2019 OHIO STORMWATER CONFERENCE 12th Annual

ARCADIS Design & Consultancy for natural and built assets

OPERATING AND MAINTAINING A GREEN INFRASTRUCTURE PROGRAM

Four Key Elements

May 10th 2019

Introductions

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Four Elements for Success

Four Elements for Success

Workforce – Determining Roles

Construction Manager

Inspectors

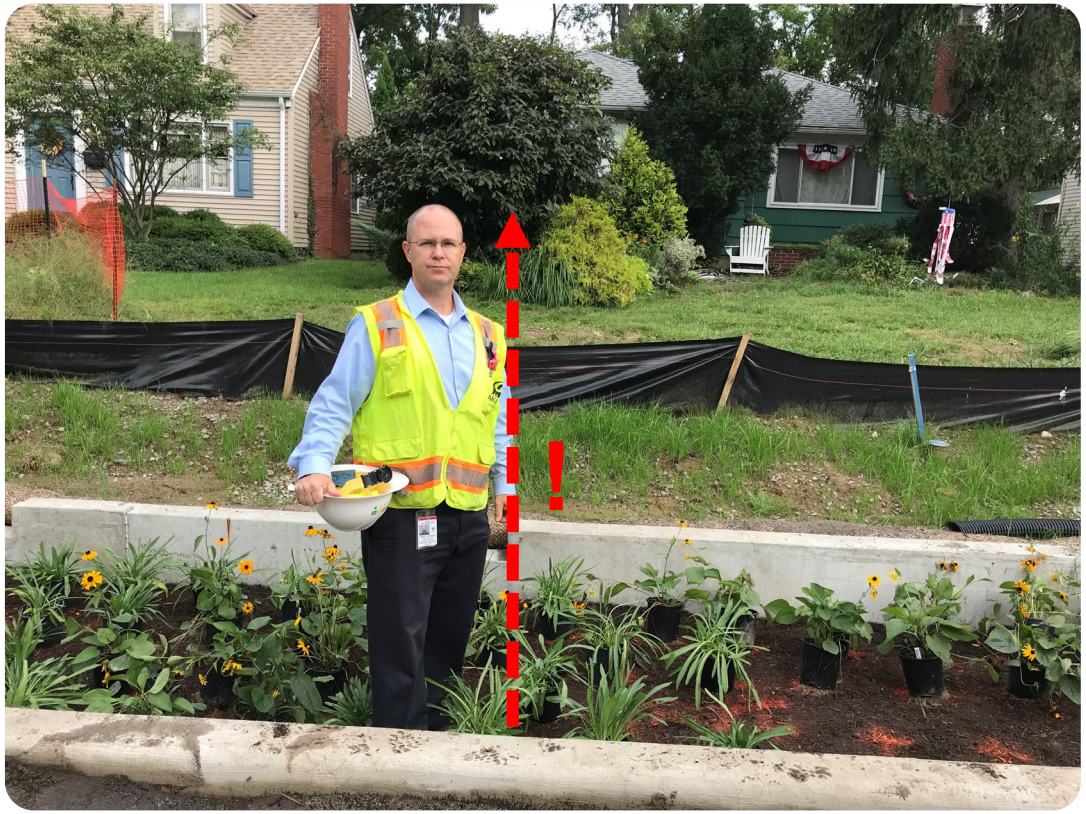
City Project Manager

