

Stormwater Action Monitoring

2019 Annual Report

May 2020



This is the fifth annual report from the Washington State Department of Ecology (Ecology) on implementation of Stormwater Action Monitoring (SAM), a collaborative program funded by more than 90 Western Washington cities and counties, the ports of Seattle and Tacoma, and the Washington State Department of Transportation (WSDOT). Ecology manages SAM's revenues, expenditures, agreements, and communication of findings.



About SAM

Stormwater Action Monitoring (SAM) is the regional stormwater monitoring program for the municipal stormwater permits.

The goal of SAM is to improve stormwater management, reduce pollution, improve water quality, and reduce flooding. We do this by measuring stormwater impacts on the environment and evaluating the effectiveness of stormwater management techniques.

All jurisdictions, large and small, can benefit from SAM projects that are designed to produce regionally transferable findings. All permittees can implement SAM findings to protect local lakes, rivers, streams, and Puget Sound.

SAM communication webpage

SAM's website ecology.wa.gov/SAM, has a new communication page for all SAM publications, including project fact sheets, newsletters, videos, presentation templates, and more. Ecology maintains between 17-20 webpages for SAM annually, with most detailing individual projects for active studies. Additional pages give overviews and provide transparency on the administration of SAM.

Highlights

Status and Trends monitoring

Are conditions in receiving waters getting better or worse?

In 2019, SAM scientists finalized the study design for long-term streams and nearshore monitoring in the Puget Sound region. Water level loggers were deployed at the first 33 stream sites in 2019-2020, and have been monitoring continuous water level and temperature. Round 3 mussel monitoring was completed at 41 nearshore marine sites.

Effectiveness Studies

How well are required or innovative stormwater management practices working?

The final two Round 2 SAM Effectiveness Studies began in 2019. Planning for a third round of studies was well underway in 2019; solicitation and selection will occur in 2020. Source Identification projects are going to be combined with Effectiveness Studies for Round 3.

Source Identification projects

What are the common sources of illicit discharges and best ways to reduce them?

Two Source Identification projects are underway: the feasibility of a regional spill hotline, and updates to the *Illicit Connection & Illicit Discharge Manual*.

Future studies

What SAM activities are planned for 2020?

Several SAM projects will wrap up in mid 2020. The Round 3 study selection process will begin in January, with a request for proposals. Stakeholder and technical reviews will occur over the summer. SWG will host a workshop in September and recommend which projects to fund in November 2020.

Program Management



Stormwater Work Group

The Stormwater Work Group (SWG) of the Puget Sound Ecosystem Monitoring Program (PSEMP) is a coalition of representatives of local, state, and federal governments, environmental and business organizations, public ports, tribes, and agriculture. The SWG formed in 2008 to develop a strategic, coordinated, and integrated approach to understanding and addressing the stormwater problem in Western Washington.

The SWG welcomes participation on the group's subcommittees and caucuses. All meetings are open to the public. See the SWG website: <https://sites.google.com/site/pugetsoundstormwaterworkgroup>.

Oversight

The PRO-C approves contract scopes of work and amendments for SAM-funded projects. In 2019, Ecology published four quarterly reports and the 2018 Annual Report on SAM implementation. The SWG and subgroups worked through the process to identify study topics and questions for a third round of Effectiveness Studies and new Source Identification projects that PRO-C will oversee in late 2020 and beyond.

Also in 2019, the PRO-C produced a second "report card" evaluation of Ecology's administration of the SAM program for the SWG. Ecology met expectations for coordination, timely management of contracted SAM studies, and SAM budget management.

What is the connection between SAM and the SWG?

All SAM projects are selected and approved by the SWG. The SWG sets priorities and makes recommendations to support SAM implementation and other stormwater-related monitoring.

Permittees and state and federal agencies provide funding and leadership on SAM projects. Ecology serves as the administrative entity that manages SAM funds and executes SAM contracts.

