ARCADIS Design & Consultancy for natural and built assets

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DEVELOPING STORMWATER & GREEN INFRASTRUCTURE ASSET MANAGEMENT TOOLS AND GUIDANCE

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Agenda

- Drivers for Asset Management (AM)
- Needs for Holistic Stormwater (SW) Asset Management
- Current National SW AM Research Project
- What's Next – Data Visualization/Analytics Tools
- Questions?

Drivers for Asset Management

Asset Management Definition – Adapted from US EPA

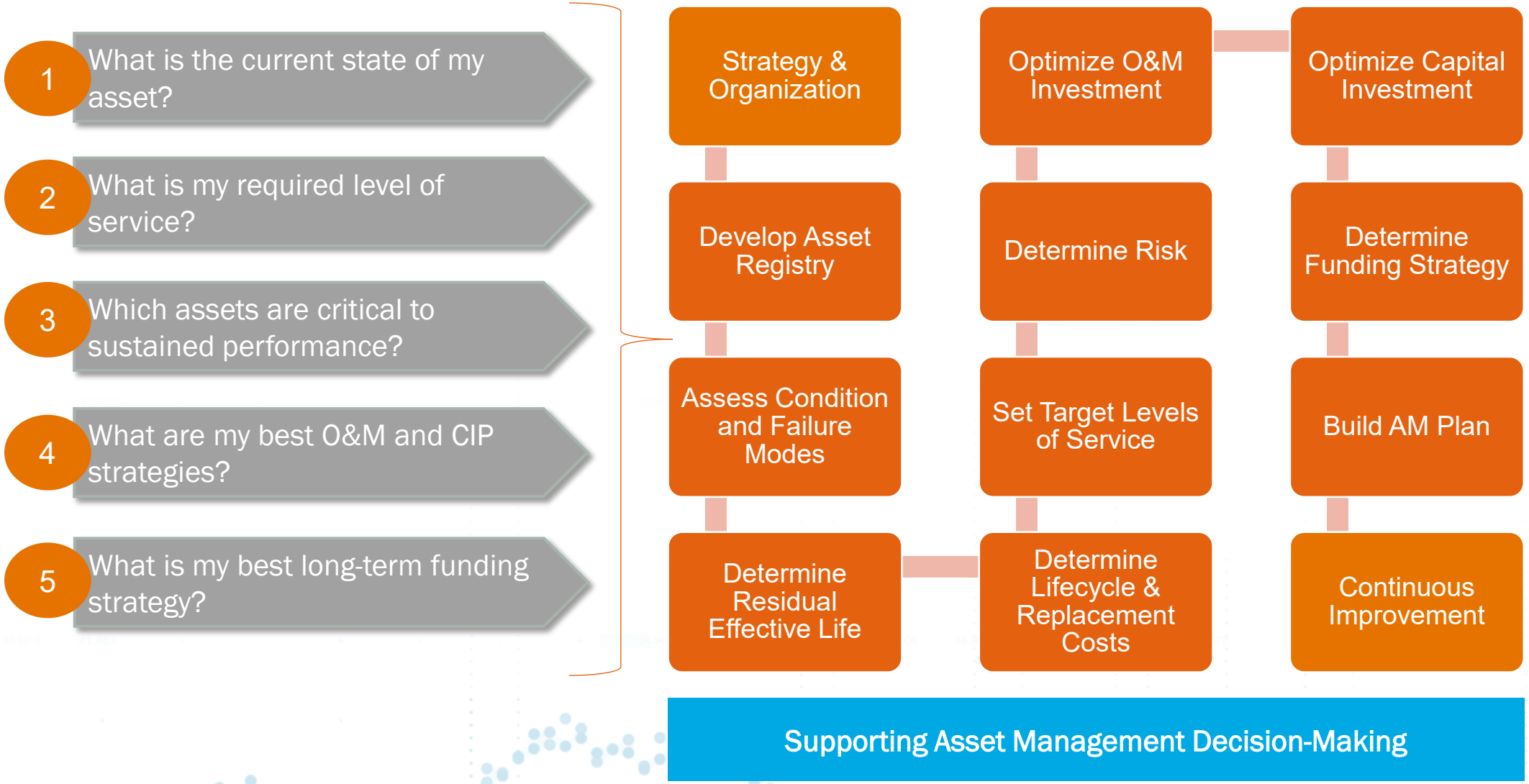
Asset Management is a body of *management practices* that:

- Is applied to the ***entire portfolio of infrastructure assets*** at all levels of the organization
- Seeks to ***minimize total costs*** of acquiring, operating, maintaining, and renewing assets
- Works within an environment of ***limited resources***
- Delivers ***service levels*** customers desire and regulators require
- Targets that ***acceptable level of risk*** to the organization

Benefits of Asset Management

- ✓ Informed asset investment decisions
- ✓ Managed risk
- ✓ Improved services and outputs
- ✓ Demonstrated social responsibility
- ✓ Demonstrated compliance
- ✓ Improved organizational sustainability
- ✓ Improved efficiency and effectiveness
- ✓ ***Real organizational savings (reduced borrowing costs, right-timed asset replacement, reduced asset failures)***

Core Concepts of Asset Management



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Most Agencies Focus on Data Collection Only

2 Service Levels Drive Needs and also Build Transparency and Stakeholder Relationships

SL Category	Issues
Reliability	•Inlet, sewer & culvert blockages/collapses •limited capacity •stream erosion •SCM issues
Quality	•odor, trash, excess vegetation complaints
Customer Service	•event response •call center performance
Regulatory	•permit compliance •water quality compliance

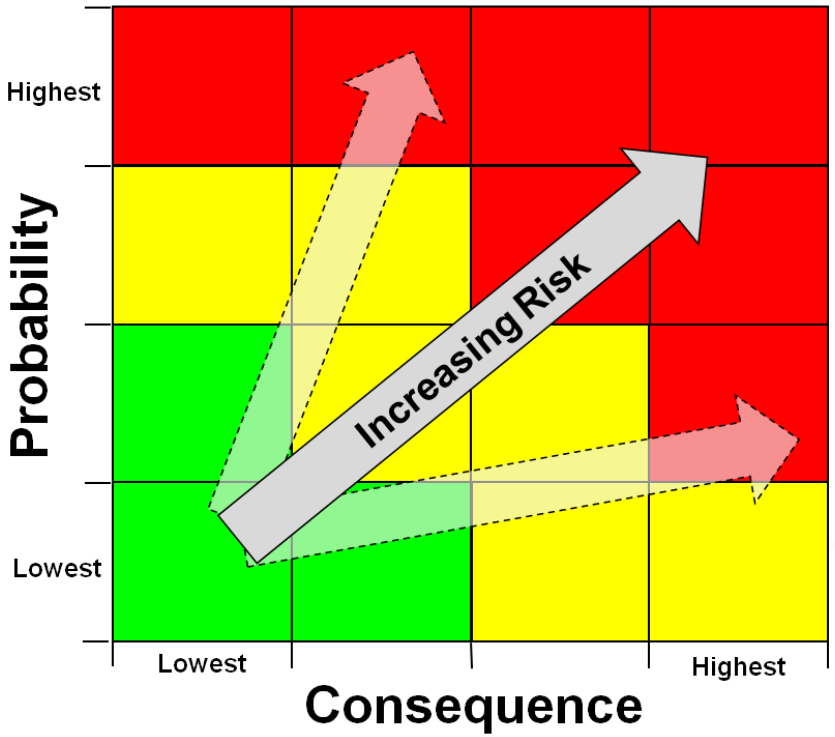
Strategic Plan Elements		LOS Category and Measures
1	Ensure system and asset reliability and minimize interruptions	**Stormwater Collection** • LOS X1 Blockages/Collapses • LOS X2 Property Flooding • LOS X3 Discharge Compliance • LOS X4 Event Response Time
2	Provide high quality service and effective response	

