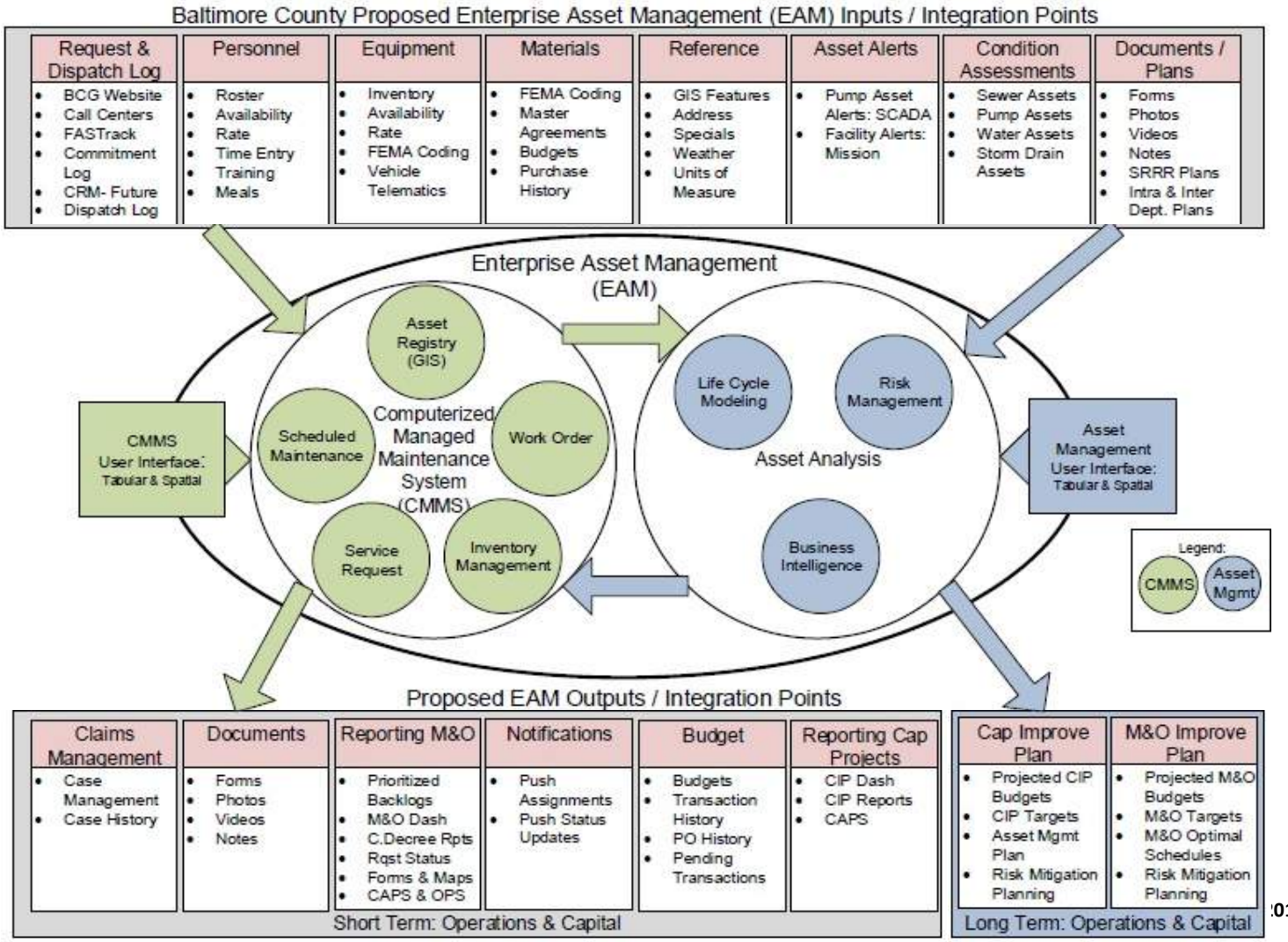
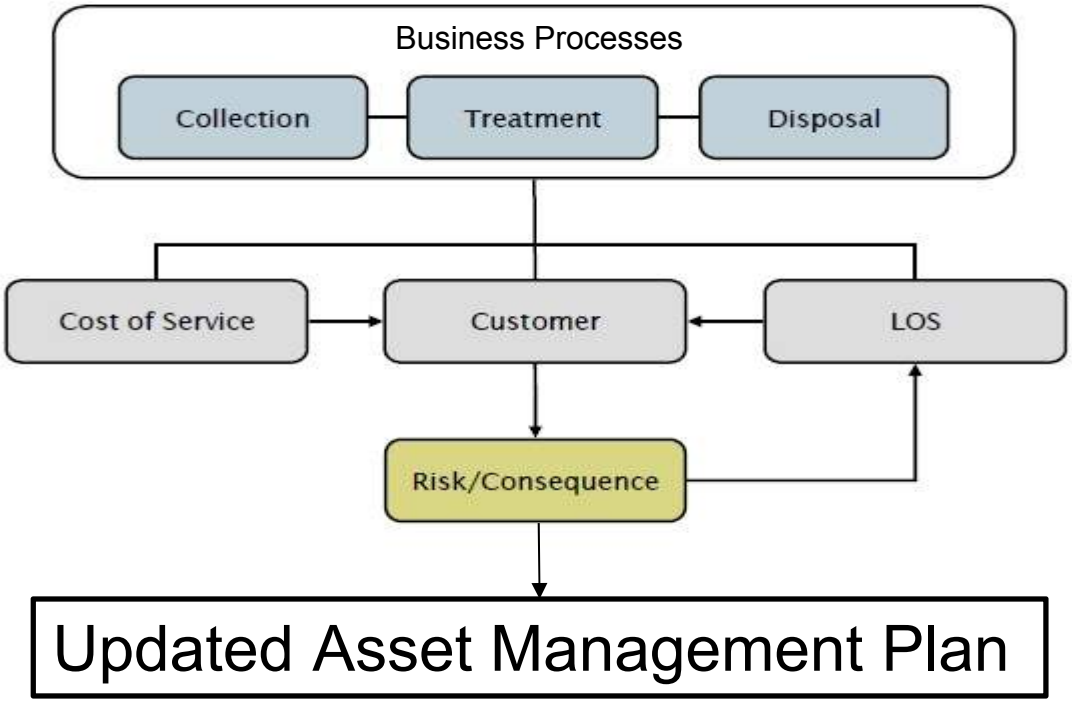


Getting Started




Baltimore County Proposed Enterprise Asset Management (EAM) Inputs / Integration Points
Request & Dispatch Log
BCG Website
Call Centers
FASTrack
Commitment Log
CRM- Future
Dispatch Log
Personnel
Roster
Availability
Rate
Time Entry
Training
Meals
Equipment
Inventory
Availability
Rate
FEMA Coding
Vehicle Telematics
Materials
FEMA Coding
Master Agreements
Budgets
Purchase History
Reference
GIS Features
Address
Specials
Weather
Units of Measure
Asset Alerts
Pump Asset Alerts: SCADA
Facility Alerts: Mission
Condition Assessments
Sewer Assets
Pump Assets
Water Assets
Storm Drain Assets
Documents / Plans
Forms
Photos
Videos
Notes
SRRR Plans
Intra & Inter Dept. Plans
Enterprise Asset Management (EAM)
Asset Registry (GIS)
CMMS User Interface: Tabular & Spatial
Scheduled Maintenance
Computerized Managed Maintenance System (CMMS)
Work Order
Service Request
Inventory Management
Life Cycle Modeling
Risk Management
Asset Analysis
Business Intelligence
Asset Management User Interface: Tabular & Spatial
Legend:
CMMS
Asset Mgmt
Proposed EAM Outputs / Integration Points
Claims Management
Case Management
Case History
Documents
Forms
Photos
Videos
Notes
Reporting M&O
Prioritized Backlogs
M&O Dash
C.Decree Rpts
Rqst Status
Forms & Maps
CAPS & OPS
Notifications
Push Assignments
Push Status Updates
Budget
Budgets
Transaction History
PO History
Pending Transactions
Reporting Cap Projects
CIP Dash
CIP Reports
CAPS
Short Term: Operations & Capital
Cap Improve Plan
Projected CIP Budgets
CIP Targets
Asset Mgmt Plan
Risk Mitigation Planning
M&O Improve Plan
Projected M&O Budgets
M&O Targets
M&O Optimal Schedules
Risk Mitigation Planning
Long Term: Operations & Capital

Getting Started



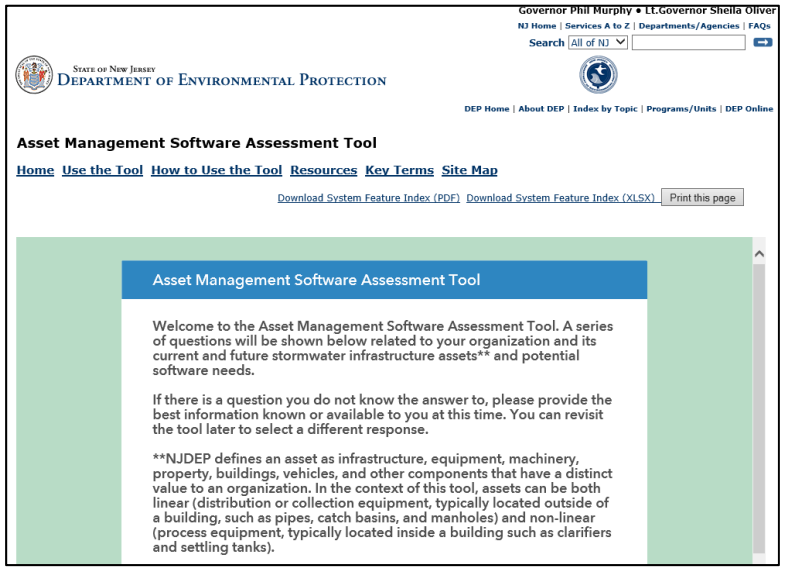
Module 1 O&M

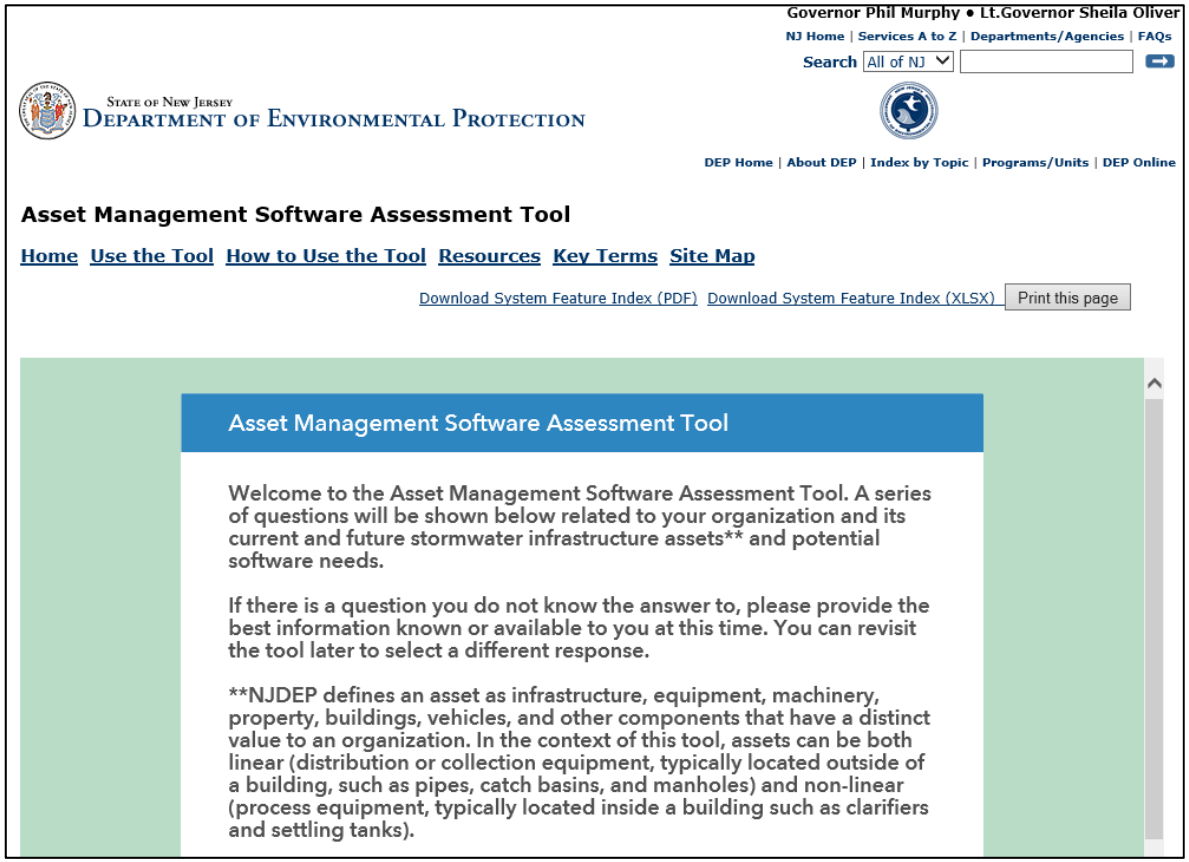
Asset Management Software Assessment Tool (AMSAT)