Design Professional

Plant Expert Address planting issues and plant health concerns

Workforce – Determining Level's of Expertise

Plant Expert Address planting issues and plant health concerns

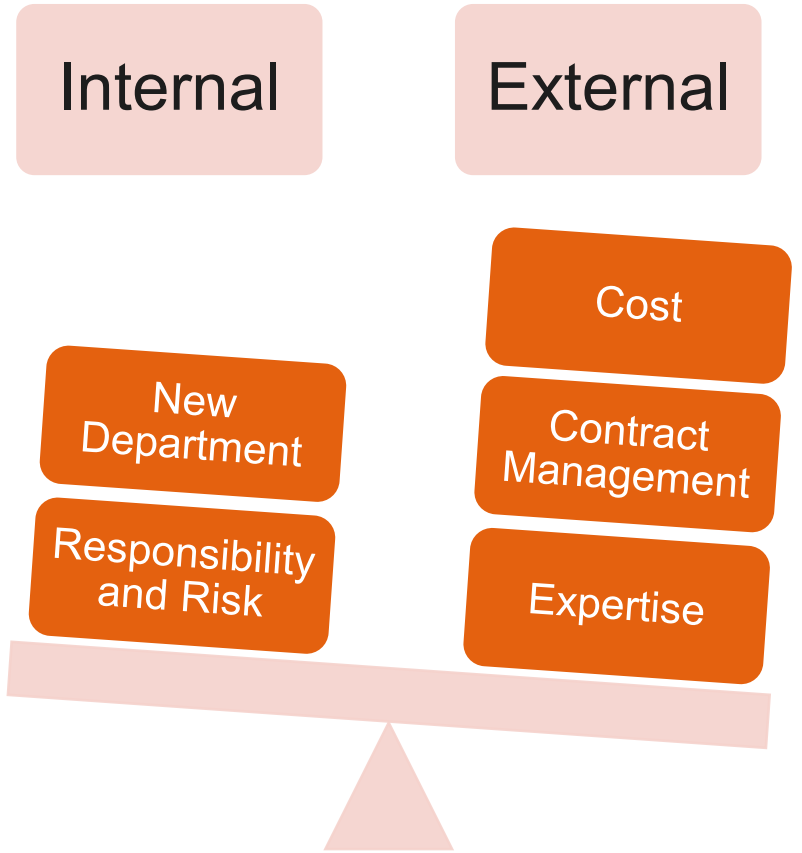


Workforce – Determining Level's of Expertise

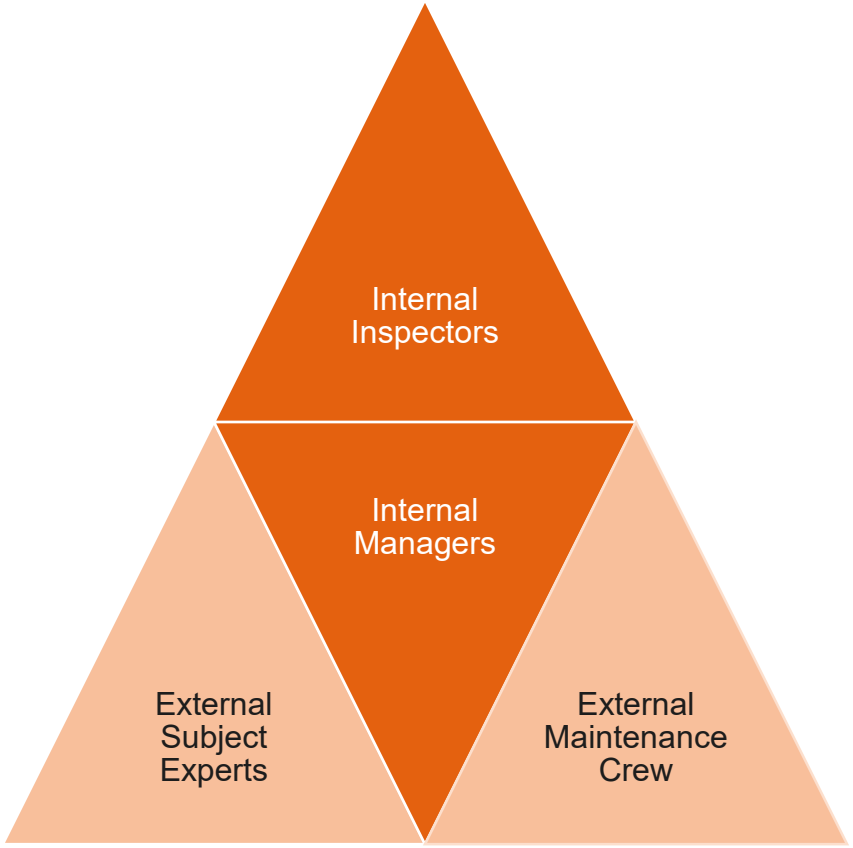
- Basin Inspection Techniques
  - Erosion
  - Sedimentation
  - Mulch
- Planting Protocols
- General understanding how each BMP works

