

Stormwater Action Monitoring

2020 Annual Report

May 2021



This is the sixth 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.



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.

Ecology maintains approximately 20 webpages for SAM communication and transparency. Individual project pages exist for each of the active SAM studies. Completed projects are summarized, in the accordions, under Effectiveness Studies Source Identification and Status & Trends.

<https://ecology.wa.gov/SAM>

Highlights for 2020:

We adapted in many ways to continue administration of the SAM program while working full time remotely.

Round 3 SAM study selection workshop

Solicitation for new SAM study ideas, reviews, stakeholder meetings, and the September 16th Study Selection Workshop were held virtually. Considerable effort was made by AWC and Ecology to ensure easy registration, available materials in advance, and valuable presentations. The workshop was well attended by MS4 permittees and stakeholders and fortunately was a glitch free!

Some but not all contracts were impacted by the global pandemic

Field work was still accomplished but more slowly this year for the streams, mussels, and few of the effectiveness studies. Delayed laboratory analysis of samples is still affecting some projects. The effectiveness studies that provided workshops and trainings last year were able to adapt to the virtual platform.

Flexible and committed partnerships are key

We successfully completed projects thanks to the flexibility of SAM contract amendments, an engaged oversight committee, and dedication from our project teams. Recorded presentations and trainings reached more permittees than originally anticipated.

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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 monitor the stormwater problem in Western Washington and effectiveness of stormwater practices and management activities.

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/>

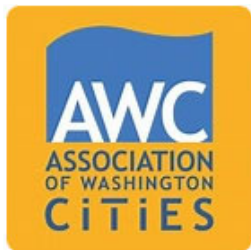
What is the connection between SAM and the SWG?

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, state and federal agencies, and university faculty provide funding and/or 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. The PRO-C approves all SAM contracting decisions and spending and also reviews each project scopes of work and amendments. Both the SWG and PRO-C are formal committees whose members represent stakeholder groups.

Communications



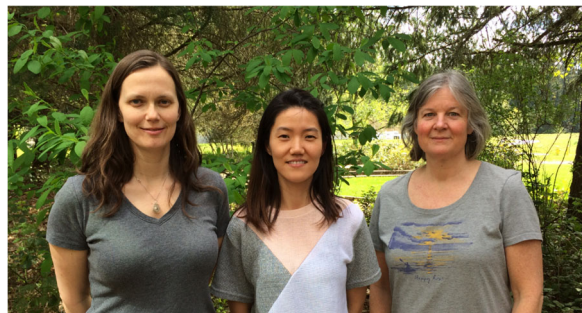
SAM has worked the Association of Washington Cities for years to develop the SAM name, logo, templates for fact sheets and presentations, SAM's communication strategy, multiple SAM workshops, and many highly valued communication products. The products are on the SAM Communications webpage include; the bioretention storymap, four SAM videos, 23 completed study fact sheets, 11 newsletters, two City Vision articles, and the SAM Booklet on the work done during since 2014. Thanks to Andy Meyer and many talented staff at AWC!

SAM funded projects planned to be featured at MuniCon, Green Stormwater Infrastructure Summit, local APWA stormwater managers meetings, PSEMP Freshwater and Toxics workgroup and other meetings in 2020-21.

Staff

Ecology is committed to the success of SAM and continues to fund staff for the SWG. In 2020, Emma Trewthitt (not pictured) began training to provide future Ecology staffing of SWG. Ecology assumes this role to ensure SWG meets all stakeholders needs to work together to set priorities for SAM studies as part of the municipal stormwater general permits.

