How are we doing? Evaluating the Effectiveness of the St. Louis County Stormwater Management Plan

Roland Biehl

Metropolitan St. Louis Sewer District Project Clear

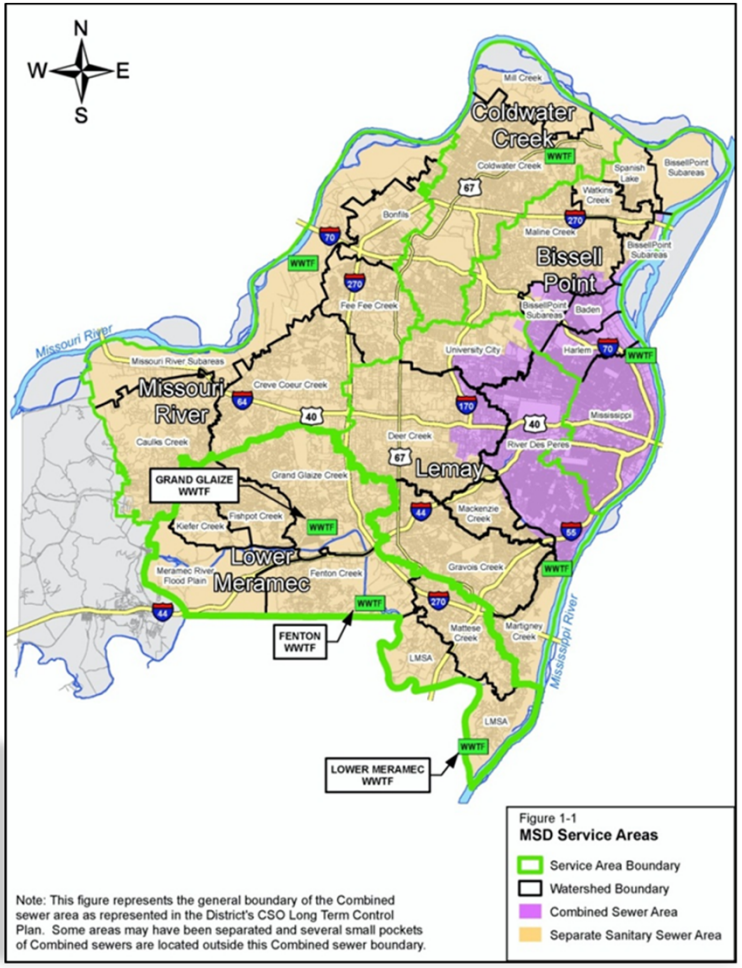
November 8, 2022

Agenda

- St. Louis County Stormwater Management Program overview
- Evaluation strategy

Metropolitan St. Louis Sewer District Overview

- Two utilities in one
  - Sanitary
  - Stormwater
- Service Area
  - 535 sq. miles
  - 1.3 million people
  - 93 Municipalities
- Sewer Stats
  - 3,000 miles of storm sewers
  - 4,800 miles of sanitary sewer
  - 1,800 miles combined
  - 7 WWTPs
  - 278 pump stations

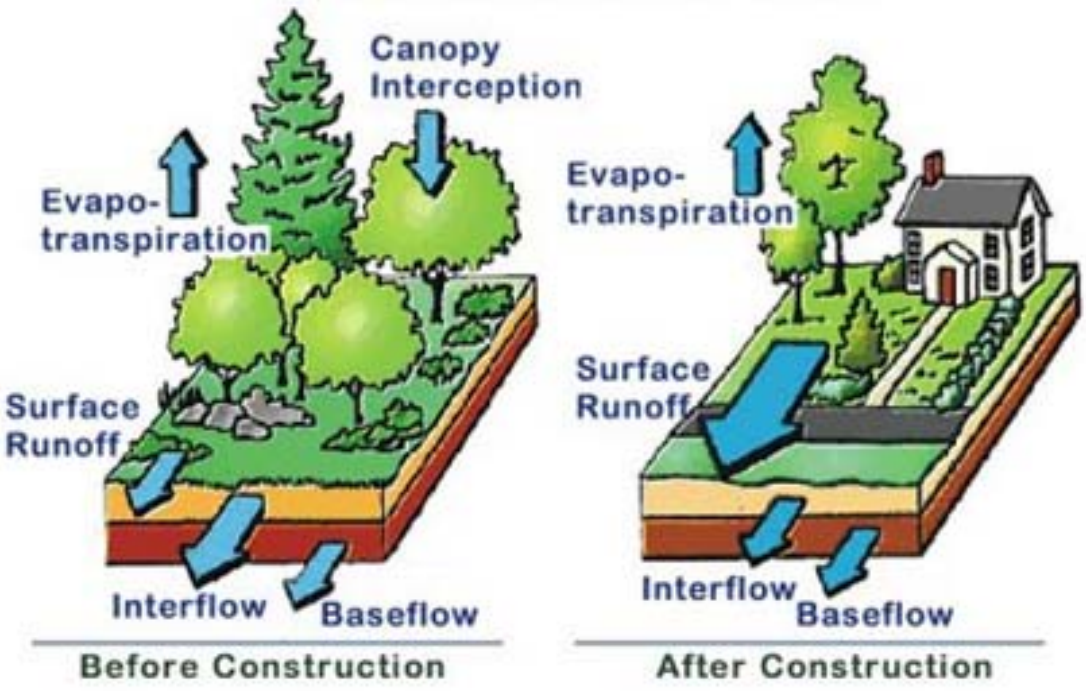


Stormwater Pollutants and Impact on Water Quality

- Sediment
- Bacteria
- Chloride
- Nutrients
- Trash
- Fat, Oil, Grease (FOG)
- Metals and Organics

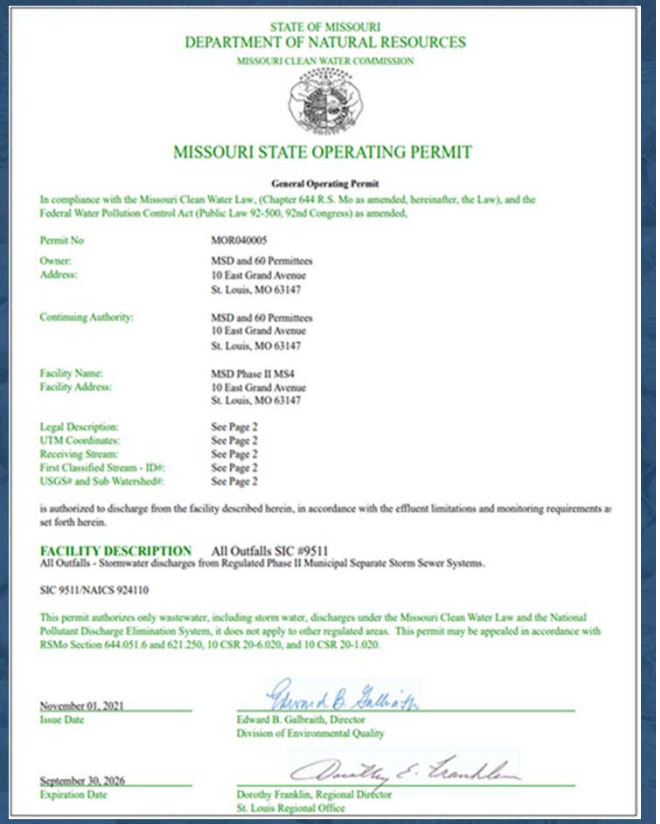
Stormwater Pollutants and Impact on Water Quality

- Increase in impervious area contributes to stormwater pollution



Stormwater Pollution Regulations

- Clean Water Act Amendments – 1987
- National Stormwater Program
- 1990 Phase I – Large cities
- 1999 Phase II – small cities (St. Louis County)



STATE OF MISSOURI
DEPARTMENT OF NATURAL RESOURCES
MISSOURI CLEAN WATER COMMISSION

MISSOURI STATE OPERATING PERMIT

General Operating Permit

In compliance with the Missouri Clean Water Law, (Chapter 644 R.S. Mo as amended, hereinafter, the Law), and the Federal Water Pollution Control Act (Public Law 92-500, 92nd Congress) as amended,

Permit No	MOR040005
Owner:	MSD and 60 Permittees
Address:	10 East Grand Avenue St. Louis, MO 63147
Continuing Authority:	MSD and 60 Permittees 10 East Grand Avenue St. Louis, MO 63147
Facility Name:	MSD Phase II MS4
Facility Address:	10 East Grand Avenue St. Louis, MO 63147
Legal Description:	See Page 2
UTM Coordinates:	See Page 2
Receiving Stream:	See Page 2
First Classified Stream - ID#:	See Page 2
USGS# and Sub Watershed#:	See Page 2

is authorized to discharge from the facility described herein, in accordance with the effluent limitations and monitoring requirements as set forth herein.

FACILITY DESCRIPTION All Outfalls SIC #9511
All Outfalls - Stormwater discharges from Regulated Phase II Municipal Separate Storm Sewer Systems.

SIC 9511/NAICS 924110

This permit authorizes only wastewater, including storm water, discharges under the Missouri Clean Water Law and the National Pollutant Discharge Elimination System, it does not apply to other regulated areas. This permit may be appealed in accordance with RSMo Section 644.051.6 and 621.250, 10 CSR 20-6.020, and 10 CSR 20-1.020.