Workforce – Computer Application Training

Workforce – Internal Vs. External



Workforce – Internal Vs. External



Four Elements for Success

Recommended Inspection Types

Standard Maintenance Inspections (External):

Mowing

Trash removal

Plant replacement

Mulching

Quality-Related Inspections (Internal):

Effectiveness

Structural repair

Regulating overflow

Asset integrity

Resident concern

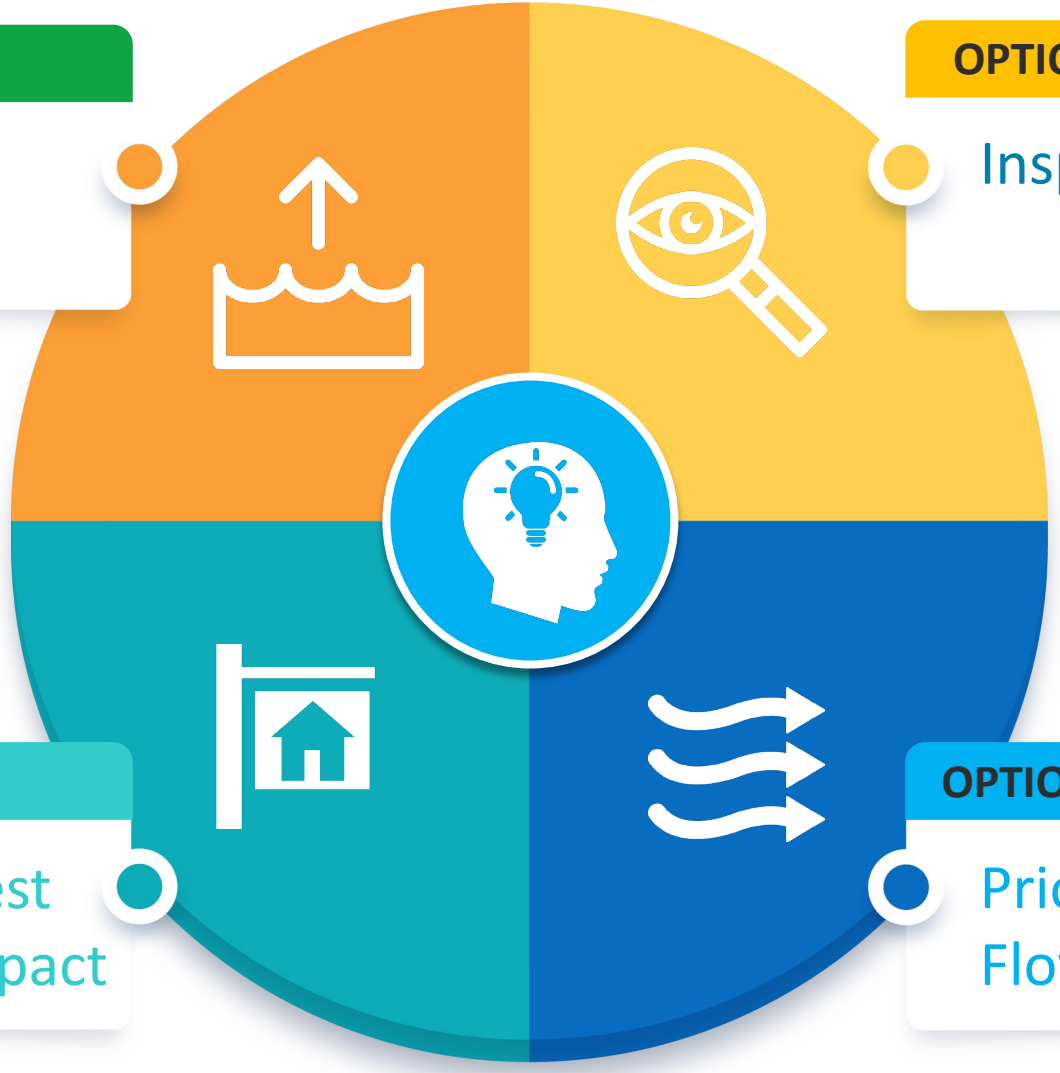
Prioritization and Frequency Options

OPTION 4

Only Inspect After Major Storm Events

OPTION 1

Inspect Monthly



OPTION 3

Potential for the Largest Failure or Resident Impact

OPTION 2

Prioritize Based on Flow & Slope

Inspection Guidelines

Seattle Public Utilities Green Stormwater Operations and Maintenance Manual

Erosion

Service Level A (Excellent Effort)	Service Level B (Good Effort)	Service Level C (Moderate Effort)	Service D (Poor Effort)
