An overview of stormwater monitoring in Washington State

Washington Stormwater Center webinar
August 12, 2015
Topics for today

- Overview of Clean Water Act permit–driven stormwater monitoring programs in Washington State
- Details of the unique coordinated, pooled resources approaches for each of three regions of the state
- Some lessons learned, and some results/findings
Context: the Stormwater Problem

Leading contributor to water quality pollution in urban and suburban waters

- Pollution from urban areas
- Dirt, oils and metals from roads
- Nutrients
- Metals
- Toxic pollutants
- Bacteria & pathogens
- High flows that scour stream beds
National Pollutant Discharge Elimination System (NPDES) permits:

- Cover “Municipal Separate Storm Sewer Systems” (MS4s)
- Prescribe stormwater management programs
- Traditionally, most permittees conduct their own monitoring to evaluate effectiveness and compliance
Why Monitor?

Big Questions

Receiving waters:
- Are things getting better or worse?
- Are we protecting key resources?

Effectiveness studies:
- What is/isn’t working?
- What works better or more cost-effectively?
The New Regional Stormwater Monitoring Programs

Karen Dinicola, Stormwater Monitoring Policy & Technical Lead
Washington State Dept. of Ecology
Water Quality Program
The largest municipal stormwater permittees did monitoring for the last 5-year permit.

In 2005 a group of Puget Sound Permittees asked Ecology for a different approach:

- Start with a bigger picture, coordinate...
How to change a paradigm

- Stakeholder Recommendations
- Permit Requirements
- New Monitoring Program
Years of Process

- Why is process so important?
  - Asking the right questions
  - Setting clear priorities
  - Shared understanding
  - Good (not perfect) scientific framework
    - Peer-reviewed
  - Appropriate level of effort
  - Implementation plan

- Preceded by Puget Sound Monitoring Consortium
Stormwater Work Group

- Assigned seats at the table for representatives of each **stakeholder caucus**

- **Subcommittees with open participation**
  - Pooled Resources
  - Status and Trends
  - Effectiveness
  - Source Identification
  - Communication
  - Agricultural Runoff
  - Roads and Highways

- **Public workshops**

Convened in 2008, ongoing
Stakeholder Recommendations

- Mostly by Consensus
  - 85 consensus recommendations in 2010
  - Plus 3 majority recommendations with minority concerns noted
    - Majority recommendations include minority concerns
- Ecology accepted the recommendations
  - Recommendations are the basis of the permit requirements
  - Ecology engaged with stakeholders to translate recommendations into permit language
How to change a paradigm

Stakeholder Recommendations

Permit Requirements

New Monitoring Program
### Key Recommendations in 2010

**Establish a new, collaborative Regional Stormwater Monitoring Program (RSMP)**

- Status and trends in receiving waters
- Effectiveness studies
- Source identification information repository

**Require all permittees to pay to fund the RSMP**

**Ecology should administer the RSMP for this permit cycle**
Each permittee must choose to either:

- Pay into a pooled funding account (costs allocated in the permit)
- Conduct their own monitoring intended to complement the RSMP for the duration of the permit term
RSMP is not Ecology’s program

- Ecology is the service provider
  - Other options considered, but Ecology had capacity, contracting experience, and low overhead (5%)
  - PSEMP was not yet up and running in 2010

- Permittees and stakeholders determine priorities, content, and level of effort

- Leverages other regional monitoring efforts

- Ongoing oversight by stakeholder group
Trust but verify

- Pooled Resources Oversight Committee
  - Caucus representation, charter
  - Regular updates from RSMP Coordinator
  - Project management type oversight
    - Scope, schedule, budget, deliverables
  - Ensure implementation of the stakeholder group recommendations
Lessons we’re learning

- Benefits of having the details outside the permit
  - Stakeholders make adjustments to budget and priorities
  - Opt-outs are a lot of work; inflexible

- Other monitoring programs will come and go

- Effectiveness monitoring questions are hard to answer on a regional basis

- Challenge to analyze and report findings in time to inform next permit cycle

- Oversight is a good thing

- Puget Sound is easier than other parts of the state
Ongoing recommendations

For example:

