PENNDOT STORMWATER CONTROL MEASURE INSPECTIONS:
THE PROCEDURES AND FINDINGS

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PENNDOT SCM INSPECTIONS: THE PROCEDURES AND FINDINGS

- Framework
- Statewide SCM maintenance program
  - Inventory established
- Inspection protocols
  - Procedures developed
  - Training courses
- Statewide implementation
- Initial inspection findings
FRAMEWORK: DEFINITIONS

- **Best Management Practices (BMPs):** physical engineered structures or non-structural methodologies that are effective and practical means of preventing or minimizing pollution.

- **Stormwater Control Measures (SCMs):** physical features designed to slow down, reduce, and/or treat stormwater runoff before it enters waterbodies and groundwater.

- SCMs are a subset of BMPs.
PennDOT owns over 2,500 SCMs
- District 6 alone is approximately 550!

Several large corridor projects will add to this exponentially in the next few years

SCM maintenance program is being shaped to address current and future long-term operation and maintenance (O&M) commitments
STATEWIDE SCM MAINTENANCE PROGRAM

WHY?

- Districts are currently required to maintain SCMs in accordance with individual PCSM Plan
- Standardized practices needed for:
  - inspections
  - maintenance
  - documentation
- PA Stormwater BMP Manual “recommendations” not suitable
- Have been adding roughly 170+ SCMs per year to the inventory*
  *Not including “restoration” SCMs
STATEWIDE SCM MAINTENANCE PROGRAM

- SCM Maintenance Manual (Publication 888)
- New publication outlining all aspects of maintenance program
- Released May 2019
STATEWIDE SCM MAINTENANCE PROGRAM

Comprised of:

- SCM inventory database
  - Custom GIS application (Maintenance-IQ)
- Inspections
  - Visual screenings and condition assessments
  - Start-up and cyclic
  - Standardized forms
- Maintenance
  - Routine – regularly scheduled, preventative
  - Corrective – as needed
- Work assemblies
- Training
  - Face-to-face training/certification for inspectors
  - Recorded training for maintenance foremen
STATEWIDE SCM MAINTENANCE PROGRAM: INVENTORY

Where are all of the SCMs (and what are they)?

- 2015-2016 BOMO developed a statewide inventory of SCMs
  - Districts responsible for confirming existing and adding all new SCMs
- Contains 40+ data fields including SCM type and location to facilitate:
  - Statewide tracking
  - Permit compliance
  - Inspections
  - Maintenance
Inventory can be viewed in PennDOT’s custom GIS Application called Maintenance-IQ
### What types of SCMs are there?

<table>
<thead>
<tr>
<th>SCM Name</th>
<th>Type Code</th>
<th>SCM Name</th>
<th>Type Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basin, Dry Detention</td>
<td>BDD</td>
<td>Non-Basin SCM, Other</td>
<td>NBO</td>
</tr>
<tr>
<td>Basin, Dry Extended Detention</td>
<td>BED</td>
<td>Pervious Pavement, Asphalt</td>
<td>PPA</td>
</tr>
<tr>
<td>Basin, Dry Ultra-Extended Detention</td>
<td>BUD</td>
<td>Pervious Pavement, Concrete</td>
<td>PPC</td>
</tr>
<tr>
<td>Basin, Infiltration Detention</td>
<td>BID</td>
<td>Pervious Pavement, Pavers</td>
<td>PPP</td>
</tr>
<tr>
<td>Basin, Other</td>
<td>BOT</td>
<td>Reforestation/Tree Plantings*</td>
<td>RTP</td>
</tr>
<tr>
<td>Basin, Naturalized Detention</td>
<td>BND</td>
<td>Regenerative Step Pool</td>
<td>RSP</td>
</tr>
<tr>
<td>Basin, Wet Detention</td>
<td>BWD</td>
<td>Riparian Buffer Enhancement*</td>
<td>RBE</td>
</tr>
<tr>
<td>Bioretention</td>
<td>BRE</td>
<td>Riparian Buffer Offset*</td>
<td>RBO</td>
</tr>
<tr>
<td>Bioretention w/Underdrain</td>
<td>BRU</td>
<td>Soil Amendment Restoration*</td>
<td>SAR</td>
</tr>
<tr>
<td>Constructed Stormwater Filter</td>
<td>CSF</td>
<td>Stormwater Wetland</td>
<td>SWE</td>
</tr>
<tr>
<td>Flow Dispersion, Forest/Buffer</td>
<td>FDF</td>
<td>Stream Restoration*</td>
<td>SRE</td>
</tr>
<tr>
<td>Flow Dispersion, Veg. Filter Strip</td>
<td>FDV</td>
<td>Stream Stabilization*</td>
<td>SST</td>
</tr>
<tr>
<td>Forest Preservation*</td>
<td>FPR</td>
<td>Subsurface Detention Storage</td>
<td>SDS</td>
</tr>
<tr>
<td>Infiltration Berm</td>
<td>IBE</td>
<td>Subsurface Infiltration Trench</td>
<td>SIT</td>
</tr>
<tr>
<td>Landscape Restoration Meadow*</td>
<td>LRM</td>
<td>Vegetated Filter Strip</td>
<td>VFS</td>
</tr>
<tr>
<td>Level Spreader Outfall</td>
<td>LSO</td>
<td>Vegetated Filter Strip, Steep Slope</td>
<td>VSS</td>
</tr>
<tr>
<td>Manufactured Treatment Devices</td>
<td>MTD</td>
<td>Vegetated Swale</td>
<td>VSW</td>
</tr>
<tr>
<td>Media Filter Drain</td>
<td>MFD</td>
<td>Vegetated Swale w/ Check Dams</td>
<td>VSC</td>
</tr>
</tbody>
</table>
Key Aspects of Inspections Program:

- **Timing** – Uniform regular inspection cycle
- **Types** – Visual screening and condition assessment
- **Rating** – Standardized grading system for condition and function
- **Documentation** – Standardized forms to complete for each inspection
- **Response** – Standardized recommendations based on urgency and need
INSPECTION PROTOCOLS

Visual Screening Inspection

- Routine, non-invasive inspection
- Identify obvious problems and maintenance needs based on visual indicators
- Comparison to as-built plan not needed
- Performed triennial (once every 3 years) for most SCMs
VSI Form M-77

- Single page, smart pdf
- 0 to 5 rating for each aspect
INSPECTION PROTOCOLS

Condition Assessment Inspection

- In-depth inspection w/ 8 page, clickable pdf
- Verify that the SCM is functioning and providing intended PCSM benefits
- As-built plan required
- Includes field form and report
- Rates individual features resulting in overall Performance “Letter Grade” (A-F)
- Performed every 10 years for most SCMs
Inspection Cycle Timeline:

Year 0 → Y1 → Y2 → Y3 → Y4

- **Construction Completed**
- **Start-up***
- **Condition Assessment**
- **Visual Screening Inspection**

* If needed. Limited to Infiltration Basin (BID) and Bioretention, Riparian Buffer, Stormwater Wetland, Restoration.

3 years

Y7 → Y8 → Y9 → Y10

- **Continue Triennial Cycle**
- **Condition Assessment**
- **Visual Screening Inspection**
Statewide Inspection Trainings

- 3 pilot trainings from Nov 2017- Ap 2018
  - Grantville (D8), Indiana (D10), Allentown (D5)
- 3 again from Oct 2018 – May 2019
  - King of Prussia (D6), Uniontown (D12), Montoursville (D3)
- 3 Upcoming:
  - Clearfield (D2) Oct 2019
  - Bridgeville (D11) April 2020
  - Allentown (D5) May 2020
Inventoried SCMs inspected by December 31, 2018*

VSI forms reviewed to assess:

- Severity of problems and overall condition of SCMs
- Most common corrective maintenance needs
- Assess severity and overall condition of SCMs
- Identify trends to facilitate improved designs and maintenance approaches

* Those subject to PCSM regulation
INSPECTIONS COMPLETED

As of September 1, 2019

- 1,800 visual screening inspections completed for 23 different SCM types

<table>
<thead>
<tr>
<th>General SCM Type</th>
<th>SCM Type Codes</th>
<th>Number of SCMs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vegetated Swale</td>
<td>VSW, VSC</td>
<td>539</td>
</tr>
<tr>
<td>Basin</td>
<td>BDD, BED, BOT, BWD</td>
<td>516</td>
</tr>
<tr>
<td>Infiltration</td>
<td>BID, IBE, SIT</td>
<td>371</td>
</tr>
<tr>
<td>Bioretention</td>
<td>BRE, BRU</td>
<td>162</td>
</tr>
<tr>
<td>Manuf. Treatment Device</td>
<td>MTD</td>
<td>82</td>
</tr>
<tr>
<td>Other</td>
<td>NBO</td>
<td>42</td>
</tr>
<tr>
<td>Vegetated Filter Strip</td>
<td>VFS</td>
<td>26</td>
</tr>
<tr>
<td>Restoration</td>
<td>LRM, RTP, SAR</td>
<td>23</td>
</tr>
<tr>
<td>Filter</td>
<td>MFD</td>
<td>17</td>
</tr>
<tr>
<td>Stormwater Wetland</td>
<td>SWE</td>
<td>15</td>
</tr>
</tbody>
</table>
- **4,823 problems found to date**
  - 2,531 routine maintenance items (6+ month response time)
  - 1,620 corrective maintenance items (immediate to 6 month response time)
  - 672 environmental/engineering evaluations