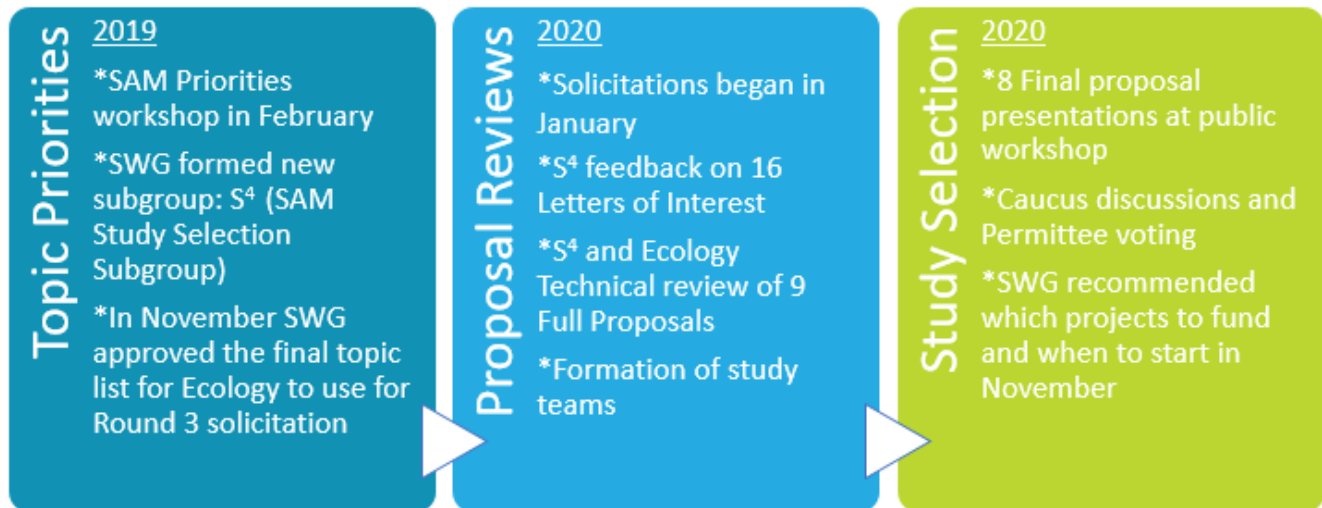
SAM staff (Brandi and Keunyea) manage the program at Ecology and work with project leads to develop detailed scopes of work, review deliverables, approve project invoices, and maintain the website for transparency to permittees and SWG stakeholders.



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

Round 3 SAM study solicitation

SAM's Round 3 Effectiveness Study Solicitation was released in January, and we received 16 Letters of Interest (LOIs). SAM Staff coordinated the S⁴ (SAM Study Solicitation Subgroup), a temporary subgroup of the SWG, to review both the LOIs and Full Proposals (FP). By May, nine FPs were received and reviewed by SAM staff and Ecology staff on relevance to the stormwater permits and/or manual implementation, and to provide suggestions to make them most useful to permittees and Ecology. Additional reviews and scoring was done by the S⁴ according to the rubric set forth in the solicitation. All of this work was completed and provided back to the study proponents to make adjustments to their proposals before their pitches at the September 16th workshop.



While initially planned to be in-person, the SAM Study Selection Workshop was transitioned online and was attended by 70 non-Ecology participants. In October, permittees voted on the eight proposals showcased at the workshop. Based on the results of the permittee votes and reviewing the summary of caucus discussions in November, the SWG decided to fund all eight projects as SAM income and staff capacity allows. SAM will have adequate funding to cover the estimated budgets in the 2019-2024 permit term. In November, Ecology received the following SWG recommendations for the contracting timeframe.

Winter 2020-21:

- FP2 Guidance for evaluating the effectiveness of public education and outreach programs
- FP5 Developing and refining source control inspection programs for businesses
- FP6 Mobile businesses, illicit discharges, and multi-jurisdiction coordination

Summer 2021:

- FP3 The role of ditches in pollutant management and how cleaning impacts their biogeochemical function
- FP7 Stormwater BMPs maintenance conditions evaluation

Thereafter, as staff capacity becomes available:

- FP1 Tools and strategies to determine the most effective BMP depending on pollutant type and source
- FP4 Replacement and lifecycle costs of permeable pavements compared with conventional pavements
- FP8 Evaluation of the influence of bioretention soil infiltration performance rate and safety factors on facility sizing and maintenance