Key Performance Indicators

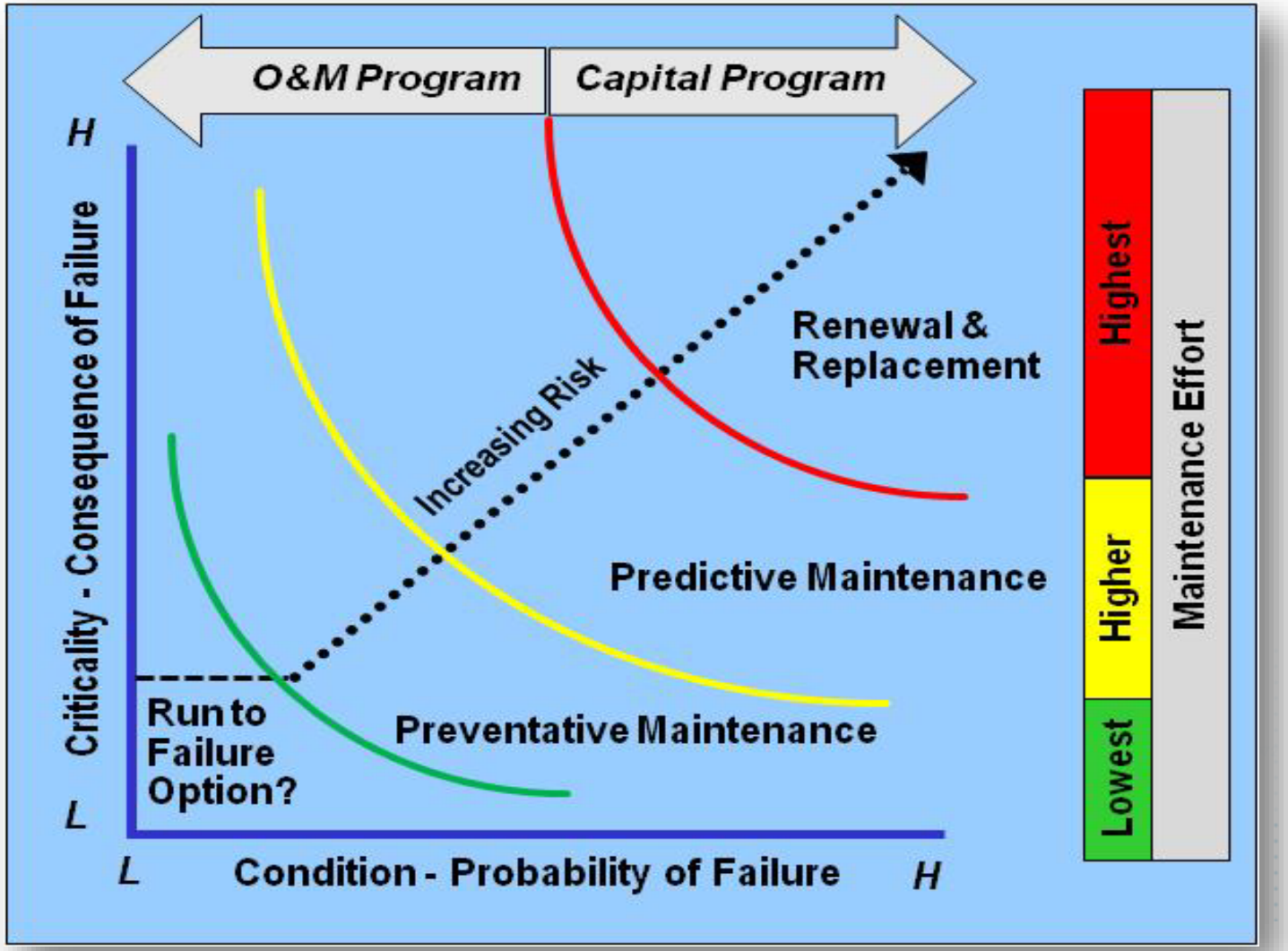
Operations and Maintenance
- Number of times assets were inspected
- Number of storm sewer lines, inlets & SCMs cleaned/repaired
- Work order completion ratio

A Key Focus of the Asset Management Process is Risk Based Evaluations

- Risk Is a Simple Equation:
  *Probability * Consequence*
- Probability of Failure (POF)
  - Physical
  - Performance
- Consequence of Failure (COF)
  - Triple Bottom Line (economic, social, & environmental)

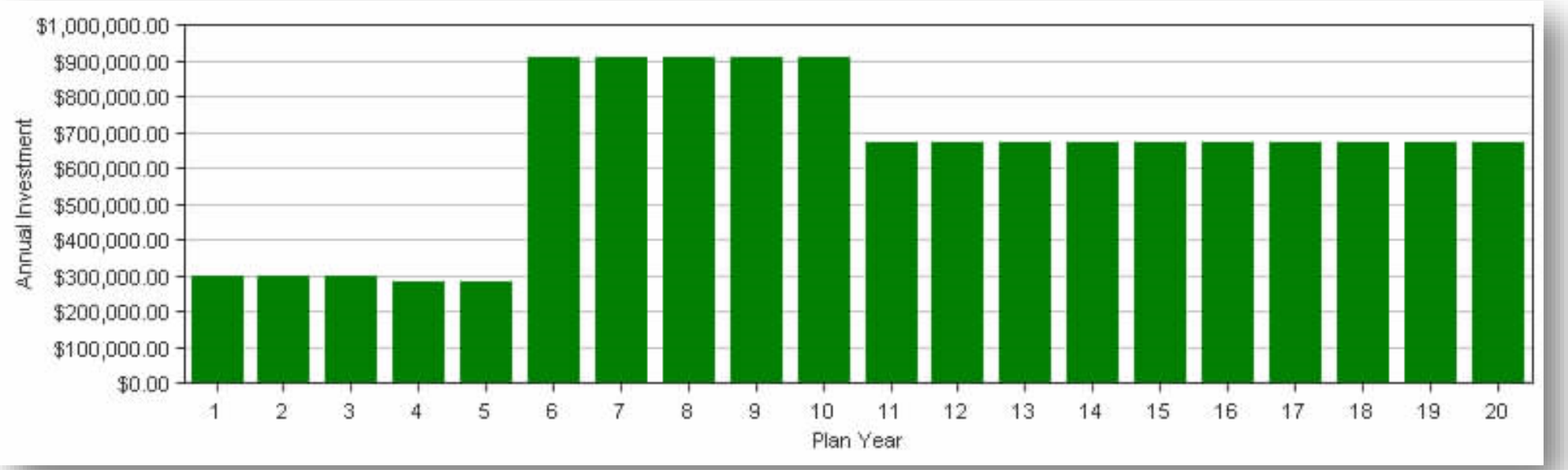


AM Risk Assessment Supports O&M and Capital Funding Decisions



Short- and Long-Term Financial Needs Drive Program Funding Structure

- Prioritize both system CIP and O&M
- Determine which projects or alternatives have the highest benefit to the utility
- Consider the most important and measurable project costs and benefits
- Consider Risk for existing assets and Risk of not acting