Presented by:
Brian Porter
Management Consultant
CDM Smith
Boston, MA

AMSAT: Project Scope

- Produce and pilot a voluntary screening tool to identify potential Computerized Maintenance Management System (CMMS) software systems
- Intended for organizations seeking a way to manage stormwater infrastructure assets




Governor Phil Murphy • Lt.Governor Sheila Oliver
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Search All of NJ
State of New Jersey
Department of Environmental Protection
DEP Home | About DEP | Index by Topic | Programs/Units | DEP Online
Asset Management Software Assessment Tool
Home Use the Tool How to Use the Tool Resources Key Terms Site Map
Download System Feature Index (PDF) Download System Feature Index (XLSX) Print this page
Asset Management Software Assessment Tool
Welcome to the Asset Management Software Assessment Tool. A series of questions will be shown below related to your organization and its current and future stormwater infrastructure assets** and potential software needs.
If there is a question you do not know the answer to, please provide the best information known or available to you at this time. You can revisit the tool later to select a different response.
**NJDEP defines an asset as infrastructure, equipment, machinery, property, buildings, vehicles, and other components that have a distinct value to an organization. In the context of this tool, assets can be both linear (distribution or collection equipment, typically located outside of a building, such as pipes, catch basins, and manholes) and non-linear (process equipment, typically located inside a building such as clarifiers and settling tanks).

1) How many stormwater assets are owned and managed by your organization?*

- ○ 1-10,000
- ◉ 10,000-25,000
- ○ 25,000-50,000
- ○ >50,000

2) How many direct users of the software do you envision?*

- ○ 1-10
- ◉ 11-20
- ○ 21-30
- ○ >30

3) What is the size of the population that your stormwater assets serve?*

- ○ <25,000
- ◉ 25,000-1,000,000
- ○ >1,000,000

4) What is the budget your organization has set aside for the implementation of CMMS software?*

- ○ <$50,000
- ◉ $50,000-$500,000
- ○ >$500,000

5) Do you have an information technology department in-house that is capable of hosting web-based software?*

- (●) Yes
- ( ) No

5a) Does your Information Technology Department preclude the use of cloud-hosted software?

- ( ) Yes
- (●) No

6) Do you require the software to aid in asset risk evaluation or capital planning now or in the future?*

- ○ Yes
- ◉ No

7) Do you require the software to have a mobile component to address issues in the field now or in the future?*

- (●) Yes
- ( ) No

8) Does your stormwater collection system contain assets, such as pipes and catch basins that exist outside of a building, requiring the software to interact or integrate with Geographic Information Systems (GIS) now or in the future?*

- (●) Yes
- ( ) No

9) Does your organization require the software to interact or integrate with other business systems (311, Financial or Billing System) now or in the future?*

- ○ Yes
- ◉ No

Based on your answers, the standard software tier is recommended for your organization.

	Basic	Standard	Advanced
Maintain asset registry	✓	✓	✓
Schedule tasks	✓	✓	✓
Store budget info	✓	✓	✓
Track costs and work orders	✓	✓	✓
Maintain work oder history	✓	✓	✓
GIS (horizontal asset) integration	—	✓	✓
Application programming interface	—	✓	✓
Customization of user workflow	—	✓	✓
Substatial training required	—	✓	✓
Strategic planning support	—	—	✓
Can perform risk evaluations	—	—	✓
Can perform capital planning	—	—	✓
Typical platform	Desktop + Web	Desktop + Web + Mobile	Desktop + Web + Mobile
Costs required	$0 - $5,000	$5,000 - $200,000	$200,000 +

"Standard" tier software is typically used by small- to medium-sized organizations to help manage asset inventories and regular asset maintenance. Software in this tier provides additional services when compared to the services of the basic tier, such as GIS integration; tracking service requests and work orders; and managing inventory, permits, projects, and inspections. These systems also provide more options for interacting with other business system software, such as Microsoft Outlook.

Standard tier software has moderate barriers of entry for organizations. These barriers include higher costs and potential server hardware, training, and administration requirements. Annual license and maintenance fees, as well as costs for various modules, vary based on an organization's specific needs and among the different software systems. Software start-up costs in this tier tends to range from approximately $5,000 to $200,000. Standard tier systems evaluated as part of this project included:

- Beehive
- Cityworks
- NEXGEN
- VUEWorks

Please refer to the System Feature Index above to learn more about the different functional, technical and cost features of these programs. Other Standard Systems for consideration, though not evaluated as part of this study include:

- Lucity
- MUINIS/Tyler Technologies
- GoMocha
- SpryPoint
- Acela
- Cartegraph

Please note, the population of responses to the system feature index was an objective exercise intended to better highlight capabilities of several systems so that organizations can make informed decisions when considering a potential software program. The NJDEP does not in any way represent or endorse the software companies examined in the system feature index in any capacity. Answers provided to the system feature index were objective and conducted as part of a third-party independent study. This Tool is intended to be a general guide.

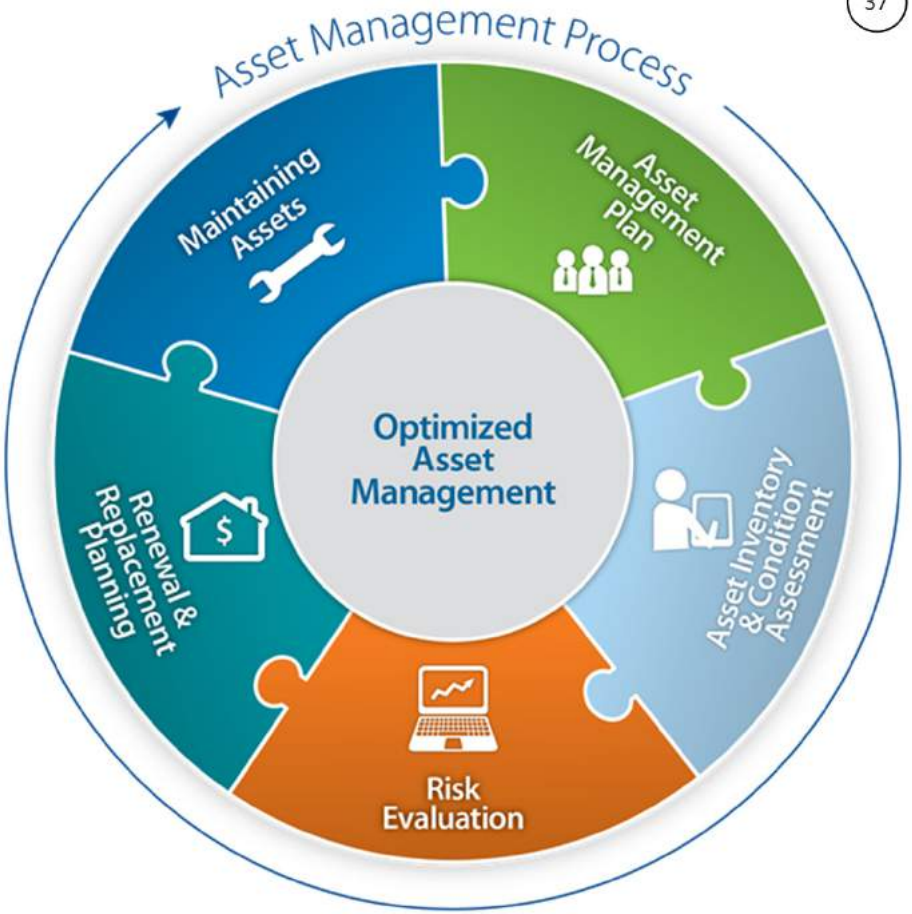
Also, note that a representative sample of software systems at each tier was used to develop the system feature index. These software systems are not an exhaustive list of software packages available. Moreover, the ability of the software systems evaluated to meet the individual functional, technical, and cost elements included in the system feature index are subject to change over time as the software lifecycle continues and features are added or removed. Note, documentation and tracking of some aspects of asset management, such as creation of an asset registry (also known as an asset inventory), can be achieved by paper-based methods, use of a spreadsheet, or stand-alone database mechanisms outside of the software programs presented as part of this Tool.

Select from the options below to learn more about the other software tiers.

- ○ Basic Software Tier
- ○ Advanced Software Tier

What is Asset Management

"A Way of doing business that allows **Utilities** to achieve the desired **Level of Service** and **Acceptable Level of Risk** at the **Lowest Lifecycle Cost**"



Making Smarter Decisions Related to Utility Management

Knowing Your Assets, Their Condition, How Critical they Are, and Their Risk of Failure

Employing **Technology** to Track Assets, Analyze Assets, and to Predict Problem Areas

Implementing & Improving **Processes** to Support More Effective PM, R&R, and CIP Programs

Investing in **People** through proper training to ensure buy-in and stewardship

Initial Questions

- Areas of Focus?
- Procurement process?
- AM components of interest?
  - *Asset Inventory/Register*
  - *Asset Condition*
  - *Service Requests*
  - *Work Orders*
  - *Risk Assessment*
  - *Capital Planning*
  - *Inventory Tracking*
  - *Fleet Management*
- Technology requirements/barriers

Key Software Differentiators

- Requirements compatibility
- Cost pricing not uniform across software
- Training requirements
- IT Infrastructure / Computing Environment
- CMMS vs. Asset Management Software

Methodology

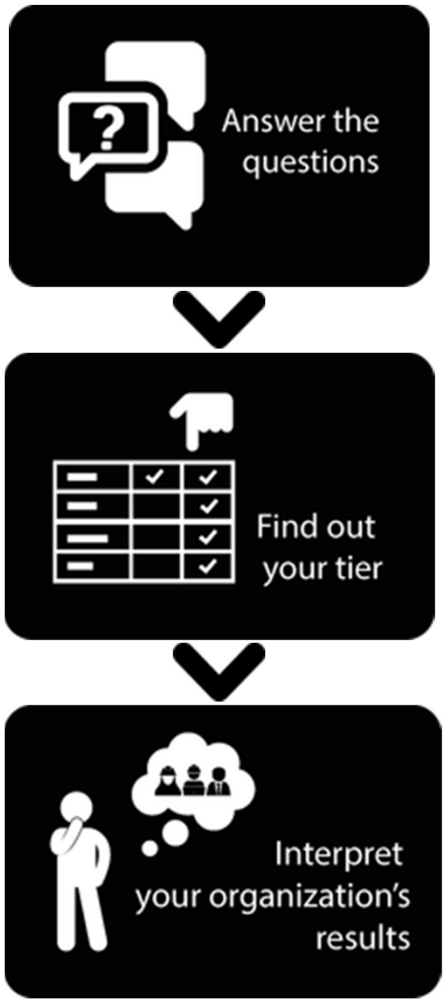
- Created matrix of systems & requirements (System Feature Index)
  - *Evaluated Functional, Technical & Cost Criteria*
  - *Developed Basic, Standard & Advanced "Tiers"*
- Created series of questions relating back to the matrix/tiers

