



[Regulations & Permits](#) > [Reporting requirements](#) > [Stormwater monitoring](#) > [Stormwater Action Monitoring](#) > [SAM effectiveness studies](#) > [BMP maintenance conditions](#)

Reporting requirements

[SAM effectiveness studies](#)

[Bioretention effectiveness
for 6PPD and PFAS](#)

[Bioretention infiltration](#)

**[BMP maintenance
conditions](#)**

Evaluation of Best Management Practices Maintenance Conditions

The city of Bellevue, in collaboration with Herrera Environmental Consultants, will evaluate the maintenance thresholds or conditions for the following stormwater Best Management Practices (BMPs): ponds, vaults, trenches, and tanks. Findings will suggest how permittees might adjust BMP maintenance efforts to maximize overall environmental outcomes to meet permit requirements.

SAM Study: Stormwater BMPs Maintenance Conditions Evaluation

Central NPDES Permit Coordinators Forum
February 20, 2025



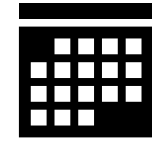
Study Purpose

Evaluate stormwater BMP maintenance standards.

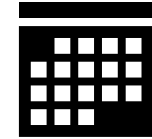
- Includes ponds, trenches, & tanks
 - o Trenches include swales
 - o Tanks include vaults (non-CBs)
- What BMPs are in use by permittees
- What maintenance standards do permittees use
- What maintenance issues occur for these BMPs
- How do permittees keep records of BMP O&M

Technical Advisory Committee

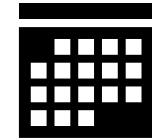
- City of Bellevue
- City of Redmond
- City of Sumner
- City of Woodinville
- City of Tacoma (Phase I)



June 2022



November 2022



August 2023



November 2024



February 2025

Study Tasks

Task 1: Technical Advisory Committee and Project Management

Task 2: Survey of Municipal Stormwater O&M Programs

Task 3: Published Data Review/Literature Review

Task 4: Interviews with Ecology

Task 5: Pilot Data Analysis

Task 6: White Paper

Task 7: Communications Plan



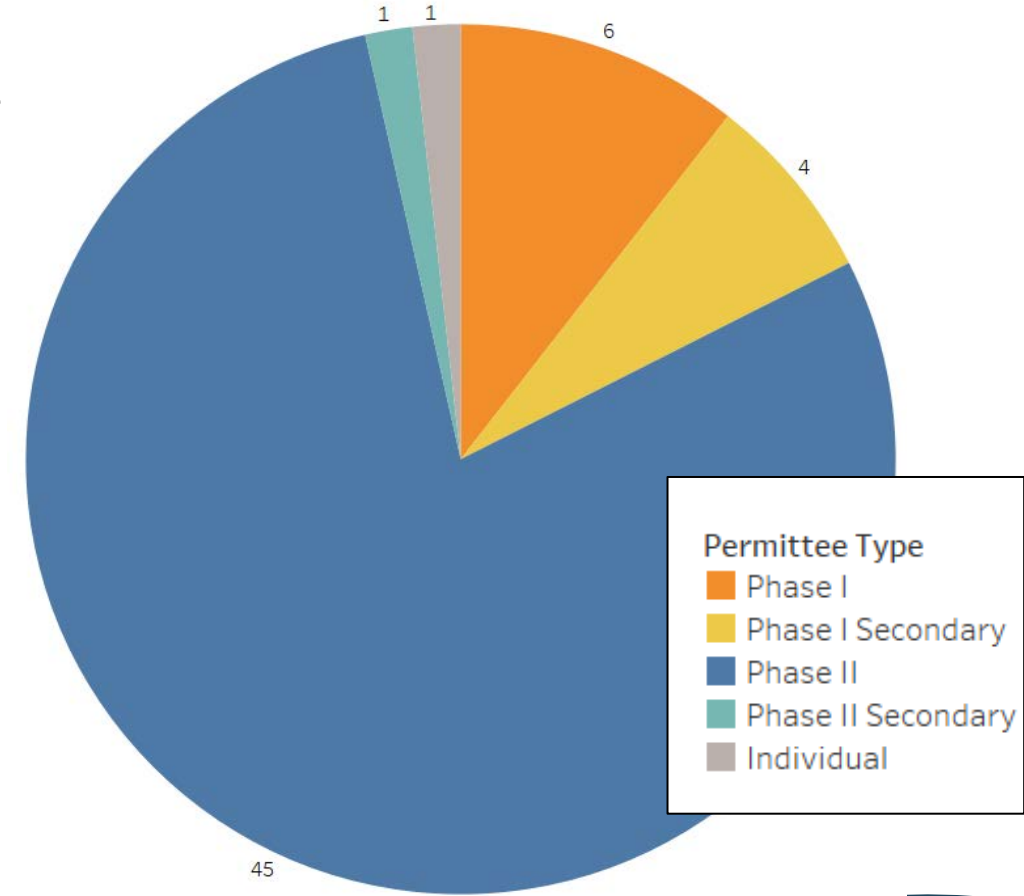
Task 2. Survey of Municipal O&M Programs

SURVEY

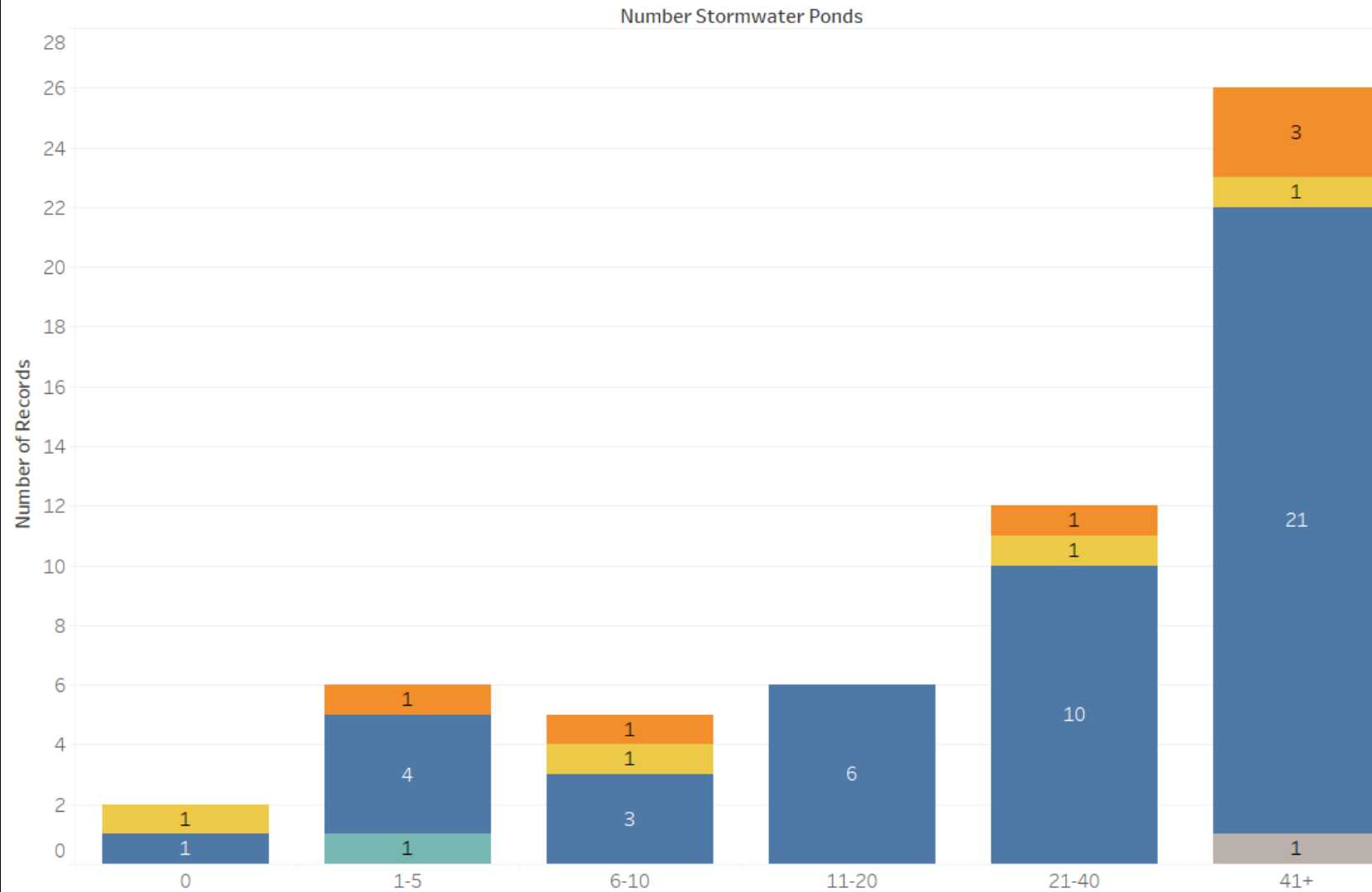
- Targeted to municipal stormwater permittees
- Learn about operations and maintenance programs for BMPs

17 QUESTIONS

- What BMPs are in use
- Program staffing and budgets
- Stormwater manuals and maintenance standards used
- Recordkeeping methods