November 01, 2021
Issue Date

Edward B. Galbraith, Director
Division of Environmental Quality

September 30, 2026
Expiration Date

Dorothy Franklin, Regional Director
St. Louis Regional Office

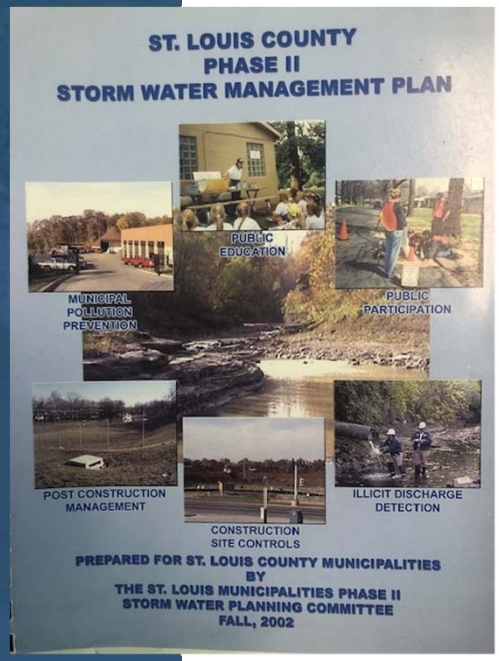
Stormwater Management Permit

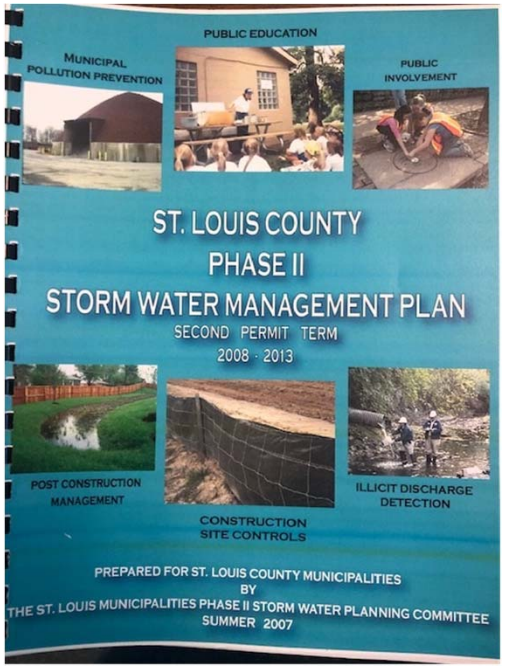
- Reduce the contamination of stormwater runoff and prohibit illicit discharges
- 5 year permit terms
- Six Minimum Control Measures

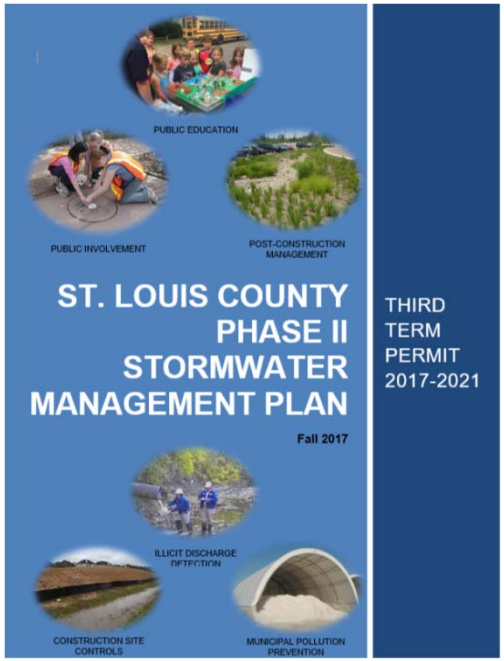
Stormwater Management Plan (SWMP)

1. Public education and outreach on stormwater impacts
2. Public involvement & participation
3. Illicit discharge detection and elimination
4. Construction site storm water runoff control
5. Post-construction stormwater management in new development and redevelopment
6. Pollution prevention & good housekeeping for municipal operations

The Past
2003 – 2021 SWMPs

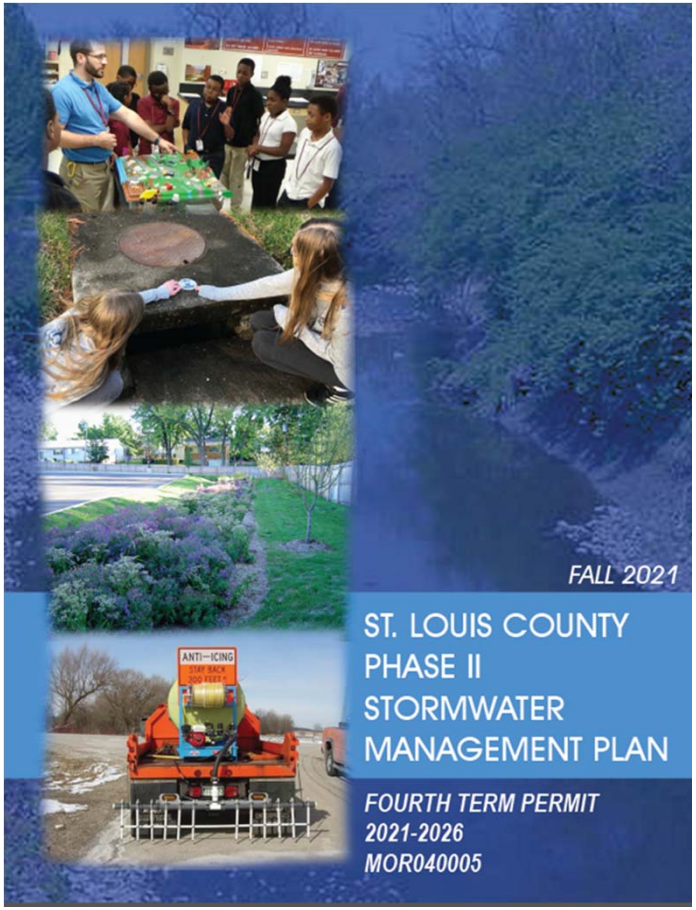






The Future
2022 – 2026 SWMP

- Approved by Missouri Department of Natural Resources in August 2021
- 61 co-permittees
- Co-permittees share compliance responsibilities: 69 Best Management Practices (BMPs) across the six minimum control measures
- Plan is formatted with two key elements: The **Narrative** and the **Table**