ID	Feature	CUPSS	Fiix	Beehive	Cityworks	NEXGEN	Vueworks	Maximo
		Basic		Standard				Advanced
Incorporate Maintenance Protocols								
F-1	The system can integrate compliance protocols for assets	No	No	Yes	Yes	Yes	Yes	Yes
Monitoring Materials								
F-2	Service requests can track estimated costs for the requested work	No	Yes	Yes	Yes	Yes	Yes	Yes
F-3	The system tracks equipment costs at the work order level	No	Yes	Yes	Yes	Yes	Yes	Yes
F-4	The system tracks materials costs at the work order level	Yes	Yes	Yes	Yes	Yes	Yes	Yes
F-5	The system tracks job-costing information for all defined preventive and predictive maintenance activities	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Monitoring Staffing								
F-6	The system tracks service requests	No	Yes	Yes	Yes	Yes	Yes	Yes
F-7	The system can assign a service request to a crew	No	Yes	Yes	Yes	Yes	Yes	Yes
F-8	The system can assign a service request to a single person	No	Yes	Yes	Yes	Yes	Yes	Yes
F-9	The system can track crew assignments daily	No	Yes	Yes	Yes	Yes	Yes	Yes
F-10	The system captures time on-site for each crew member	No	Yes	Yes	Yes	Yes	Yes	Yes

Yes | No | Modification to the software required | Third party software required

Tool Workflow

- Answer a series of questions
- Tool produces a recommended tier
- Organization interprets results



Tool Questions

- Number of stormwater assets managed
- Number of users
- Number of citizens served
- CMMS Budget
- IT Department In-house
- Risk Evaluation/Capital Planning needs
- Mobile component
- GIS component
- Business System Integration

Tool Results

- Recommended Tier
  - *Written explanation*
  - *Cost ranges*
  - *Disclaimers*
  - *Links to explanation of other tiers*

	Basic	Standard	Advanced
Maintain asset registry	✓	✓	✓
Schedule tasks	✓	✓	✓
Store budget info	✓	✓	✓
Track costs and work orders	✓	✓	✓
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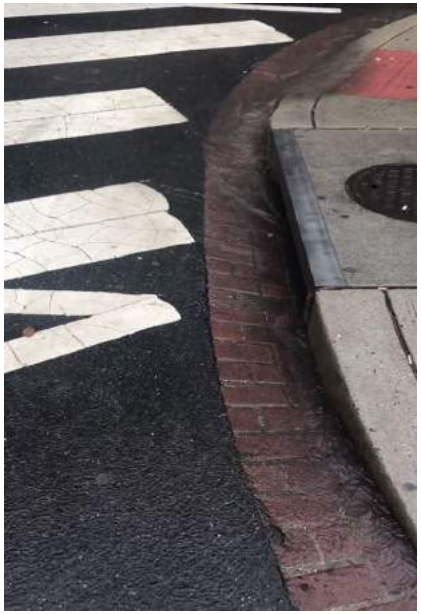
Substatial training required	–	✓	✓
Strategic planning support	–	–	✓
Can perform risk evaluations	–	–	✓
Can perform capital planning	–	–	✓
Typical platform	Desktop + Web	Desktop + Web + Mobile	Desktop + Web + Mobile
Costs required	$0 - $5,000	$5,000 - $200,000	$200,000 +

Module 1 O&M

Institutional Options for Improved Stormwater O&M

Presented by:
Bill Cesanek, AICP
CDM Smith

Presentation Overview



- History of Stormwater Services in NJ
- Benefits of Expanded Stormwater O&M
- Who Can Provide and Manage Stormwater O&M Services in NJ?
- Options to Expand O&M Capacity

History of Stormwater Management in NJ

- Stormwater drainage systems in NJ suburbs were typically “inherited” by towns, from developers
- No mechanism exists for towns to collect funds dedicated to stormwater mgmt., O&M
- Stormwater systems might be characterized as an “orphan” utility in NJ
- Storm system maintenance usually funded from property taxes
- Reactive stormwater management & maintenance vs. Proactive; shift in approach

Early Project Findings

Regional Entity

The scarcity of intermunicipal arrangements, or using a regional entity to manage stormwater makes O&M responsibilities among jurisdictions *less efficient* and *more challenging*.

Institutional Knowledge

Providing additional information to towns about options, opportunities, and sharing knowledge about emerging best practices would support improved stormwater management.

Benefits of Improved Stormwater O&M

- Major drivers: Reducing flooding, improving public safety, & regulatory compliance
- Preventative maintenance is less costly than facility replacement; extends the life of infrastructure
- Public safety includes avoiding emergencies, such as sink holes, pipe failures, road damage/closure
- Reduces incidences of maintenance-related flooding (e.g., clogged catch basins)
- Water quality benefits

Existing Entities that Might Improve Stormwater Management O&M

Public Utility Framework

- Water or Wastewater Utility
- Municipal and County Utilities Authority
- Stormwater Utility
- Environmental Authorities
- County Improvement Authorities
- Flood Control Commissions
- Private (Investor-Owned) Utilities

Jurisdiction-Based Framework

- Municipal Government
- County Government
- Inter-Municipal Services Agreements
- Jurisdiction-Based Private Contracting

State or Regulatory Agency Functions

- State-Authorized Regional Commission (Highlands, Meadowlands, Pinelands)
- Special (Improvement) Districts

Level of Service Matrix: To Achieve Mgmt Goals

Level of Service	Program Management	Regulatory Compliance	Operation and Maintenance	Capital Improvement Projects
5	Comprehensive Planning & Full Implementation Capabilities	Exemplary Permit Compliance	Fully Preventative/ 100% Routine	Prioritized / Fully-Funded
4	Pro-Active Planning & Systematic CIP Implementation Capabilities	Pro-Active Permit Compliance	Mixture of Routine and Inspection Based	Phased Implementation / Allocated Budgets
3	Priority Planning & Partial CIP Implementation Capabilities	Permit Compliance	Mixture of Inspection and Responsive Based	Complaint, Inspection-Based / Moderate Budget
2	Reactionary Planning & Minimal CIP Implementation Capabilities	Below Minimum Permit Compliance	Primarily Reactive	Critical Needs Only / Minimum Budget
1	No Planning & No CIP Implementation Capabilities	Low Compliance	Resources Not Available	No Planning / No Budget

Comparison: Stormwater O&M Functions by Existing Entity Type

Entity type	Program Management/ Technical Staff	Maintenance Staff and Equipment	Technology and Skills for Inventorying/ Asset Management	Utility Fee Collection System Structure
Local Municipal/County	🟢	🟢	🟠	🔴
Inter-Municipal Agreement	🟢	🟢	🟠	🔴
Private Contractor Support	🟢	🟢	🟠	🔴
Municipal or Co-Utility Authority	🟡	🟡 🔴	🟡	🟡
Investor-Owned Utility	🟡	🟡 🔴	🟡	🟡
Regional Board/Commission/Council (Overseeing Water Resources)	🟠	🔴	🔴	🟠
Special District	🔴	🟠	🟠	🟡

🟢 = good mgmt. potential ranging to low mgmt. potential= 🔴

Examples of Expanded or Improved Stormwater O&M

- Implement routine stormwater infrastructure *condition assessment* program
- Seek public input to identify most serious stormwater management issues/concerns, identify LoS
- Identify preventative maintenance functions to avoid emergencies
- Collaborate with adjacent/similar towns to share equipment/staff resources

Institutional Options for Improved Stormwater Mgmt

- Option 1: Create inter-municipal agreements to perform agreed-upon *shared stormwater O&M functions*, by sharing equipment, staff, and expertise

- Benefit: Improves cost-effectiveness over parallel individual stormwater O&M, through economies of scale

Institutional Options for Improved Stormwater Mgmt

- Option 2: Leverage regional agency powers to help implement multi-municipal stormwater O&M management services (e.g., counties, Meadowlands, Pinelands, Highlands)

- Benefit: Improves cost-effectiveness over individual stormwater O&M through economies-of-scale, and possible regional entity funding; can simplify contracting for storm services

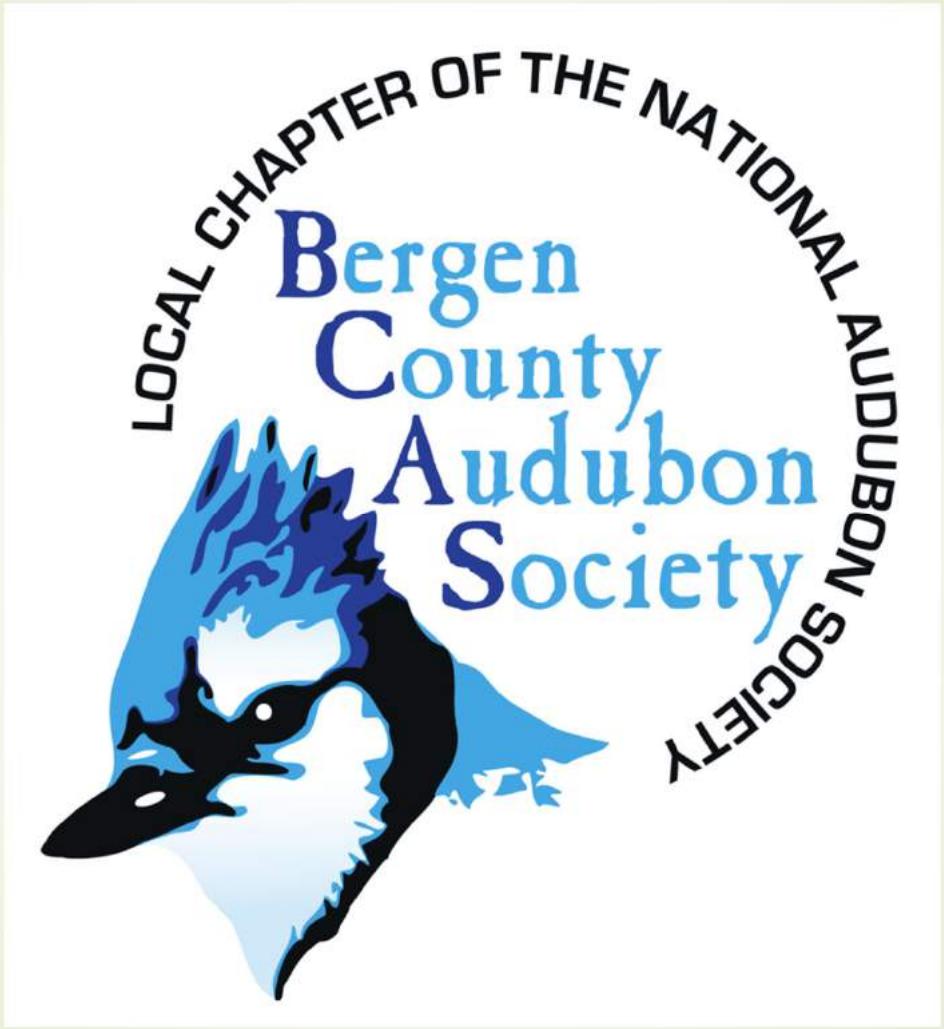
Institutional Options for Improved Stormwater Mgmt

- Option 3: Explore current authority that may allow for creation of some form of stormwater utility; untested legally but not prohibited
- Benefit: Creates both a dedicated utility function for stormwater (like water and sewer) and a dedicated funding mechanism

Open Forum
Questions and Answers

Breakout Session

Feedback on successes, challenges & recommendations for implementing AM/O&M processes for stormwater infrastructure


LOCAL CHAPTER OF THE NATIONAL AUDUBON SOCIETY
Bergen
County
Audubon
Society

Restoring Native Plants in the Meadowlands

Go Native!

- **Adapt** better to our soils and climate
- Require **less** care and watering when established
- Use **less** fertilizer
- Need **less** pest control
- **Attract** Pollinators and butterflies
- **Offer** food and shelter year round

What's an Invasive Plant ?

- SOME SOLD AT GARDEN CENTERS
- Japanese Barberry
- Burning Bush
- Japanese Honeysuckle
- Multi-flora Rose
- Russian & Autumn Olive
- Mile-a-Minute Vine

Japanese knotweed

RIVER BIRCH

Eastern Red Cedar

NATIVE SHRUBS

Silky Dogwood

Bayberry

Inkberry Holly

Groundsel Shrub

Our Native Butterfly-bush

Buttonbush

Eastern Tiger Swallowtail

In the Backyard too

Plant Spicebush-Not Forsythia

Spicebush Swallowtail !!!