Needs for Holistic Stormwater (SW) Asset Management

The Benefits of Stormwater AM and Evaluating Business Risk

- Know more about your stormwater system assets
- Switch from reactive to proactive O&M
- Data driven evaluation of stormwater assets
- Positions you for regulatory compliance

Historically Stormwater Asset Management Work has been Regulatory or Data Driven

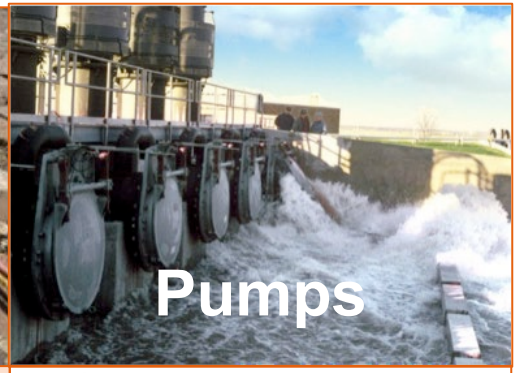
- MS4 Permitting/ Compliance
  - Collection system/outfall
  - Water quality focused

- Data/GIS
  - Stormwater infrastructure
  - O&M focused

Increased Resiliency to Flooding Requires Knowledge of Your SW System

The U.S. has sustained more than 300 weather and climate disasters since 1980 with costs of these events exceeding $2 trillion.

A Well-Defined and Holistic Asset Management Program is Highly Recommended

ASSET GROUP			
ASSET TYPE	• Pipe • Pipe Inlet • Pipe Outlet	• Manhole • Catch basin • Junction box • Drop inlet	• Pump • Gate • Valve
ASSET COMP-ONENT	• Manhole • Catch basin • Headwall • Flume	• Walls • Chimney • Lid	• Motor (if < 100 HP pump)

Familiar Assets

A Well-Defined and Holistic Asset Management Program is Highly Recommended

ASSET GROUP		
ASSET TYPE	• Ditch • Channel • Swale	• Rain gardens • Bioswales • Wet ponds • Dry ponds • Constructed wetlands • Manufactured devices
ASSET COMP-ONENT	• Check dams • Vegetation	• Forebay • Overflow/riser • Channel • Vegetation • Structure protection

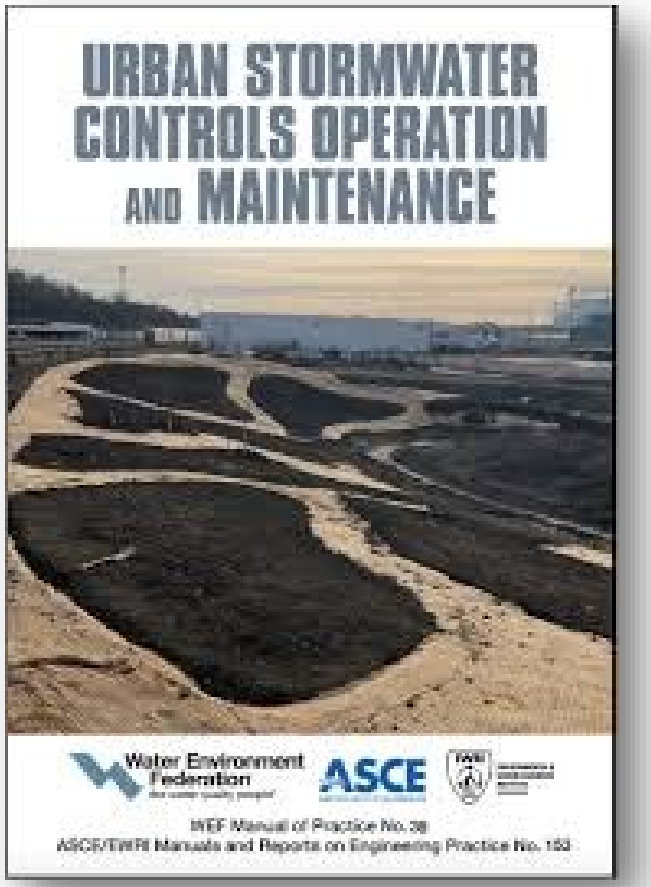
Non-Traditional Assets

Most SW Asset Categories Need Guidance

Stormwater Asset Category	Example Types of Assets	
Basins	- Dry basins - Cisterns and rain barrels - Wetlands	- Wet basins - Vaults and swirl concentrators - Forebays
Swales and Strips	- Swales - Level spreaders	- Vegetated strips
Filters	- Surface and subsurface sand filters - Landscaped / vegetated roofs - Manufactured filters (boxes)	- Bioretention - Drain inlet inserts - Subsurface gravel wetlands
Infiltrators	- Infiltration basins - Dry wells	- Infiltration trenches and vaults - Permeable pavement
Gross Pollutant Traps and Mechanical Operations*	- Screens - Baskets - Hoods	- Nets - Racks
	*(*note that this category of asset types may already be adequately addressed by industry standards like WRF's SIMPLE)*	

WEF/ASCE Urban Stormwater Controls O&M Manual – SW AM Chapter

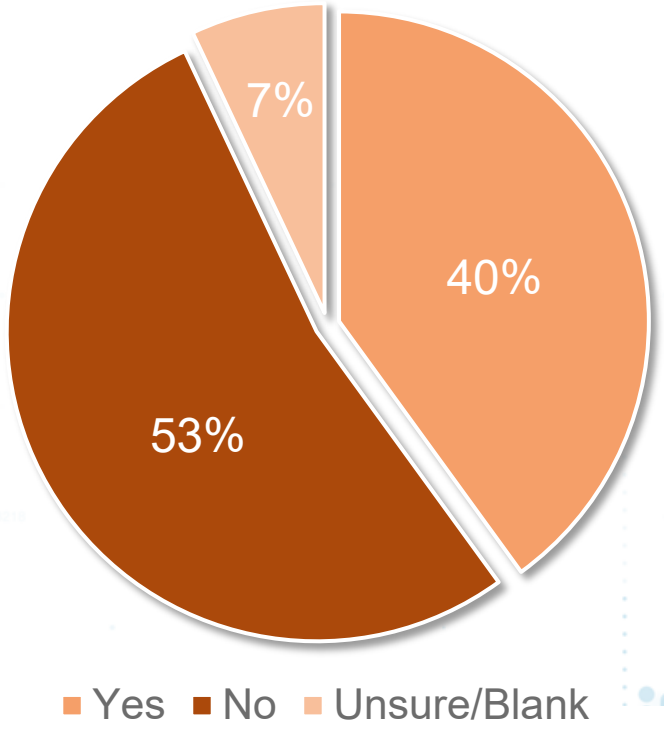
- Overview of Asset Management
- Evaluate Current State of Assets
- Identify Appropriate Level of Service
- Evaluate Critical Assets
- Evaluate Investment Strategies
- Evaluate Long-Term Funding Options
- Adaptive Management

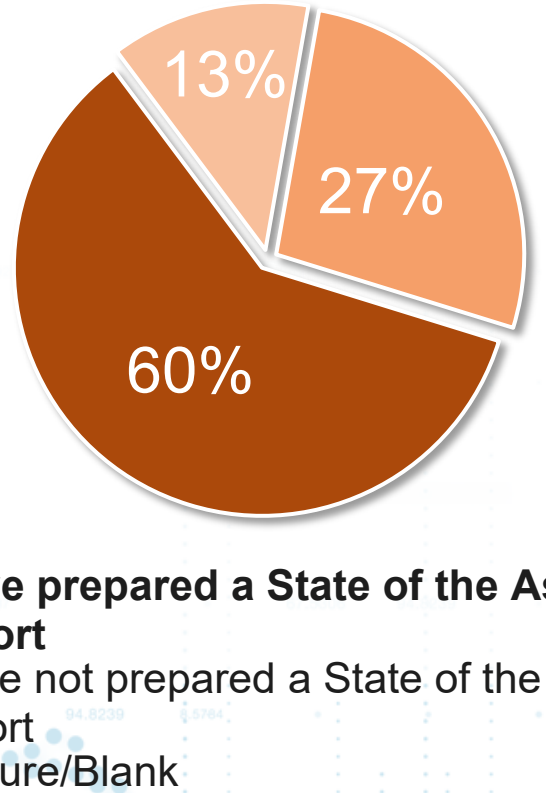


Current National SW AM Research Project

WEF Stormwater Questionnaire Results

Do you have a dedicated Asset Manager and/or AM steering committee?