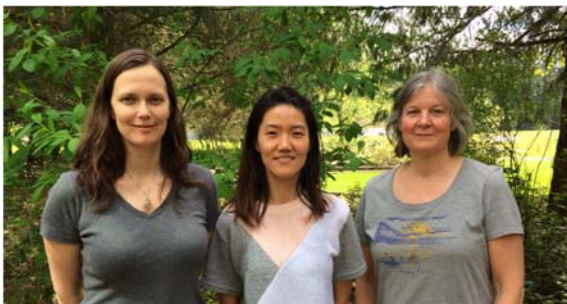
The Pooled Resources Oversight Committee (PRO-C), a subgroup of SWG, oversees Ecology's administration of SAM and approves all SAM contracting decisions and spending. The PRO-C reviews and approves scopes of work and budgets for SAM projects. In 2018, the PRO-C agreed to provide the oversight role for Lower Columbia urban streams monitoring, a new SAM project beginning in 2020 with decision-making by a different group of regional stakeholders and a separate, new SAM account.

Both the SWG and PRO-C are formal committees whose members represent stakeholder groups.

Staff

Ecology is committed to the success of SAM and continues to fund staff for the SWG.

The SAM Coordinator and SAM Scientist work with project leads to develop detailed scopes of work for contracting. They review deliverables, approve project invoices, manage cash flow for the SAM accounts, and maintain transparency to permittees and SWG stakeholders. The SWG Project Manager ensures all stakeholders work together to set priorities for studies that will provide meaningful information for stormwater managers.



Brandi Lubliner, SAM Coordinator; Keunyea Song, SAM Scientist; and Karen Dinicola, SWG Project Manager

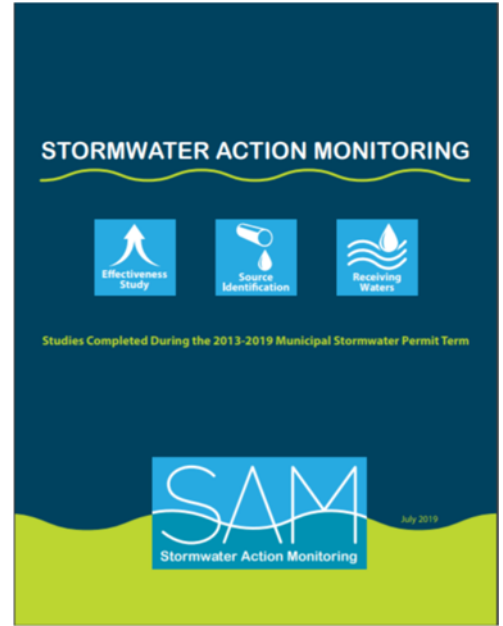
SAM 2019 Annual Report

Communications

The Association of Washington Cities is SAM's partner for communication products. This year we learned that stormwater managers mostly use the SAM Booklet, completed study fact sheets, and videos to communicate SAM study findings and progress.

Look for the following communication products on the SAM website:

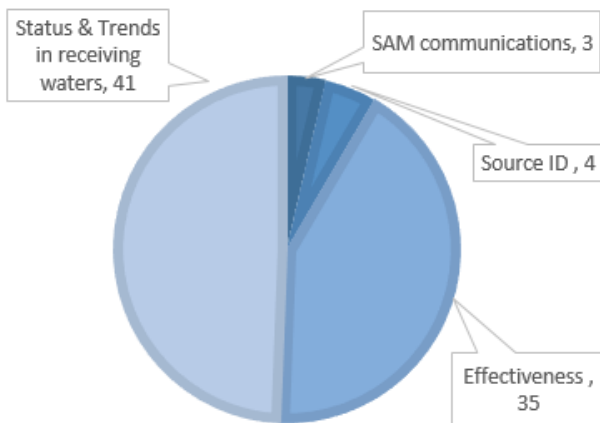
- ◆ The scopes of work, amendments, and deliverables posted to each project's page on the SAM website.
- ◆ The SAM Booklet that binds together all completed study fact sheets for the 2013-2018 permit term.
- ◆ Individual fact sheets written for stormwater managers about SAM and the findings of completed studies.
- ◆ Videos about bioretention, receiving water studies, and a downloadable presentation on how SAM works.
- ◆ Newsletters, quarterly reports, and prior annual reports on SAM activities.