SWMP Table

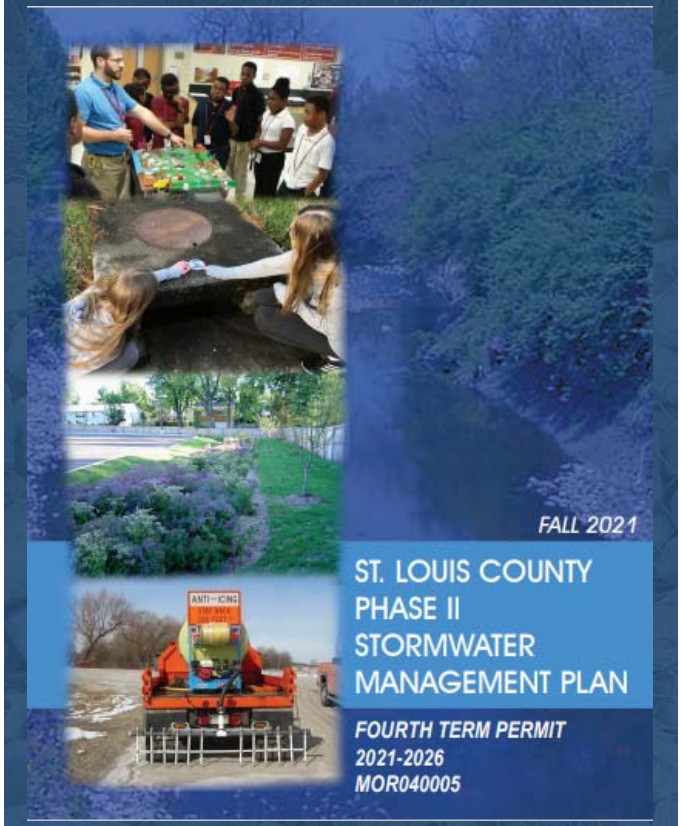
Defines who, what, why, when and how

Who

What and Why

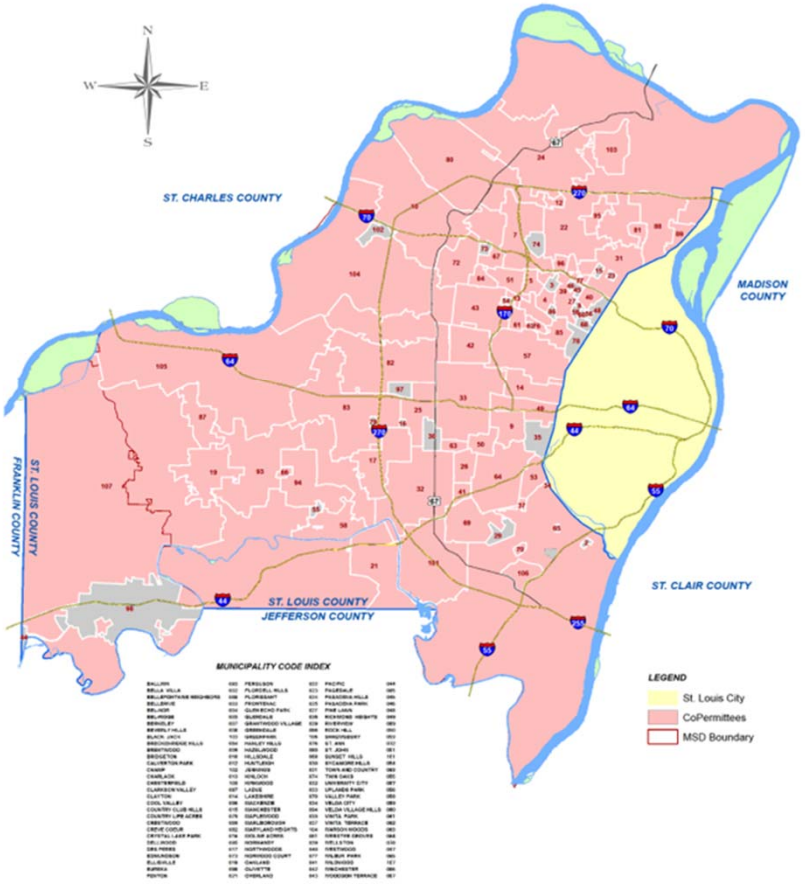
When and How

Permit Section	BMP Table 1 Best Management Practice (BMP)					Measurable Goals, Milestones, and Dates	Measurable Goals, Milestones, and Dates	Measurable Goals, Milestones, and Dates	Measurable Goals, Milestones, and Dates	Measurable Goals, Milestones, and Dates	Iterative Process Evaluation	
	Responsibility		Description	Purpose	Expected Resul	2021 - 2022	2023	2024	2025	2026	Evaluation Process	Effective BMP Criteria
MCM1 4.1.A	MSD	1	Query MSD Compliance Pretreatment Information Management System for active industrial entities.	Maintain list of active industrial entities who could have a significant stormwater impact.	Provide co-permittees with a list of industrial stormwater sources.	Update list and distribute to co-permittees by end of plan year.	Update l distribute to co-permittees by end of plan year.	distribute to co-permittees by end of plan year.	distribute to co-permittees by end of plan year.	Update list and distribute to co-permittees by end of plan year.	List updated, distributed, and filed. Each annual report documents annual measurable goals and milestones completed. Evaluate audience identification trend by end of permit term.	Measurable goals and milestones completed and consistent ongoing identification trend of this target audience throughout plan area continues.
	MSD	2	Query MSD Environmental Compliance Pretreatment Information Management System for approved commercial haul-waste vendors.	Maintain list of active commercial individual waste haulers who could have a significant stormwater impact.	Provide co-permittees with a list of waste haulers.	Update list and distribute to co-permittees by end of plan year.	Update list and distribute to co-permittees by end of plan year.	Update list and distribute to co-permittees by end of plan year.	Update list and distribute to co-permittees by end of plan year.	Update list and distribute to co-permittees by end of plan year.	List updated, distributed, and filed. Each annual report documents annual measurable goals and milestones completed. Evaluate audience identification trend by end of permit term.	Measurable goals and milestones completed and consistent ongoing identification trend of this target audience throughout plan area continues.
	MSD	3	Query MSD Asset Management System for list of active food service and restaurant establishment facilities.	Maintain list of active food service and restaurant establishments who could have a significant stormwater impact.	Provide co-permittees with a list of food service and restaurant establishments.	Update list and distribute to co-permittees by end of plan year.	Update list and distribute to co-permittees by end of plan year.	Update list and distribute to co-permittees by end of plan year.	Update list and distribute to co-permittees by end of plan year.	Update list and distribute to co-permittees by end of plan year.	List updated, distributed, and filed. Each annual report documents annual measurable goals and milestones completed. Evaluate audience identification trend by end of permit term.	Measurable goals and milestones completed and consistent ongoing identification trend of this target audience throughout plan area continues.
	MSD	4	Survey trade associations (such as Home Builders Association, Associated General Contractors, American Society of Civil Engineers, and Property Managers) involved with land disturbance, land development, and property management activities.	Maintain list of trade associations with members that could have a significant stormwater impact.	Provide co-permittees with list of trade associations.	Develop list and distribute to co-permittees by end of plan year.	Update list and distribute to co-permittees by end of plan year.	Update list and distribute to co-permittees by end of plan year.	Update list and distribute to co-permittees by end of plan year.	Update list and distribute to co-permittees by end of plan year.	List updated, distributed, and filed. Each annual report documents annual measurable goals and milestones completed. Evaluate audience identification trend by end of permit term.	Measurable goals and milestones completed and consistent ongoing identification trend of this target audience throughout plan area continues.
	All	5	Query municipal building permit databases for active major land disturbance contractors.	Maintain list of contractors that could have a significant stormwater impact.	Provide co-permittees with a list of contractors who are currently engaged in major land disturbance activities.	Update list and distribute to co-permittees by end of plan year.	Update list and distribute to co-permittees by end of plan year.	Update list and distribute to co-permittees by end of plan year.	Update list and distribute to co-permittees by end of plan year.	Update list and distribute to co-permittees by end of plan year.	List updated, distributed, and filed. Each annual report documents annual measurable goals and milestones completed. Evaluate audience identification trend by end of permit term.	Measurable goals and milestones completed and consistent ongoing identification trend of this target audience throughout plan area continues.
	MSD	6	Collect stormwater education survey.	Survey water quality and nonpoint source pollution awareness and behaviors, and identify target audiences for future SWMP revisions.	Monitor trends in public water quality awareness in service area.	None	None	None	Develop survey questions, complete third party survey, record and analyze findings.	None	Awareness baseline developed. 2025 annual report documents 2025 goal completed. Evaluate awareness and behavior changes.	2025 Measurable goals and milestones completed and survey tracks awareness and behavior changes.



St. Louis County SWMP

- 525 square miles



Successes…

Missouri Stream Team

2018 Benefactor Award

2022 WEF Municipal Stormwater and Green Infrastructure Awards Program

Program Management Winner

APWA St. Louis Branch

Management Innovation Award

Effectiveness Evaluation and the Iterative Process – A Permit Requirement

- St. Louis County Two-Step Permit
- 2017-2021 Permit, Section 4.1.1.4

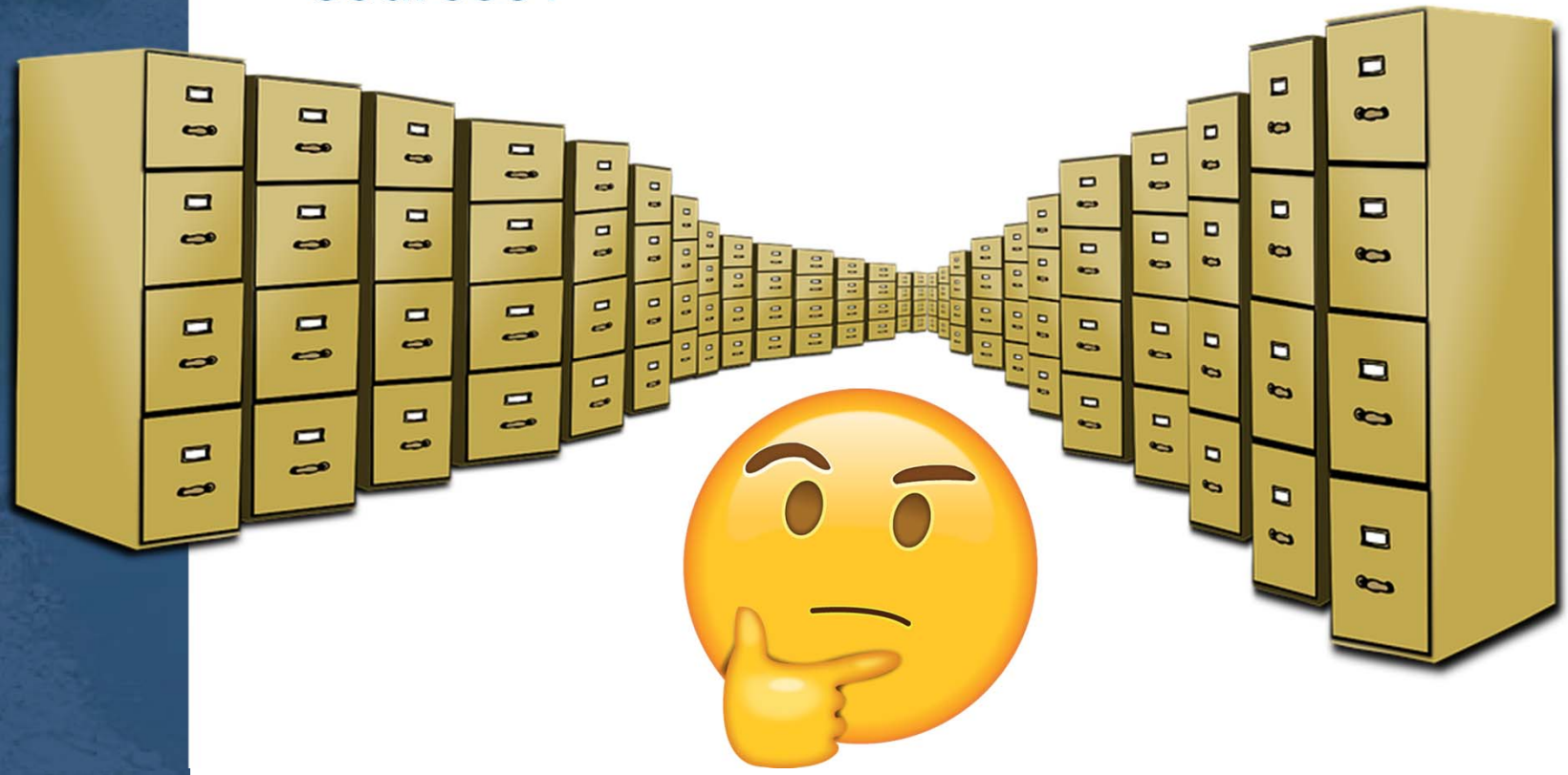
  "The SWMP document shall include…An iterative process to be utilized by the permittee that documents how each BMP is evaluated and subject to replacement or modification. The permittee shall apply reasonable further progress by replacing or modifying ineffective BMPs with effective BMPs"

- 2021-2026 Permit, Section 3.1.B

  "The SWMP shall include…A description of the iterative process to be utilized by the permittee documenting how each BMP is evaluated and subject to replacement or modification. The permittee shall apply reasonable further progress by replacing or modifying ineffective BMPs with effective BMPs"

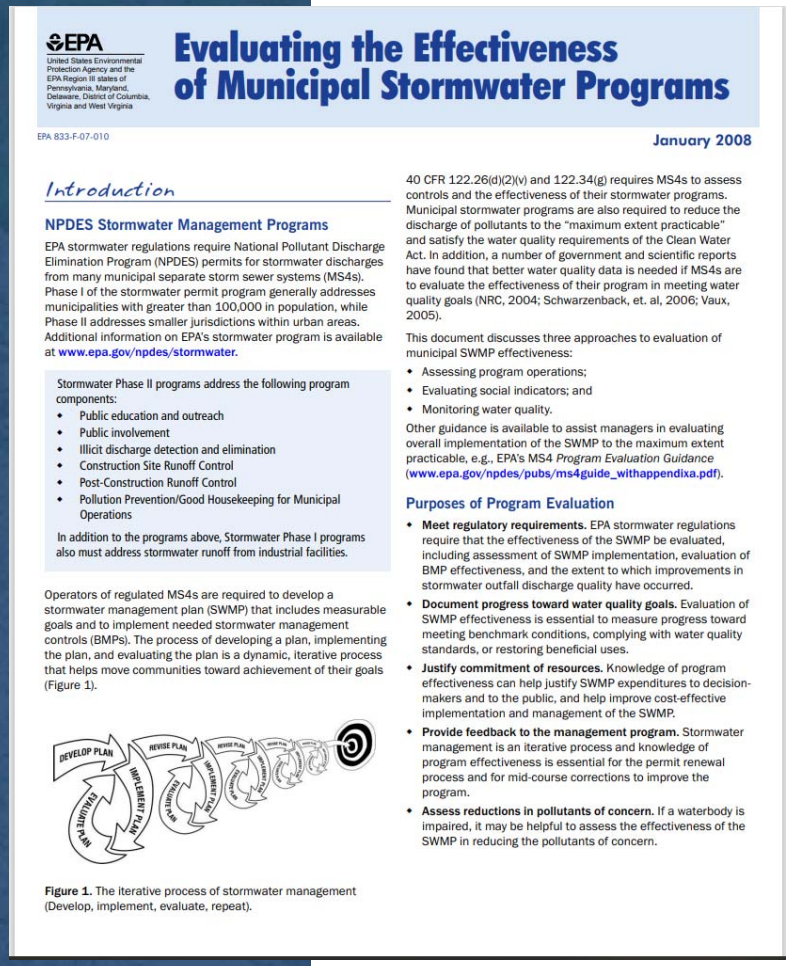
Effectiveness Evaluation and the Iterative Process - How?