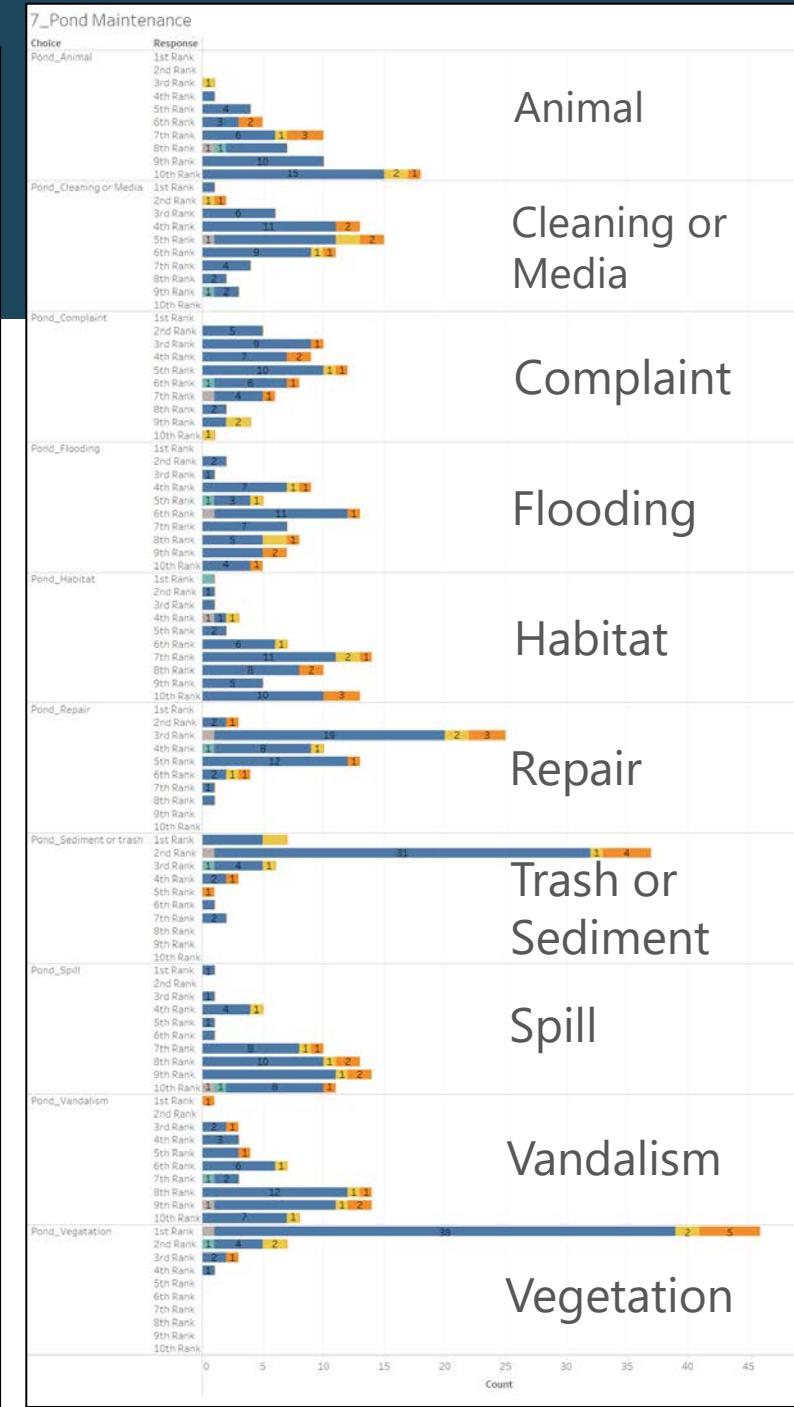


6_#Ponds

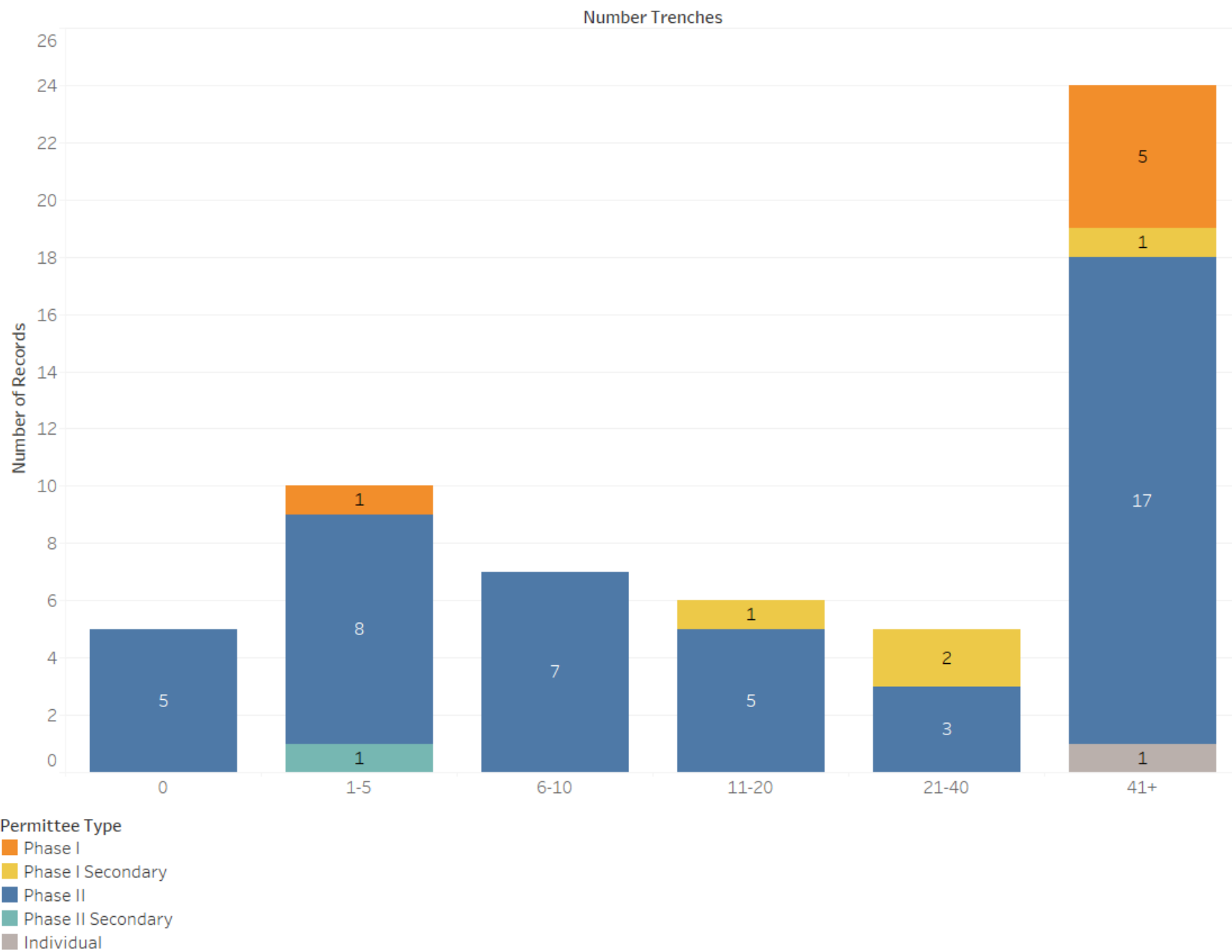


Permittee Type

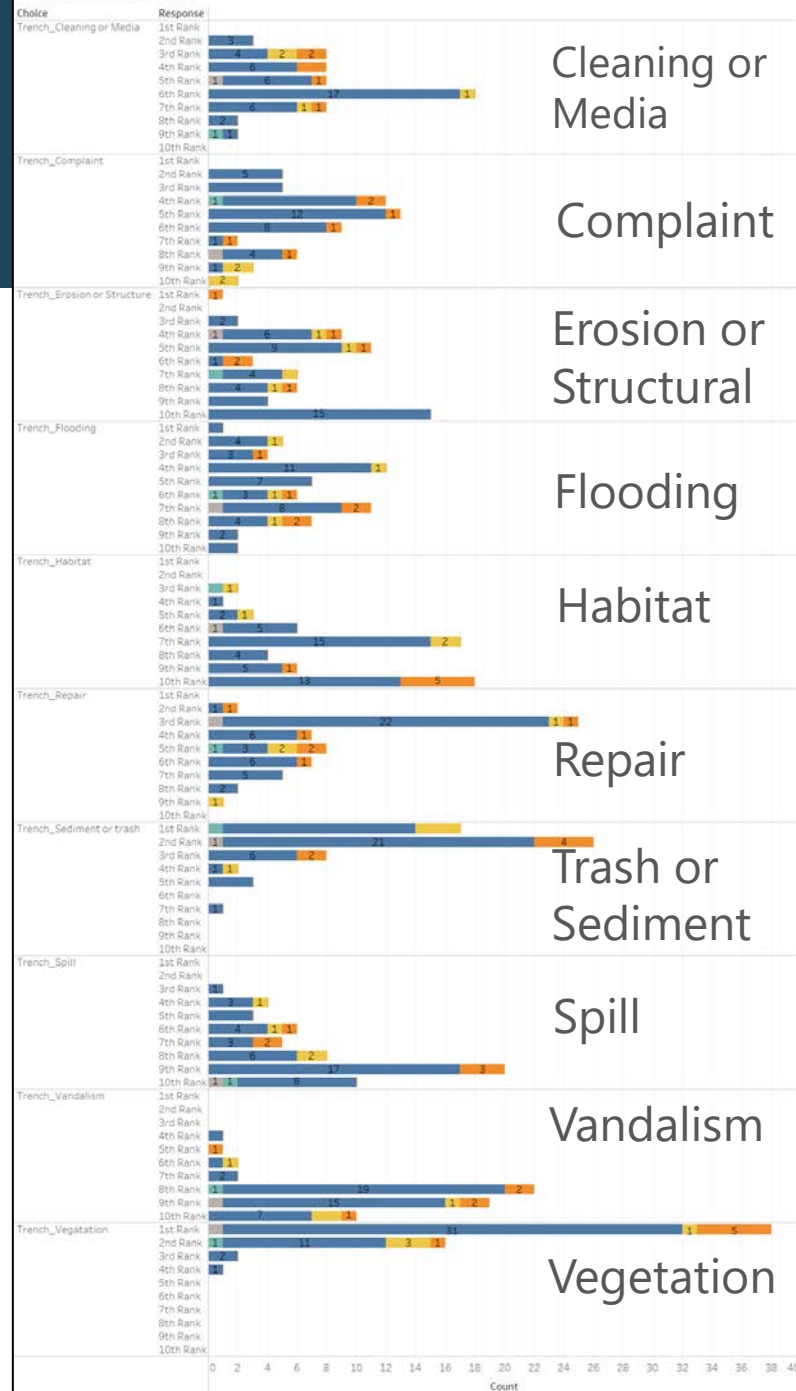
- Phase I
- Phase I Secondary
- Phase II
- Phase II Secondary
- Individual