Receiving Water Status & Trends

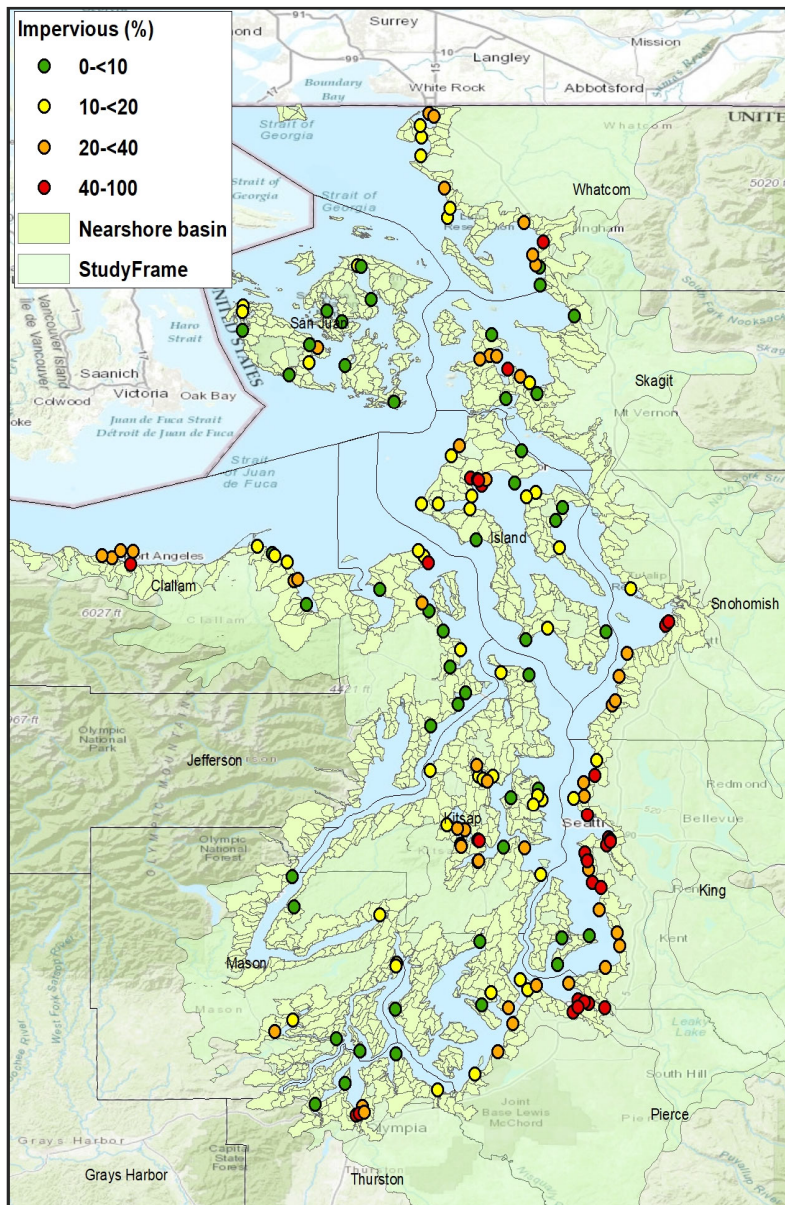


Are conditions in receiving waters getting better or worse?

SAM is monitoring and assessing the impacts of stormwater runoff in urban and urbanizing areas in the Puget Sound nearshore and small stream environments in both Puget Sound and Lower Columbia River watersheds. Completed reports are shown in the blue boxes.

Puget Sound Nearshore Mussel Tissue Study

After the first two rounds of sampling in the winters of 2015-16 and 2017-18, the Status and Trends scientists determined, and SWG agreed, that the Urban Growth Area (UGA)-only geographic area of the mussel study was too small. This year the SAM Scientist worked with EPA statistical staff to develop a larger study frame that extends to the entire Puget Sound that adds low impervious sites for study comparison. WDFW is the project lead and is finishing data analysis for winter 2019-20, which is the last UGA-only sampling. Pandemic-related delays at laboratories are impacting the timeframe for data analysis and report writing.



New study design details:

Key features of the new study design are;

- Sampling will continue to be biannual.
- Extended study frame from UGA-only to the entire nearshore of Puget Sound for a total of 4540 potential sampling sites.
- Stratification of site selection. Sampling sites stratified by percent impervious surface cover of watershed into four strata which allows for status and trend detection within these site categories.

The map shows the sampling sites labeled by strata (impervious cover %) as: 0<10, 10<20, 20<40 and 40-100 for next 20 years.

First monitoring using the new study design will be in winter 2021-20.

Round 2 and 3 Mussel Monitoring of Puget Sound UGAs

WDFW published the Winter 2017-18 results (Round 2) in 2020 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.

The Winter 2019-20 report (Round 3) was delayed due to slower lab results due to the pandemic and is anticipated in 2021.

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SAM Stream Monitoring Studies in Western Washington

Puget Small Streams (PSS)

U.S. Geological Survey (USGS) successfully completed summer field monitoring at 33 urban gradient sites and two reference (least-disturbed) sites successfully. This monitoring includes water, sediment, macroinvertebrate sampling and physical habitat assessment. Water level and temperature using sensors were monitored continuously throughout the year.

Restrictions related to the pandemic slowed down chemical analysis, reporting, site evaluation and sensor deployment. Site evaluation of the 2021 sampling sites and sensor deployment began but are behind schedule, resulting in a couple months of missed water level data. The annual report for water year 2020 due in November 2021, will likely be delayed and be combined with the second report in 2022.

Lower Columbia Urban Streams (LCUS)

Clark County in partnership with Cowlitz County, Cities of Battle Ground, Camas, Kelso, Longview, Vancouver, and Washougal, and the Washington State Department of Transportation (WSDOT) finalized the Quality Assurance Project Plan (QAPP) in October 2020.