- What do we do with all our data?
- How do we effectively measure non-point sources?



Effectiveness Evaluation and the Iterative Process - Our Approach

- Researched BMP evaluation work around the country
- EPA Region III Publication 833-F-07-010



EPA
United States Environmental Protection Agency and the EPA Region III states of Pennsylvania, Maryland, Delaware, District of Columbia, Virginia and West Virginia

Evaluating the Effectiveness of Municipal Stormwater Programs

EPA 833-F-07-010

January 2008

Introduction

NPDES Stormwater Management Programs

EPA stormwater regulations require National Pollutant Discharge Elimination Program (NPDES) permits for stormwater discharges from many municipal separate storm sewer systems (MS4s). Phase I of the stormwater permit program generally addresses municipalities with greater than 100,000 in population, while Phase II addresses smaller jurisdictions within urban areas. Additional information on EPA's stormwater program is available at www.epa.gov/npdes/stormwater.

Stormwater Phase II programs address the following program components:

- Public education and outreach
- Public involvement
- Illicit discharge detection and elimination
- Construction Site Runoff Control
- Post-Construction Runoff Control
- Pollution Prevention/Good Housekeeping for Municipal Operations

In addition to the programs above, Stormwater Phase I programs also must address stormwater runoff from industrial facilities.

Operators of regulated MS4s are required to develop a stormwater management plan (SWMP) that includes measurable goals and to implement needed stormwater management controls (BMPs). The process of developing a plan, implementing the plan, and evaluating the plan is a dynamic, iterative process that helps move communities toward achievement of their goals (Figure 1).

Figure 1. The iterative process of stormwater management (Develop, implement, evaluate, repeat).

40 CFR 122.26(d)(2)(v) and 122.34(g) requires MS4s to assess controls and the effectiveness of their stormwater programs. Municipal stormwater programs are also required to reduce the discharge of pollutants to the "maximum extent practicable" and satisfy the water quality requirements of the Clean Water Act. In addition, a number of government and scientific reports have found that better water quality data is needed if MS4s are to evaluate the effectiveness of their program in meeting water quality goals (NRC, 2004; Schwarzenback, et. al, 2006; Vaux, 2005).

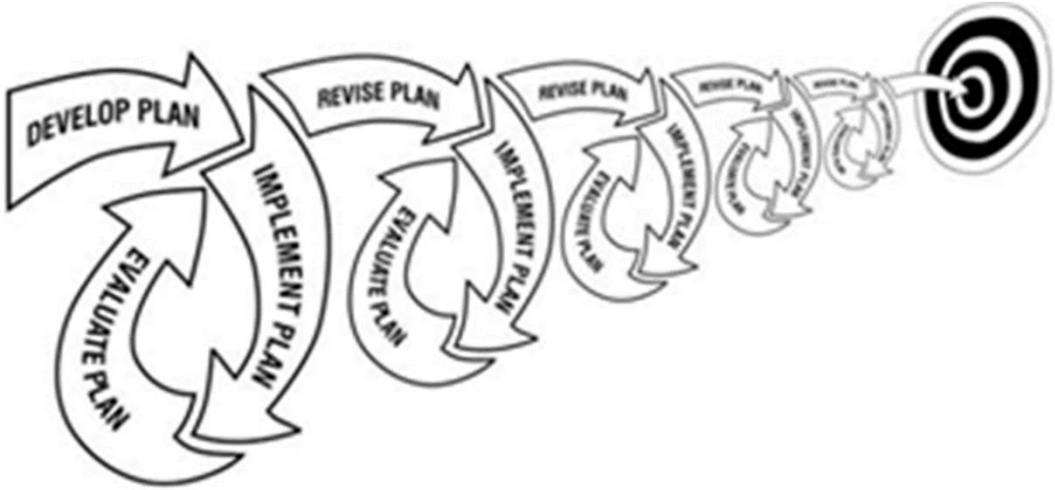
This document discusses three approaches to evaluation of municipal SWMP effectiveness:

- Assessing program operations;
- Evaluating social indicators; and
- Monitoring water quality.

Other guidance is available to assist managers in evaluating overall implementation of the SWMP to the maximum extent practicable, e.g., EPA's MS4 *Program Evaluation Guidance* (www.epa.gov/npdes/pubs/ms4guide_withappendixa.pdf).

Purposes of Program Evaluation

- **Meet regulatory requirements.** EPA stormwater regulations require that the effectiveness of the SWMP be evaluated, including assessment of SWMP implementation, evaluation of BMP effectiveness, and the extent to which improvements in stormwater outfall discharge quality have occurred.
- **Document progress toward water quality goals.** Evaluation of SWMP effectiveness is essential to measure progress toward meeting benchmark conditions, complying with water quality standards, or restoring beneficial uses.
- **Justify commitment of resources.** Knowledge of program effectiveness can help justify SWMP expenditures to decision-makers and to the public, and help improve cost-effective implementation and management of the SWMP.
- **Provide feedback to the management program.** Stormwater management is an iterative process and knowledge of program effectiveness is essential for the permit renewal process and for mid-course corrections to improve the program.
- **Assess reductions in pollutants of concern.** If a waterbody is impaired, it may be helpful to assess the effectiveness of the SWMP in reducing the pollutants of concern.

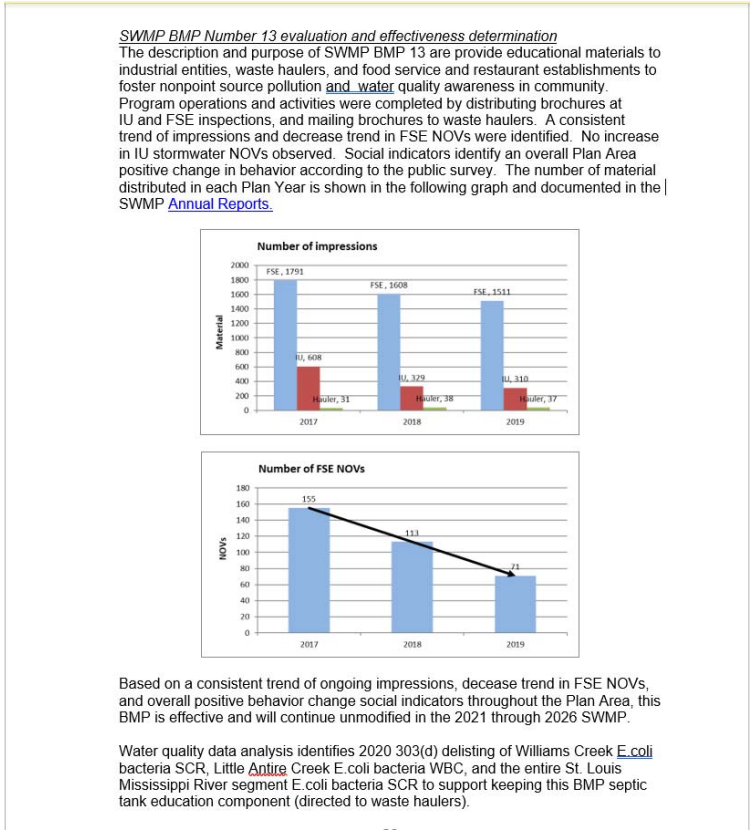


Effectiveness Evaluation and the Iterative Process - Our Strategy

- All current SWMP BMPs evaluated for effectiveness – Keep it, modify it, or replace it. THREE KEY AREAS:
  - Program Operations – analyze metrics for trends
  - Social Indicators – examine public survey reports for behavior changes
  - Water Quality – compare stream sampling results to illicit discharge findings and 303(d) list monitoring

Effectiveness Evaluation and the Iterative Process - Our Strategy

- Evaluation Summary Report, see MSD 2021 MS4 Annual Report online
  - Brief narrative, data, key area of analysis, and result (keep, modify, or replace) for each BMP.



SWMP BMP Number 13 evaluation and effectiveness determination

The description and purpose of SWMP BMP 13 are provide educational materials to industrial entities, waste haulers, and food service and restaurant establishments to foster nonpoint source pollution and water quality awareness in community. Program operations and activities were completed by distributing brochures at IU and FSE inspections, and mailing brochures to waste haulers. A consistent trend of impressions and decrease trend in FSE NOVs were identified. No increase in IU stormwater NOVs observed. Social indicators identify an overall Plan Area positive change in behavior according to the public survey. The number of material distributed in each Plan Year is shown in the following graph and documented in the SWMP Annual Reports.

Based on a consistent trend of ongoing impressions, decease trend in FSE NOVs, and overall positive behavior change social indicators throughout the Plan Area, this BMP is effective and will continue unmodified in the 2021 through 2026 SWMP.

Water quality data analysis identifies 2020 303(d) delisting of Williams Creek E.coli bacteria SCR, Little Antire Creek E.coli bacteria WBC, and the entire St. Louis Mississippi River segment E.coli bacteria SCR to support keeping this BMP septic tank education component (directed to waste haulers).