Ecology has organized the SAM webpages to provide transparency on overall SAM administration and studies and share findings. In 2019, SAM projects were featured at MuniCon, local APWA stormwater managers meetings, the National Water Quality Monitoring Council conference, and PSEMP Freshwater and Toxics workgroup meetings.

Contracts and Agreements

In 2019, 4 new contracts were signed bringing the total number of unique contracts up to 51. This chart shows number of contracting actions (initial contract and amendments) for SAM projects from program launch in 2014 through the end of 2019. The total number of actions is 83.



Budget

At the close of 2019, 92% of all SAM funds were obligated or spent. Ecology's SAM administration costs were less than 10% of the total program budget.

PRO-C oversees SAM spending and recommended that any unspent funds be carried forward to the new permit term. At the close of 2019, approximately 17% of the Status and Trends budget was unobligated and will be used for 2020-2024 studies. PRO-C approved obligating all effectiveness study funds to get the last Round 2 uncontracted studies under contract, bringing this SAM account to less than 1% unobligated at the end of 2019.

Based on decisions made by permittees as of December 1, 2019, the anticipated annual revenue for the 2019-2024 permit term is approximately \$1.4M for Effectiveness and Source ID, \$750K for Puget Sound Status and Trends of streams and nearshore, and \$136K for Lower Columbia urban streams.

Ecology manages permittees' annual funding contributions toward SAM and stores payment receipts in [PARIS](#).