5 year process to decide what effectiveness studies to do

- >170 ideas compiled into 22 topics and associated questions
- Literature review – ECY funded
- Synthesis papers – ECY funded
- Revised list: 6 priority topics
- 23 pre-proposals
- Two workshops in 2014
- Final list of 10 studies
- 6 began this year – RSMP funded
How to change a paradigm

- Stakeholder Recommendations
- Permit Requirements
- New Monitoring Program
Implementing the RSMP

Brandi Lubliner, RSMP Coordinator
Washington Dept. of Ecology
Water Quality Program
Ecology as RSMP Service Provider

- Invoice permittees
- Separate accounts for 3 RSMP components
- State spending authority
- Contracting: 14 agreements so far, more coming
- Project oversight, budget oversight
- Deliverables review and approval
- Quarterly budget reports
- Web postings
- Draft QAPPs for S&T
- EIM
<table>
<thead>
<tr>
<th>Status and trends</th>
<th>Effectiveness studies</th>
<th>Source ID info repository</th>
</tr>
</thead>
<tbody>
<tr>
<td>Are conditions in streams and nearshore areas getting better or worse?</td>
<td>How well are management approaches working?</td>
<td>Share results and identify regional solutions</td>
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</tbody>
</table>

- **Status and trends**: Are conditions in streams and nearshore areas getting better or worse?
- **Effectiveness studies**: How well are management approaches working?
- **Source ID info repository**: Share results and identify regional solutions
2010 SWG recommendations

- Priority water bodies are small streams and marine nearshore
- Probabilistic design to get regional information useful to Ecology and applicable to all permittees regardless of whether a site is located inside their jurisdiction
- Leverage current long-term monitoring efforts:
  - State Salmon Recovery Monitoring
  - Mussel Watch
  - Ecology sediment monitoring
  - WDOH shellfish and bacteria monitoring
Status and Trends Monitoring

2011-15 Accomplishments

- Streamflow gaging network analysis
- Draft Quality Assurance Project Plans (QAPPs) and more details
  - Focus on Puget Lowland streams inside and outside UGAs
  - Focus on UGA shoreline for nearshore
    - Sample sediment at 6’ below MLLW
    - Use same shoreline site where possible for sediment and mussels
    - Use caged mussels rather than wild mussels
    - Analyze other programs’ bacteria data rather than collecting new data
- Permits issued
  - Allowed permittees to “opt-out” of regional program
  - Two selected this option
- Final budget: ~$3.5M for S&T
  - Revise scope, site list, and parameters as needed
- Final QAPPs, contract agreements to do the stream monitoring
Status and Trends Monitoring

2015 -18 Work Ahead

- Small streams in Puget Lowlands
  - Finish monitoring to December
  - Data Analysis
  - Recommendations for trend program sampling design

- Marine UGA shorelines (40 UGA sites)
  - Contaminants filtered by mussels
    - Winter 2015 – 2016
    - Winter 2017 – 2018
  - Sediment chemistry
    - Summer 2016
RSMP Small Streams (Jan–Dec 2015) (~$1.7M + data analysis and report)

- Monitoring Design
  - WA Master Sample – randomly selected
  - 60 sites for water quality and instantaneous flow
    - Monthly: Jan – Dec 2015
    - Conventionals, 7 metals, PAHs
  - 100 sites for Watershed Health (bugs, habitat, sediment and periphyton)
    - Once summer 2015
    - Sediment Chemistry (metals, PAHs, phthalates, PCBs, PBDEs, pesticides)
Streams cont’d

- Streams Monitoring Team
  (#s of WQ:WH sites)
  - USGS (35:57)
  - King County (19:38)
  - Skagit County (5:0)
  - San Juan CD (1:0)
  - EAP
  - Regular calls + training

- Laboratory Contracts
  - MEL + subs for sediment
  - KCEL
  - Inter-lab comparison between MEL-KCEL
  - Rhithron
  - Clallam
  - Edge Analytical
Intended Outcomes