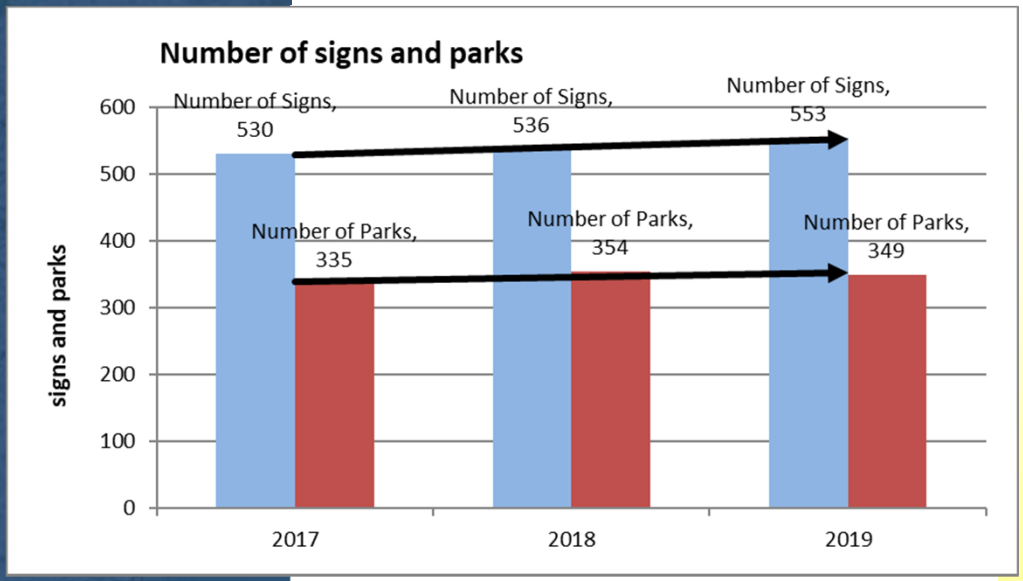
Effectiveness Evaluation - Highlights

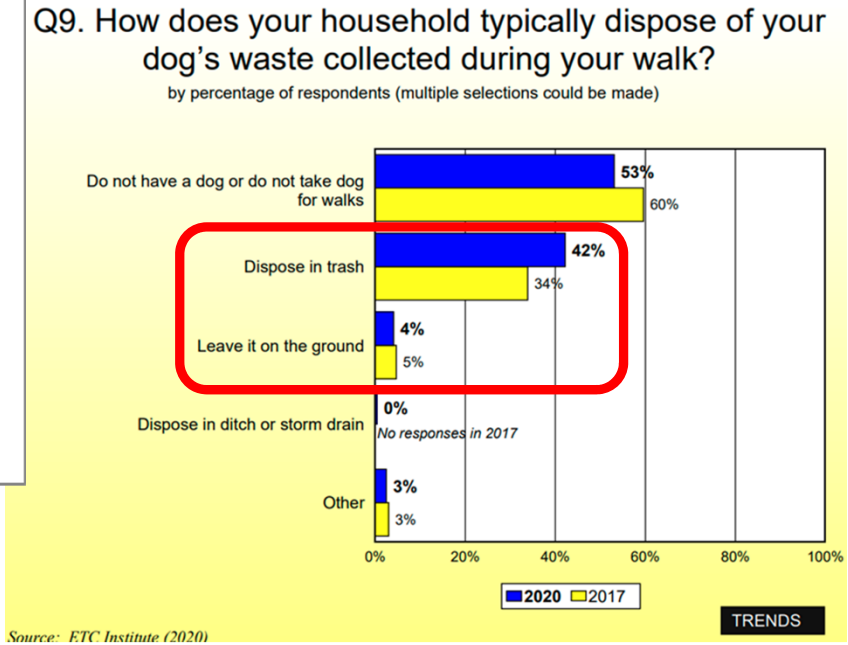
- We have implemented each of the BMPs with success (even during a pandemic)
- We see positive indicators in social attitudes and behaviors
- BMP tracking metrics are showing positive implementation trends across the entire board
- 2020 303(d) List of Impaired waters
  - Kiefer Creek was delisted for its Chloride impairment
  - Williams Creek was delisted for its E. Coli Secondary Contact Recreation impairment
  - Little Antire Creek was delisted for its E. coli Whole Body Contact Recreation impairment
  - Mississippi River – entire segment throughout St. Louis was delisted for E. coli Secondary Contact Recreation impairment

Effectiveness Evaluation - Highlights

MCM 1 assessment example

- BMP: Post pet waste signs in parks
  - Program operations completed: YES
  - Trends and/or indicators: Positive trend of posted signs and parks, and positive change in behavior identified
  - KEEP BMP MOVING FORWARD

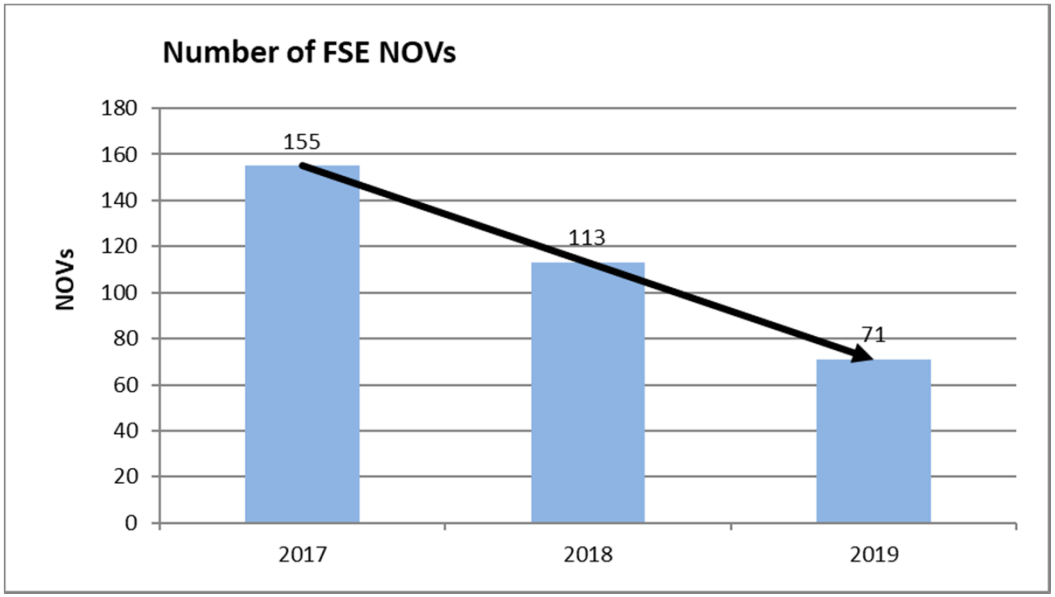




Effectiveness Evaluation - Highlights

MCM 1 assessment example

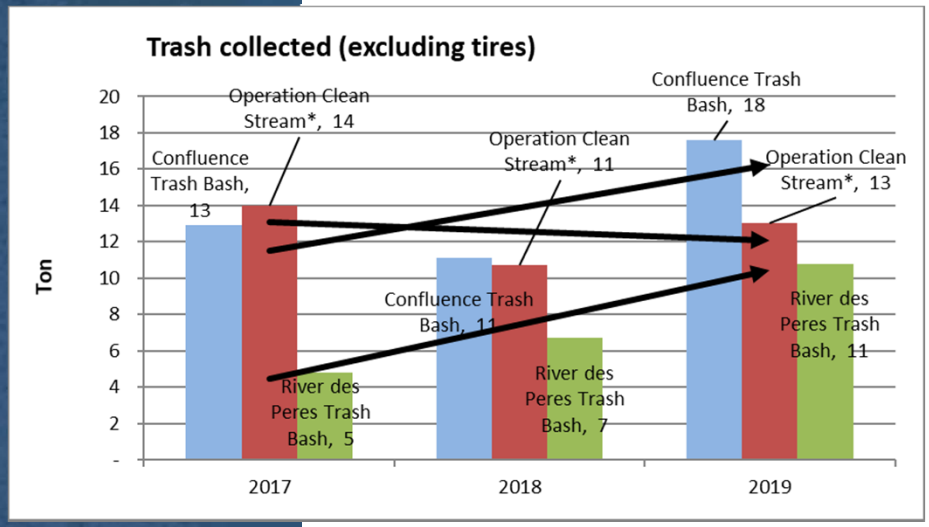
- BMP: Distribute educational materials to food establishment facilities
  - Program operations completed: YES
  - Trends and/or indicators: Consistent trend of impressions and decrease trend in food service establishment (FSE) notice of violations (NOVs)
  - KEEP BMP MOVING FORWARD

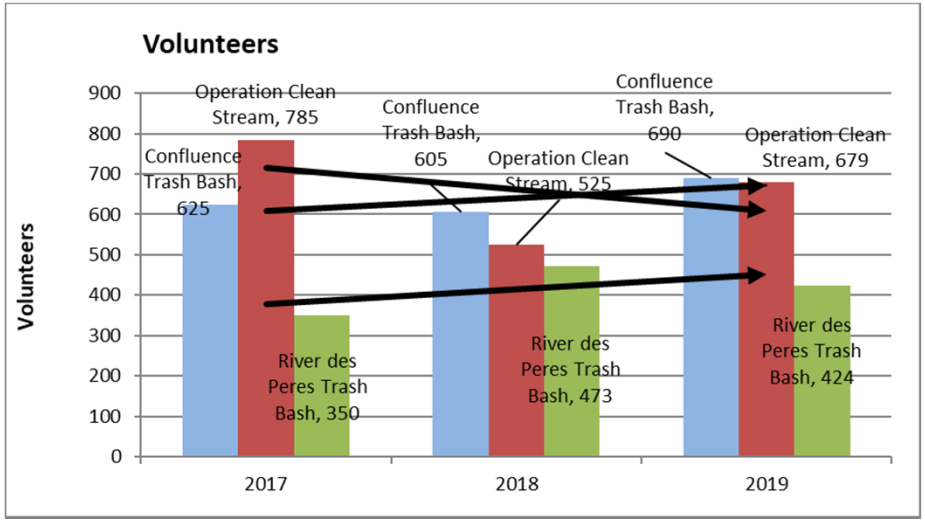


Effectiveness Evaluation - Highlights

MCM 2 assessment example

- BMP: Clean-up events
  - Program operations completed: YES
  - Trends and/or indicators: Positive trends of trash collected, participation, and impressions.
  - KEEP BMP MOVING FORWARD