Spicebush Caterpillar

OUR NATIVE WILDFLOWERS

Agastache (Hyssop)

Joe-Pye Weed

MILKWEED for the Monarchs !

Swamp Milkweed

Monarchs will Thank you !

MORE MILKWEED !

Common Milkweed

Butterfly Weed

PLEASE PLANT GOLDENROD !!!

WILD SENNA-Makes Pollinators CRAZY !!

Prairie Coneflower-Great For Naturalizing

Obedient Plant

More Native Wildflowers

NY ASTERS

MONARDA

Native Grasses -Important Ecosystem

Big Bluestem

Little Bluestem

Truck Load –Big Bluestem

Switch Grass

Host Plant

Delaware Skipper

Northern

Broken-dash Skipper

Please Visit Our Gardens

Open Forum
Questions and Answers

Lunch

Workshop will resume at 12:55 PM

Rutgers

RUTGERS
THE STATE UNIVERSITY OF NEW JERSEY

Case Studies: Green Stormwater Infrastructure Projects and Lessons Learned

Christopher Perez
cperez@envsci.rutgers.edu
www.water.rutgers.edu

January 9, 2019

RUTGERS
THE STATE UNIVERSITY OF NEW JERSEY

Lessons Learned:

1) Maintenance agreements and MOU's

2) Find the right audience

3) Community engagement and finding a local green infrastructure champion

Rutgers Cooperative Extension Water Resources Program

Our mission is to identify and address community water resources issues using sustainable and practical science-based solutions.

Green Infrastructure Planning process:

Impervious Cover Assessment

Identifying the problem

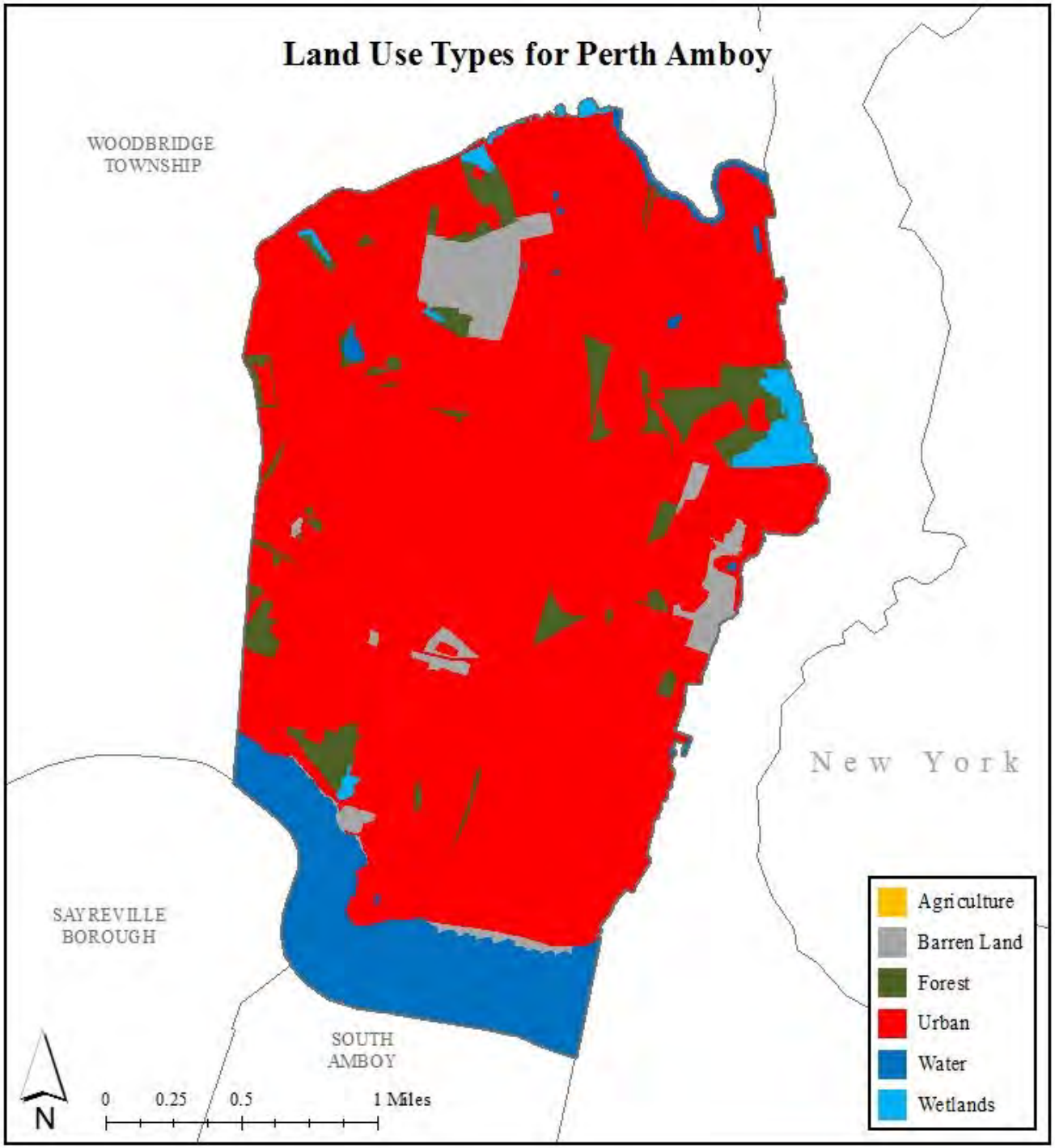
Impervious Cover Reduction Action Plan

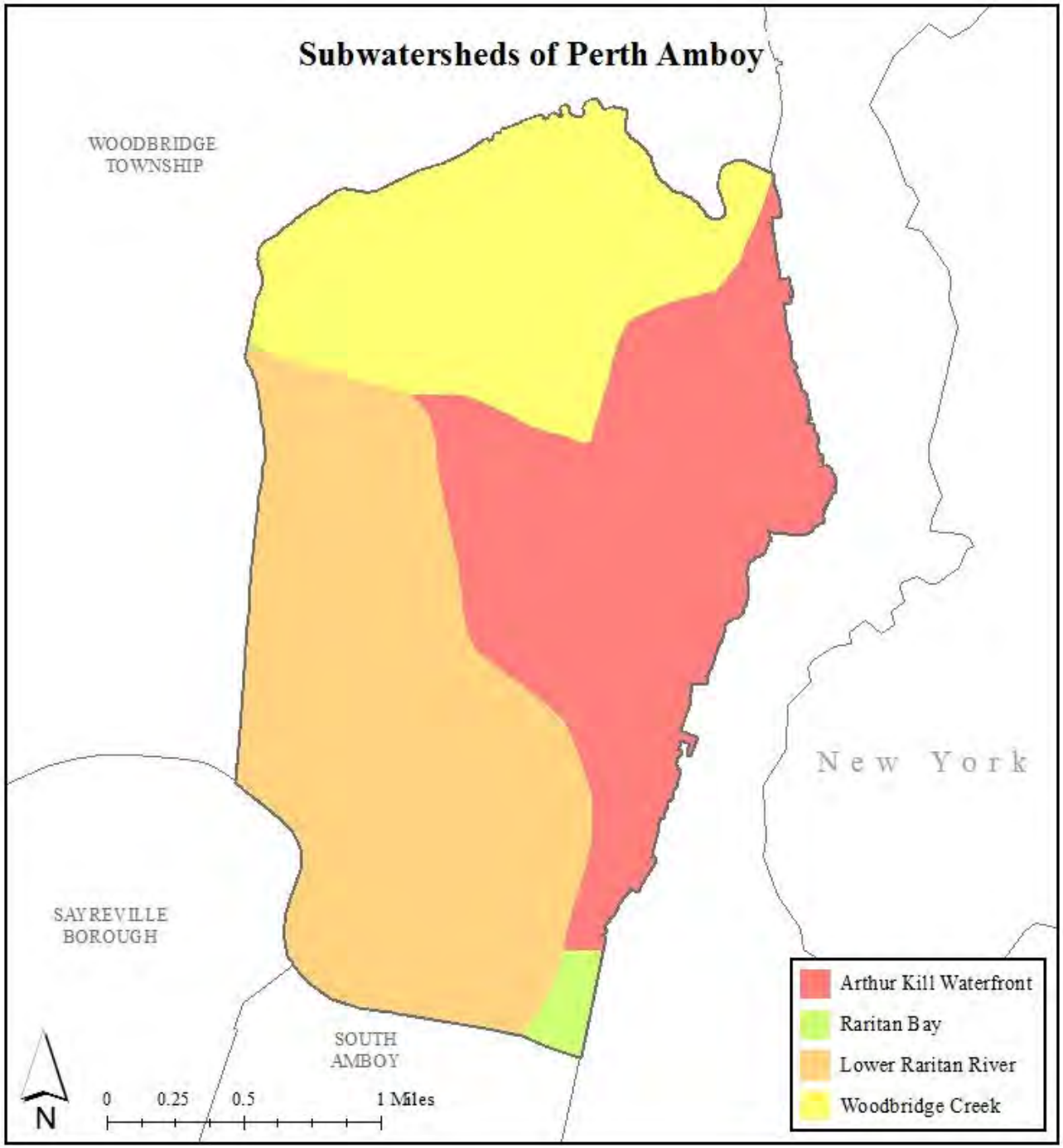
Identifying potential solutions

Green Infrastructure Feasibility Study

Marketing and building local partnerships

= Buildable projects


Land Use Types for Perth Amboy
WOODBRIDGE TOWNSHIP
New York
SAYREVILLE BOROUGH
SOUTH AMBOY
N
0
0.25
0.5
1 Miles
Agriculture
Barren Land
Forest
Urban
Water
Wetlands


Subwatersheds of Perth Amboy
WOODBRIDGE TOWNSHIP
New York
SAYREVILLE BOROUGH
SOUTH AMBOY
N
0
0.25
0.5
1 Miles
Arthur Kill Waterfront
Raritan Bay
Lower Raritan River
Woodbridge Creek

Perth Amboy

ALL SITES | ARTHUR KILL WATERFRONT | LOWER RARITAN RIVER | WOODBRIDGE CREEK


1 Anthony V. Ceres School


2 Assumption Catholic School


3 Education Center


4 Ignacio Cruz Early Childhood Center


5 Perth Amboy High School


6 Perth Amboy Vocational School


7 687 Fayette St Plaza


8 Convery Plaza Shopping Center


9 Dr. Herbert N. Richardson 21st Century School


10 Public School No. 7


11 Raritan Bay Medical Center


12 Robert N. Wilentz Elementary


13 Walgreens


14 Washington Park


15 YMCA and Perth Amboy Police Department

WASHINGTON PARK

Subwatershed: Lower Raritan River

Site Area: 309,374 sq. ft.

Address: Weirup Street
Perth Amboy, NJ 08861

Block and Lot: Block 191.01, Lot 1

Parking spaces can be replaced with pervious pavement to infiltrate stormwater. Gutters and a rain garden can be installed to capture, treat, and infiltrate runoff near the playground. A preliminary soil assessment suggests that the soils have suitable drainage characteristics for green infrastructure.

Impervious Cover		Existing Loads from Impervious Cover (lbs/yr)			Runoff Volume from Impervious Cover (Mgal)	
%	sq. ft.	TP	TN	TSS	For the 1.25" Water Quality Storm	For an Annual Rainfall of 44"
21	63,682	3.1	32.2	292.4	0.050	1.75

Recommended Green Infrastructure Practices	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Maximum Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cu. ft./second)	Estimated Size (sq. ft.)	Estimated Cost
Bioretention systems	0.019	3	1,384	0.05	543	$2,715
Pervious pavements	0.335	56	24,587	0.92	7,344	$183,600

GREEN INFRASTRUCTURE RECOMMENDATIONS

Washington Park

- pervious pavements
- drainage areas
- property line
- 2012 Aerial: NJOIT, OGIS

0 25' 50'

RUTGERS
THE STATE UNIVERSITY
OF NEW JERSEY

1) **Lesson Learned: A handshake agreement for maintenance is not enough, but a Memorandum of Understanding and written maintenance agreement works.**

Case Studies: Milltown and many, many more


Parkview Middle School
Milltown, NJ


NO
PARKING
ANY
TIME


Parkview
Ram Garden
GARDEN

Kilmer Elementary School
Milltown, NJ

Parkview Middle School
Milltown, NJ

RUTGERS
THE STATE UNIVERSITY
OF NEW JERSEY

2) Lesson Learned: Finding the right audience and bringing the right people to the table.