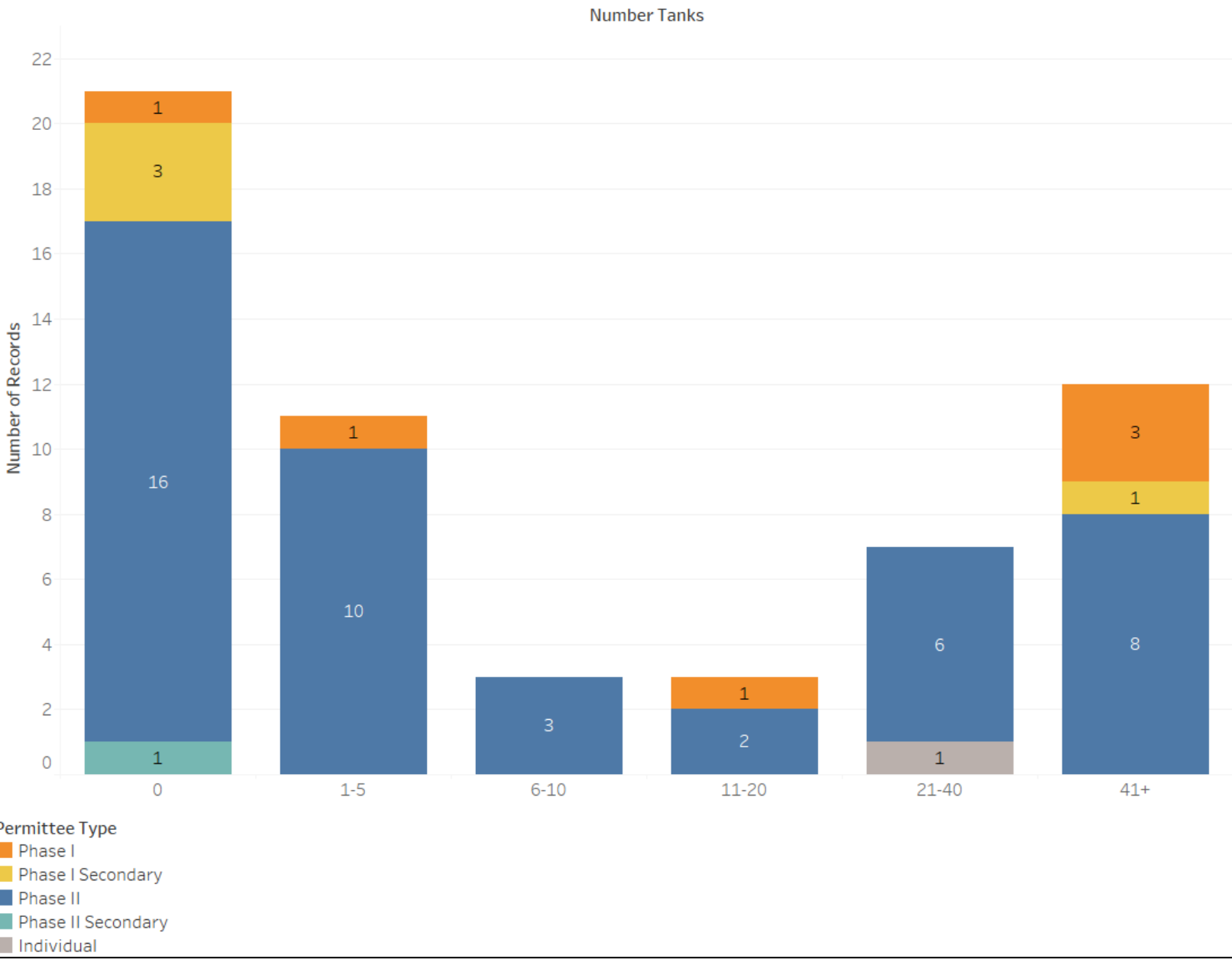
8_#Trenches



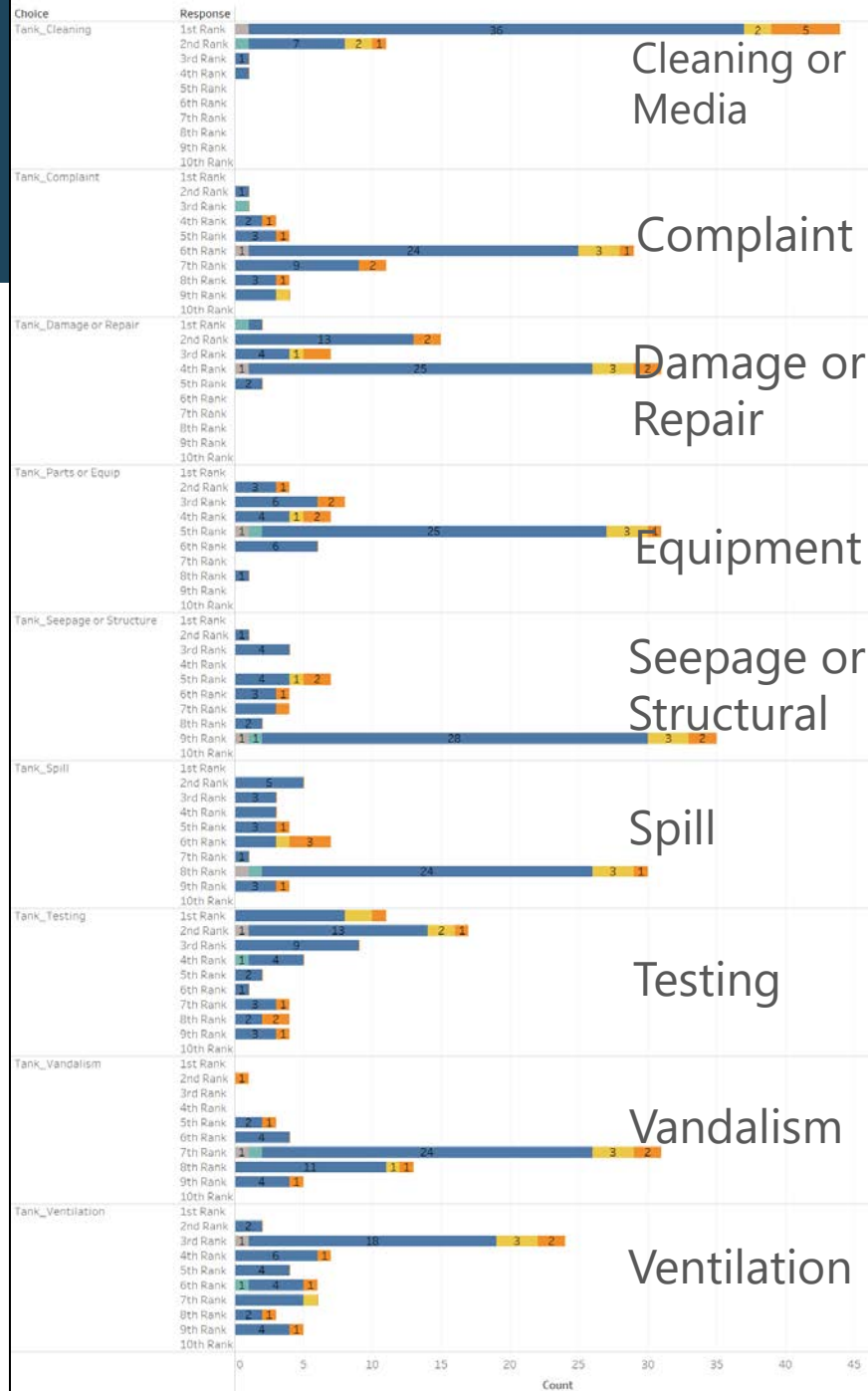
9_Trench Maintenance



12_#Tanks



13_Tank Maintenance



Task 3. Published Data/Literature Review

INITIAL TASK

- Search for, compile, and analyze published BMP maintenance data
 - o Existing databases, BMP performance publications, gray literature
 - o Data available focused on BMP performance and cost.
 - o Data on maintenance not published.