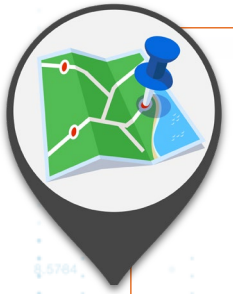
Half are not part of an enterprise wide AM program.

WEF Stormwater Questionnaire Results

Common SW AM Tools/Templates Currently Used:

In-house Checklists/Forms

Excel Spreadsheets



GIS/CMMS

Previous Efforts to Develop Targeted Stormwater Asset Management Project

- Develop Stormwater Strategic Asset Management Tools and Guidance
- Nationwide participants will advance the use of stormwater asset management with a particular emphasis on natural and built green elements

wef Stormwater Institute

THE Water Research FOUNDATION

nmsa

Research Concept

Identify gaps in knowledge and application of AM principles to stormwater/GI and develop tools and guidance for community use

Stormwater assets present unique challenges including natural components that must be managed to ensure performance

Green Infrastructure Leadership Exchange (GILE) SW AM Research Project

Current GILE Initiatives

- GSI & Equity Learning Circle
- Local Governments and Nonprofit Water Agencies Learning Circle
- GSI Maintenance
- GSI Procurement
- GSI Workforce Development
- Using GSI to Advance Sustainability & Climate Resilience

GREEN INFRASTRUCTURE LEADERSHIP EXCHANGE

SW AM Research Project

- Team includes GILE, Arcadis and HDR
- Focused on development of SW AM tools and guidance materials for all communities

Green Infrastructure Leadership Exchange (GILE) SW AM Research Project

The research will comprise the following steps:

1. **Conduct survey of GILE members and other interested parties on asset management and confirm project goals (Oct 2025 – Jan 2026)**
2. Determine current state of the industry and identify potential information gaps of current GILE Toolkit (2026)
3. Evaluate and summarize stormwater asset management to develop a standardized framework and approach (2026)
4. Develop the tools, checklists, approaches and related data needed to address the identified gaps and support the standardized framework (2026)
5. Share results among participants in a learning forum and finalize guidance (2026-27)

Green Infrastructure Leadership Exchange (GILE) SW AM Research Project

- Survey released in late October 2025
- Survey went to existing GILE members and municipal contacts, but **other interested parties will also be able to participate**
- In discussions with US EPA Four Centers of Excellence for Stormwater Control Infrastructure Technologies to make survey available in each region:
  - Southeast (Center for Watershed Protection)
  - Southwest (Southwest Center for Stormwater Technology/Board of Regents Nevada System of Higher Education)
  - Great Plains Stormwater Center of Excellence (University of Oklahoma)
  - Cold Climate Center of Excellence (University of New Hampshire)

Green Infrastructure Leadership Exchange (GILE)
SW AM Research Project – Survey Question Topics

1. Utility/Department Information
2. Asset Inventory of Publicly Owned GSI
3. Budget for GSI
4. Financing/Funding for GSI
5. Workforce Dedicated to GSI
6. Equipment Used to Manage GSI
7. Established Goals/Metrics for GSI
8. SOPs or Workflows for GSI
9. GSI Asset Inventory
10. GSI O&M
11. GSI Inspections
12. GSI Maintenance Procedures
13. GSI Renewal & Repair
14. Ranking/Prioritization of GSI Assets
15. GSI Asset Management Technology
16. CMMS Software

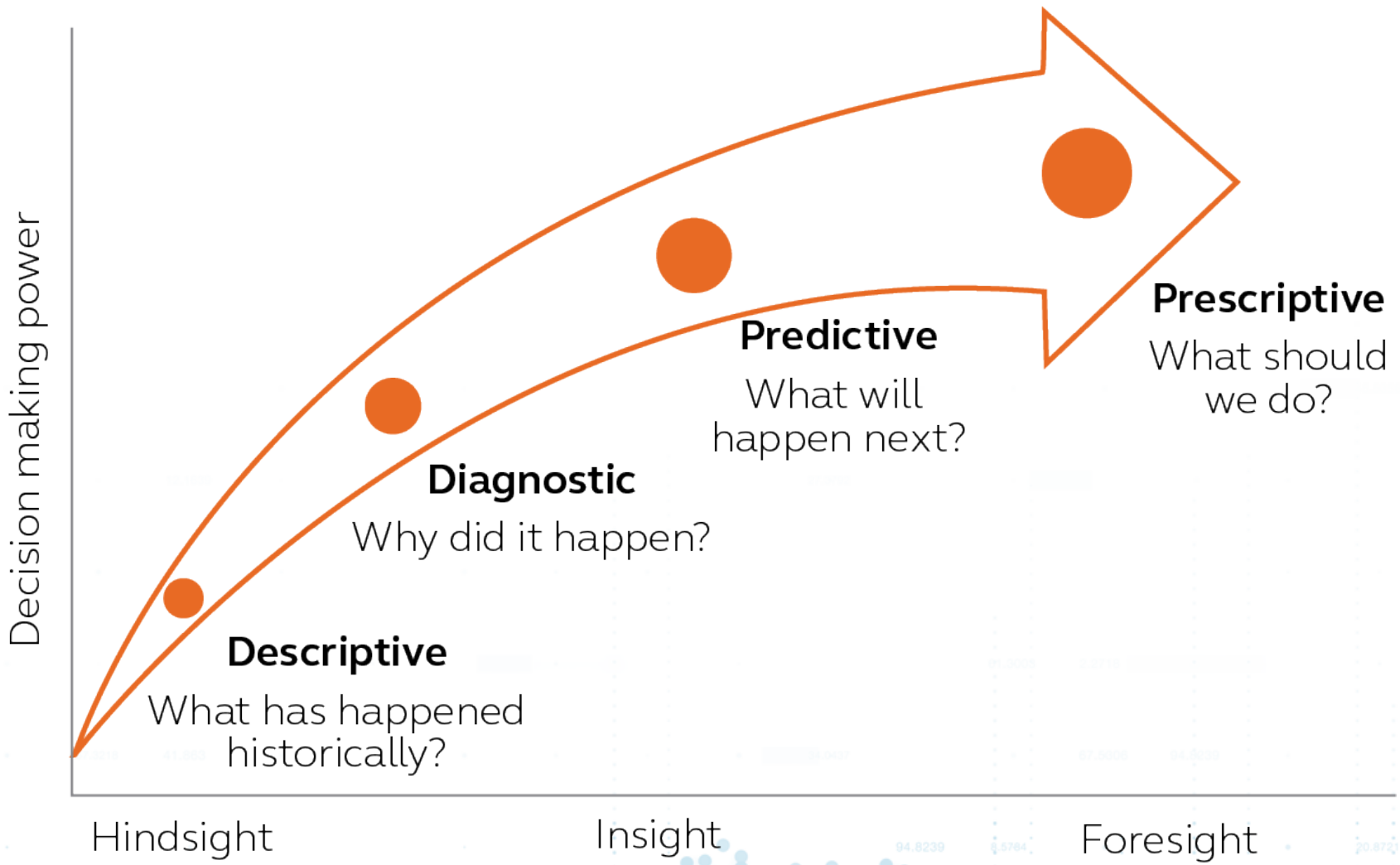
Green Infrastructure Leadership Exchange (GILE) SW AM Research Project