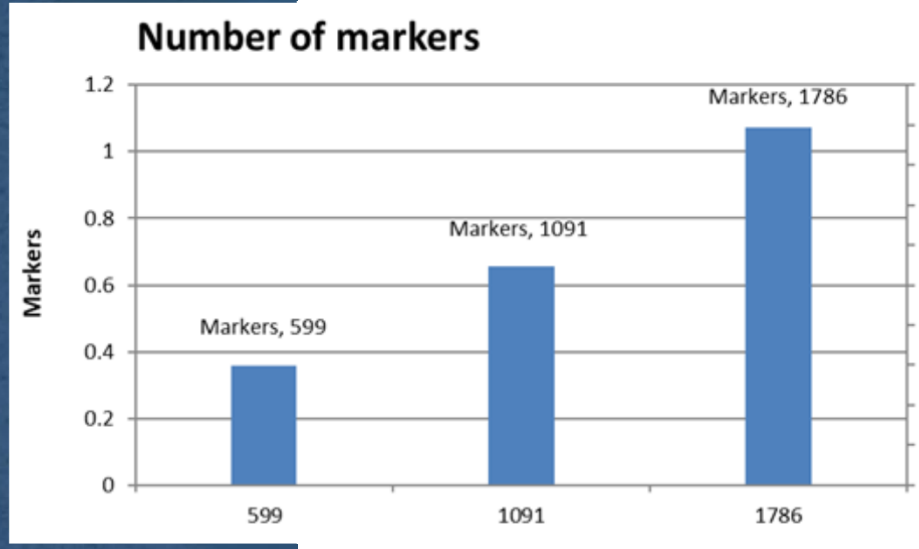


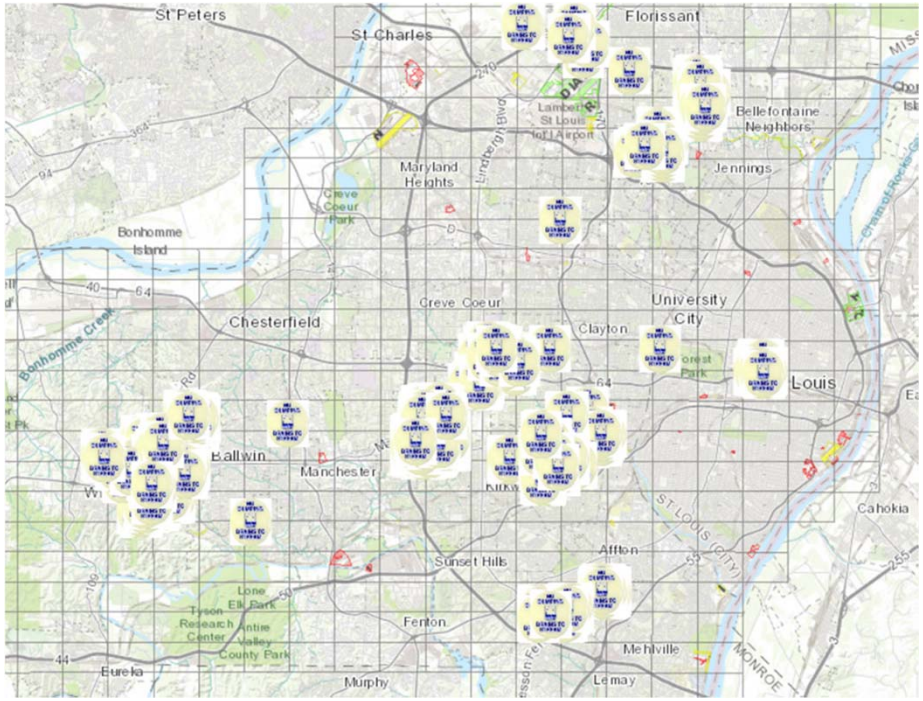


Effectiveness Evaluation - Highlights

MCM 2 assessment example

- BMPs: Inlet labeling and inlet labeling mapping
  - Program operations completed: YES
  - Trends and/or indicators: Positive trend of marking events and positive change in behavior identified.
  - KEEP BMP MOVING FORWARD





Effectiveness Evaluation - Highlights

MCM 2 assessment example

- BMPs: Inlet labeling and inlet labeling mapping
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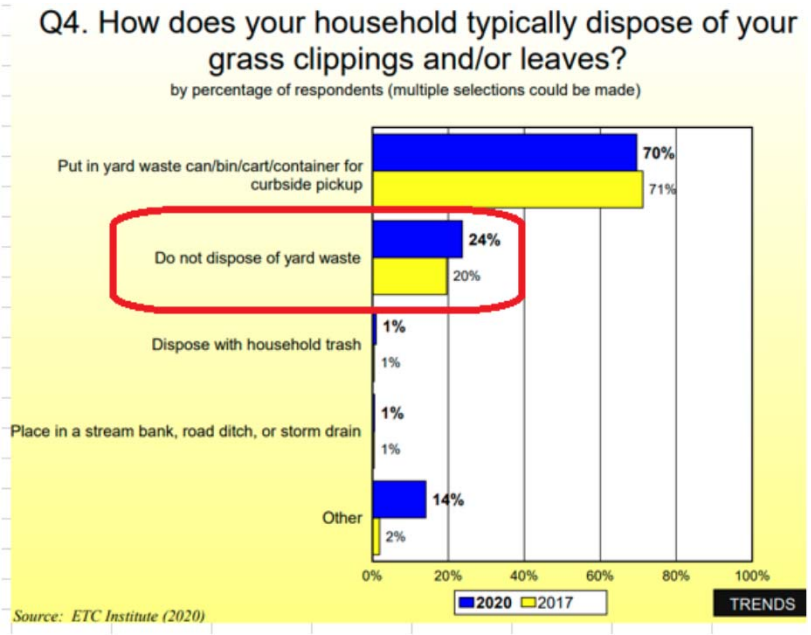
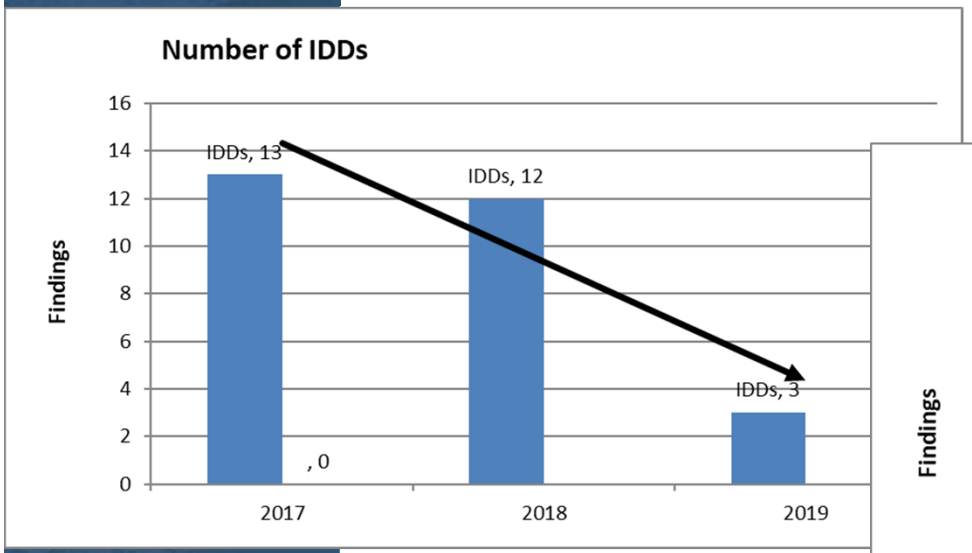
  - KEEP BMP MOVING FORWARD



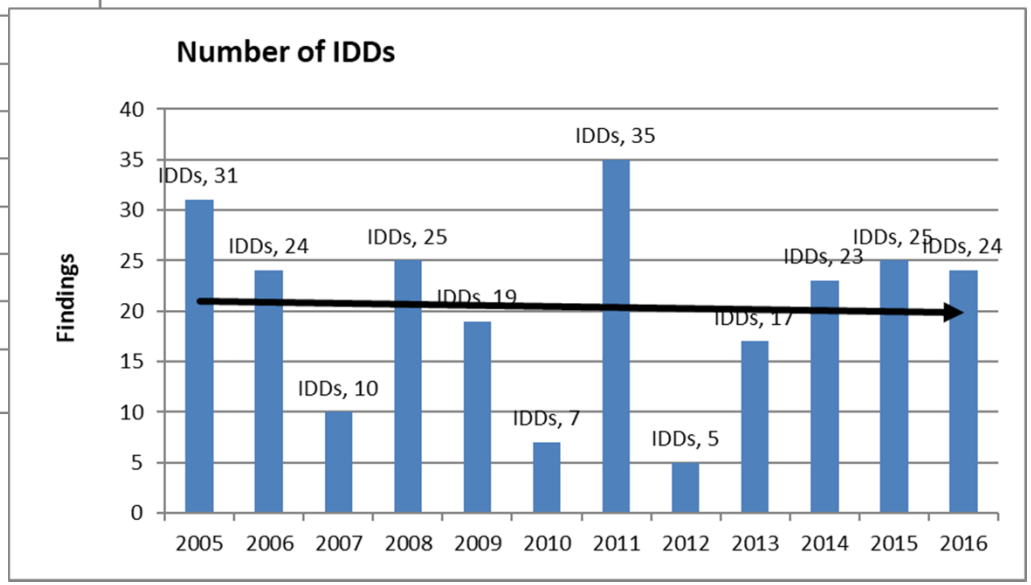
Effectiveness Evaluation - Highlights

MCM 3 assessment example

- BMP: MSD, survey all channels, 270 miles annually
- Data review – decreasing trend in findings, 21% of last three years total findings septic tank related