EVOLVED TASK

- Review of stormwater manuals and comparison of maintenance standards.
- History of stormwater BMP maintenance standards in western WA.
- Informed by input from Ecology on Task 4.

Task 4. Ecology Interviews

PURPOSE

- Interview current Ecology engineers and permit writers
 - Learn about the origins of the BMP Maintenance Tables in the SWMMWW
 - How maintenance conditions were identified
 - What publications or references were used
 - What standards need more input

INTERVIEW QUESTIONS

- Bibliography for maintenance standards
- How ranges of values for quantitative standards were determined
- Recommended maintenance frequencies

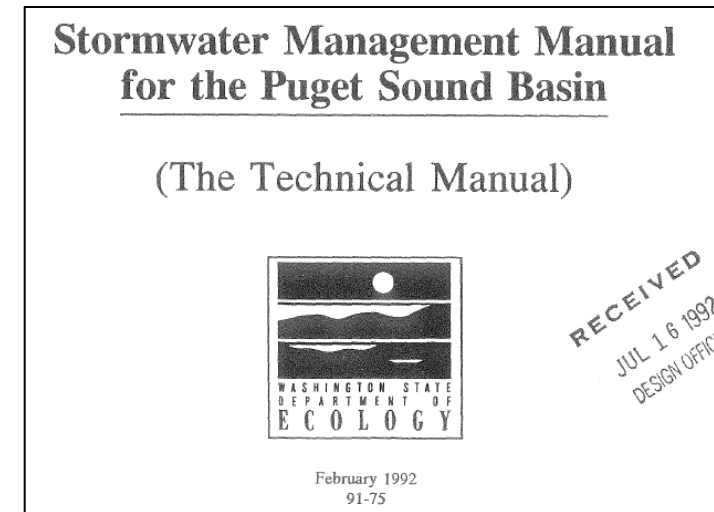
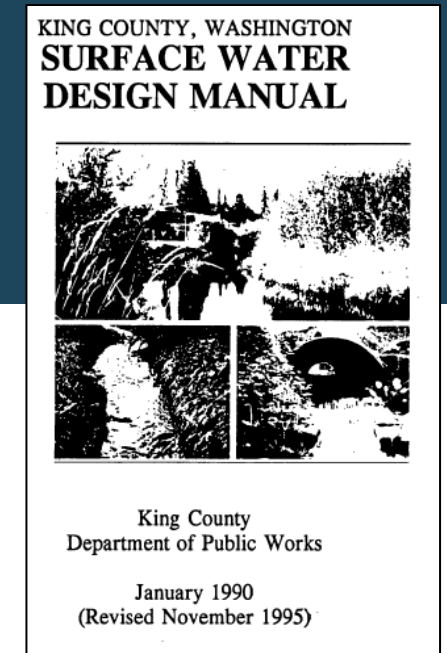
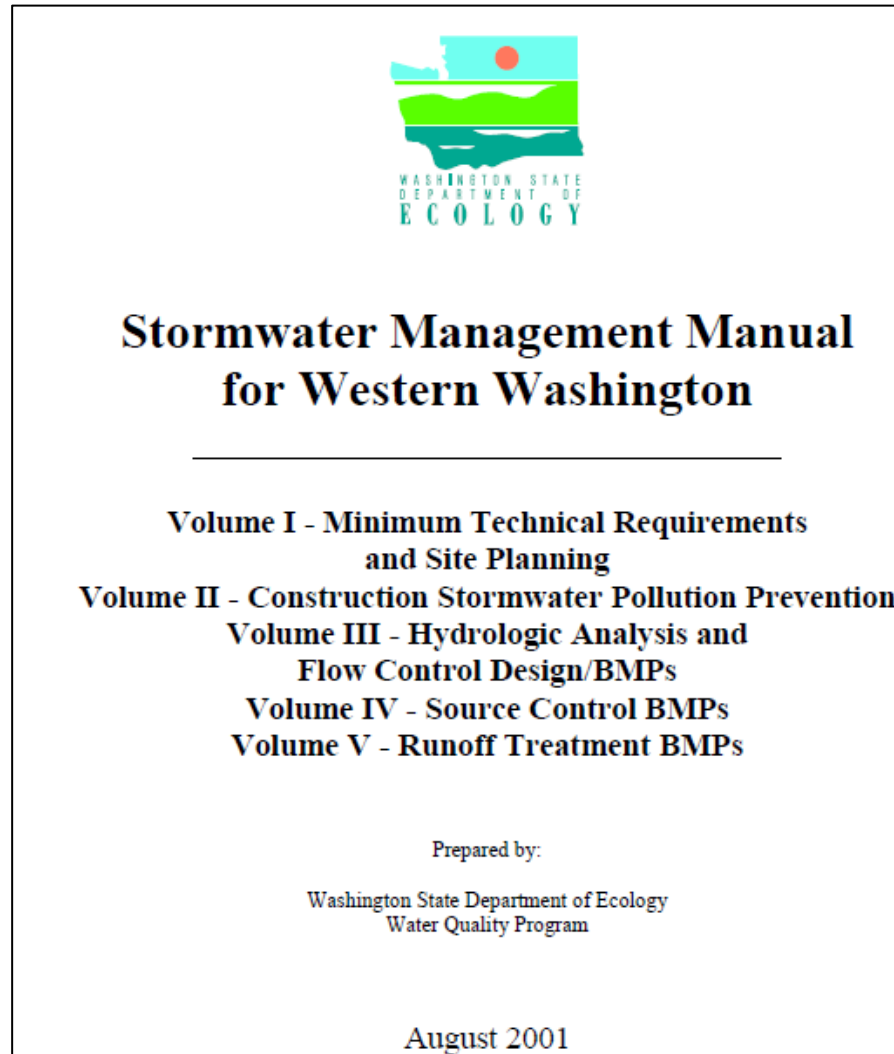
RESPONSES

- Today's standards based on 2001 Ecology SWMMWW
- Specific references not known for most maintenance standards

Literature Review

HISTORY OF BMP MAINTENANCE STANDARDS

- 1990 King County Surface Water Design Manual
- 1992 Ecology Stormwater Management Manual for the Puget Sound Basin
- 2001 Stormwater Management Manual for Western Washington (SWMMWW)



Comparison of Maintenance Standards

Stormwater Management Manual for Western Washington

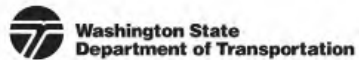


KING COUNTY, WASHINGTON SURFACE WATER DESIGN MANUAL

King County
Department of Natural Resources and Parks
July 23, 2021



City of Seattle Stormwater Manual July 2021



Highway Runoff Manual

M 31-16.05
April 2019



City of Tacoma Environmental Services

Stormwater Management Manual July 2021 Edition



Comparison of Maintenance Standards

COMPARED

18 Maintenance Elements

- | | |
|-----------------------|--------------------------------|
| 1. Access | 12. Pollution |
| 2. Animals | 13. Slope/Erosion |
| 3. Berms | 14. Storage Capacity Reduction |
| 4. Bollards | 15. Trash Racks |
| 5. Energy Dissipators | 16. Trash/Debris/Sediment |
| 6. Fence/Gate | 17. Trees |
| 7. Filterbag Full | 18. Vegetation Blockage |
| 8. Inlet/Outlet | |
| 9. Liner or Structure | |
| 10. Noxious Weeds | |
| 11. Overflow Spillway | |

KEY DIFFERENCES

- **Grass cover height** (nonaquatic)
- **Pond liner** integrity
- **Sediment accumulation:** ponds and pipes
- **Standing water** in ponds
- **Blockage:** pipes, air vents, treatment media, and filters
- **Cracks** or structural issues: vaults and tanks
- **Sludge:** settled (solids) versus floating (oil)

Task 5. Pilot Data Analysis

PURPOSE

1. Exploratory Pilot-level Effort

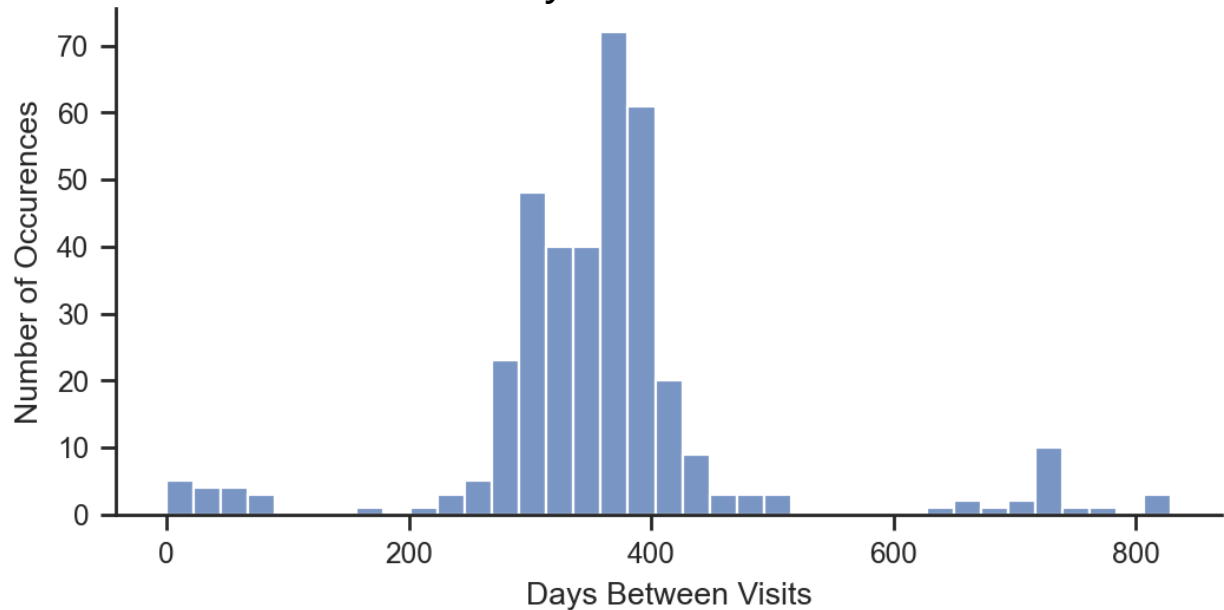
- How do BMP maintenance data compare to the maintenance standards?
- What BMP inspection and maintenance data are collected by permittees?
- Data from just three permittees – one Phase I and two Phase IIs