Level loggers were deployed in 2020 for continuous monitoring of water level, temperature and conductivity for a full water year. Summer field sampling will begin in 2021.



Effectiveness Studies

How well are required or innovative stormwater management practices working?

SAM is measuring the effectiveness of BMPs and stormwater management actions to reduce negative hydrologic impacts and the discharge of pollutants to receiving waters. The following studies were active in 2020.



- ◆ **Hydrologic benefit of individual trees (Photo on the right)**
Washington Department of Natural Resources and Washington Stormwater Center (WSC) are quantifying the hydrologic benefits of retaining mature trees during development. Sensors are monitoring water used (transpiration), through fall, and other hydrologic components of individual native evergreen and deciduous trees at two locations in Western Washington. The report is expected in late 2021.
- ◆ **Oyster shell retrofits in catch basins:** King County is evaluating the effectiveness of dissolved metals treatment by adding crushed oyster shells in catch basins on Mercer Island. The report is expected in 2021.



Effectiveness Studies (cont'd)

Two effectiveness studies were completed in 2020. All final reports, scopes of work, and other key deliverables are available on the SAM websites under completed studies. SAM staff and the study lead co-author a two-page fact sheet for each final report.

Bioretention amendment with fungi and plants

SAM Fact Sheet #19, February 2021

U.S. Fish & Wildlife Service (USFWS) and the Washington Stormwater Center (WSC) quantified the effectiveness of fungal inoculated mulch in bioretention mesocosms to treat urban runoff. While plants pull moisture from the bioretention soil for growth, the establishment of soil mycelia helped retain water in the soil for plant availability. Bioretention mesocosms effectively remove metals, bacteria, solids and organic compounds from urban runoff, regardless of the presence of plants or fungi.

The fungi treatments showed remarkable reductions of ortho-phosphorus in the outflow from the compost layer within the first year, but the effect diminished in the second year of the study. Other water quality and toxicology parameters showed no differences between the fungi mesocosms and the controls.



Fungal colonization will occur in any mulch layer over time. Because fungi improve soil moisture content, provide favorable conditions for plants, and reduces phosphorus export during the establishment year, stormwater managers may consider fungal inoculated mulch for bioretention facilities.

Hydrologic performance of current design bioretention BMPs

SAM Fact Sheet #20, March 2021

The City of Olympia evaluated the hydrologic performance of ten new bioretention facilities; five were retrofits. All were designed and built in accordance with the 2012 *Stormwater Management Manual for Western Washington*.



Conclusions from the first phase of this study (pre-2012 bioretention designs) were reaffirmed and some new findings are specific to the retrofit facilities monitored in this study on “current design” bioretention facilities.

While Ecology does not require retrofit facilities to fully meet the design criteria as new and redeveloped facilities, the designers were successful at maximizing the hydrologic control of runoff flows.

- Geotechnical findings: bioretention facilities tend to be built with coarser soils than recommended, allowing rapid infiltration. This infiltration primarily occurs near inflow locations potentially affecting vegetation survival farther from the inflow.
- Hydrology model inputs: infiltration rates, safety factors, and top area of the bioretention facility were found to be improperly set up in the Western Washington Hydrology Model (WVHM). Better review of a few key WVHM settings by local reviewers is needed.
- Vegetation: plantings reflected the designs; however most of the water-loving herbaceous plants cannot tolerate the well drained soils in bioretention. Hardier species are more successful.

The authors provided specific recommendations to more than 260 practitioners to address findings. Development and utilization of a review checklist for BMP designers and jurisdictional reviewers will ensure function of future bioretention facilities.

Effectiveness Studies (cont'd active studies)

- ◆ **Mulch choices for bioretention (Figure to right):** WSC is evaluating impacts of three types of mulch on stormwater treatment: bark mulch (fir), shredded bark mulch (cedar), and arborist wood chips. The QAPP was finalized in early 2020 but the project incurred minor field sampling and lab analysis delays due to the pandemic. A project extension may be needed in 2021.