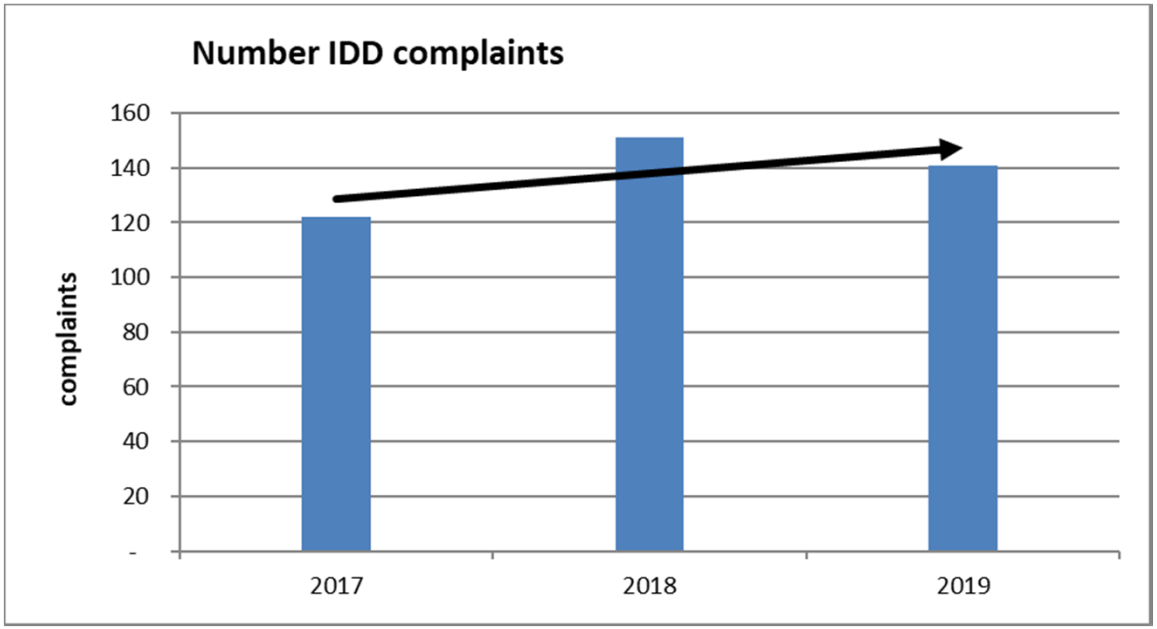
IDD - Illicit Discharge Detection



Effectiveness Evaluation - Highlights

MCM 3 assessment example (continued)

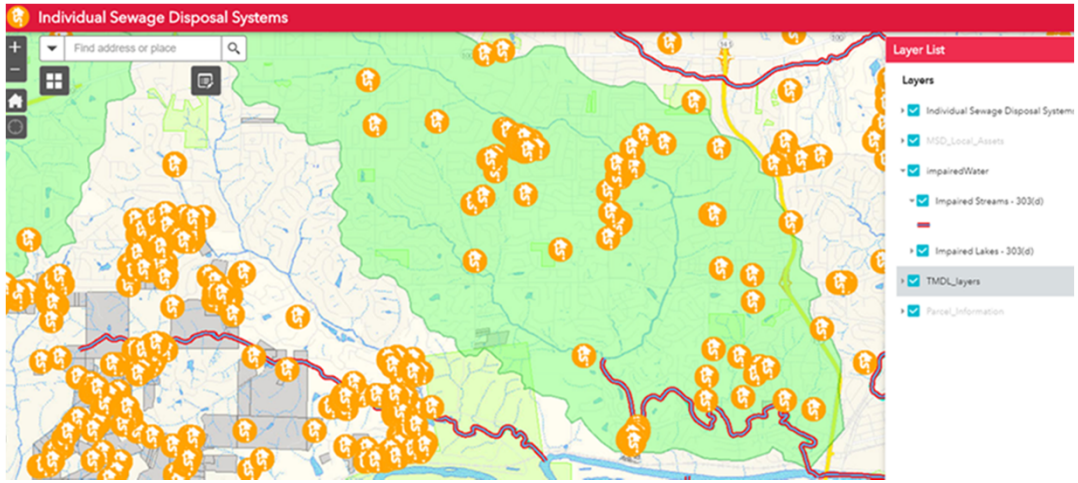
- BMP: MSD, survey all channels, 270 miles annually
- Data review – More IDD complaints than survey findings



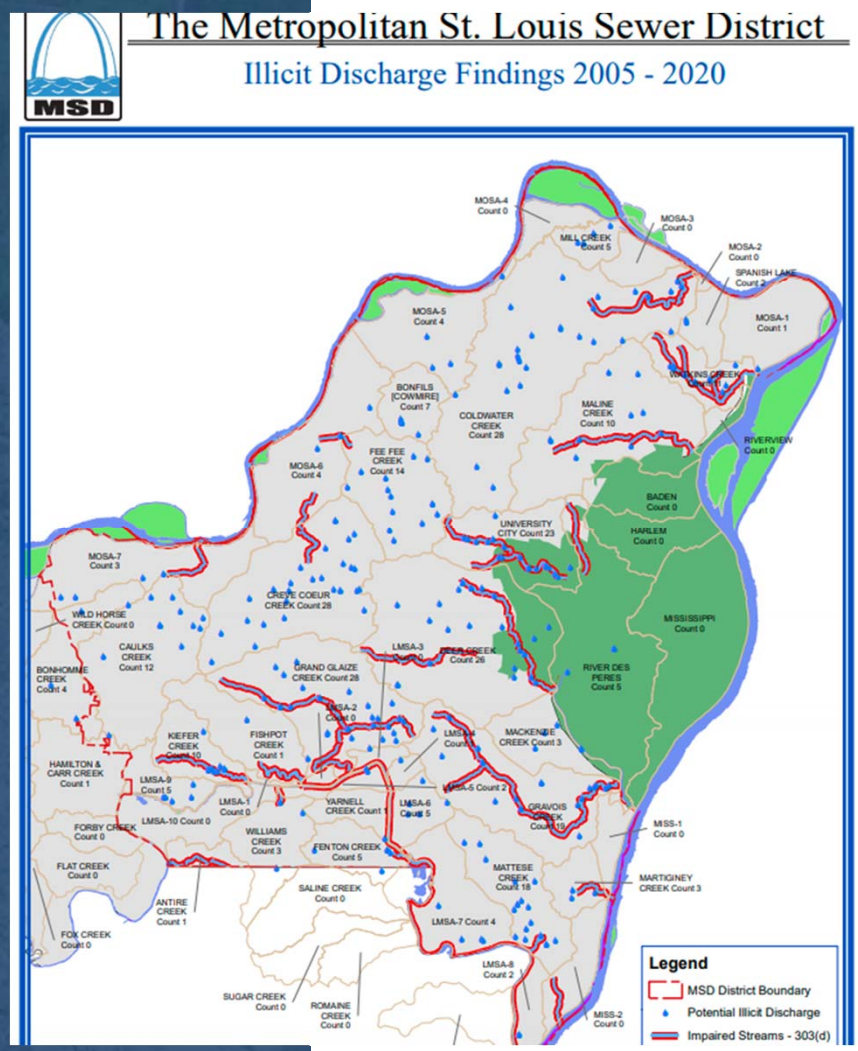
Effectiveness Evaluation - Highlights

MCM 3 assessment example (continued)

- BMP: MSD, survey all channels, 270 miles annually
- Water quality review – 21 bacteria impaired listed stream watersheds, (nearly 1,000 miles of total impaired listed streams watersheds open channels)
- Data review - 21% of last three years total survey findings were septic tank related
- Data review - Septic tank layer (2018-2019 BMP)



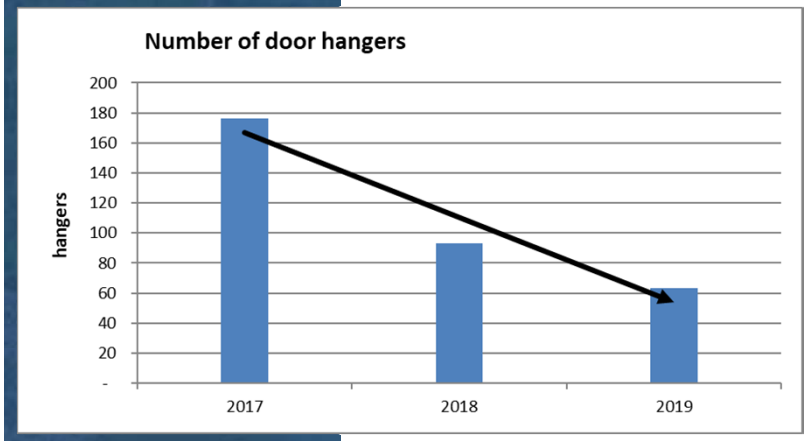
Effectiveness Evaluation - Highlights



MCM 3 assessment example (continued)

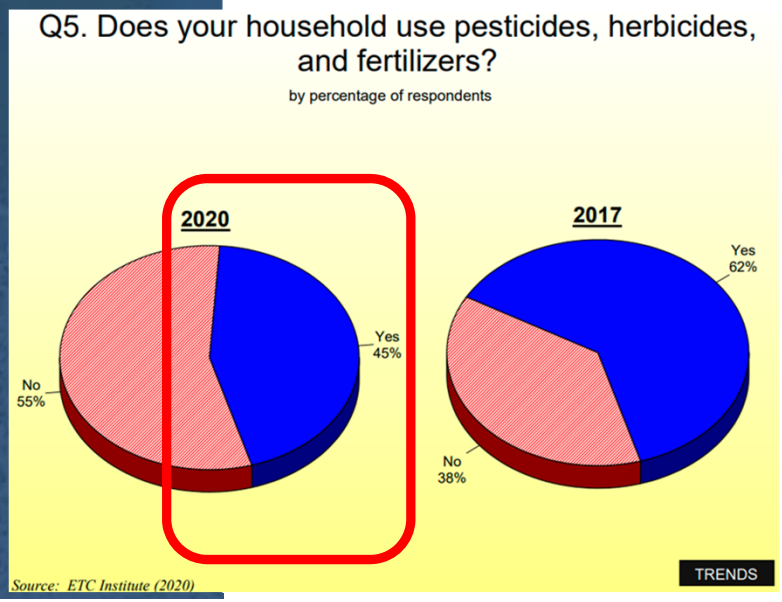
- BMP: MSD, survey all channels, 270 miles annually
  - Program operations completed: YES
  - Recommendation: MODIFY BMPs to target impaired stream watersheds and add septic tank field surveys. 195 new miles to survey annually

