**Green City, Clean Waters**

The City of Philadelphia’s Program for Combined Sewer Overflow Control

$2.4 Billion Investment over the next 25 years

<table>
<thead>
<tr>
<th>Green Stormwater Infrastructure</th>
<th>$1.67 Billion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traditional Infrastructure</td>
<td>$345M</td>
</tr>
<tr>
<td>Adaptive Management</td>
<td>$420M</td>
</tr>
</tbody>
</table>
Maintenance Manual Development

PA DEP Compliance

- Maintenance Manual Process Plan
- Maintenance Manual (CO&A Deliverable)

Extensive Development and Testing

- Equipment
- Procedures
- Personnel
Core Programmatic Admin Tasks FY11 -12

**Program Development**
Personnel and Equipment
Protocol Development

**Contract Management**
Intra-Departmental Coordination
- GIS → Ground-truthing
- Construction → Feedback
- Planning and Design → Feedback

- Lance Butler
  - Unit Manager
- Chris Bergeson
  - Group Manager
- Katie Shafer
  - Consultant Support
Core Programmatic Field Tasks FY11-12

Surface
• Field Testing Inspection Protocols
• Field Testing Maintenance Protocols

Subsurface
• Field Testing Inspection Protocols
• Field Testing Maintenance Protocols
Surface Maintenance Challenges

- **System Stressors**
  - sedimentation
  - heat
  - drought
  - invasive species
  - non-target species

- **Urban stressors**
  - road salts
  - vandalism
  - cars
  - rodents & pets?
Subsurface Maintenance Challenges

- Urban Stressors
  - trash/debris
  - South Philly
  - bus routes

- Maintenance Scheduling
  - access
  - wet weather events
  - schools
Core Programmatic Admin Tasks FY13 -14

Program Development

- Personnel and Equipment
- Project Inventory
- Asset Management
- District-Based Regime
- Work-order Management

Intra-Departmental Coordination

- GIS → Verification; Workflows/Network; Components DBase
- Construction → PLAR; Planting Demo; Inspector’s Guide
- Design → Design Reviews (30%, 70%); Feedback
Core Programmatic Admin Tasks FY13 -14

Lance Butler
Unit Manager

Annie Mikol
Consultant Support

Gerald Bright
Group Manager

Alex Warwood
Consultant Support

Barbara Cushing
Subsurface Lead

Hasan Malik
Surface Lead

William Whalen
Subsurface Support

Meg Malloy
Surface Support
SMP Count and Distribution by Maintenance Fiscal Year

- Green Roof
- Stormwater Basin
- Swale
- Pervious Paving
- Stormwater Bumpout
- Stormwater Planter
- Infiltration/Storage Trench
- Rain Garden
- Stormwater Trees
- Stormwater Tree Trench
Vegetated Area = 255,000 sf

Number of Trees = 1600

Length of Pipe = 47,600 feet
Core Programmatic Admin Tasks FY13 -14

Program Development

- Personnel and Equipment
- Project Inventory
- Asset Management
- District-Based Regime
- Work-order Management

Intra-Departmental Coordination

- GIS → Verification; Workflows/Network; Components DBase
- Construction → PLAR; Planting Demo; Inspector’s Guide
- Design → Design Reviews (30%, 70%); Feedback
Green It
- Project Status
- SMP Metrics

GIS
- SMP Locations
- Component Specifications

GSIMN Databases
- GSIMN_MAD
  - Detailed Project Status Tracking
  - Maintenance FY
- GSIMN Component Dbase
  - Assigns Component IDs which feeds back into GIS
- Visual Inspection and CCTV Inspection
  - Component level I&M data for reactive work order creation

Assets
- SMP Level Asset tracking at “Design Complete”
- Inventory Management
Maintenance Districts

Belmont
Fox St. North
Fox St. South
Southeast
Southwest
MS4 East
MS4 West
Core Programmatic Field Tasks FY13-14

**Surface**
- Inspection (Dry/Wet)
- Pervious Paving
- Aesthetic Maintenance
- Tiered Approach
- Pretreatment Maintenance

**Subsurface**
- PWD CCTV Inspection
- Maintenance
- Pretreatment Maintenance

**Reactive**
- Pretreatment Maintenance
- Retrofits/Repairs
Aesthetic Maintenance

• 212 Task Orders Assigned
• 136 Work Orders
• Collected 3500 gallons of residential garbage, leaves/organic debris, and commercial/construction material
  o 575 gal. from Tree Trench and Stormwater Trees
  o 25 gal. from Stormwater Basins
  o 975 gal. from Rain Gardens
  o 1300 gal. from Stormwater Bumpouts
  o 525 gal. from Stormwater Planters
  o 100 gal. from Swales
• 41.75 hours on site conducting aesthetic maintenance
Subsurface I&M
Locating Utility Infrastructure Services (LUIS)

• EnviroSight Camera
• Hand Tools and Safety Equipment
• Sonde Locator
Subsurface I&M

Mobile Dredging and Pumping Co.