2. Analysis

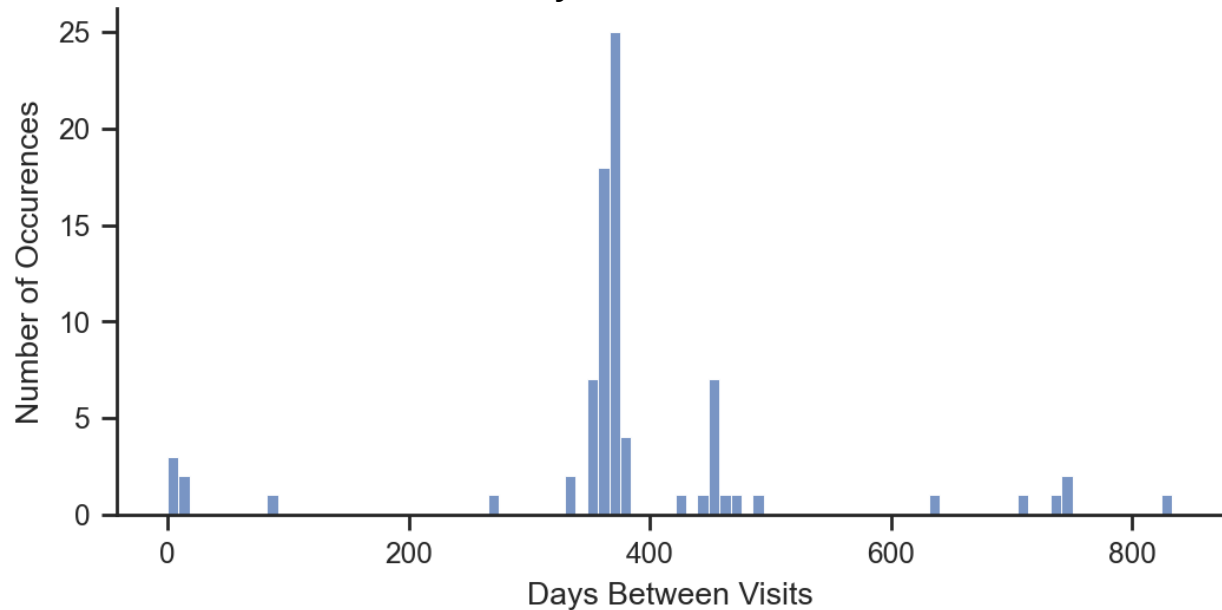
- Inspection and maintenance frequencies
- Maintenance outcomes
- Differences in recordkeeping