No erosion or bare spots 	Some erosion and bare spots (0-5%) 	Substantial erosion and bare spots (5-10%) 	Completely eroded and bare spots(More than 10%) 

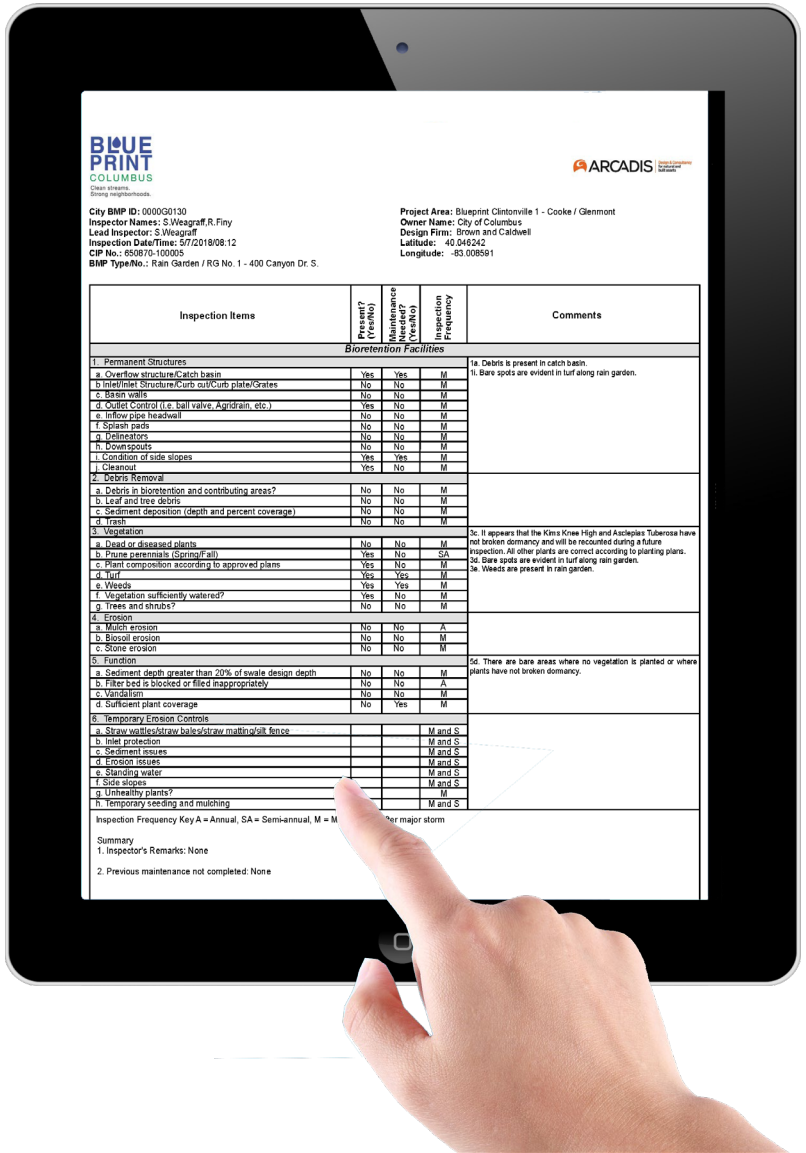
Inspection Guidelines

Seattle Public Utilities Green Stormwater Operations and Maintenance Manual

Service Level B (Good Effort)	Service Level C (Moderate Effort)	Service Level D (Low Effort)
water infiltrates well, pavers are up to 10% clogged or minimal ponding is observed	water infiltrates well, pavers are between 10-40% clogged and minimal ponding is observed	water does not infiltrate well, pavers are more than 40% clogged
		

Data Collection Tools – Tablet Inspection

Tablet Inspections Deliver One-Touch Reporting



BLUE PRINT COLUMBUS
Clean streams. Strong neighborhoods.