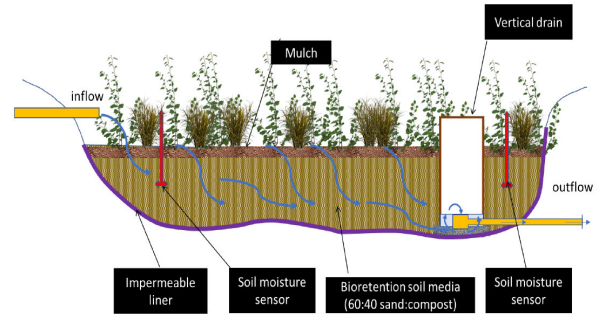
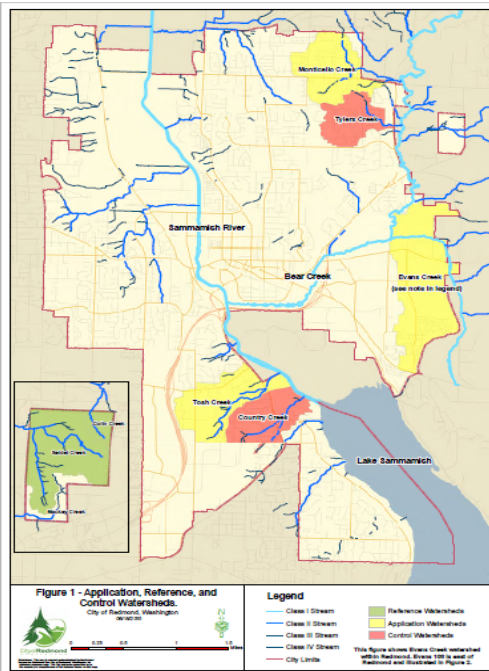


Figure 6: Cross-section of a single bioretention test cell



- ◆ **Orifice control of bioretention for water quality treatment:** WSC is evaluating impacts of smaller orifices on underdrains to treat stormwater quality and water quantity. First-phase results are expected in early 2022.
- ◆ **Longevity of bioretention soil mix for toxicity reduction:** USFWS and WSC started this project to learn how long bioretention treatment of toxicity lasts and what soil media depths effectively reduce toxicity. USFWS terminated the contract in December 2020 and WSC will continue the study under a new contract in 2021. The report is expected in 2022.
- ◆ **Watershed scale retrofit and restoration (Map to the left):** 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 was published in 2020 (SAM Fact Sheet #23, March 2021). Not many trends were evident yet; however street sweeping is emerging as an effective practice for improving water quality.

Source Identification Projects

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

SAM Source Identification projects identify common problems and propose regional actions on source control to prevent transport of pollutants in stormwater. The following studies were active in 2020. Completed studies are shown in the blue boxes.



2020 Illicit connection and illicit discharge (IC/ID) field screening manual

SAM Fact Sheet #21, Feb 2021

King County led this project to update methods to detect, identify, and trace sources of pollutants in stormwater. Eight trainings on the updated IC/ID manual held in 2020 reached over 200 municipal staff. The final manual, six new training videos, and recorded manual overview training are available from the WSC webpage for IC-ID and on their YouTube Channel.

www.wastormwatercenter.org/permit-assistance/municipal/permit-assistance-2/ic-id/

Source Identification (cont'd)

- ◆ **Spill hotline feasibility:** King County published the final report in late 2020 on the feasibility of a regional spill hotline to improve response and inter-jurisdictional communication. A local presentation is all that remains for 2021.

Administration

Contracts and Agreements

In 2020, four Effectiveness Study or Source Identification project contracts were amended from delays or changes due to the pandemic. Two new Status and Trends contracts were made.

By late 2020, the SAM Coordinator began contract scopes of work for three Round 3 SAM proposals:

- ◆ *Building a business source control & inspection program (WSC led)*
- ◆ *Evaluating your stormwater education & outreach program (WSU led)*
- ◆ *Coordination on Mobile Businesses and Source Control (King County led)*

SAM Budget

The SAM Coordinator spent time covering other duties at Ecology in late 2020 and therefore administration charges to the SAM accounts were half the normal rate for the third and fourth quarters of 2020.

PRO-C oversees SAM's budgets and the Round 3 studies approved for SAM funds will spend down the old Source Identification account and from the now combined Effectiveness Studies and Source Identification account. By 2023 there will be enough revenue available to support another call for proposals for new Effectiveness studies and Source Identification projects.

The anticipated annual revenue for the 2019-2024 permit term is \$1.4M for Effectiveness and Source Identification, \$750K for Puget Sound Status and Trends in streams and nearshore. Starting in 2020, projected annual revenue for Lower Columbia Urban Streams study is \$136K.

Ecology manages permittees' annual funding receipts in PARIS: <https://apps.ecology.wa.gov/paris>.

STAY INVOLVED AND UP TO DATE!

<https://listserv.ecology.wa.gov>

SWG and SAM want your involvement. Stay aware of meetings and activities by joining the listservs!

STORMWATER-ACTION-MONITORING: a newsletter announcing 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, summaries, and announcements related to our work.

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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 annually funded by Cities, Counties, Ports, and US Navy; has received in-kind funds from cities, business and agencies:

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, Lynden, 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, Snoqualmie, 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.