Status & Trends

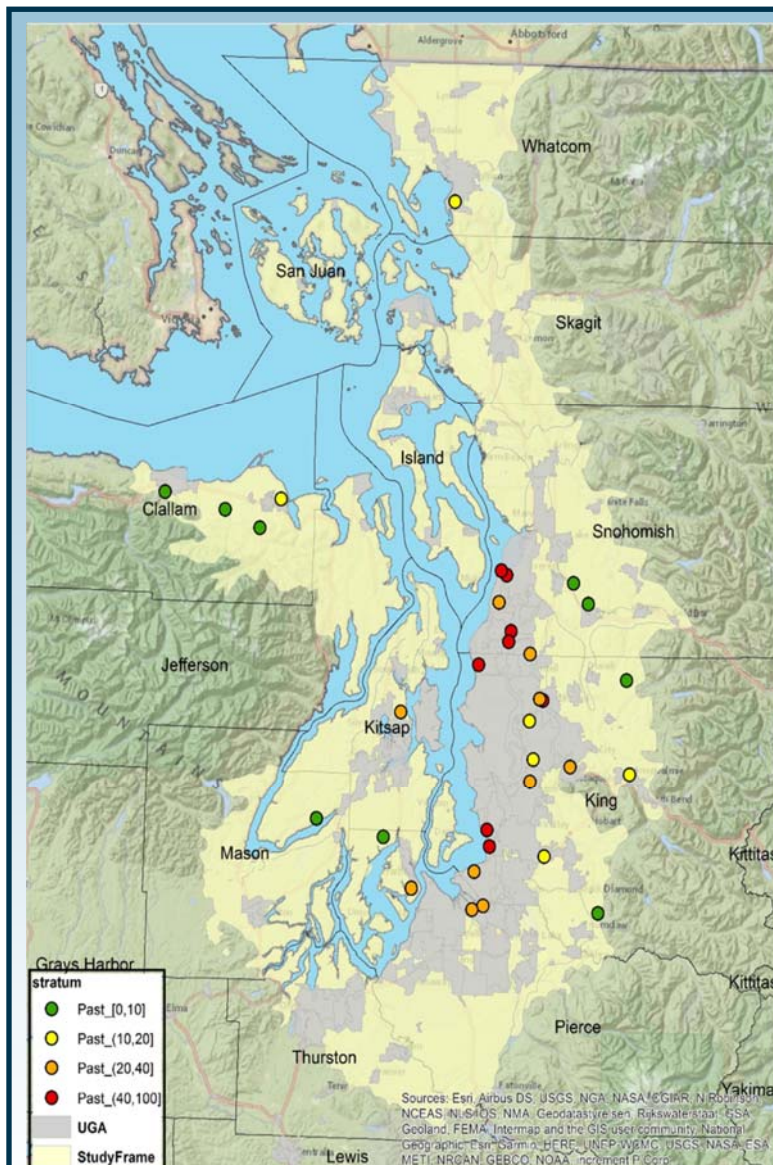


Puget Sound Region Receiving Waters Studies

SAM is monitoring and assessing the impacts of stormwater runoff in urban and urbanizing areas in the Puget Sound nearshore and small stream environments. The 2019 update to the study design increased statistical robustness and efficiency of monitoring for both long-term streams and nearshore receiving water studies. Monitoring under the new design will begin for small streams in 2020, and in the nearshore in 2021.

The main adjustments to the Puget Sound region Status & Trends study design are to:

- Stratify the study area into four groups using average percent of impervious surface cover in watershed to better represent the full gradient of urban and urbanizing conditions.
- Sample stream conditions every year at 33 sites, rather than 100 sites every five years, to improve trend detection power and capture year-to-year variability.
- Expand the nearshore study area from inside the UGA to the whole Puget Sound nearshore.



Puget Lowland Small Streams

Watershed delineation and stratification

New design requires to stratify sampling sites by the percent impervious cover in the contributing watershed area. To do this and maintain statistical robustness, SAM needed the delineated watershed area and associated landscape information for every one of the 19,970 potential sampling points for stream monitoring.

The U.S. Geological Survey (USGS) GIS experts led and conducted these tasks, delineating and characterizing watersheds for 19,970 potential sampling points using USGS-developed, automated watershed delineation tools and the 2016 updated National Land Cover Database.

Site evaluation and level logger deployment

The USGS evaluated each of the 2020 summer sampling sites to verify sampling suitability and accessibility. The 33 sites for 2020 summer sampling are a subset of past 2015 sampling sites that met the new study design criteria. The map shows these sites labeled by strata (impervious cover %) as: Past (0-10), Past (10-20), Past (20-40) and Past (40-100).

Level loggers were deployed in these sites to continuously monitor water level for a full water year (October 2019-September 2020), inclusive of the summer sampling timeframe.

Puget Sound Mussel Tissue Contaminant Monitoring

Washington Department of Fish & Wildlife (WDFW) successfully deployed mussel cages in late October for the third round winter deployment. Monitoring is at the same 41 probabilistically selected monitoring sites along the Puget Sound urban shoreline and one reference site established in Penn Cove. The cages will be retrieved in late January 2020.

WDFW has been working on data analysis and reporting for second round of SAM mussel monitoring (2017-2018 winter deployment). The second round monitoring report will be published in spring 2020. Preliminary results shared in 2019 were similar to the first round (2015-2016 winter deployment) results, showing a strong correlation between the concentrations of the most abundant contaminants (i.e., PAHs, PCBs, PBDEs and DDTs) and urban development in the contributing watershed.



Lower Columbia Region Urban Stream Monitoring (LCUS)

The 2019-2024 Phase I NPDES Municipal Stormwater Permit requires a new Status and Trends monitoring study for Lower Columbia Region. The permittees participating in LCUS monitoring are Clark and Cowlitz counties, the cities of Battle Ground, Camas, Kelso, Longview, Vancouver, and Washougal, and the Washington State Department of Transportation (WSDOT). Clark County is the lead entity for the study.



In 2020, Clark County and Ecology will work together to finalize the monitoring design, identify sampling sites, sampling frequency, and finalize parameters. The monitoring Quality Assurance Project Plan (QAPP) including final study design will be published in 2020, and summer sampling will begin in 2021. Level loggers will be deployed in 2020 for continuously monitor water level for a full water year (October 2020-September 2021).

Many of the area streams are engineered or structurally altered, limiting suitable monitoring sites. Instead of using a random site selection, LCUS will likely monitor fixed locations in all suitable streams in a long-term rotation. The photo on the left is an example of stream conditions in the region.

Effectiveness Studies



SAM is measuring the effectiveness of BMPs and management actions to reduce negative hydrologic impacts and the discharge of pollutants to receiving waters. These studies were active in 2019. Completed studies are shown in the boxes.