ARCADIS Design & Consultancy for natural and built assets

City BMP ID: 0000G0130
Inspector Names: S.Weagraff,R.Finy
Lead Inspector: S.Weagraff
Inspection Date/Time: 5/7/2018/08:12
CIP No.: 650870-100005
BMP Type/No.: Rain Garden / RG No. 1 - 400 Canyon Dr. S.

Project Area: Blueprint Clintonville 1 - Cooke / Glenmont
Owner Name: City of Columbus
Design Firm: Brown and Caldwell
Latitude: 40.046242
Longitude: -83.008591

Inspection Items	Present? (Yes/No)	Maintenance Needed? (Yes/No)	Inspection Frequency	Comments
Bioretention Facilities				
1. Permanent Structures				1a. Debris is present in catch basin. 1i. Bare spots are evident in turf along rain garden.
a. Overflow structure/Catch basin	Yes	Yes	M	
b.Inlet/Inlet Structure/Curb cut/Curb plate/Grates	No	No	M	
c. Basin walls	No	No	M	
d. Outlet Control (i.e. ball valve, Agridrain, etc.)	Yes	No	M	
e. Inflow pipe headwall	No	No	M	
f. Splash pads	No	No	M	
g. Delineators	No	No	M	
h. Downspouts	No	No	M	
i. Condition of side slopes	Yes	Yes	M	
j. Cleanout	Yes	No	M	
2. Debris Removal				
a. Debris in bioretention and contributing areas?	No	No	M	
b. Leaf and tree debris	No	No	M	
c. Sediment deposition (depth and percent coverage)	No	No	M	
d. Trash	No	No	M	
3. Vegetation				3c. It appears that the Kims Knee High and Asclepias Tuberosa have not broken dormancy and will be recounted during a future inspection. All other plants are correct according to planting plans. 3d. Bare spots are evident in turf along rain garden. 3e. Weeds are present in rain garden.
a. Dead or diseased plants	No	No	M	
b. Prune perennials (Spring/Fall)	Yes	No	SA	
c. Plant composition according to approved plans	Yes	No	M	
d. Turf	Yes	Yes	M	
e. Weeds	Yes	Yes	M	
f. Vegetation sufficiently watered?	Yes	No	M	
g. Trees and shrubs?	No	No	M	
4. Erosion				
a. Mulch erosion	No	No	A	
b. Biosoil erosion	No	No	M	
c. Stone erosion	No	No	M	
5. Function				5d. There are bare areas where no vegetation is planted or where plants have not broken dormancy.
a. Sediment depth greater than 20% of swale design depth	No	No	M	
b. Filter bed is blocked or filled inappropriately	No	No	A	
c. Vandalism	No	No	M	
d. Sufficient plant coverage	No	Yes	M	
6. Temporary Erosion Controls				
a. Straw wattles/straw bales/straw matting/silt fence			M and S	
b. Inlet protection			M and S	
c. Sediment issues			M and S	
d. Erosion issues			M and S	
e. Standing water			M and S	
f. Side slopes			M and S	
g. Unhealthy plants?			M	
h. Temporary seeding and mulching			M and S	