Case Studies: Woodbridge Township


Kennedy Park
Woodbridge, NJ

Inman Library
Woodbridge, NJ


DINGO
1080

Inman Library
Woodbridge, NJ

Fords Library
Woodbridge, NJ


FORDS BRANCH
WOODBRIDGE
PUBLIC
LIBRARY

Fords Library
Woodbridge, NJ

Iselin Library
Woodbridge, NJ

Iselin Library
Woodbridge, NJ

Woodbridge Municipal Building
Woodbridge, NJ

Woodbridge Municipal Building
Woodbridge, NJ

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OF NEW JERSEY

3) Lesson Learned: Community engagement and finding a local green infrastructure champion

Case Studies: Pilesgrove, Hillsborough, Pohatcong, Camden, Hampton, Newton

Municipal Building
Pilesgrove, NJ

Municipal Building
Hillsborough, NJ

Municipal Building
Hillsborough, NJ

Municipal Building
Pohatcong, NJ

Stormwater Planter
Public School
Camden, NJ

Camden, NJ

McKeown Elementary School
Hampton Township, NJ


HAMPTON
TOWNSHIP
HYUNDAI


160LC-3

McKeown Elementary School
Hampton Township, NJ

Memory Park
Newton, NJ


DEERE
60C


RESERVED
PARKING
PENALTY
$100 1ST OFFENSE
SUBSEQUENT OFFENSES
$100 MIN AND/OR
UP TO 90 DAYS
COMMUNITY SERVICE
TOW-AWAY ZONE
SHERIFF'S


CLUBHOUSE

RUTGERS
THE STATE UNIVERSITY
OF NEW JERSEY

Christopher Perez
cperez@envsci.rutgers.edu
www.water.rutgers.edu

Advancing the Local GSI Industry, Innovation, and Economy

NDR Regional Stormwater Infrastructure Toolkit Workshop
January 9, 2019

GSI PARTNERS
REIMAGINING STORMWATER

Sustainable Business Network of Greater Philadelphia

- Building a just, green, and thriving economy in the Greater Philadelphia region
- In support of *Green City, Clean Waters* nature-based vision

Green Stormwater Infrastructure (GSI) Partners

- Initiative of SBN
- Advancing the local GSI industry and innovation to maximize the *triple bottom line* impact of GCCW
- 80 members in GSI design, build, maintenance, material supply

**SBN's GSI Partners are generously funded by the Surdna Foundation, William Penn Foundation and Spring Point Partners*

GSI PARTNERS
REIMAGINING STORMWATER

Green City, Clean Waters

GCCW is the City of Philadelphia's 25-year comprehensive nature-based stormwater management plan to meet state and federal regulations related to combined sewer overflows (CSOs).

- The City's commitment to primarily using green stormwater infrastructure (GSI)
- Positioned Philadelphia as a national leader in stormwater management
- Philadelphia Water Department (PWD) met and exceeded GCCW's first 5-year targets, and they have stated that they are on track to meet and exceed year 10 targets.
- Demonstrated environmental, social and economic benefits

As defined by PWD, "Green Stormwater Infrastructure (GSI) includes a range of soil-water-plant systems that intercept stormwater, infiltrate a portion of it into the ground, evaporate a portion of it into the air, and in some cases release a portion of it slowly back into the sewer system."

Environmental Benefits

- Reduces stormwater runoff
- Improves water quality
- Improves air quality, reduced greenhouse gasses, reduced urban heat island effect
- Enhances adaptability and resiliency
- Improves habitat and biodiversity
- Provides other ecosystem services

Social Benefits

- Supports new and improved community amenities and recreation opportunities
- Reduces crime and violence
- Improves employee and student health and productivity

Economic Benefits

- **More affordable municipal approach**
- **More accessible on-ramps to employment**
- **More contracting opportunities for small and/or local firms**
- **Increased revenue to the City**
- **Quantifiable environmental and social benefits**

GSI PARTNERS
REIMAGINING STORMWATER

GSI Operations & Maintenance

- Developed in 2015, as the region's first and only course targeted at landscape professionals seeking to strengthen or expand their service portfolio in public and/or private GSI Operations and Maintenance.
- The course has support from PWD and is offered annually each fall.
- Engage nearly 100 local landscape professionals as students, and dozens of local public and private practitioners as instructors.

Course Framework

Three-day Course → 2 classroom and 1 field day

- Module 1: Foundation Knowledge
  - Regulatory Context and Stormwater Basics
  - Definitions of SMP Types and Anatomy
  - Design Considerations
  - Construction Considerations
  - O&M Agreements
  - Adaptive & Prescriptive Management
- Module 2: Tasks, Common Issues, and Issue Response
  - Crew Safety and Communication
  - Public Safety and Performance Issues
  - Debris Removal
  - Porous Asphalt & Paver Maintenance
  - Inspection & Maintenance of Subsurface Elements
  - Other Tasks and Considerations
  - Monitoring & Maintenance
- Module 3: Cultural Landscape Practices
  - Planting, Transplanting, and Seeding
  - Watering and Mulching
  - Soil Management
  - Target and Non-Target Vegetation Management

Opportunities & Needs

- Maintenance informing other aspects of GSI (i.e. design, construction, costs, etc.)
- Local focus within Philadelphia and surrounding municipalities
- Build business capacity (services and staff)
- Leverage the skills and expertise of other businesses
- Contract opportunities in public and private GSI

- Continue to identify best practices → bring other experts into the conversation
- Tools that connect property owners to GSI businesses
  - PWD Stormwater Connect

GSI PARTNERS
REIMAGINING STORMWATER

Thank you!

Fran Lawn
Manager, GSI Partners
Sustainable Business Network of Greater Philadelphia
fran@sbnphiladelphia.org

Open Forum
Questions and Answers

RACI Exercise



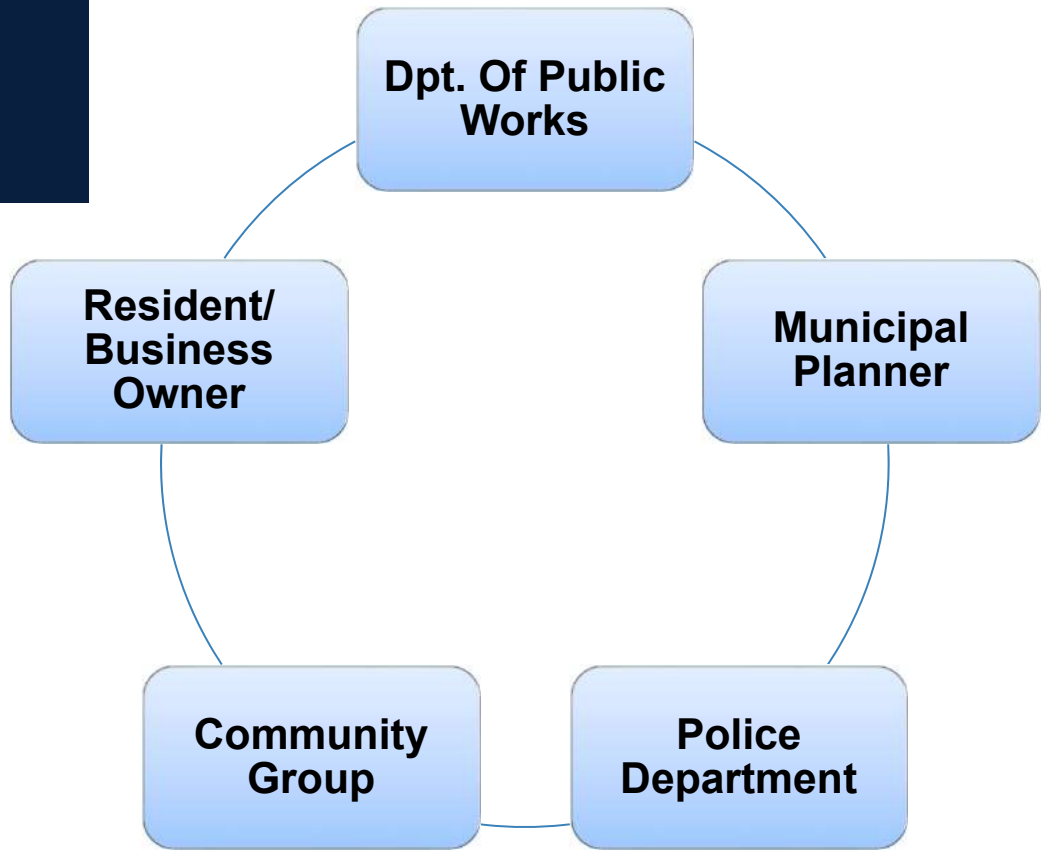
Responsibility Charting Management Tool: RACI Matrix

Presented by:
Mel Harclerode, PhD BCES ENV SP
CDM Smith
Edison, New Jersey

Responsibility Charting

- Systematic process to clarify roles and relationships to achieve an outcome, such as maintaining stormwater infrastructure
- A collaborative tool to address work flow process gaps
- Communicate departmental and stakeholder roles and expectations

Stormwater Infrastructure Stakeholders



RACI Matrix

Responsible "R"	The individual(s) who actually completes the task, the action/implementation. Responsibility can be shared.
Authorize "A"	The individual who is ultimately responsible. Includes yes or no authority and veto power.
Consult "C"	The individual(s)or groups to be consulted prior to a final decision or action.
Inform "I"	The individual(s) or groups who need to be informed after a decision or action is taken.

RACI Matrix Town Fair Example

	Department of Public Works	Municipal Planner	Police Department	Community Volunteer Group	Public (Residents/ Business Owners)
Identify location	C	A/R	C	C	I
Select vendors	I	R	I	C	C
Fair oversight	R/C	A	R/C		
Health & Safety	C	C	A/R	I	I

Rain Garden O&M Exercise

- Mix of low and high growth vegetation in a municipal park constructed by the DPW
- Contains two stormwater collection drains
- Includes a walking path thru the vegetation
- Suburban area, in vicinity of a school and train station
- Environmental Commission is the active community group

Rain Garden O&M Exercise

Individual Exercise:

1. Complete the RACI matrix based on your organization's roles/responsibilities

2. Identify work flow process gaps and solutions

3. Share exercise findings and feedback with the group

RACI Matrix

Rain Garden O&M Exercise

	Department of Public Works	Municipal Planner	Police Department	Community Volunteer Group	Public (Residents/ Business Owners)
Budget/ Reporting					
Debris/ Trash Maintenance					
Replanting/ Weeding					
Health & Safety					