PONDS

Phase II city, Pond Facilities

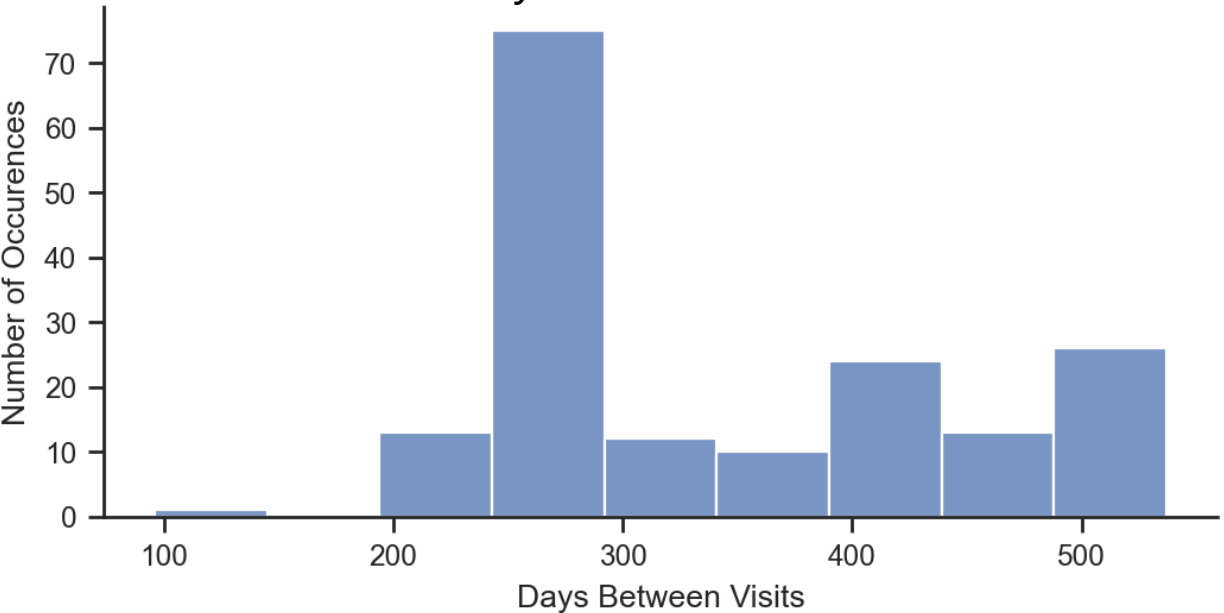


Phase I city, Pond Facilities

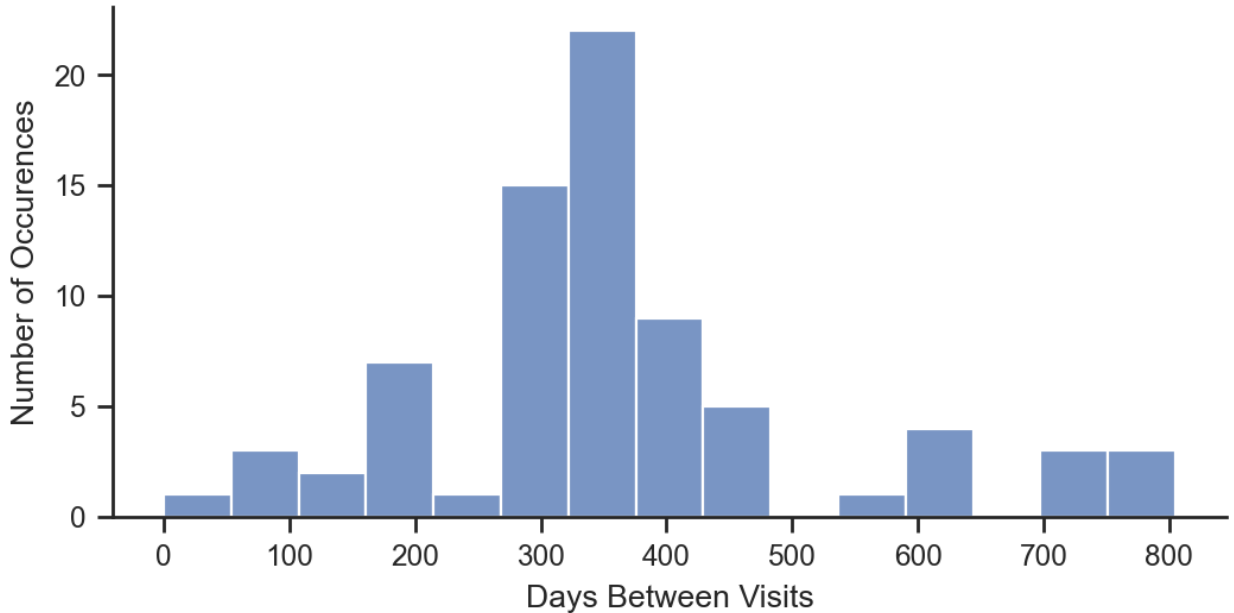


TRENCHES/SWALES

Phase II city, Trench/Swale Facilities

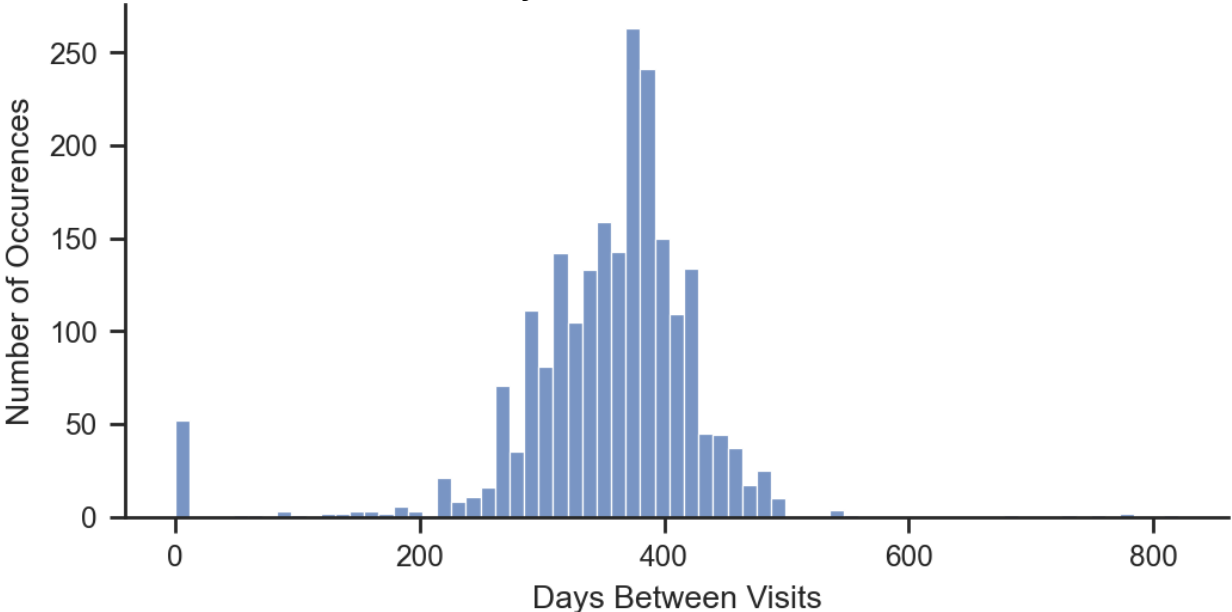


Phase I city, Trench/Swale Facilities

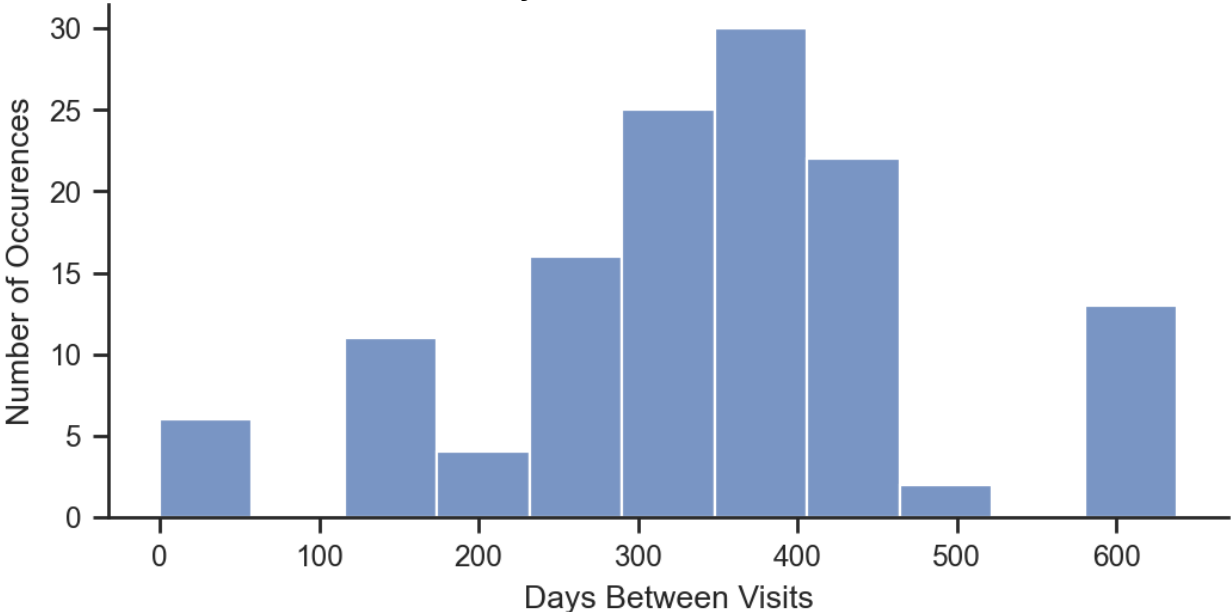


TANKS/VAULTS

Phase II city, Tank/Vault Facilities

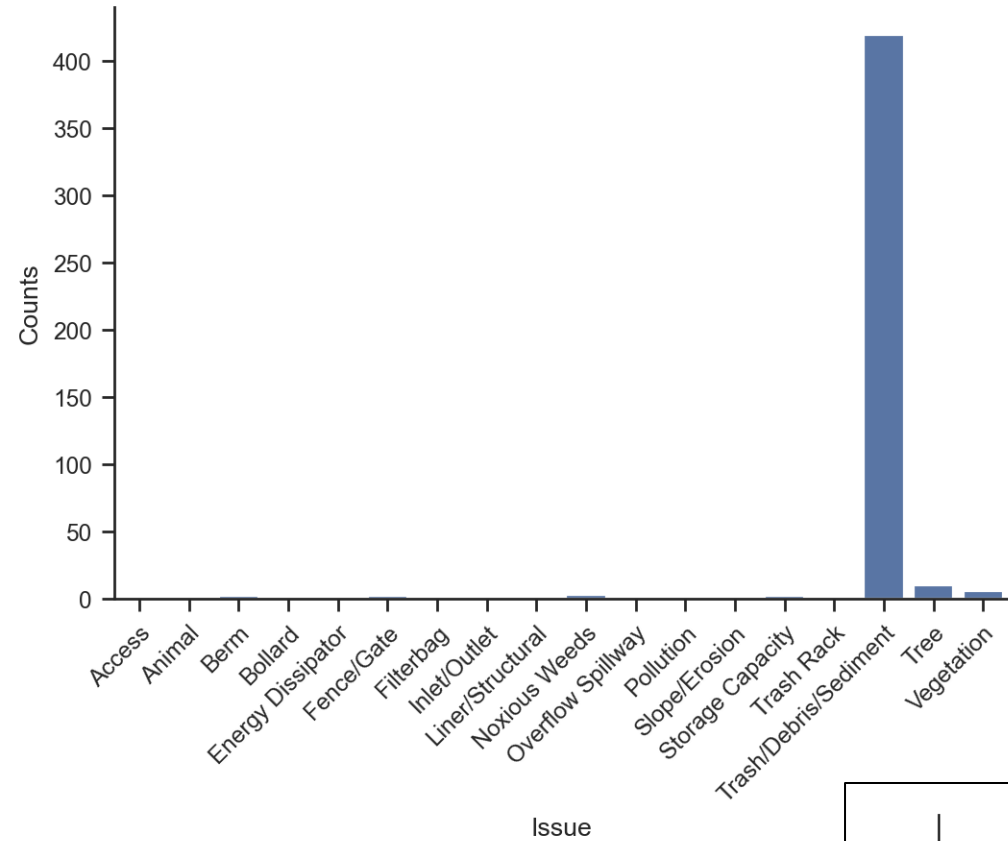


Phase I city, Tank/Vault Facilities

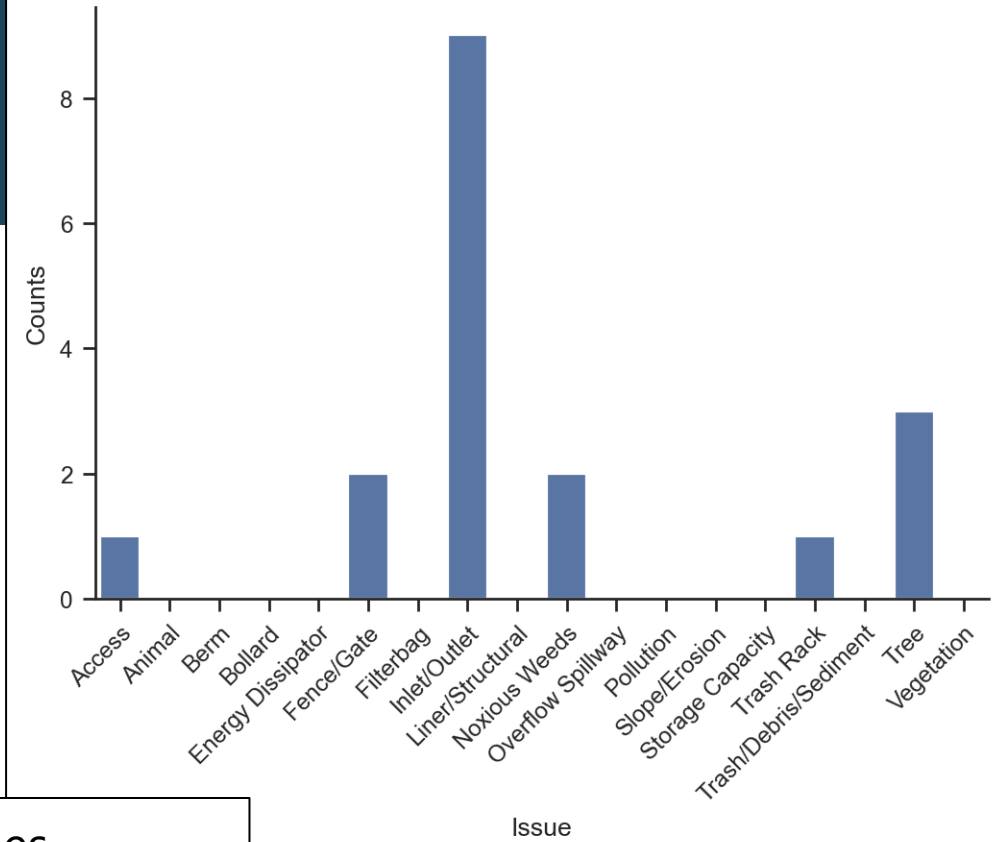


PONDS

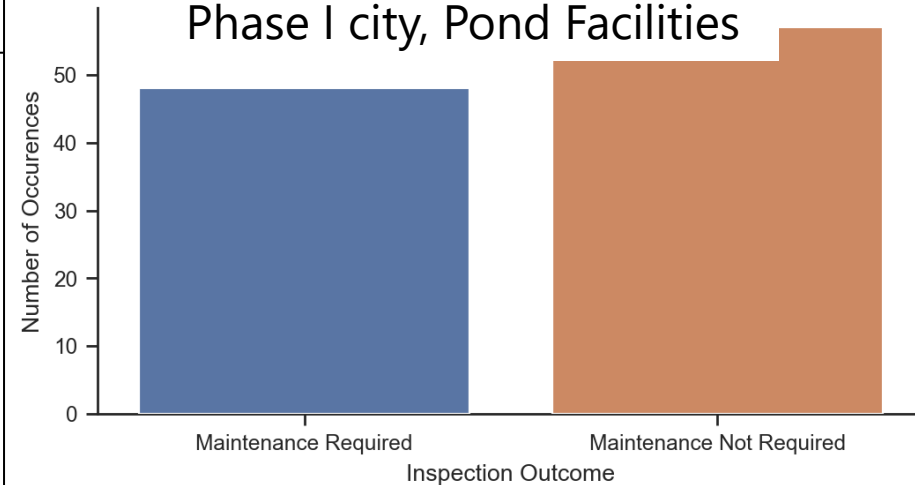
Phase II city, Pond Facilities



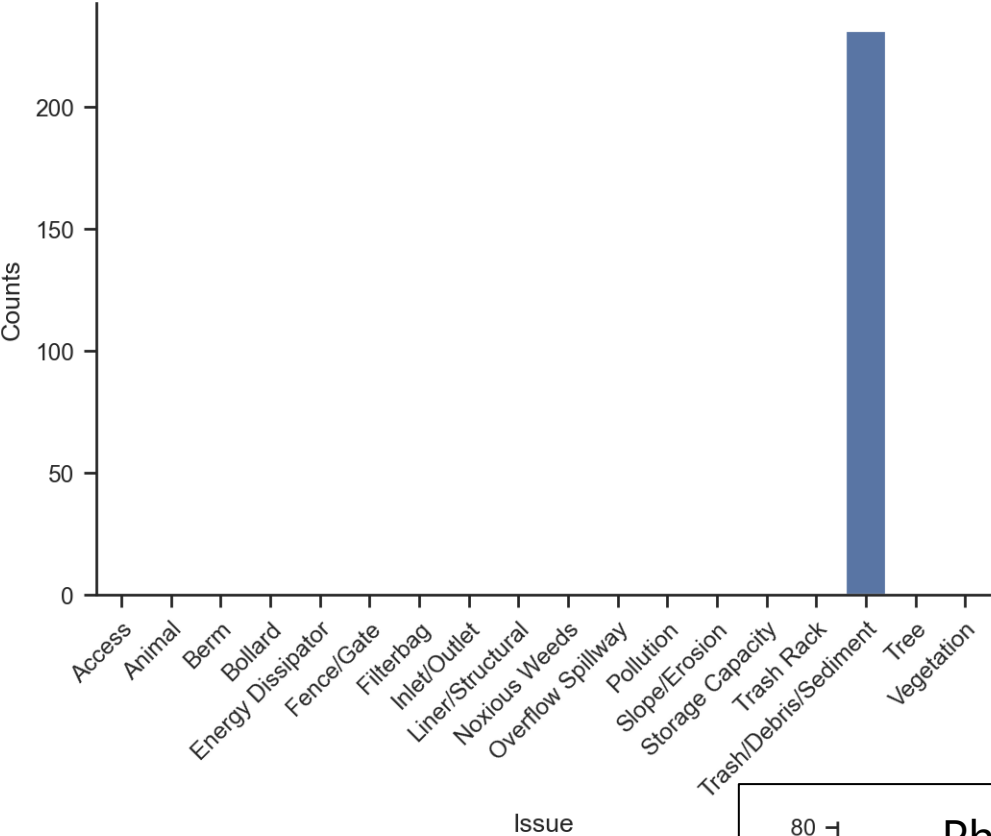
Phase II city, Pond Facilities



Phase I city, Pond Facilities

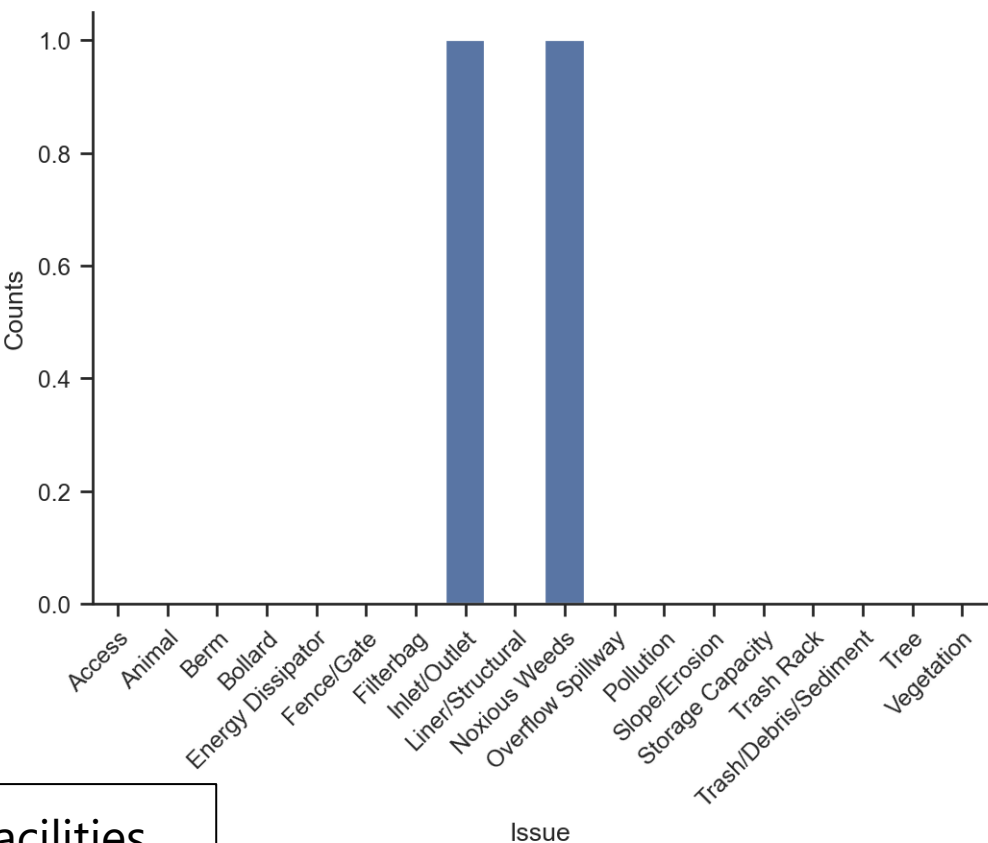


Phase II city, Trench/Swale Facilities

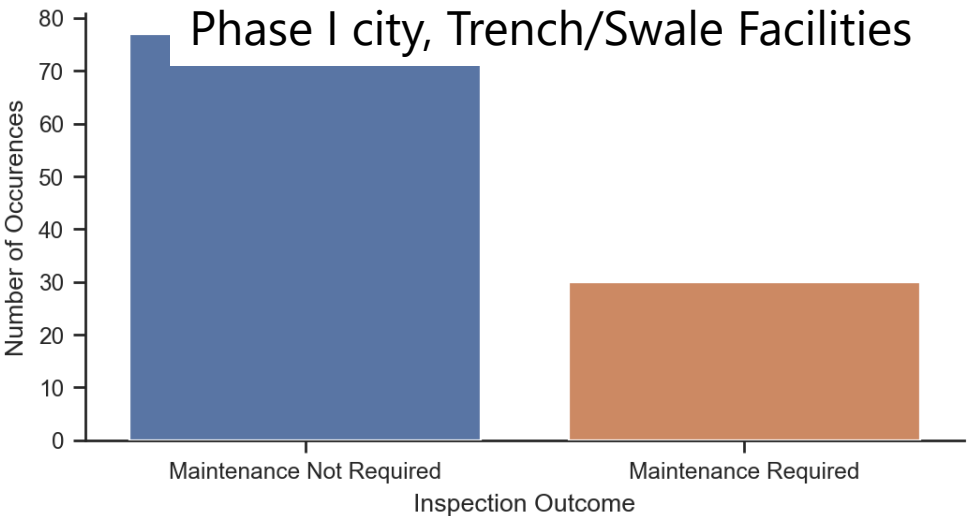


**TRENCHES/
SWALES**

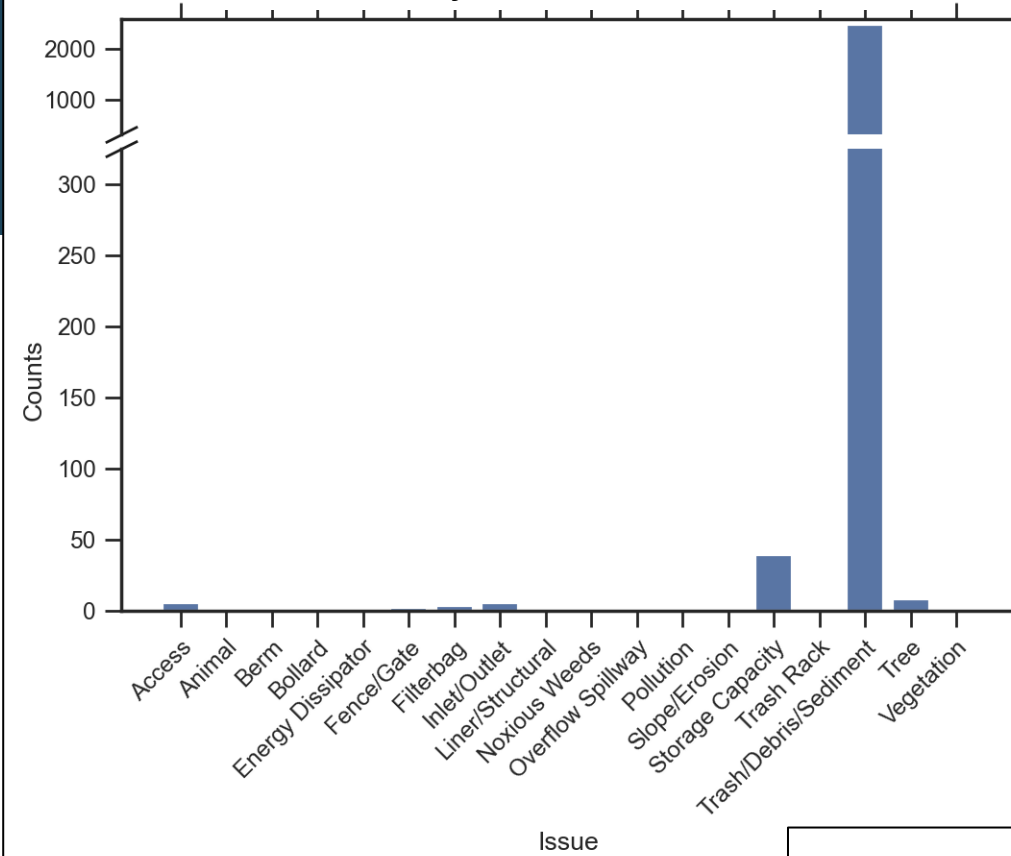
Phase II city, Trench/Swale Facilities



Phase I city, Trench/Swale Facilities

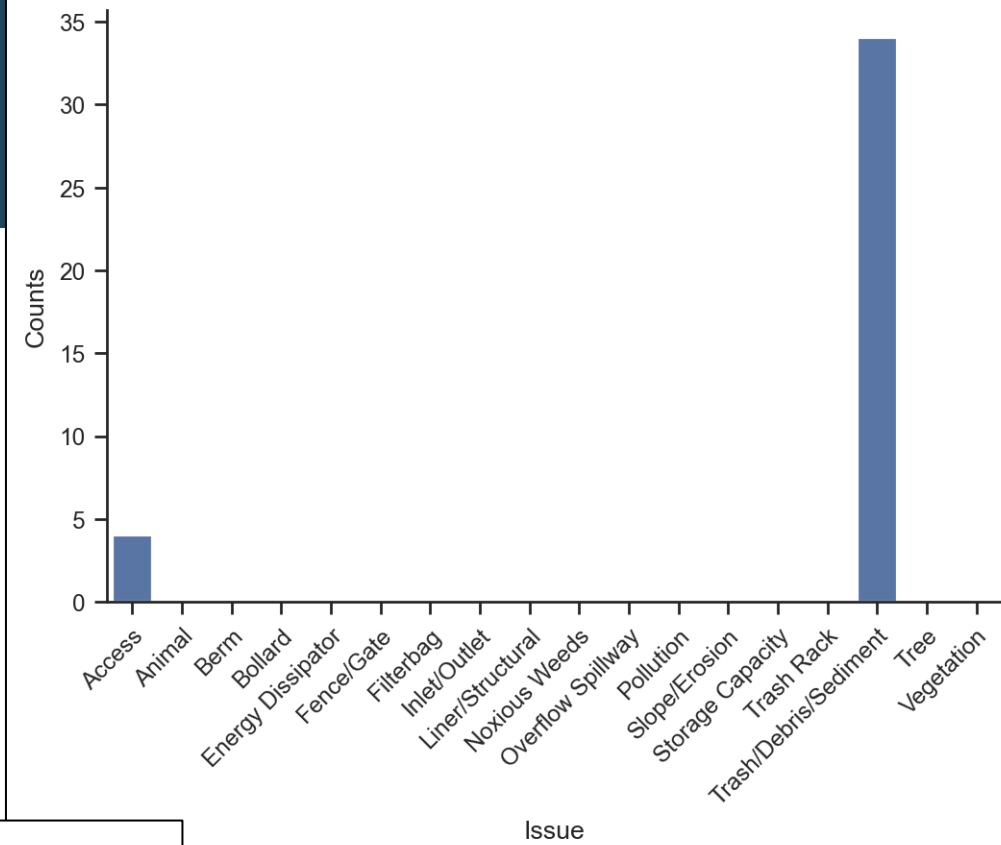


Phase II city, Tank/Vault Facilities

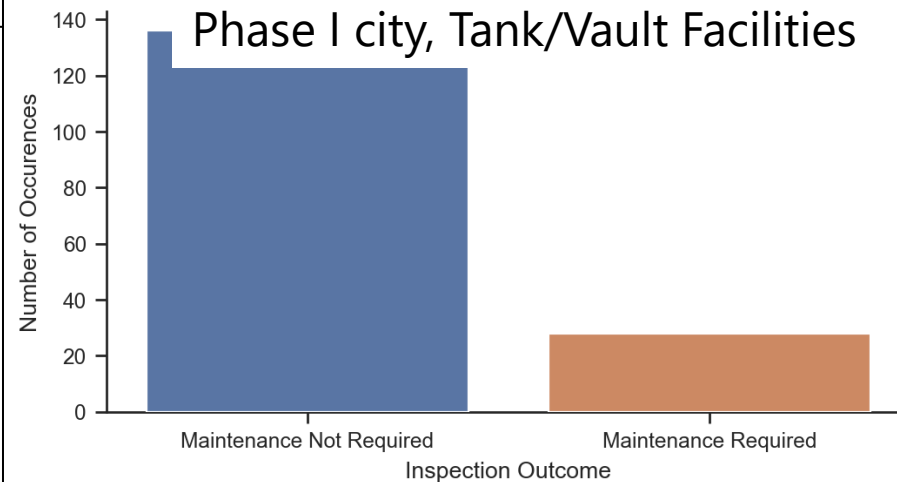


**VAULTS/
TANKS**

Phase II city, Tank/Vault Facilities



Phase I city, Tank/Vault Facilities



Task 6. White Paper: Conclusions and Recommendations

BMP Maintenance Standards in Western WA

1. Derived from the 2001 Ecology stormwater manual (SWMMWW).