Inspection Frequency Key A = Annual, SA = Semi-annual, M = M … er major storm

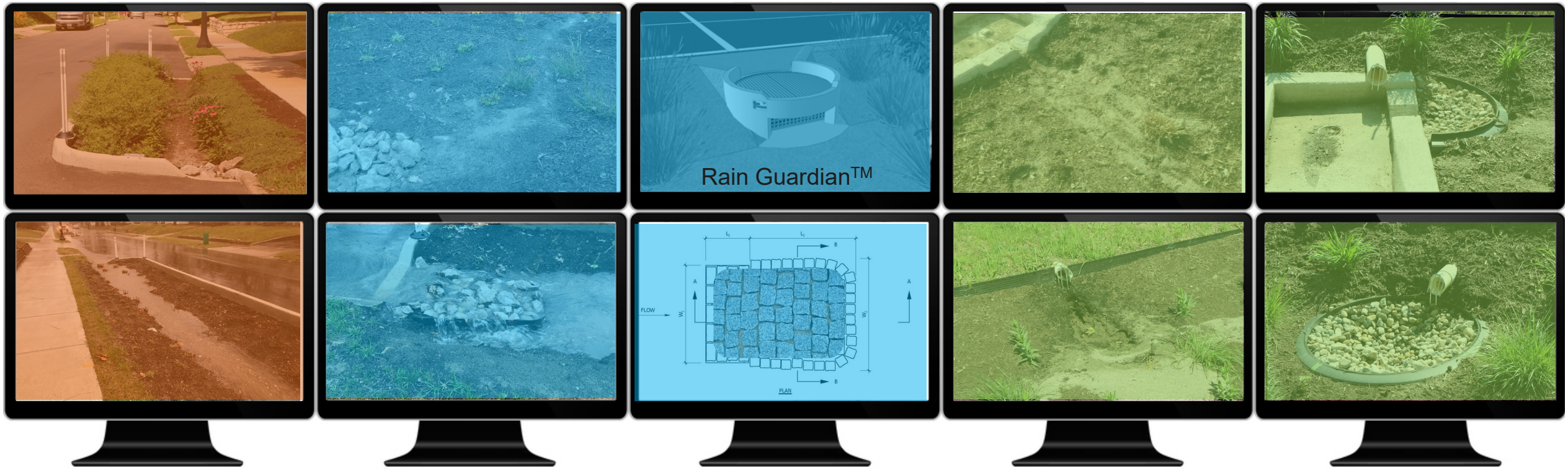
Summary
1. Inspector's Remarks: None

2. Previous maintenance not completed: None

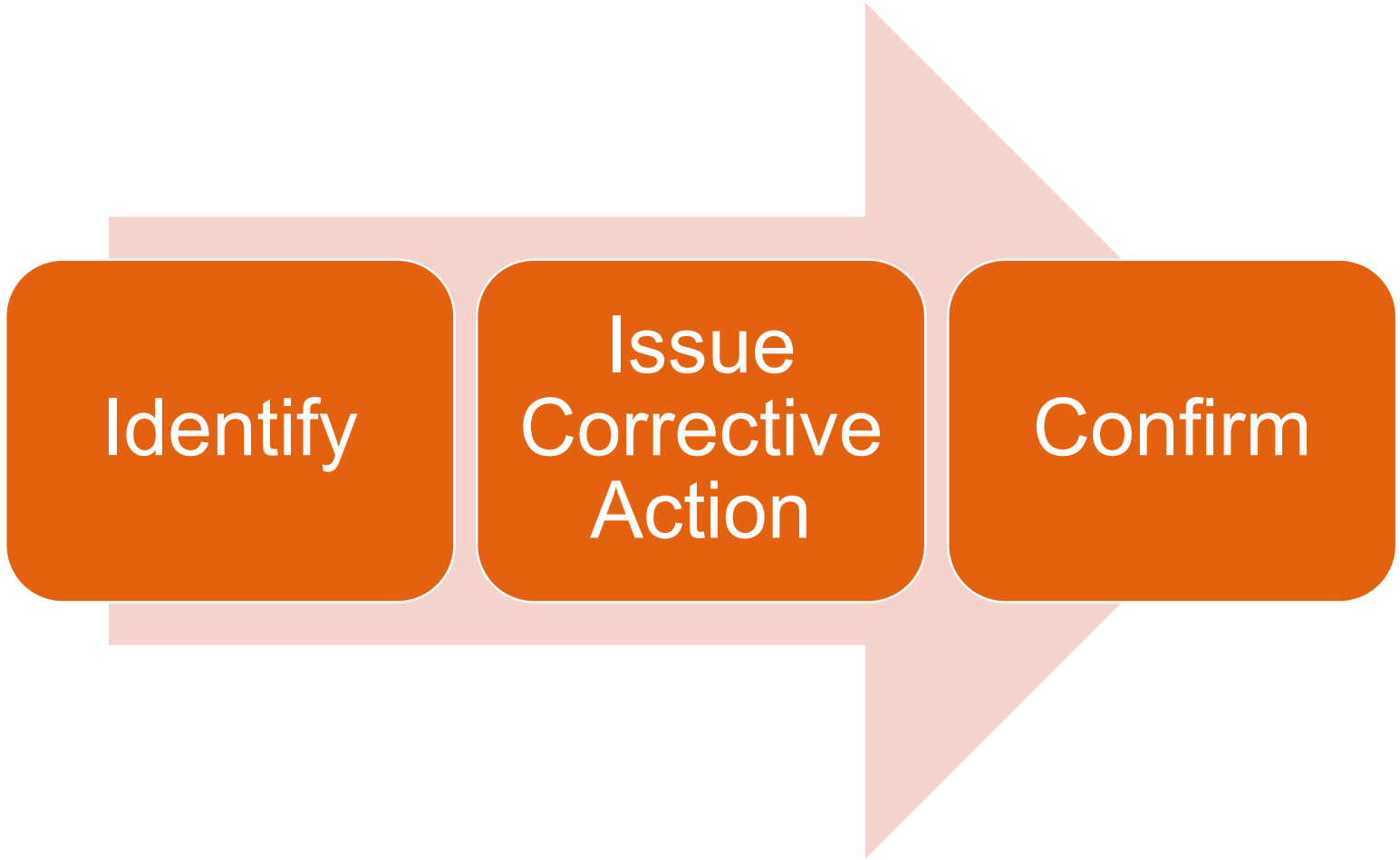
Four Elements for Success

Typical Design/Construction Issues

Velocity | Inlet Before | Inlet After | Erosion Before | Erosion After



Corrective Action Process



Issuing Corrective Action

- Capital Improvement Project