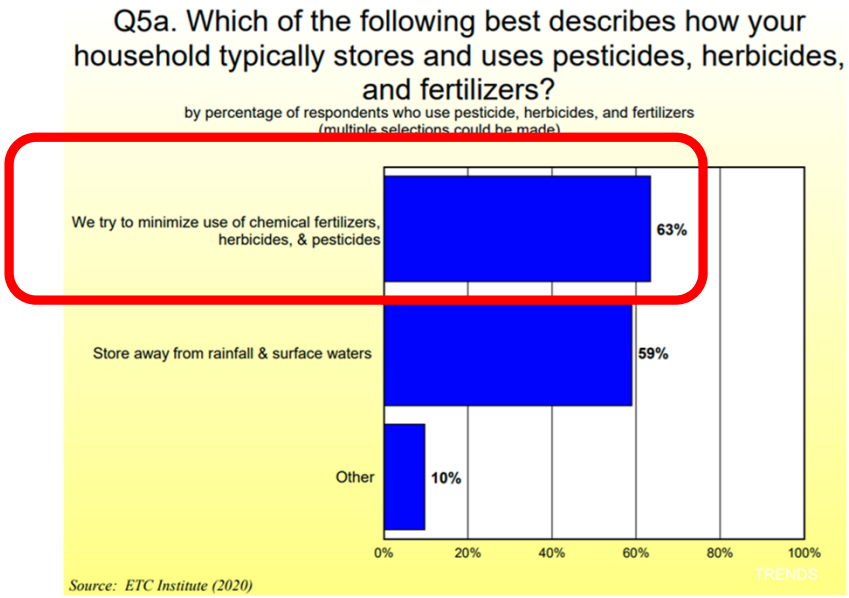
Effectiveness Evaluation - Highlights



MCM 3 assessment example

- BMP: Distribute yard waste related door hangers
  - Program operations completed: YES
  - Trends and/or indicators: Positive change in behavior identified.
  - KEEP BMP MOVING FORWARD

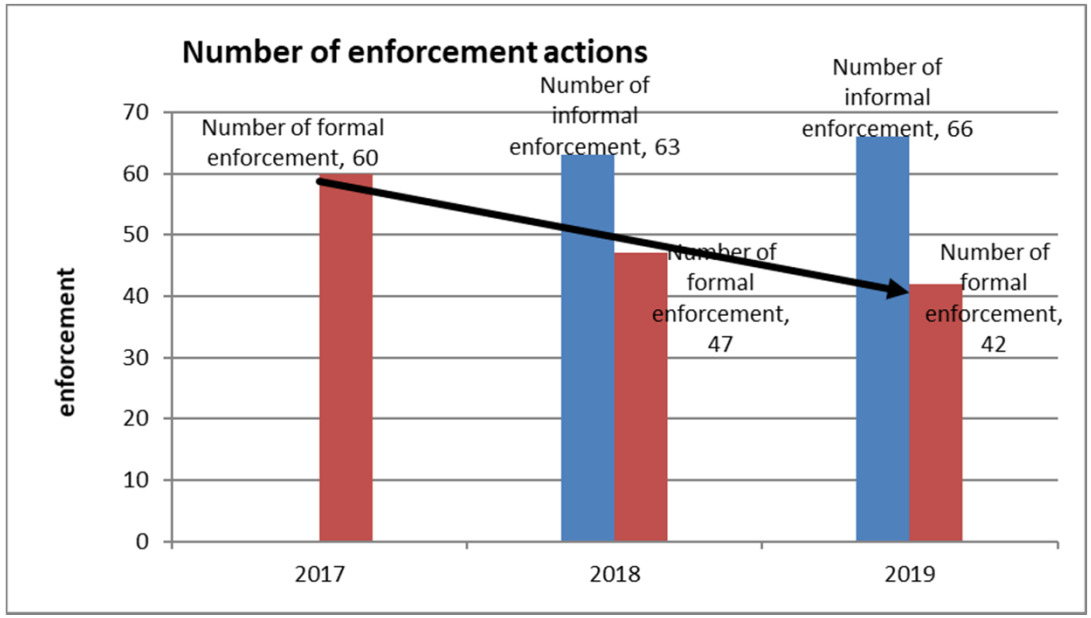




Effectiveness Evaluation - Highlights

MCM 4 assessment example

- BMP 47: Track construction waste BMP procedures, complaints, and findings, co-permittees and MSD (findings)
  - Program operations completed: YES
  - Trends and/or indicators: Positive trend in decreasing formal NOVs.
  - Water quality: No increase in Plan Area total suspended solids
  - KEEP BMP MOVING FORWARD



Effectiveness Evaluation - Highlights

MCM 5 assessment example

- BMP 51: Post construction strategies and controls, copermittees and MSD
  - Program operations completed: YES
  - Trends and/or indicators: BMPs/strategies are effective to improve water quality
  - Water quality: Ecoli stream delistings
  - KEEP BMP MOVING FORWARD

Table 2. Target Pollutant Benefit Scoring Guidance for Water Quality Benefits for BMPs.

Score	Target Pollutant Benefit
3	High pollutant removal
2	Medium pollutant removal
1	Low or no pollutant removal

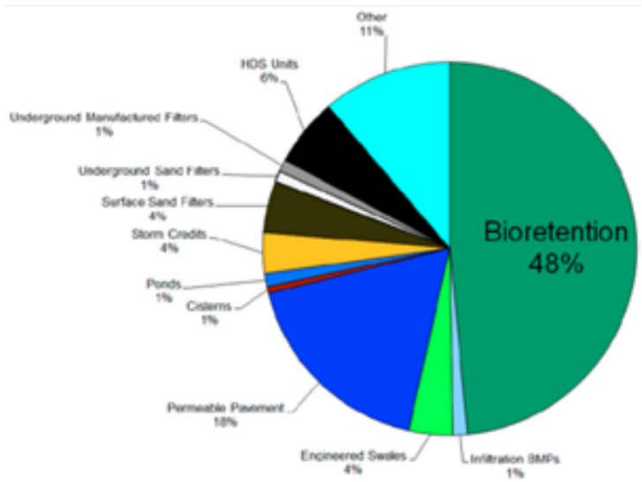


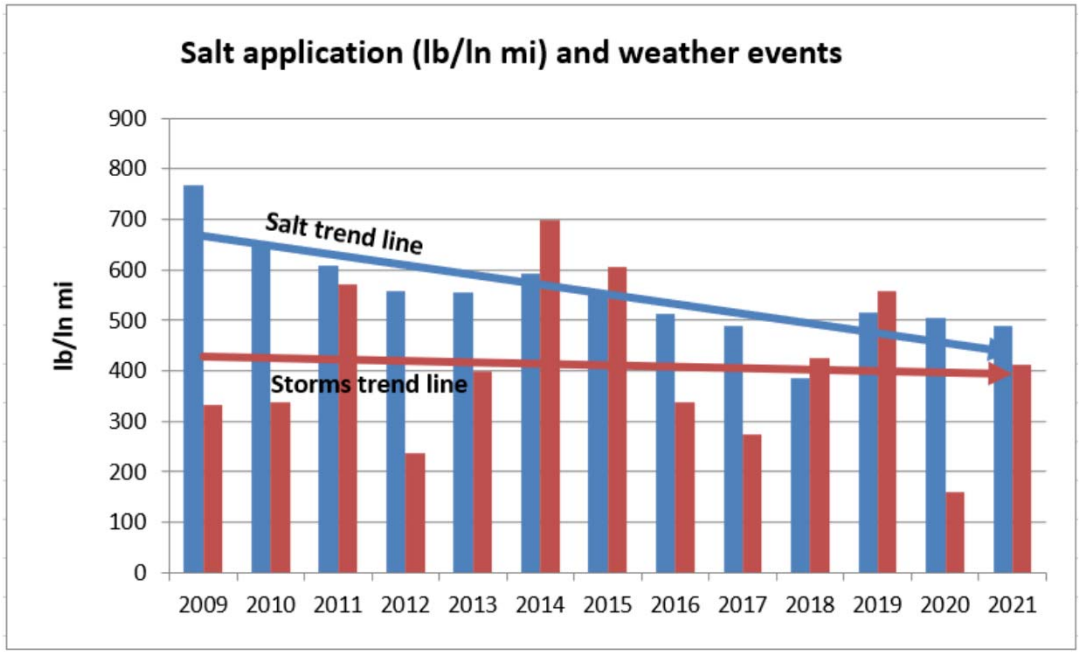
Table 4. Distribution of BMPs Used within the MSD Service Area and Benefits Ranking.

Rank	BMP	Score	% of BMPs Built or Planned
1	Infiltration BMPs	2.9	1%
2	Subsurface Flow Wetlands	2.8	NA
3	Ponds	2.6	1%
4	Enhanced Biofilters	2.5	NA
5	Bioretention	2.4	48%
5	Permeable Pavement	2.0	18%
7	Surface Sand Filters	1.8	0.04
8	Underground Sand Filters	1.8	1%
9	Underground Manufactured Filters	1.5	0.01
10	HDS Units	1.5	6%
11	Cisterns	1.4	0.01
12	Impervious Area Reduction	1.4	NA
13	Engineered Swales	1.3	4%
14	Tree Preservation Ordinance	1.2	NA
14	Stream Buffer	1.2	NA

Effectiveness Evaluation - Highlights

MCM 6 assessment example

- BMP 64: Track salt application rates, copermittees
  - Program operations completed: YES
  - Trends and/or indicators: Decreasing trend in application rates correlates to a decreasing trend in several Plan Area streams chloride concentrations
  - KEEP BMP MOVING FORWARD



Thank You!

Questions?

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