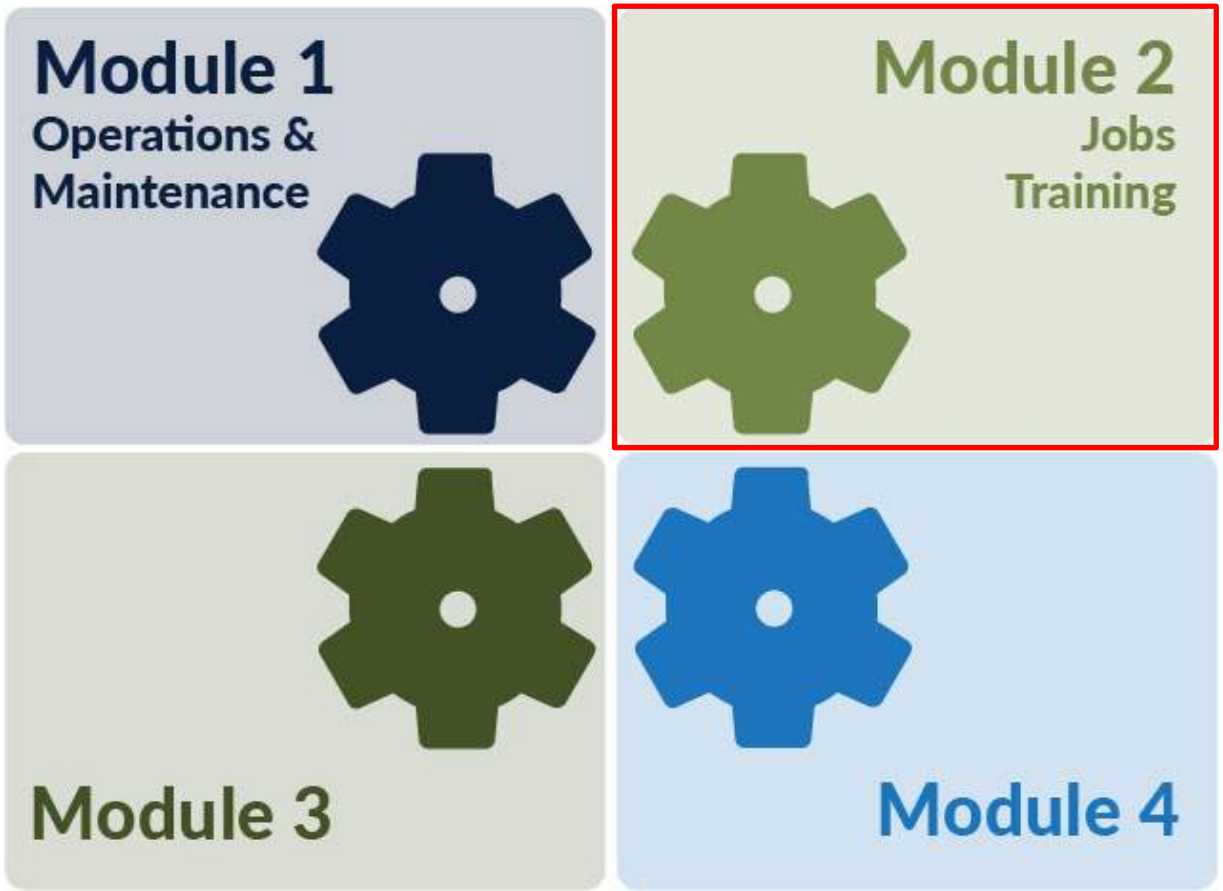
Module 2

Jobs Training Learning Session

Presented by:
Margaret Stewart, ENV SP
Louis Berger
Washington, DC

Module 2 – Jobs Training Presentation Overview

- **Module 2 Overview**
- **Module 2 Progress**
- **Module 2 Next Steps**
- **The National Green Infrastructure Program – *Presented by Adriana Caldarelli***


Module 1
Operations &
Maintenance
Module 2
Jobs
Training
Module 3
Module 4

NDR Regional Stormwater Infrastructure Toolkit

Module 2 Overview

Module 2 Components

Stormwater O&M Training Programs

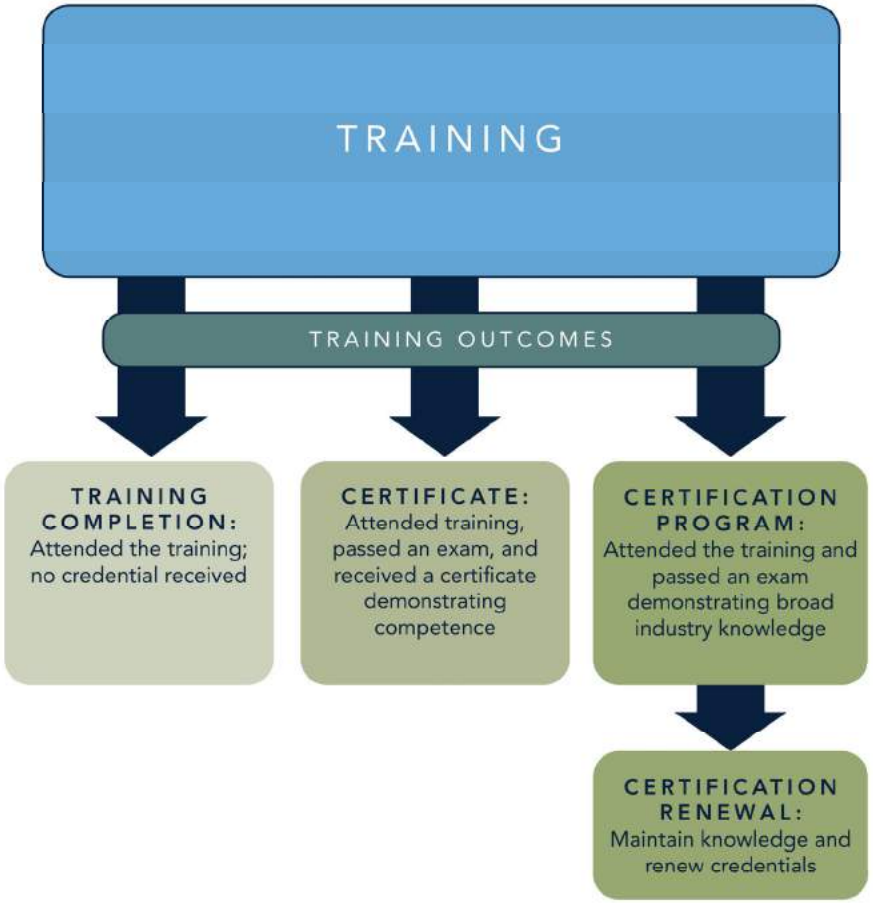
Conduct research to identify best training practices

Professional Certification Options

Examine existing GI operations and maintenance certification programs

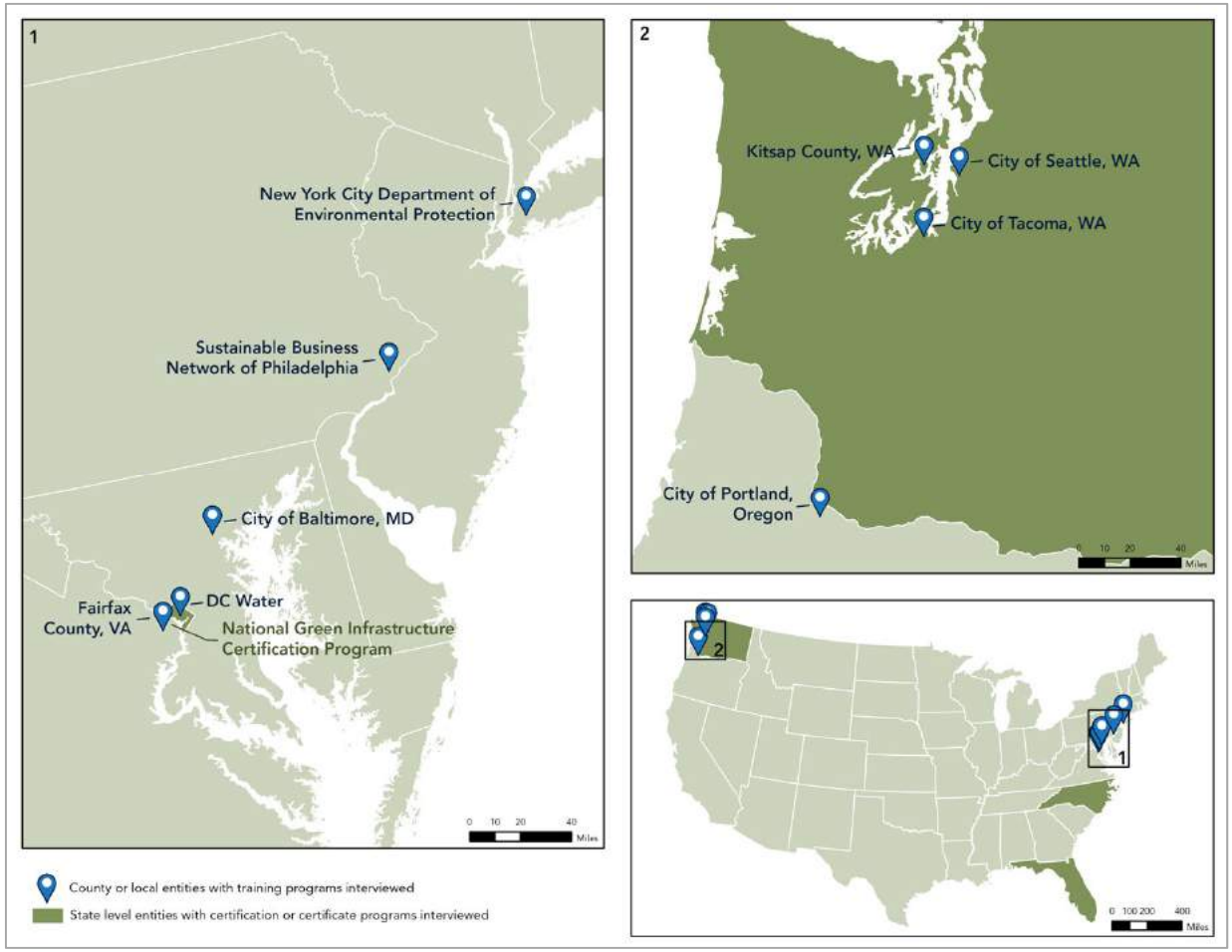
Career Development Opportunities

Analyze career opportunities within existing stormwater infrastructure maintenance programs


TRAINING
TRAINING OUTCOMES
TRAINING COMPLETION:
Attended the training; no credential received
CERTIFICATE:
Attended training, passed an exam, and received a certificate demonstrating competence
CERTIFICATION PROGRAM:
Attended the training and passed an exam demonstrating broad industry knowledge
CERTIFICATION RENEWAL:
Maintain knowledge and renew credentials

NDR Regional Stormwater Infrastructure Toolkit

Module 2 Progress


1
New York City Department of Environmental Protection
Sustainable Business Network of Philadelphia
City of Baltimore, MD
Fairfax County, VA
DC Water
National Green Infrastructure Certification Program
0 10 20 40 Miles
2
Kitsap County, WA
City of Seattle, WA
City of Tacoma, WA
City of Portland, Oregon
0 10 20 40 Miles
0 100 200 400 Miles
County or local entities with training programs interviewed
State level entities with certification or certificate programs interviewed

Stormwater O&M Training Programs

Factors Considered

- Maintenance and inspection protocols
- Who is trained…and by whom
- Training Frequency
- Training program cost and accessibility
- Success indicators
- Association with certificate or certification programs

Stormwater O&M Training Programs

Initial Findings

- Training generally geared towards in-house staff and contractors/consultants
- Cost and access is important
- Training programs often include community stakeholders and officials
- Geographic and climate-focused training most valued
- Educational material focused on core concepts, and contained a field component
- GI facilities on private property and in smaller jurisdictions will increase—long-term consideration
- Training can be a part of workforce and business development programs

GENERAL MAINTENANCE CARD

SiteID/FacilityID: 0161S/0175DP
Location: 10250 New Guinea Rd, Fairfax, VA 22032
PFM: Enhanced Extended Detention Dry Pond
Ownership: Fairfax County Board of Supervisors

ROUTINE MAINTENANCE

Note: Maintenance staff should be prepared for entry into the pool and marsh areas. Waders may be necessary. Waterproof gloves and eye protection should also be worn during maintenance and inspection activities.

First Routine Maintenance — Annually: July - August

Trash and Debris Management

1. Check for trash and debris in and around the facility including the inflows (A), rock weirs (B), and micropools (C). Walk entire site including upland (F) and marsh areas (D, E) to check for and remove trash and debris.
2. Report excessive trash to MSMD.

Operation Management

1. Check for blockage at the control structure (G), principal spillway pipe (H), and outfall (I). Remove debris when necessary.
2. Clean out excess sediment where applicable.

Wetland Plant Identification and Invasive Plant Species Removal

1. Catalog the type, health, distribution, and density of wetland plant species within the facility.
2. Identify and remove invasive species after cataloging, and before invasive plant species go to seed (July).

Second Routine Maintenance — Annually: February-April

Trash and Sediment Forebay Maintenance

1. Remove all trash and debris as in the First Routine Maintenance.
2. Clean out sediment where applicable.

Grass and Wetland Vegetation Management

This maintenance should occur once every 1-3 years as needed to control vegetation.