Low Impact Development (LID)

- ◆ **Hydrologic benefit of individual trees**
Washington Department of Natural Resources is quantifying the hydrologic benefits of retaining mature trees during development. Native evergreen and deciduous trees are being monitored at two locations in Western Washington. The report is expected in 2021.

Alternative blends for bioretention soil media

King County led a bench-scale study to test bioretention soil media blends to develop a low-to-no phosphorus export specification for use in bioretention facilities. The successful media provides an alternative to the default bioretention soil media that meets treatment goals for suspended solids, copper, zinc, and phosphorus, and also prevents toxicity to aquatic organisms.

The new media components (sand, coir, biochar, activated alumina, and iron aggregate) are available at a reasonable cost.

The authors recommend the alternative blend be added to Ecology's stormwater management manuals to greatly expand the settings where designers and jurisdictions can confidently apply bioretention systems to manage stormwater runoff. The alternative blend is intended for stormwater treatment projects in areas where receiving waters are sensitive to nutrient enrichment.



Bioretention reduction of PCBs

King County studied bioretention treatment and sequestration of poly-chlorinated biphenyls (PCBs) using the same mesocosms as the fungi amendment study. On average, effluent concentrations of PCBs were approximately 90% lower than stormwater influent when filtered through the default 60:40 bioretention soil mix. Seasonality was not found to change PCB

concentrations in bioretention soils or effluents and PCBs did not accumulate in bioretention soils over the 2-year study.

The study provides some assurance that bioretention will not accumulate dangerous concentrations in residential settings.



- ◆ **Bioretention hydrologic performance of current designs**
The City of Olympia is evaluating the hydrologic performance of ten bioretention facilities designed and built in accordance with the 2012 SWMMWW. The report is expected in mid 2020. The earlier phase of the study found "early designs" (pre-2012 SWMMWW) performed as modeled, despite the variety of models used.
- ◆ **Bioretention amendment with fungi and plants**
U.S. Fish & Wildlife Service (USFWS) and Washington State University (WSU) are monitoring treatment performance of bioretention mesocosms with fungal amendments. The report is expected in 2020.

SAM 2019 Annual Report

Low Impact Development (LID)

(continued)

- ◆ **Mulch choices for bioretention:** The WSU Stormwater Center is evaluating impacts of three types of mulch on stormwater treatment: bark mulch (fir), shredded bark mulch (cedar), and arborist wood chips.
- ◆ **Orifice control of bioretention for water quality treatment:** The WSU Stormwater Center is evaluating impacts of smaller orifices on underdrains to stormwater quality and water quantity treatment.
- ◆ **Longevity of bioretention soil mix for toxicity reduction:** USFWS and WSU aim to learn how long bioretention treatment of toxicity lasts and test soil media depth most effective to reduce toxicity. This study will test ten water-year volumes passed through the bioretention soil media mesocosms over a two-year period. The report is expected in 2022.

Retrofits

- ◆ **Oyster shell retrofits in catch basins:** King County is evaluating the effectiveness of dissolved metals treatment using crushed oyster shells added to catch basins on Mercer Island. The report is expected in 2021.



- ◆ **Watershed scale retrofit and restoration:** The City of Redmond is actively monitoring seven sites in a paired watershed design. This watershed-scale study will continue for several more years. An interim report is expected in 2020.

Source Identification

SAM Source Identification projects identify common problems and propose regional actions on source control to prevent transport of pollutants in stormwater.



- ◆ **Regional Spill Hotline Feasibility:** King County is investigating feasibility of and potential options for a regional or statewide single reporting hotline for spills to stormwater systems. The report and recommendations are expected in 2020.
- ◆ **Illicit Connection and Illicit Discharge (IC/ID) Manual Update:** King County is updating methods to detect, identify, and trace sources of pollutants in stormwater. Two workshops were held in early 2019 to identify new techniques and gaps. Eight trainings on the IC/ID manual and updates will be scheduled in 2020. The report is expected in 2020.