- Regional **status** assessment
  - Streams Within UGA
  - Streams Outside UGA
- Recommendations for **trend** monitoring
- Assessment of Stream health and related predictor variables
  - Land use
    - Basin size, land cover, impervious, forested, riparian health, road density
  - Stormwater management
    - outfall density, age of infrastructure, % UGA under stormwater treatment, etc
RSMP Mussels (Winter 2015–16 and 2017–18)
(~$270K each winter)

- WA Dept of Fish & Wildlife – Jennifer Lanksbury (lead)
  - 40 UGA shoreline sites – randomly drawn
  - Caged mussels deployed at sub-tidal sites for ~4 months
  - Penn Cove - *Mytilus trossulus*
    - Similar age – pre-sorted and bagged
  - Chemistry
    - PCBs, PBDEs, OCPs, PAHs, and metals (As, Cu, Cd, Hg, Pb, Zn)
- Results compared to targeted site results.
  - Lanksbury 2014 pilot study, national Mussel Watch, and other sponsored sites around Puget Sound
Mussels cont’d

- Mussel Monitoring
  - WDFW 40 random RSMP sites
  - “Sponsors” additional random and targeted sites
  - Regular calls + training

- Laboratory Contracts
  - Northwest marine fisheries science center
  - KCEL

- Intended Outcomes
  - Regional **status** assessment on shorelines urban areas
    - Chemistry and biological results
  - Recommendations for RSMP **trend** program
RSMP Status and Trends Website

# RSMP components

<table>
<thead>
<tr>
<th>Status and trends</th>
<th>Effectiveness studies</th>
<th>Source ID info repository</th>
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<tbody>
<tr>
<td>• Are conditions in streams</td>
<td>• How well are management approaches</td>
<td>• Share results and identify regional</td>
</tr>
<tr>
<td>and nearshore areas getting</td>
<td>working?</td>
<td>solutions</td>
</tr>
<tr>
<td>better or worse?</td>
<td></td>
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</tbody>
</table>

![Image of status and trends](image1)

![Image of effectiveness studies](image2)

![Image of source ID info repository](image3)
RSMP Effectiveness Studies

- Mostly led by local governments, some private sub-contractors
- Steering committees: multiple agency experts and liaisons to oversee design and review deliverables
- Multi-year studies, some broken into phases for experimental design and QAPP development
- Some nationally relevant
- Some much bigger than could be funded by grant programs
RSMP Effectiveness Studies

1. Mining the existing Western Washington catch basin inspection and maintenance data for maintenance needs and cost-efficiencies
2. Paired Urban Small Stream Watershed Restoration Effectiveness Study
3. Effectiveness of Bioretention in Reducing Stormwater Flows, Pollutants and Toxicity in Federal Way
4. Stormwater Source Control at Small Businesses
5. Bioretention Hydrologic Performance Study
6. Can bioretention prevent toxicity to coho salmon exposed to road runoff?
7. Field test of plants and fungi on bioretention performance over time
8. Effectiveness of treating highway runoff to Echo Lake with LID retrofits
9. Quantifying the Impact of Voluntary Private Property Rain Gardens across Puget Sound
10. Efficacy of current rain garden installations at interrupting PCB cycling

6 studies began this year
1 in contracting process
Effectiveness Study Objectives

- **Urban Small Stream Watershed Scale Retrofit and Restoration**
  - Assess cumulative stormwater retrofit actions and impacts to local streams, and determine the target for a recovered condition

- **Reducing stormwater flows, pollutants and toxicity by bioretention**
  - Regional stormwater facility retrofit will evaluate benefit of additional stormwater detention and treatment to W Hylesbos creek where only 23 of 212 acres were previously treated
  - Evaluate benefit to stormwater quality discharged to Echo Lake due to dozens of small retrofits along highway at a sub-basin scale

- **Prevention of toxicity to coho salmon by bioretention**
  - Evaluate treatment by filtration through engineered “60/40” soil mix required by Ecology’s Stormwater Management Manual
Toxicity reduction study findings

**Interim Results**

- “…all of the [adult] coho exposed to the unfiltered runoff were dead at the end of the exposure period, whereas all of the coho exposed to the filtered runoff or to well water were still alive at the end of the exposure period.”

- “…embryos exposed to the 7 episodes of filtered runoff were not different than controls.”