As a project participant, you will have opportunities to directly contribute to the research effort:

1. Providing survey response with data, needs and related case studies from your community on stormwater strategic asset management. (up to 4 hours)
2. Participating (either in person or remotely) in two workshops to develop state-of-the-industry framework and guidance materials. (up to 16 hours)
3. Reviewing the draft final work products. (up to 8 hours)

What's Next? – Data Visualization/ Analytics Tools

Leveraging Analytics



- Analytics is the use of data to deliver insight & support better decision making
- For AM, analytics combines mathematics & statistics, data techniques and advanced algorithms to quantify and predict performance, risk, condition, service, cost & revenue
- Analytics is most effective when presented with rich data visualization to communicate insight

Analytics 101

Visualization: Walk before you Run

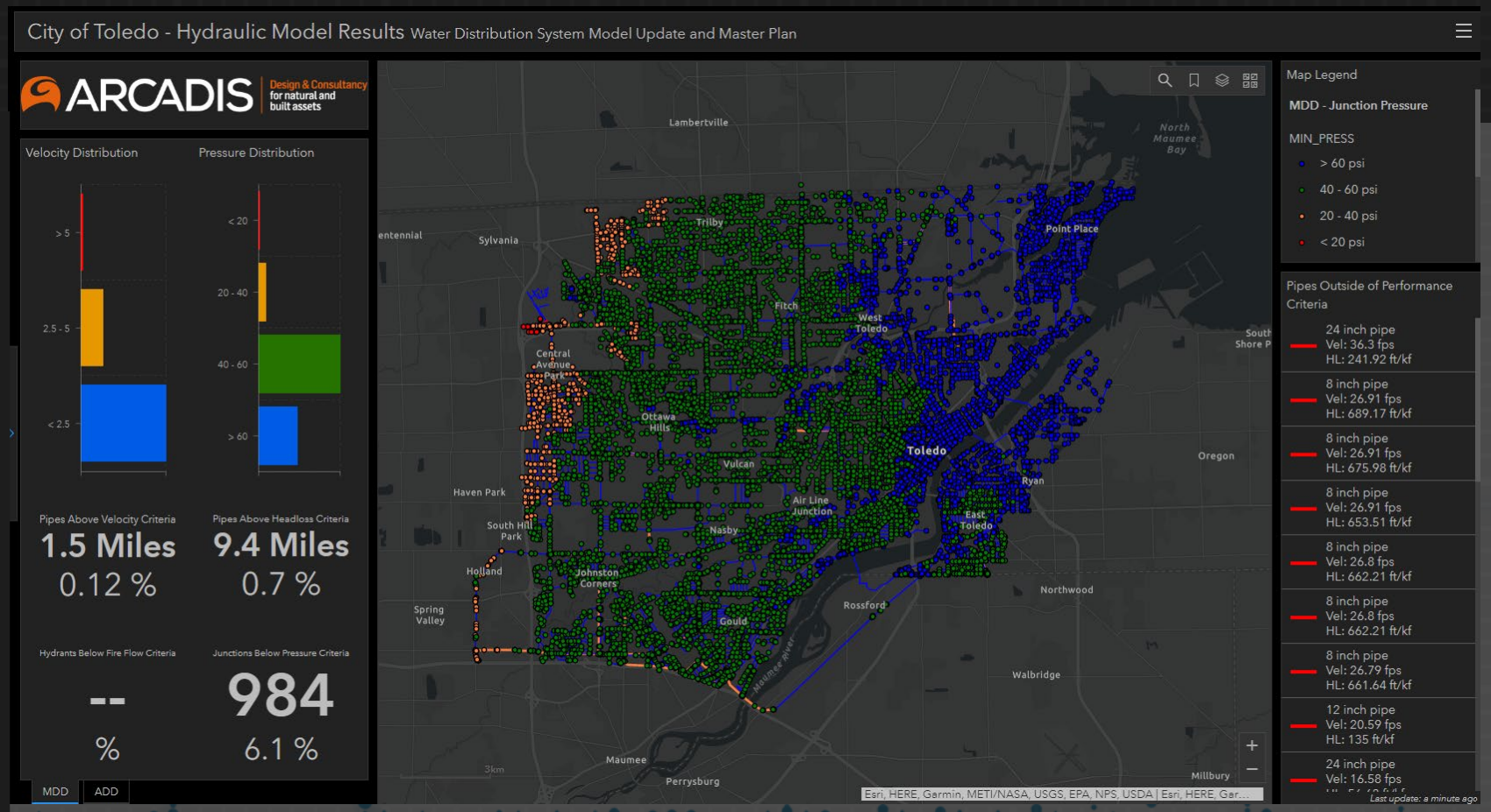
WHAT & HOW

Less raw data, more insight

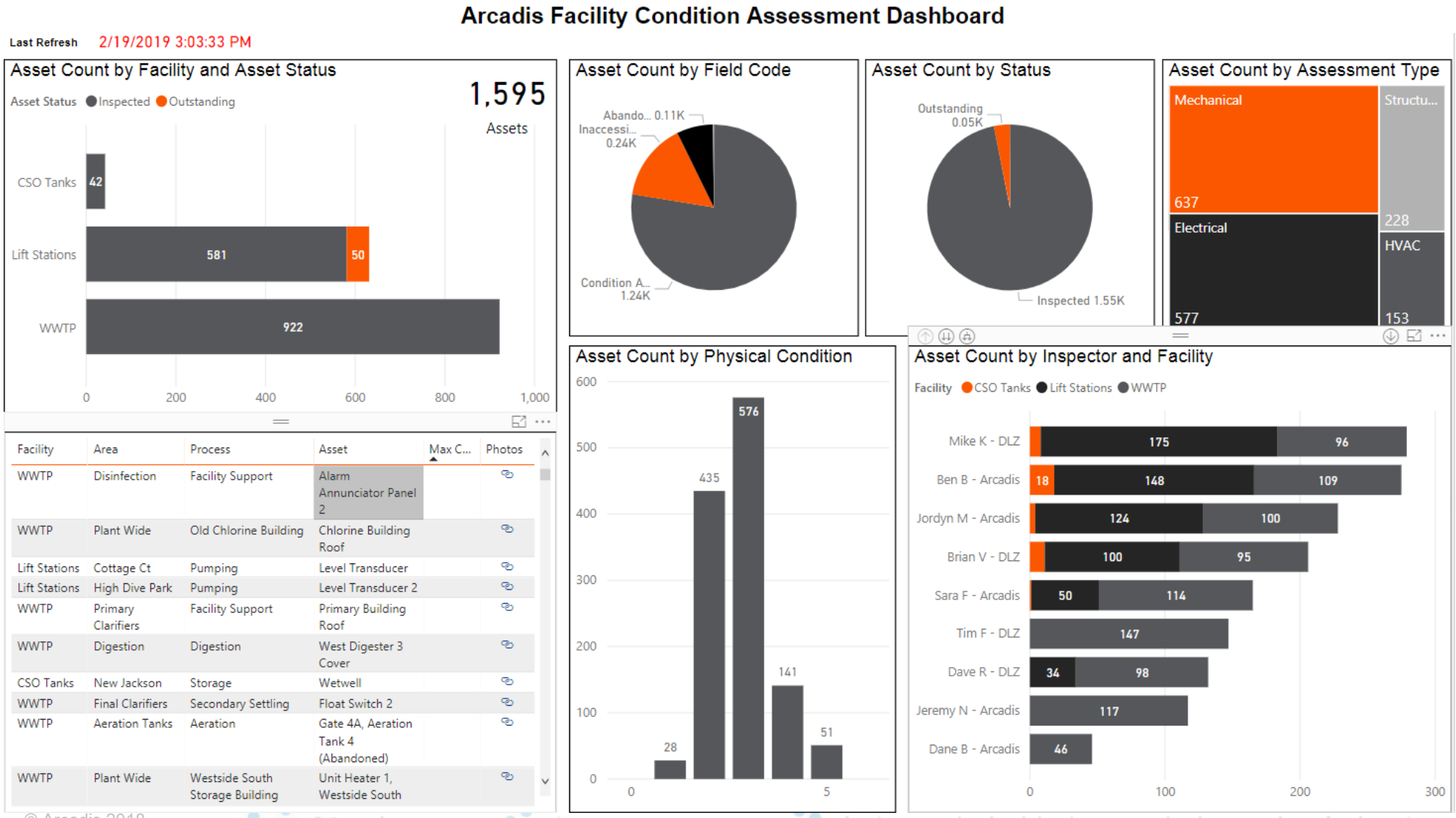
Many applications for simple dashboard development

BENEFIT

Increase the value of your data efforts through basic visualization and development of dashboards



Data Collection Monitoring

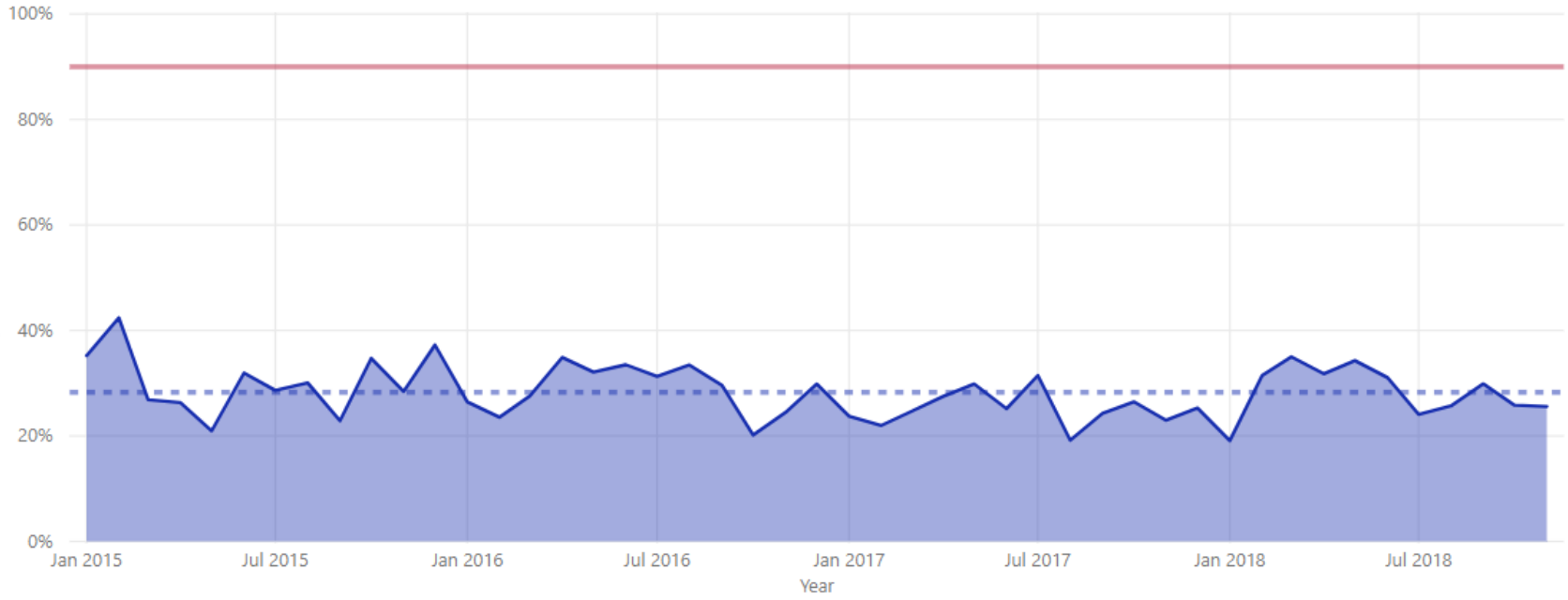


Are We Meeting Our Preventative Maintenance Targets?

Lucity CMMS Performance

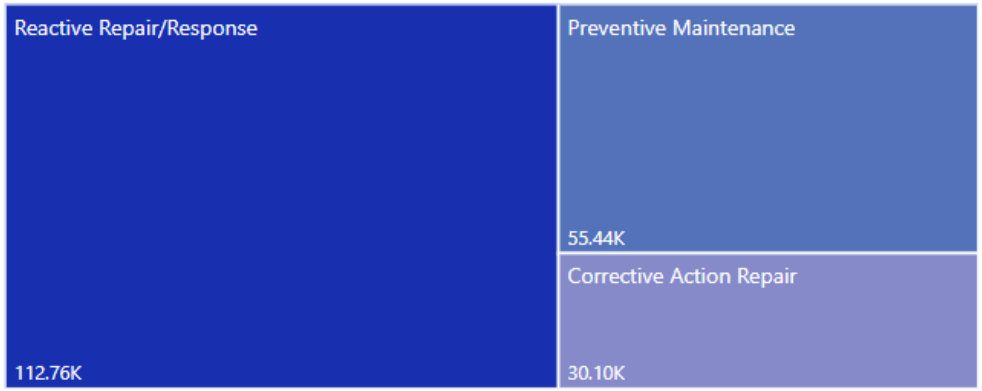
Planned Maintenance Percentage

Planned Maintenance Percentage (Percentage of Preventive Maintenance Labor Hours) over Time

