

Development of an ArcGIS-based Program for Tracking Inspection and Maintenance of Stormwater Facilities

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Proper operation and maintenance (O&M) of infrastructure is a common challenge for stormwater utilities. The Water Environment Federation's Stormwater Institute has identified asset management and lack of sustained operation and maintenance as consistent challenges for stormwater programs across the United States. A major contributor to inadequate O&M is insufficient information on long-term maintenance needs and costs. This lack of information prevents utilities from acquiring the technical and financial capacity needed to maintain stormwater infrastructure performance (Water Environment Foundation, 2015).

Stormwater O&M encompasses a wide range of activities intended to ensure that stormwater infrastructure operates as designed to protect ground and surface waters and prevent flooding (Washington Department of Ecology, 2019). Managing stormwater runoff is critical for water quality in urban environments. When rain falls on impervious surfaces (e.g., rooftops, roadways, parking lots) it accumulates nonpoint source pollutants (e.g., oil, chemicals, sediment) in stormwater runoff. Without proper management, polluted stormwater runoff discharges into surface waterways significantly degrading water quality. Stormwater Low Impact Development (LID) attempts to emulate natural processes, preserving the health of aquatic ecosystems, biodiversity, and drinking water sources while concurrently mitigating the risks associated with

flooding and erosion. Stormwater O&M ensures that LID design components continue to provide long-term water quality benefits.

The National Pollutant Discharge Elimination System (NPDES) and State Waste Discharge General Permit for Small Municipal Separate Storm Sewers in Western Washington is implemented through the Western Washington Phase II Municipal Stormwater Permit (Permit), which outlines stormwater activities and implementation milestones that permittees must follow to comply with the federal Clean Water Act and the Washington State Water Pollution Control Act. Developed in collaboration with local governments, the Permit is administered by the Washington State Department of Ecology (Washington Department of Ecology, 2019).

Per O&M section S5.C.7 of the Permit, the City of Washougal is required to inspect and maintain over 300 stormwater treatment and flow-control facilities (City of Washougal, 2023). These inspection and maintenance activities must be documented and reported to the Washington State Department of Ecology annually. The project I completed for my PSM internship was to develop and implement an ArcGIS-based program for tracking inspection and maintenance of stormwater facilities. I used Survey123, a program that was included as part of the ESRI ArcGIS software license, to develop and implement digital survey forms to collect O&M data.

My internship project consisted of refining stormwater infrastructure GIS data, researching how to develop Survey123 digital forms, and then conducting the form development and implementation process. I created two digital forms: one for recording stormwater facility inspections and another for tracking stormwater maintenance activities. Following extensive tutorials and testing, I constructed two digital forms that

accurately reflected the required inspection and maintenance standards for each stormwater facility type listed in the 2019 Stormwater Management Manual for Western Washington (2019 SWMMWW). Screenshots of the digital inspection form can be seen in Figure 1 below.

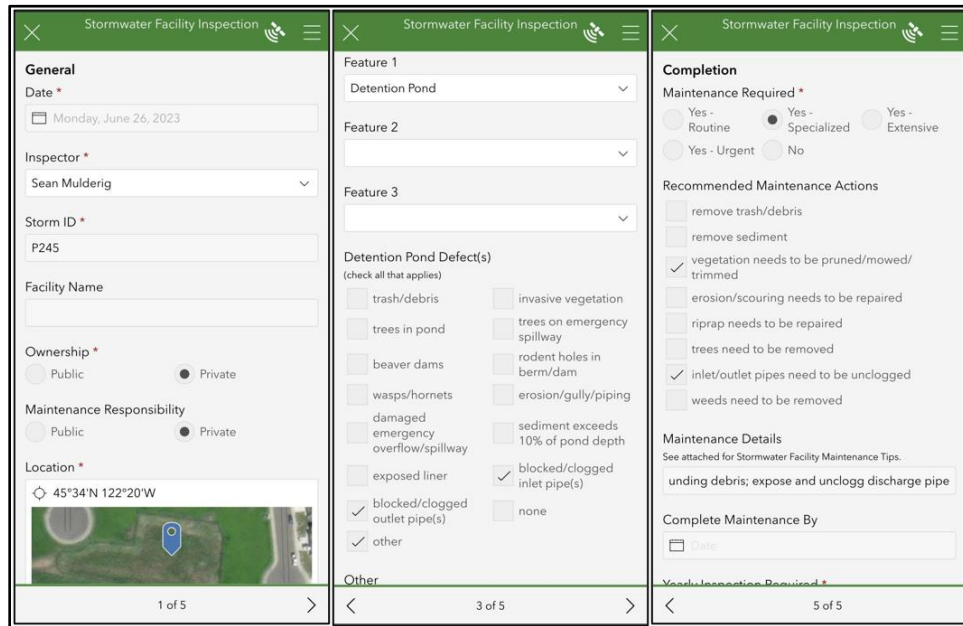


Figure 1 - Screenshots of Page 1, 3, and 5 of an example Stormwater Facility Inspection form entry

After the implementation, I conducted a comprehensive review of the form's efficacy in gathering applicable data, carefully considering both its ability to capture all necessary information and the time required to complete the forms while in the field. I then documented proposed edits for upcoming development of the revised 2024 versions. Upon initial observation, the Survey123 forms had already demonstrated their value by improving staff organization, maintenance prioritization, and Permit compliance and reporting efficacy.

Over time, the efforts completed for this project will help improve water quality and preserve biodiversity through the effective long-term management of stormwater LID

features. Proper inspection and maintenance tracking will also help mitigate human health risks associated with deteriorated water quality, flooding, and erosion. Quantifying the benefit or cost savings associated with an improvement in environmental or human health is no trivial task. However, this project signifies a step in the right direction towards implementing proactive approaches to address anthropogenic impacts on the environment and create a sustainable future.

References

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