Radiator fluid (photo courtesy Federal Way)

New permit term started in 2019

Western Washington municipal stormwater permittees made their choices to either collaborate and pay into the SAM pooled funds under S8 of the permit or conduct their own outfall monitoring. By December 2019, all permittees opted to join SAM's Status and Trends in receiving waters in both the Puget Sound watersheds and the Lower Columbia watersheds. All but one permittee opted to join SAM for Effectiveness Studies and Source Identification projects for the permit term.

Putting together SAM study solicitation Round 3

The SWG spent much of 2019 refining priority questions and topics for SAM projects to be funded by permittees' SAM funding contributions during the 2019-2024 permit term. More than 75 people attended the SAM Priorities Workshop on February 27, 2019, to prioritize SAM studies for the 2019 permit term. Attendees provided input to finalize the Status and Trends study design and parameters for Puget Sound receiving waters and ranked topics for Effectiveness Studies and Source Identification projects. The SWG finalized the SAM priority topic list for SAM Round 3 request for proposals in June 2019, and worked with subgroups on clarifications into the fall.

Ecology finalized the Round 3 application and funding guidelines and worked with PRO-C on total funding available for new projects. SAM funding for the 2019-2024 permit term is based on both unobligated funds from the prior term and permittee's December 2019 decisions to join SAM for the 2019 permit term. The Round 3 SAM request for proposals went out in early January 2020.

SAVE THE DATE!

SAM Round 3 Study Selection Workshop is September 16, 2020

SWG welcomes participation in its caucuses and subgroups, contact the SWG Project Manager. Join the listservs!

[STORMWATER-ACTION-MONITORING](#) newsletter: three issues per year to hear about SAM study findings and upcoming workshops.

[SWG-REPORTER](#): four issues per year to hear about study findings and the process for prioritizing and selecting studies.

[STORMWATER-WORK-GROUP](#): meeting agendas, materials, and summaries, and additional announcements related to our work.

Brandi Lubliner
SAM Coordinator

(360) 407-7140

brandi.lubliner@ecy.wa.gov

Keunyea Song

SAM Scientist

(360) 407-6158

keunyea.song@ecy.wa.gov

Karen Dinicola

SWG Project Manager

(360) 407-6550

karen.dinicola@ecy.wa.gov

Special accommodations

To request materials in a format for the visually impaired, visit <https://ecology.wa.gov/accessibility>, or call Ecology at (360) 407-6600, Relay Service 711, or TTY (877) 833-6341.

SAM is funded by:

Cities: Aberdeen, Algona, Anacortes, Arlington, Auburn, Bainbridge Island, Battle Ground, Bellevue, Bellingham, Black Diamond, Bonney Lake, Bothell, Bremerton, Brier, Buckley, Burien, Burlington, Camas, Centralia, Clyde Hill, Covington, Des Moines, DuPont, Duvall, Edgewood, Edmonds, Enumclaw, Everett, Federal Way, Ferndale, Fife, Fircrest, Gig Harbor, Granite Falls, Issaquah, Kelso, Kenmore, Kent, Kirkland, Lacey, Lake Forest Park, Lake Stevens, Lakewood, Longview, Lynnwood, Maple Valley, Marysville, Medina, Mercer Island, Mill Creek, Milton, Monroe, Mount Vernon, Mountlake Terrace, Mukilteo, Newcastle, Normandy Park, Oak Harbor, Olympia, Orting, Pacific, Port Angeles, Port Orchard, Poulsbo, Puyallup, Redmond, Renton, Sammamish, SeaTac, Seattle, Sedro-Woolley, Shoreline, Snohomish, Steilacoom, Sumner, Tacoma, Tukwila, Tumwater, University Place, Vancouver, Washougal, Woodinville. **Counties:** Clark, Cowlitz, King, Kitsap, Pierce, Skagit, Snohomish, Thurston, Whatcom. **Ports:** Tacoma and Seattle. **State:** Washington Department of Transportation, Washington Department of Ecology, Washington Department of Agriculture, Washington Department of Fish and Wildlife. **Federal:** United States Geological Survey. **Business:** Penn Cove Shellfish, Cedar Grove.