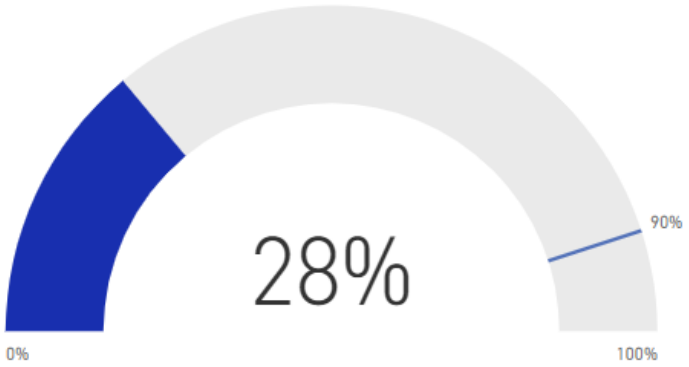


Reason	Workorders	Average Hours
Repair	**1**	**175.00**
Investigate	1	175.00
Corrective Action Repair	**5576**	**5.47**
Mainline Replacement	3	113.33
Mainline Blockage	1	30.00
Flow Restriction	1	24.00
Damaged Handrail	1	23.00
Water Shutdown	22	21.41
Erosion	9	17.50
Sunken Trenches	2	17.00
Valve Broken	17	16.90
Wet Weather Event	1	16.00
Drive Chain Loose	3	14.33
Water Quality Free Chlorine	1	14.00
Wet Tap NOB	1	14.00
Debris	45	13.18
Building Modification	37	13.00
Blockage	66	11.60
Meter Lid Damaged	6	11.00
Equipment Not Running	24	10.48
Broken Mainline	5	10.30
Low Chlorine	4	9.63
Establish Potable Service NOB	3	9.50
Fading	2	9.50
System Interruption	3	9.33
Corrosion	15	9.13
Unable To Cut Off	9	9.03
Infiltration	10	8.95
Low Water Pressure	18	8.82
Sunken MH	7	8.79
Excessive Vibrations	16	8.78
Total	**62327**	**3.20**

Labor Hours by Reason



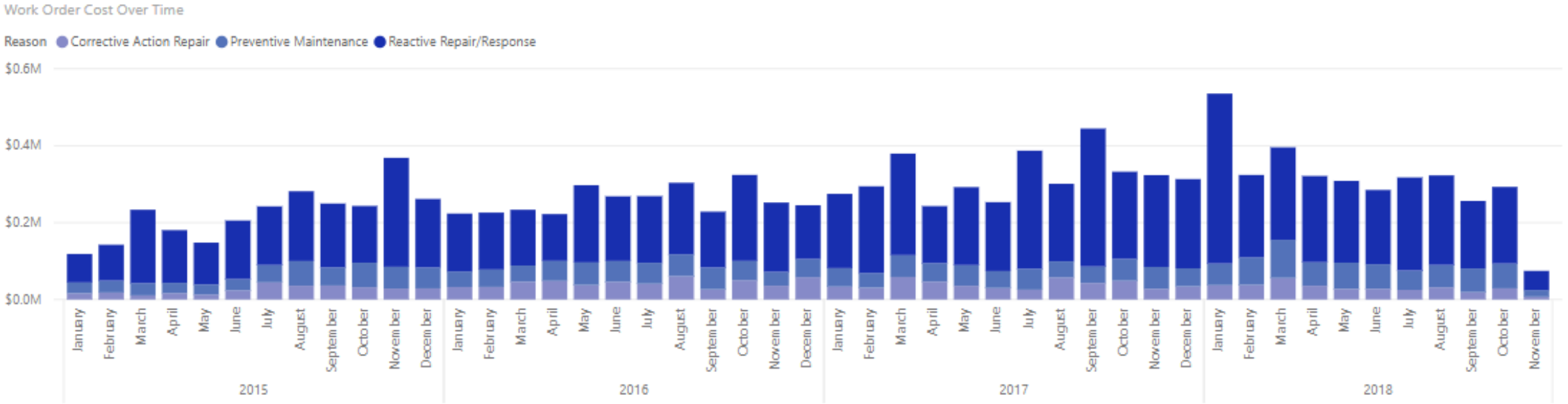
Planned Maintenance Percentage

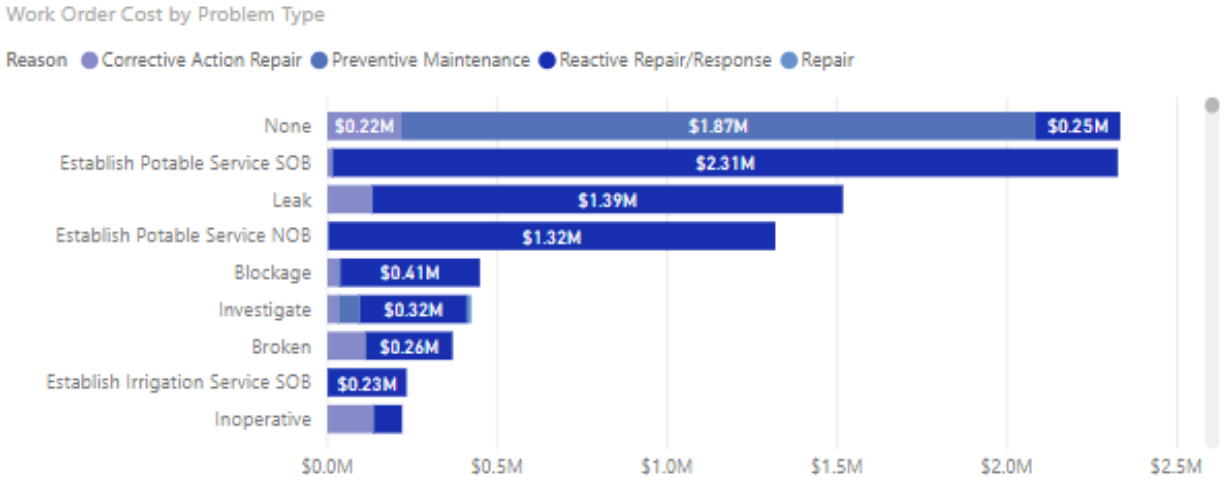


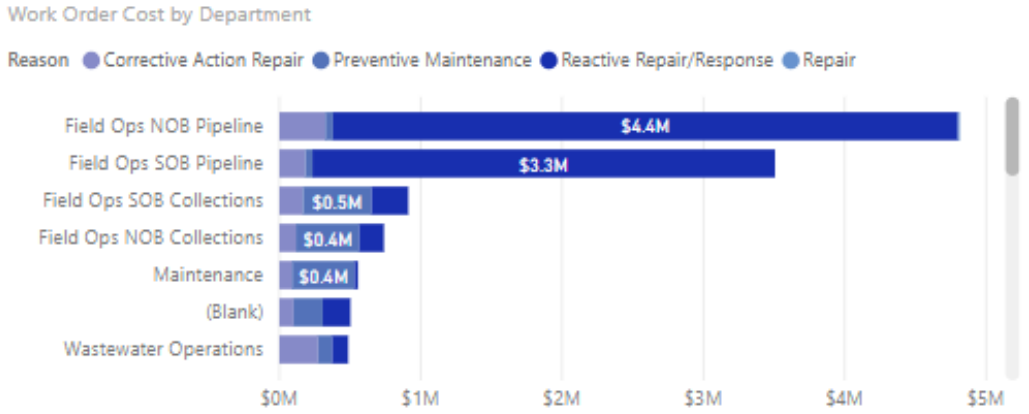
What Assets Consume Our O&M Dollars?