 - Based on the 1992 *Stormwater Management Manual for the Puget Sound Basin* and 1990 King County *Surface Water Design Manual*.
2. Bibliography in SWMMWW is extensive
 - Some references are old and from local studies and could use verifying or updating
 - Add citations for references in BMP Maintenance Tables
3. Field testing of maintenance standards in controlled setting
 - Sediment: accumulation in pipes, vaults, ponds
 - Vegetation growth, tall grasses, trees
 - Blockage: pipes, inlets, outlets
 - Water ponding: acceptable fluctuations in water storage

Conclusions and Recommendations

BMPs and Maintenance Needs

1. BMPs in use consistent between Survey (task 2) and Pilot Data Analysis (task 5)
2. Most common BMP maintenance needs:
 - Vegetation management, sediment or trash removal
3. Noted issues:
 - Pipe blockage, noxious weeds, access.
4. Least common:
 - BMP structure, slope erosion, overflow/spillway concerns, damage to a pond liner.
5. BMP visit frequencies for inspection or maintenance
 - Most common: once per year
 - Secondary frequencies: approximately 100 days and 250-300 days, especially for ponds and trenches/swales
 - Pilot data analysis data limitations
 - Represents just 3 cities
 - Could not tie specific maintenance need to reason for visit

Conclusions and Recommendations