- Work Order (Internal Maintenance Crew)
- On Call Construction Contract (External Maintenance Crew)

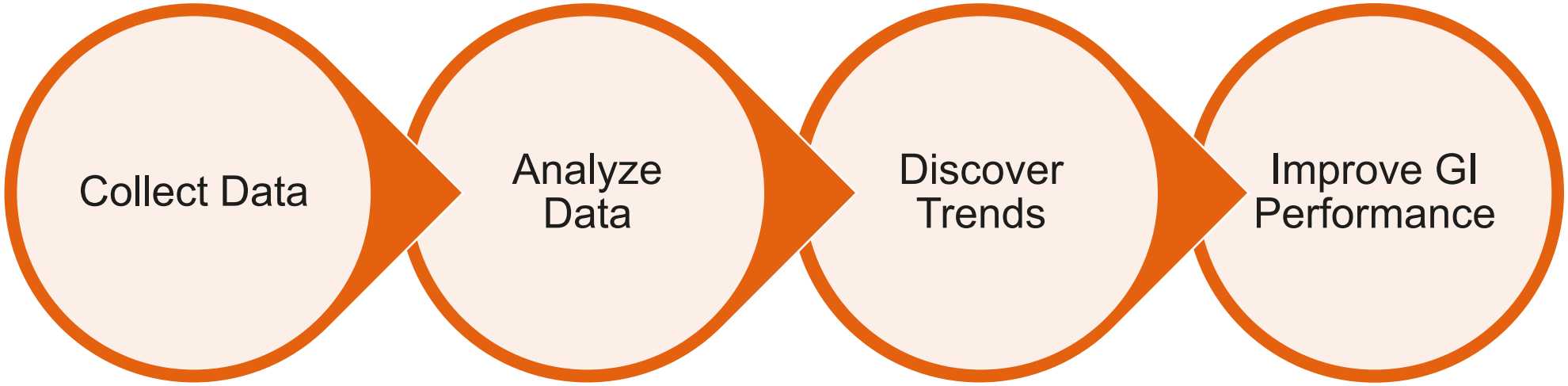
Four Elements for Success

Data Management System

Generate work order from inspection data

Data Analytics

Analyze Maintenance Data for Trends



Leveraging Best Practices

Design Feedback Loop

Utilizing the inspection data to implement design and construction improvements for future GI assets