1. **Upland and Dam Embankment Zone (F, J):** Mow all access areas, the top and back of the dam embankment, 10 feet from the toe of the dam, and down the face of the embankment in accordance with the landscaping plan.
2. **High Marsh Zone (E):** Use a rotary mower (Bush Hog or equivalent) to harvest vegetation (trim to no shorter than 6-8 inches) in all high marsh areas. Remove all clippings from facility. Do not mow or trim trees and shrubs. While maintenance personnel should always use the landscaping plan to determine where the high marsh zones are, a general rule of thumb is that if personnel can access the area with a rotary mower, it is a high marsh zone.
3. **Low Marsh Zone (D):** Use a string trimmer to harvest vegetation (trim no shorter than 6-8 inches) in all low marsh areas. Remove all clippings from facility. While maintenance personnel should always use the landscaping plan to determine where the low marsh zones are, a general rule of thumb is that if personnel can walk through the area without standing or sinking in mud, then it is a low marsh area.
4. **Micropool Zone (C):** Do not harvest the emergent vegetation found growing in the micropools. Continue routine maintenance.

Key	Function	Vegetation/Surface Cover
A	Inflows (Str. # Ex.9, Str. # Ex.13)	N/A
B	Rock Weirs	Sandstone and Rip-rap
C	Micropools	Seed Mix B & Micropool Plugs
D	Low Marsh	Seed Mix B
E	High Marsh	Seed Mix B, 18 Deciduous Trees, & 72 Shrubs
F	Upland	Seed Mix A, 50 Deciduous Trees, 30 Evergreen Trees, & 32 Shrubs
G	Control Structure (Str. # Ex.11)	N/A
H	Principal Spillway Pipe	N/A
I	Outfall (Str. # Ex.12)	N/A
J	Dam Embankment	Turfgrass

GENERAL MAINTENANCE CARD

SiteID/FacilityID: 0161S/0175DP
Location: 10250 New Guinea Rd, Fairfax, VA 22032
PFM: Enhanced Extended Detention Dry Pond
Ownership: Fairfax County Board of Supervisors

Site Photos

1) Dam Embankment (Map Key J) – check for holes and unauthorized trees and maintain as necessary.
2) Micropool (Map Key C) – maintain wetland plugs as necessary.
3) Control Structure (Map Key G) – check for debris and maintain as necessary.
4) Facility overall photo with the flow path highlighted. The inflow points (Map Key A) are marked as "In" and the control structure (Map Key G) is marked "Out" in the picture.

For more information please contact Fairfax County MSMD at 703-877-2800

Site Vegetation

Upland Seed Mix (Seed Mix A)

Scientific Name	Common Name	%Mix
Sorghastrum nutans	Indian Grass	30
Schizachyrium scoparium	Little Bluestem	20
Asclepias incarnata	Swamp Milkweed	8
Elymus virginicus	Virginia Wild Rye	5
Rudbeckia hirta	Black-Eyed Susan	5
Andropogon virginicus	Broomsedge	5
Heliopsis helianthoides	Oxeye	5
Chamaecrista fasciculata	Partridge Pea	3
Tridens flavus	Purpletop Tridens	3
Zizia aurea	Golden Alexanders	2
Eupatorium hyssopifolium	Hyssop-leaf Thoroughwort	2
Penstemon digitalis	Tall White Beardtongue	2
Monarda fistulosa	Wild Bergamot	2
Penstemon laevigatus	Smooth Beartongue	1
Solidago juncea	Early Goldenrod	1
Liatris aspera	Tall Blazing Star	1
Aster prenanthoides	Zigzag Aster	1

Marsh Seed Mix (Seed Mix B)

Scientific Name	Common Name	%Mix
Carex vulpinoidea	Fox Sedge	31
Elymus virginicus	Virginia Wild Rye	20
Carex lurida	Lurid (Shallow) Sedge	14
Scirpus atrovirens	Green Bulrush	5
Verbena hastata	Blue Vervain	4
Cinna arundinacea	Wood Reedgrass	3.5
Carex lupulina	Hop Sedge	3
Juncus effusus	Soft (Common) Rush	3
Carex scoparia	Broom Sedge	3
Onoclea sensibilis	Sensitive Fern	2
Heliopsis helianthoides	Oxeye	2
Aster umbellatus (Doellingeria)	Flat Topped White Aster	1
Asclepias incarnata	Swamp Milkweed	1
Scirpus cyperinus	Woolgrass	1
Glyceria canadensis	Rattlesnake Grass	1
Aster novae-angliae (Symphyotrichum)	New England Aster	1
Eupatorium fistulosum	Hollow Joe-Pye-Weed	0.5
Mimulus ringens	Monkey Flower	0.5
Ludwigia alternifolia	Seedbox	0.5
Eupatorium perfoliatum	Boneset	0.5
Scirpus expansus	Wood Bulrush	0.5
Sisyrinchium angustifolium	Narrowleaf Blue-Eyed Grass	0.5
Verbesina alternifolia	Wingstem	0.5
Vernonia altissima	Tall Ironweed	0.5
Carex intumescens	Bladder (Star) Sedge	0.4
Pycnanthemum tenuifolium	Slender Mountain Mint	0.1

Live Plugs for Micropool Planting

Scientific Name	Common Name	Size
Carex Stricta	Tussock Sedge	6 In.
Sagittaria Latifolia	Duck Potato	6 In.
Pontederia Cordata	Pickerel Weed	6 In.
Peltandra Virginica	Arrow Arum	6 In.

Invasive Species

The following invasive species have been identified as present or may be present at facility 0161S/0175DP. Invasive species must be identified and removed during the First Routine Maintenance schedule in July - August.

	Scientific Name / Common Name		Scientific Name / Common Name
1	Ailanthus altissima / Tree of Heaven	6	Typha Spp / Cattails
2	Cirsium arvense / Canada Thistle	7	Rosa multiflora / Multiflora Rose
3	Alliaria petiolata / Garlic Mustard	8	Rubus phoenicolasius / Wineberry
4	Microstegium vimineum / Japanese Stiltgrass	9	Rumex crispus / Curly Dock
5	Lonicera japaonicia / Japanese Honeysuckle		

Non-Routine Maintenance

Non-routine maintenance is triggered by the MS4 stormwater facility inspections. The following situations are considered non-routine maintenance problems:

- Replanting
- Clogging
- Deteriorated Principal Spillway Pipe Connection
- Rodent Activity (Holes)
- Piping Failure (Internal Erosion)
- Structural Deterioration (Cracks, Spalling, Rust)
- Undermined or Settled Structure

Treatment of these problems can be found in the General Maintenance Manual for Enhanced Extended Detention Ponds and Constructed Wetlands.

Stormwater O&M Professional Certification

Factors Considered

- Cost and accessibility
- Format and curriculum
- Local and regional applicability
- Focus on green infrastructure operations & maintenance

Stormwater O&M Professional Certification

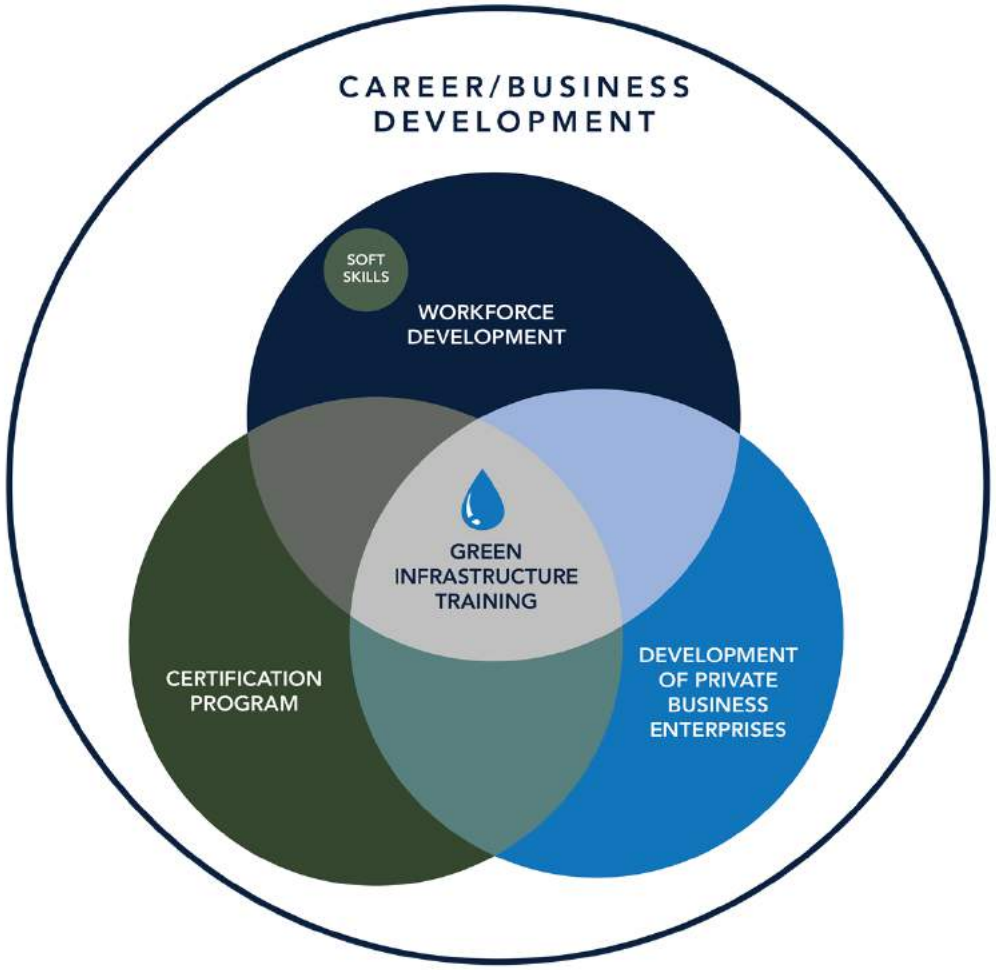
Initial Findings

- Meet needs in MS4 permits, consent decrees, resiliency programs
- Programs were on a spectrum of certificate to certification
- Links to state university extension programs
- NGICP—Only one true ANSI/ISO certification program
- Programs develop longer term capacity for stormwater O&M by providing a credential

Stormwater O&M Professional Certification

Program Benefits

- Promote knowledge and awareness of green infrastructure
- Develop long-term capacity for GI inspections, operations and maintenance
- Potentially powerful workforce and business development tool


CAREER/BUSINESS DEVELOPMENT
SOFT SKILLS
WORKFORCE DEVELOPMENT
GREEN INFRASTRUCTURE TRAINING
CERTIFICATION PROGRAM
DEVELOPMENT OF PRIVATE BUSINESS ENTERPRISES

Career Development Opportunities

Initial Findings

- Workforce development opportunities include on the job training programs
- Training programs are core components of stormwater managers' career development
- Training and credential programs are spurring development of private businesses in some areas

NDR Regional Stormwater Infrastructure Toolkit

Module 2
Next Steps

Phase II Deliverable

NATIONAL
GREEN
INFRASTRUCTURE
CERTIFICATION
PROGRAM

ngicp

Agenda

- Overview
- How was it developed?
- But what is it really?
- What now?

PROGRAM OVERVIEW

Water Environment Federation
the water quality people

ngicp | NATIONAL GREEN INFRASTRUCTURE CERTIFICATION PROGRAM

What is it?

- Tool to provide base knowledge for construction, inspection and maintenance of GI
- National credential
- Developed in accordance with ANSI accreditation guidelines

Water Environment Federation "the water quality people"

ngicp NATIONAL GREEN INFRASTRUCTURE CERTIFICATION PROGRAM

Who is it for?