60/40 mix prevents toxicity to coho salmon
Effectiveness Study Objectives

- Bioretention Hydrologic Performance Study
  - Assess facilities designed and built according to Ecology’s manual around the region

- Stormwater Source Control at Small Businesses
  - Evaluate several jurisdictions’ business inspection programs

- Raingarden Effectiveness Survey
  - Develop a regional survey and data repository to evaluate effectiveness of voluntary raingardens and bioretention programs
RSMP Effectiveness Study Website

Effectiveness Monitoring of Stormwater Management Program Activities

**Goals:** to provide widely applicable information about what works and what doesn’t work in certain situations, and how to improve stormwater management.

**Timeline for permittee-funded work:** Studies will begin in fall 2014. The process to transition from the list of study topics and questions to study designs and scopes of work is underway.

**RSMP Effectiveness Studies beginning in fall 2014**

**Bioinfiltration toxicity reduction** (US Fish and Wildlife Service)

- **Scope of Work**
- Deliverables: D1-3.2, D3.3, D4.1, D4.2

**Echo Lake highway retrofits** (King County)

- **Scope of Work**
- Deliverables:
  - Task 1 D1.1 D1.2 D1.3 D1.4
  - Task 2 D2.1 D2.2 D2.3 D2.4
  - Task 3 D3.1 D3.2
  - Task 4 D4.1 D4.2 D4.3
  - Task 5 D5.1 D5.2 D5.3 D5.4 D5.5 D5.6
  - Task 6 D6.1 D6.2 D6.3 D6.4 D6.5 D6.6 D6.7

**Federal Way bioinfiltration and pond retrofits** (King County)

- **Scope of Work**
- Deliverables:
  - Task 1 D1.1 D1.2
  - Task 2 D2.1 D2.2 D2.3 D2.4 D2.5 D2.6
  - Task 3 D3.1 D3.2 D3.3
  - Task 4 D4.1 D4.2 D4.3 D4.4
  - Task 5 D5.1 D5.2 D5.3 D5.4 D5.5 D5.6 D5.7 D5.8 D5.9
  - Task 6 D6.1 D6.2 D6.3 D6.4 D6.5

**Paired urban watershed retrofits** (City of Redmond)

- **Scope of Work**
- Deliverables:

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RSMP components

- **Status and trends**
  - Are conditions in streams and nearshore areas getting better or worse?

- **Effectiveness studies**
  - How well are management approaches working?

- **Source ID info repository**
  - Share results and identify regional solutions
Identify patterns in results/findings from local governments’ work to reduce illicit discharges:

- Use the data to set priorities for developing new approaches

Identify & prioritize new methods

- Build on Field Screening Manual
- Create an easy-to-use online library
RSMP SIDIR Task Objectives

- Analyze Illicit Discharge Detection and Elimination (IDDE) incident data submitted by permittees in their annual reports
  - What are most common IDDE sources?
  - What can the state/region do to help local governments deal with these sources?
    - Education, training, new licensure requirements, regulations, product bans or substitutions...
    - Communication between local governments
RSMP Administration

Regional Stormwater Monitoring Program Quarterly Report

For January 1 through March 31, 2015

RSMP accomplishments and key decisions reported for the quarter

- Stream monitoring for monthly water quality began in January 2015 and will go thru December 2015 at 60 sites.
  - First quarter data deliverables are arriving to RSMP Coordinator.
- Agreements for four effectiveness studies were officially signed and completed. The scope of work for one more effectiveness study was finalized and for another effectiveness study is being revised.
- Scope of work for illicit discharge information compilation, evaluation, and analysis was finalized.
- Nearshore mussel monitoring agreement was scoped out and nearly finalized.
- The Pooled Resources Oversight Committee agreed to a process for review and approval of RSMP deliverables.
- All RSMP deliverables received and approved by Ecology are posted at the RSMP website

RSMP budget for the previous quarter and anticipated for the coming quarter

Table 1 shows detail for each RSMP component and for the whole program. Encumbrances in excess of projected revenues will be for projects spanning multiple years. The 2015 streams sampling will be paid partly before August 2015 permits issuance payments are due and partly (mostly) after. Table 2, which captures the current RSMP expenditures, includes the
three RSMP components. The total balance and anticipated expenditures for the coming quarter include Ecology's administrative expenses.