<table>
<thead>
<tr>
<th>Problem Category</th>
<th>Any Problem</th>
<th>Corrective Maintenance</th>
<th>Engineering Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Action Code 0-5*</td>
<td>Action Code 2-4*</td>
<td>Action Code 5*</td>
</tr>
<tr>
<td>Debris/Trash</td>
<td>1,187</td>
<td>317</td>
<td>8</td>
</tr>
<tr>
<td>Erosion</td>
<td>505</td>
<td>319</td>
<td>35</td>
</tr>
<tr>
<td>Ponding</td>
<td>518</td>
<td>60</td>
<td>241</td>
</tr>
<tr>
<td>Vegetation</td>
<td>1,753</td>
<td>540</td>
<td>207</td>
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<tr>
<td>Miscellaneous</td>
<td>860</td>
<td>384</td>
<td>181</td>
</tr>
<tr>
<td>Total</td>
<td>4,823</td>
<td>1,620</td>
<td>672</td>
</tr>
</tbody>
</table>

*Action Code: 0 = No Action, 1 = Routine Maintenance, 2-4 = Corrective Maintenance, 5 = Engineering Evaluation*
## Most Common Problem Types

<table>
<thead>
<tr>
<th>Problem Category</th>
<th>Most Common Problem Type</th>
<th>Number</th>
<th>Second Most Common Problem Type</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Debris/Trash</td>
<td>SCM Floor/Surface, Within SCM</td>
<td>350</td>
<td>Anti-skid Accumulation</td>
<td>258</td>
</tr>
<tr>
<td></td>
<td>SCM Bottom Side Slopes</td>
<td>257</td>
<td>Inflow Channels</td>
<td>150</td>
</tr>
<tr>
<td></td>
<td>Standing Water</td>
<td>380</td>
<td>Other Signs of Poor Drainage</td>
<td>101</td>
</tr>
<tr>
<td></td>
<td>Woody Vegetation in Embankment</td>
<td>497</td>
<td>Hydrophytic Vegetation</td>
<td>438</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>Other (Type Varied)</td>
<td>269</td>
<td>Sediment Build-Up</td>
<td>213</td>
</tr>
</tbody>
</table>
Detention Basins – Widest range of problems found throughout the SCMs. Every problem category was represented with the most common types noted below.

- Debris/Trash – Anti-skid accumulation was the most reported issue, followed by accumulations partially clogging inflow and outflow points.
- Erosion – Throughout the basin from inflow points to the basin bottom and outfall area. The need to replenish or enhance rock outlet protection was noted multiple times.
- Ponding – Standing water issues were noted in 78% of dry basins inspected.
- Vegetation – Unkept and overgrown basins inhibiting inspection access and SCM function, including woody vegetation in embankments.
- Miscellaneous – Damage to SCM structural components and rutting. The most structural damage was related to fences, gates, and access roads.
TRENDS

- **Bioretention** – Most of the inspections resulted in nothing more than minor corrective maintenance being needed (respond within 6 months).
  - Typical problems included minor accumulations of sediment/trash/debris, evidence of localized areas of standing water, and minor erosion issues at inflow points.

- **Infiltration** – The main problems identified related to poor infiltration (e.g., standing water issues and hydrophytic vegetation).

- **Vegetated Swales**
  - Instances of both routine and corrective maintenance that was needed involving debris accumulations and vegetation issues (e.g., bare areas, unkept vegetation, hydrophytic vegetation).
  - Missing check dams - Almost 25% of VSC SCMs inspected in one District required engineering evaluations due to missing check dams.
TRENDS

Inspector accountability matters

- Accomplished through training and QA/QC inspections
- District X
  - Completed 200 inspection and found 16 minor problems prior to 2019
  - QA/QC follow up and additional training course offered
  - 30 new inspections completed in 2019 that found 99 problems of varying severity