Lucity CMMS Performance

Work Order Cost







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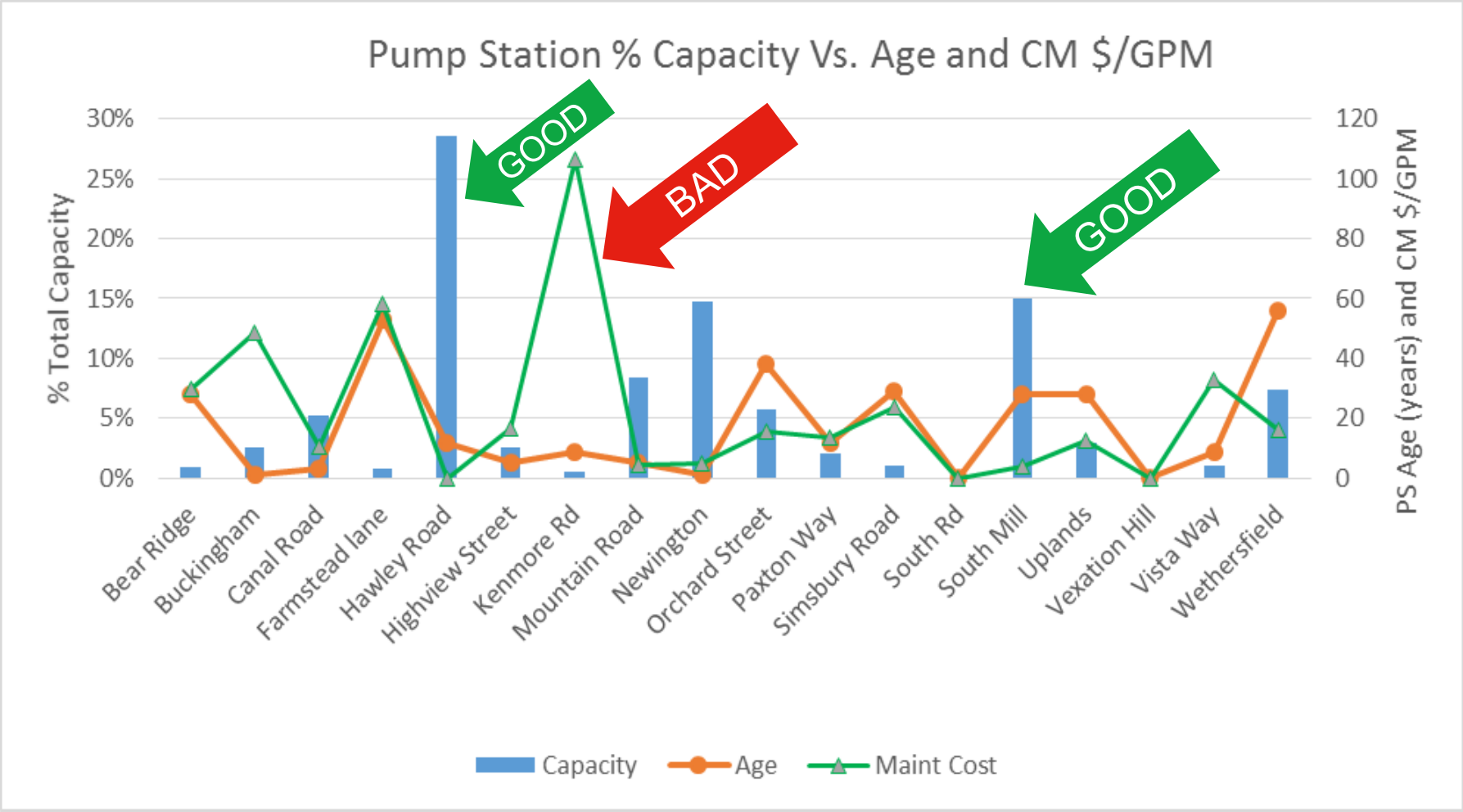
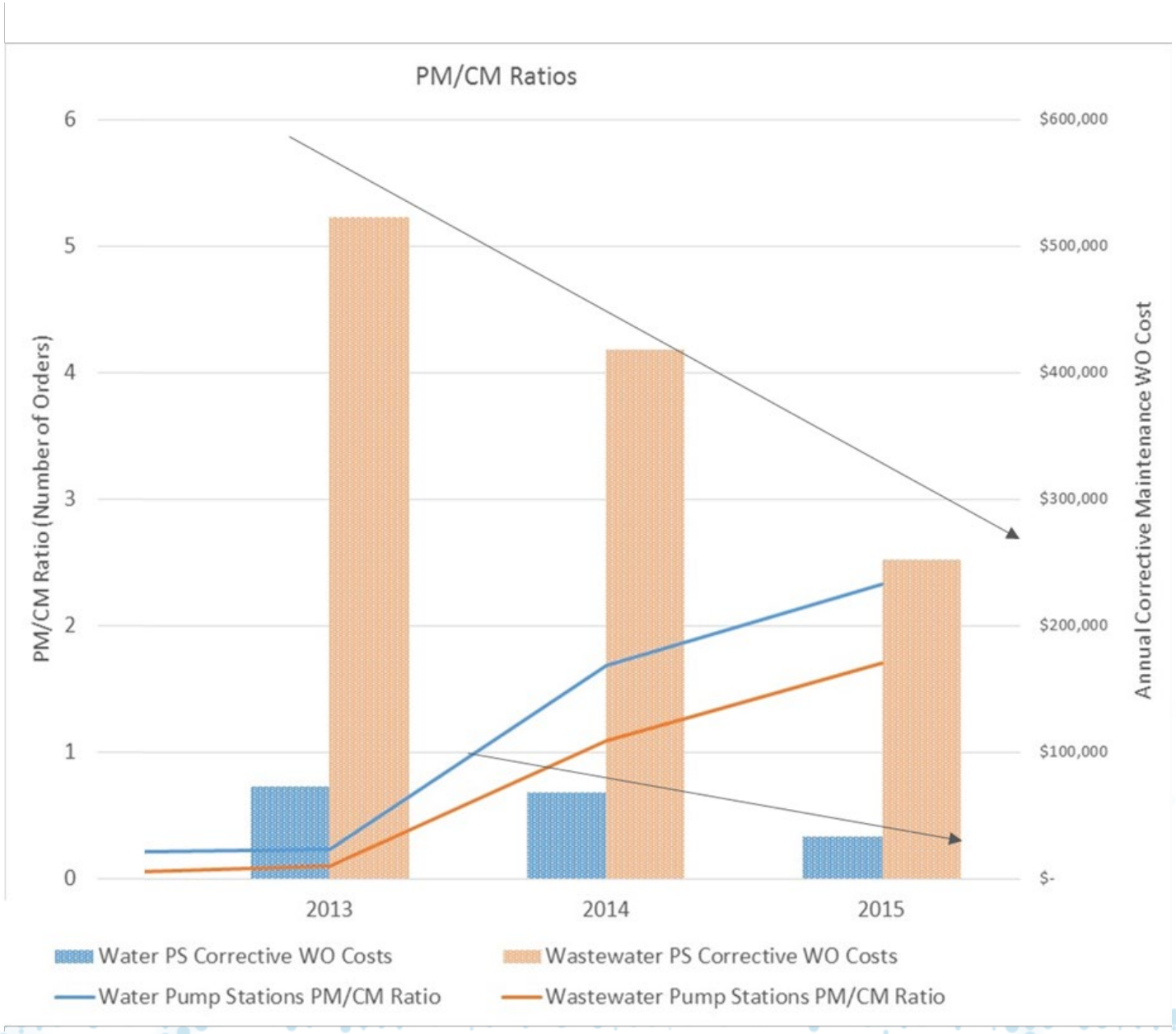
Maintenance Lagging KPIs Inform CAPEX Planning



Comparison of Planned vs Corrective Maintenance Cost



- PM/CM is an effective leading indicator
- CM costs fell sharply as PM/CM ratio increased
- CM cost fell almost 50% in three years

THANK YOU! Questions?

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