Table 1. Summary of revenues, expenditures, encumbrances, and available funds for each RSMP component

<table>
<thead>
<tr>
<th></th>
<th>Status and trends (4-year project total: $3,838,710)</th>
<th>Effectiveness studies (4-year project total: $6,299,283)</th>
<th>SIDIR (4-year project total: $677,250)</th>
<th>RSMP total (4-year project total: $10,615,198)</th>
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<tbody>
<tr>
<td>Balance at start of quarter</td>
<td>$926,269</td>
<td>$873,406</td>
<td>$1,574,808</td>
<td>$1,518,215</td>
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<td>Revenues</td>
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<td>$0</td>
<td>$0</td>
<td>$0</td>
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<td>Expenditures</td>
<td>$86,956</td>
<td>$515,010</td>
<td>$56,593</td>
<td>$200,474</td>
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<td>Balance at end of quarter</td>
<td>$873,406</td>
<td>$515,010</td>
<td>$1,518,215</td>
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<td>Encumbrances</td>
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<td>$1,646,121</td>
<td>$1,917,323</td>
<td>$2,179,375</td>
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</tbody>
</table>

Questions?

RSMP Coordinator
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SWG Program Manager
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Websites
- www.ecy.wa.gov/programs/wq/storwmater/municipal/rsmp
- www.ecy.wa.gov/programs/wq/psmonitoring/swworkgroup
Lower Columbia Habitat Status and Trends Monitoring Program

Currently participate in two RSMP components
- Effectiveness studies
- SIDIR

Just developed a receiving water study design
- Ecology-funded, stakeholder driven effort

Starting to discuss implementation
- What are the recommended roles for permittees and other agencies doing the monitoring?
- Caucus approach to making stakeholder recommendations – due to Ecology in April 2016
Strata and Site Allocation

Where and how to focus monitoring resources in this landscape?

- NPDES permit areas
- "Urban" areas, also with NPDES permits
- Other urban areas
Potential water quality sites/subwatersheds INSIDE boundaries of NPDES cities in Clark Co Count: ~16

LC_MasterSample.DArea
- 640–3,000 acres
- 3,000–12,000 acres
- >12,000 acres
Potential water quality sites/subwatersheds OUTSIDE boundaries of cities in Clark Co Count: >60
Potential water quality sites/subwatersheds INSIDE city boundaries
Count: ~8
<table>
<thead>
<tr>
<th>PARAMETERS</th>
<th>&quot;Conventional&quot; stormwater pollutants</th>
<th>RSMP</th>
<th>Earlier LCHSTM proposal</th>
<th>WA WQI</th>
<th>USGS NAWQA</th>
<th>LC HSTM February 2015</th>
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<tbody>
<tr>
<td>Water Temperature</td>
<td>X</td>
<td>X</td>
<td>hourly</td>
<td>B</td>
<td>X</td>
<td>Xc</td>
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<tr>
<td>Sediment metals</td>
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<td>Xa</td>
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<td>Conductivity</td>
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<td>monthly</td>
<td>A</td>
<td>X</td>
<td>Xc</td>
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<td>Total Nitrogen</td>
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<td>annually</td>
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<td></td>
<td></td>
<td>Xa</td>
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</table>

* = under consideration
Xa = annual data collection
Xc = continuous collection
X⁵ = once per five years

A,B are **signal to noise** grades

Some habitat measures included, too
Implementation planning

- Confirm sites
  - Decide whether/how to include “legacy” sites in a “pseudo-probabilistic” modified design
- Confirm sampling frequency and metrics
  - Improve budget estimates
- Identify who will do the monitoring
- Decide how to collect and manage funds
  - Same approach as RSMP or something different?
  - Provide compliance pathway for permittees
- Finalize the QAPP
Stormwater Management Effectiveness Studies in Eastern Washington

Art Jenkins
City of Spokane Valley
Ten “islands” of urban areas covered
Not looking at receiving water monitoring, focusing only on effectiveness studies
Permittee-led, Ecology-supported process to define regional studies
Questions?