Adjusting BMP Maintenance Frequencies

1. Secondary BMP visit frequencies: 100 days, 250-300 days
 - Examine what drives non-yearly visits
 - How do they affect maintenance outcomes and BMP functionality?
2. Tie maintenance outcomes to the maintenance standards
 - Demonstrate BMP performance relative to standards
3. Regular analysis of maintenance frequencies
 - Information about BMP performance and cost for maintenance
 - Once per permit cycle?
4. Preventative maintenance approach
 - Routine maintenance actions for prevention of issues
 - Balance between higher routine cost vs. lower risk for failure events

Conclusions and Recommendations

Recordkeeping

1. Variable approaches, methods, and software
 - Ranges from paper/pen to tablets
 - Mix of software: asset management, permit compliance, spreadsheet
2. BMP Status
 - Pass/fail
 - Tied to maintenance standards
3. Notes and comments in O&M records
 - Use sparingly
 - Capture status from searchable standardized responses (drop-down menu/picklist)
4. Terminology
 - Use common terms for BMPs from stormwater manuals

Questions

Don McQuilliams

City of Bellevue Utilities
Operations Manager

DMcQuilliams@bellevuewa.gov

425-452-7865



James Packman

Herrera Environmental Consultants
Associate Scientist

JPackman@herrerainc.com

206-787-8329



SAM website and Study webpage