- Vactor Truck
- Nozzles/Brushes/Spray Gun
- Flexible Hose
- Crawler
- Confined Space Entry
Subsurface I&M
Subsurface I&M
Reactive Maintenance

BEFORE
GSI Maintenance Manual Format

Table of Contents

Division 1 – Introduction

1.1 Introduction

1.2 Stormwater Management Practices*

1.2.1 SMPs In Practice By PWD

1.2.2 SMPs In Limited Practice Or Not Yet In Practice By PWD
GSI Maintenance Manual Format

Table of Contents

Division 2 – Maintenance Tasks
2.1 Surface Structural Maintenance
2.2 Vegetation Maintenance
2.3 Subsurface Maintenance
2.4 Waste Disposal and Decanting
Surface Maintenance
- Remove trash, sediment, and organic debris from all SMP surfaces
  - Clean pretreatment devices
- Winterize SMP
- Remove non-target/invasive vegetation
- Apply mulch
- Prune trees
- Water trees

Subsurface Maintenance
- Jet Pipes
- Vacuum clean structures
Surface Maintenance

- Remove trash, sediment, and organic debris from all SMP surfaces
- Clean pretreatment devices
- Winterize SMP

Subsurface Maintenance

- Jet Pipes
- Vacuum clean structures
Surface Maintenance
- Remove trash, sediment, and organic debris from all SMP surfaces
  - Clean pretreatment devices
- Winterize
- Apply mulch
- Remove non-target/invasive vegetation
- Cut back target perennials
- Mow turf and meadow areas
- Prune trees and shrubs
- Water trees, herbaceous vegetation and shrubs

Subsurface Maintenance
- Jet Pipes
- Vacuum clean structures
Surface Maintenance

- Remove trash, sediment, and organic debris from all SMP surfaces
  - Clean pretreatment devices
- Winterize SMP
- Apply mulch
- Remove non-target/invasive vegetation
- Cut back target perennials
- Prune trees and shrubs
- Water trees, herbaceous vegetation and shrubs

Subsurface Maintenance

- Jet Pipes
- Vacuum clean structures
Surface Maintenance

- Remove trash, sediment, and organic debris from all SMP surfaces
  - Clean pretreatment devices
- Winterize
- Paint planter box wells
- Remove non-target/invasive vegetation
- Cut back target perennials
- Prune trees
- Water trees, herbaceous vegetation and shrubs

Subsurface Maintenance

- Jet Pipes
- Vacuum clean structures
Surface Maintenance
- Remove trash, sediment, and organic debris from all SMP surfaces
  - Clean pretreatment devices
- Winterize
- Apply mulch
- Remove non-target/invasive vegetation
- Cut back target perennials
- Mow turf and meadow
- Prune trees and shrubs
- Water trees

Subsurface Maintenance
- Jet Pipes
- Vacuum clean structures
Surface Maintenance

- Remove trash, sediment, and organic debris from all SMP surfaces
  - Clean pretreatment devices
- Winterize
- Remove non-target/invasive vegetation
- Apply mulch
- Prune trees
- Water trees
Opportunities & Barriers

CISTERN

Permeable Asphalt
Stormwater on surface seeps through permeable asphalt

Permeable Concrete
Stormwater on surface seeps through permeable concrete

Permeable Pavers
Stormwater on surface seeps through permeable pavers

Gravel or other storage media provide structural support and stormwater storage

CISTERN

Gravel or other storage media provide structural support and stormwater storage
GSI Maintenance Manual Format

Table of Contents

Division 3 – Appendices
  3.1 Documentation
  3.2 Health and Safety
  3.3 Personnel
  3.4 Access Requirements
  3.5 Maintenance Event Procedures
  3.6 Points of Contact
  3.7 Jetting Nozzles

Division 4 – Glossary
Questions?

Special Thanks:

AKRF — Kevin Flynn, Beth Boivert, Lia Mastropolo, Akta Patel

PWD — Katie Shafer, Rupal Patel, Brittany Coyle