- Construction and maintenance workers and inspectors
- High school diploma or GED

Water Environment Federation
the water quality people

ngicp NATIONAL GREEN INFRASTRUCTURE CERTIFICATION PROGRAM

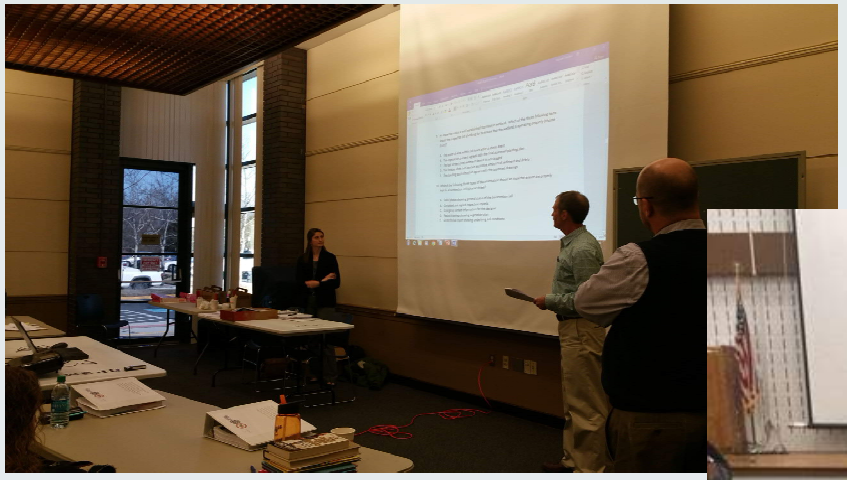
Why do we need this program?

Photos courtesy of Steve Jacobus, NJDEP

Water Environment Federation
the water quality people

ngicp NATIONAL GREEN INFRASTRUCTURE CERTIFICATION PROGRAM

How does it work?



Regional training

WEF-administered exam

Water Environment Federation
the water quality people

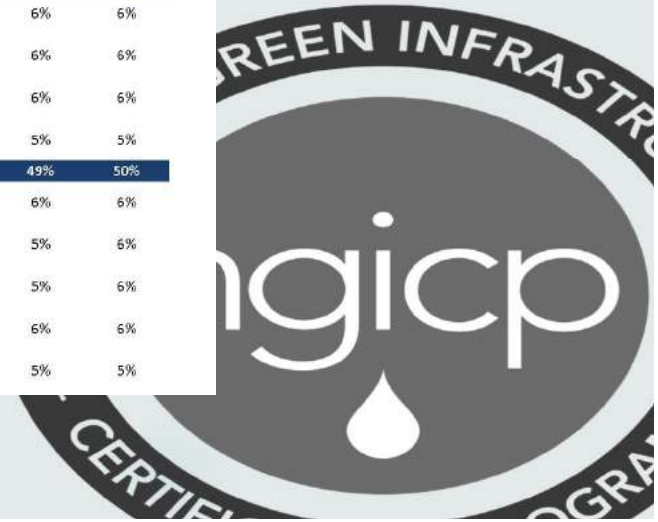
ngicp NATIONAL GREEN INFRASTRUCTURE CERTIFICATION PROGRAM

HOW WAS IT DEVELOPED?

Job Task Analysis

Initial Blueprint Weights based on the Recommendations of the JTA panel and Survey Respondants

Section/ Objective	Section/Objective Name	Weights			
			From Survey		
		From Original Panel	All Complete (n=120)	10 or fewer years in GI (n=83)	Less than Master's Degree (n=72)
1	Watershed Fundamentals	10%	11%	11%	11%
1.01	Apply the key concepts of basic hydrology/hydrologic function	6%	6%	6%	5%
1.02	Apply the basic concept and recognize the environmental benefits of stormwater management and green infrastructure	5%	6%	6%	6%
2	GI practices	22%	23%	23%	23%
2.01	Identify basic functionality of various GI practices	5%	6%	6%	6%
2.02	Identify the purpose, functionality, and properties of the basic physical components of GI practices	6%	6%	6%	6%
2.03	Apply key concepts related to lifecycle of GI practices	5%	6%	6%	6%
2.04	Identify the terminology used to describe various GI practices	5%	5%	5%	5%
3	GI Methods and Materials	52%	49%	49%	50%
3.01	Recognize the appropriate application of equipment for the construction or the maintenance of a GI practice	6%	6%	6%	6%
3.02	Apply the key concepts of site layout and grade checking	5%	6%	5%	6%
3.03	Recognize the purpose of common GI construction materials	7%	5%	5%	6%
3.04	Apply the key concepts of basic vegetation management and establishment	5%	6%	6%	6%
3.05	Recognize the significance of and identify the procedure for the proper storage and handling of materials	5%	5%	5%	5%



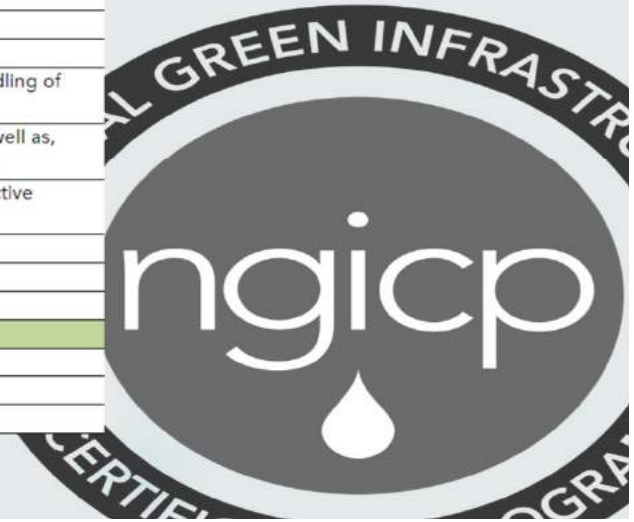
Exam Blueprint

Watershed Fundamentals	6-10%
Apply the key concepts of basic hydrology/hydrologic function	
Apply the basic concept and recognize the environmental benefits of stormwater management and green infrastructure	

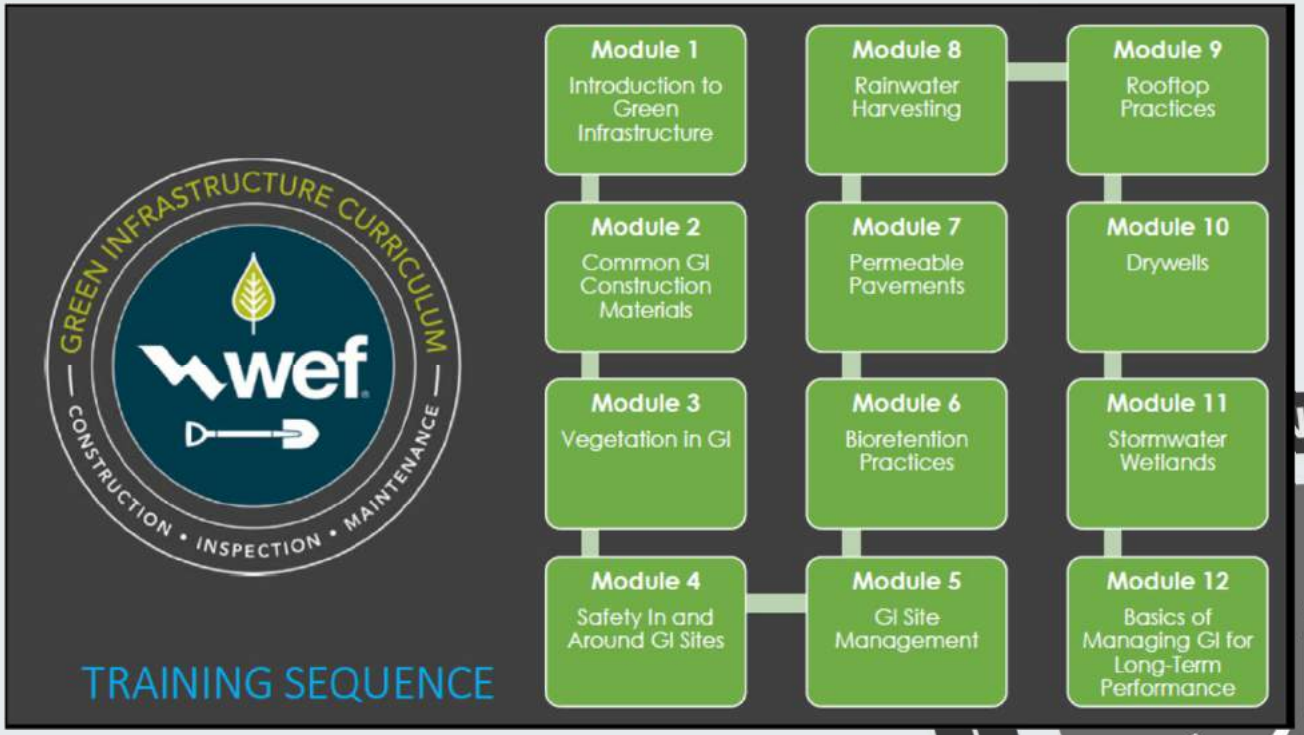
Green Infrastructure (GI) Practices	19–23%
Identify the basic functionality of various GI practices	
Identify the purpose, functionality and properties of the basic physical components of GI practices	
Apply key concepts related to the lifecycle of GI practices	
Identify the terminology used to describe various GI practices	

GI Methods and Materials	50–54%
Recognize the appropriate application of equipment for the construction or the maintenance of a GI practice	
Apply the key concepts of site layout and grade checking	
Recognize the purpose of common GI construction materials	
Apply the key concepts of basic vegetation management and establishment	
Recognize the significance of and identify the procedure for proper storage and handling of materials	
Recognize the significance of and identify the procedure for water management, as well as, erosion and sediment control during the construction and maintenance of a project	
Identify potential site safety hazards associated with GI practices and personal protective equipment (PPE)	
Read and comprehend architectural and engineering drawings	
Recognize adjacent and related infrastructure variables as they pertain to GI	

GI functionality and Appearance	17–21%
Recognize GI-related performance issues	
Diagnose the cause of common GI failures	
Recognize adequate and comprehensive documentation of GI practices	



Curriculum


GREEN INFRASTRUCTURE CURRICULUM
CONSTRUCTION • INSPECTION • MAINTENANCE
wef
Module 1
Introduction to Green Infrastructure
Module 2
Common GI Construction Materials
Module 3
Vegetation in GI
Module 4
Safety In and Around GI Sites
Module 5
GI Site Management
Module 6
Bioretention Practices
Module 7
Permeable Pavements
Module 8
Rainwater Harvesting
Module 9
Rooftop Practices
Module 10
Drywells
Module 11
Stormwater Wetlands
Module 12
Basics of Managing GI for Long-Term Performance
TRAINING SEQUENCE

BUT WHAT IS IT REALLY?

Workforce Development

DC Water

Water Environment Federation
ngicp NATIONAL GREEN INFRASTRUCTURE CERTIFICATION PROGRAM

Professional Development

Fairfax County

GA Association of Water Professionals

Water Environment Federation
the water quality people

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WHAT NOW?

Pilots, Pilots, and More Pilots

Woodson STEM High School, Ward 7, DC

Parkland College, Champaign, Illinois

NRPA

UNIVERSITY OF THE DISTRICT OF COLUMBIA 1851

Blended learning

THE KRESGE FOUNDATION

Foundation for Louisiana
At work for resilient communities.

GREATER NEW ORLEANS FOUNDATION

Program Expansion

Water Environment Federation
the water quality people

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What's Next?

- More trainings: ongoing
- New partner/licensee recruitment: ongoing
- ROI Research: ongoing
- Performance Research
- ANSI Accreditation application submission: April 2019 (ISO17024)
- Trademarking: Summer 2019
- New Zealand roll-out: Summer/Fall 2019
- Canadian roll-out: Fall 2019
- Anticipated ANSI Accreditation award: Spring 2020

Contact Information

Water Environment Federation
the water quality people

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NATIONAL GREEN INFRASTRUCTURE CERTIFICATION PROGRAM

www.ngicp.org

Open Forum
Questions and Answers

Closing Thoughts/Recap

Please be sure to complete a workshop evaluation form which is required to receive CEUs

Follow the Workshop!

Project Contact: Alexis Taylor, DEP Bureau of Flood Resilience

Project E-mail: Toolkit@dep.nj.gov

Project Website: www.resiliencetoolkit.nj.gov

THANK YOU


NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION
U.S. DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT
LB
HILL
LOUIS BERGER–HILL
JOINT VENTURE
CDM Smith