How Do You Know That Your Stormwater Program is Working?

Developing Measuring Sticks to Demonstrate Effectiveness

- Art Jenkins, PE, CSM – City of Spokane Valley
- Aimee Navickis-Brasch, PhDc, PE, HDR Engineering Inc.
This is not the presentation you are looking for.....

- If you want the all of the answers today (and expect us to give all the answers).
- If you already know all of the answers, and ......
- You know that those answers are true, consistent, and relevant to your programs.
- If you are not willing to work or expend resources to find the answers.
This is presentation will:

- Give you information on what Eastern Washington permittees are interested in knowing more about.

- Work towards answers if our Stormwater programs are working or not.

- ...and point us towards improvements and better programs.
EASTERN WASHINGTON EFFECTIVENESS STUDIES

- Phase II MS4 NDES Permit Requirement:
  - Evaluate effectiveness of stormwater management programs & activities
  - Presumptive → Demonstrative

- **EWA Stormwater Group (EWSG)**
  - 24 cities & counties
  - Lead or Participating Entity
  - 14 studies now → 8 Studies next phase

- **Study Funding**
  - Ecology Gross Grants Phase 1-3a
  - EWSG Responsible for Funding Next Phases
EWA EFFECTIVENESS STUDIES

*Phased Approach*

- **Phase 1 & 2** - Identified & Rank Studies
- **Pre-Phase 3** – Develop QAPP Templates
- **Phase 3** – Develop Experimental Design
  
  » **Phase 3a** – Detailed Study Design Proposals

  » **Phase 3b** – Quality Assurance Project Plan

- **Phase 4** - Conduct Studies
- **Phase 5** – Report Study Results → Improve Stormwater Management Program
- Repeat
S8.B Study Implementation Process/Path

**Completed June 2015**
- Phase I: Concepts/Tools
  - 100% ECY Grant
  - 12-15 Study Ideas (SIs)
  - List Ways to Fund SIs
  - Tools to decide how to participate in "regional studies"

**By June 2016**
- Phase II: Partnerships
  - 100% ECY Grant
  - ID lead entities (LE) and Participating Permittees (PPs) for each study idea
  - Rank/Submit 12-15 SIs
  - ID Funding partnerships
  - EWG endorses Implementation Plan

- S8.B.2 & 3
  - What is important?
  - Who will do it?
  - How much will it cost?

**By June 2017**
- Phase IIIa: Proposals
  - Study Teams work on detailed Study Design Proposals (SDPs) w/consultant(s)
  - Submit SDPs for 8-12 SIs by 6/30/2017
  - ECY REVIEW

- S8.B.4, 5, & 6
  - How will selected studies be implemented, data collected?

- Phase IIIb: Design
  - w/in 6 months of ECY approval of SDP(s), QAPP’s are completed
  - ECY review/approval w/in 90 days

- S8.B.7, 8, 9, & 10
  - What are the results & recommendations?

**Phase IV: Study Work**
- Start work on 4 studies w/in 6 months of ECY approval
- Start work on 4+ studies w/in 15 months of ECY approval
- Interim Reporting
- EIM data entry
- Final Results Reporting and Recommendation

Revised 25 MAY 2016
EWA EFFECTIVENESS STUDIES
PHASE 3 - PROPOSAL & QAPP

- EWA Effectiveness Studies include 3 Classifications of BMPs:
  - Structural, Operational, Education & Outreach
- Ecology QAPP Guidelines → Structural BMPs
- BMP Classifications Influence Experimental Design
  - Variables that affect quality differ
  - Potential sources of error differ
- Phase 2 – Develop QAPP Template
  - Define Required Content for Proposal and QAPPs
  - Address Differences in BMP Classifications

Eastern Washington Stormwater Effectiveness Studies

INTRODUCTION TO THE STUDIES AND PHASE 3 QUALITY ASSURANCE PROJECT PLAN (QAPP) TEMPLATES FOR:

- STRUCTURAL BMPs
- OPERATIONAL BMPs
- EDUCATION & OUTREACH
STRUCTURAL BMP STUDIES

- Constructed Facility
  - Study Goal - Evaluate runoff treatment and/or flow control effectiveness of a constructed BMP

- Studies Classified as Structural BMPs:
  - Use of Non-Vegetative Swale with Native Soils
  - Sand Filter Vault BMP
  - Catch Basin Retrofit Device Placement
  - Long-term Permeable Pavement Sidewalk Infiltration Performance

- Data Collection:
  - water quality samples, flow rate, precipitation depth

- Data Quality Indicators:
  - Precision, Bias, Representativeness, Completeness, Comparability, and Sensitivity
OPERATIONAL BMP STUDIES

- Maintenance Practices (Non-Structural BMP)
  - Study Goal - Evaluate practice for reducing pollutant runoff from municipal operations.

- EWA Effectiveness Studies Classified as Structural BMPs:
  - Street Sweeping and Catch Basin Cleaning Comparison
  - Seasonal Differences in Street Sweeping Material Removal
  - BMP Inspection and Maintenance Responsibilities

- Data Collection:
  - Water quality and street/catch basin sediment samples (analytical testing), sediment accumulation

- Data Quality Indicators:
  - Precision, Bias, Representativeness, Completeness, Comparability, and Sensitivity
EDUCATION & OUTREACH STUDIES

- Stormwater Education Program, Materials, and/or Outreach
  o Study Goal – evaluate effectiveness of E&O program for informing public about the impacts of SW discharges

- EWA Effectiveness Studies Classified as Structural BMPs:
  o Modernizing Education and Outreach Strategies
  o Mobile Contractor Illicit Discharge Education
  o Stormwater BMP Owner Awareness

- Data Collection:
  o Survey responses, focus groups, observations of human behavior

- Data Quality Indicators:
  o Validity, Reliability, Objectivity, Credibility, Transferability, Completeness, and Integrity
| EWG Rank | Study Idea Title                                                                 | City of Richland | City of Kennewick | City of Pasco | West Richland | Yakima County*** | Sela*** | Union Gap*** | Sunnyside*** | City of Yakima | City of Wenatchee*** | Chelan County* | City of East Wenatchee*** | Spokane County | City of Spokane Valley | Asotin County*** | Asotin County*** | Clarkston*** | Ellensburg County*** | Walla Walla County*** | Quad-Cities | Yakima Regional*** | Wenatchee Regional*** | Spokane Regional*** | Asotin Regional*** | EWSG Score |
|----------|-----------------------------------------------------------------------------------|------------------|------------------|--------------|---------------|-----------------|---------|-------------|-------------|---------------|----------------------|----------------|------------------------|-----------------|----------------------|----------------|-----------------|--------------|-----------------------|-----------------|-----------------|------------------|--------------------|-----------------|-----------|
| 1        | Modernizing Education and Outreach Strategies                                      | 2                | 3                | 2            | 2             | 3               | 3       | 3           | 3           | 3             | 3                    | 3              | 3                      | 3                | 3                    | 2             | 2               | 3             | 3                  | 3            | 3               | 3                | 2.58               | 2.54            | 2.50      |
| 2        | Use of Non-vegetative Swale with Native Soils                                     | 3                | 3                | 3            | 3             | 3               | 3       | 3           | 3           | 3             | 3                    | 3              | 3                      | 3                | 3                    | 3             | 3               | 2             | 3                  | 3            | 3               | 2                | 2.54               | 2.54            | 2.50      |
| 3        | Street Sweeping & Catch Basin Cleaning Comparison                                   | 2                | 3                | 2            | 2             | 2               | 2       | 2           | 3           | 3             | 3                    | 3              | 3                      | 3                | 3                    | 2             | 3               | 2             | 3                  | 2            | 3               | 3                | 2.54               | 2.54            | 2.50      |
| 4        | Mobile Contractor Illicit Discharge Education                                      | 2                | 3                | 2            | 2             | 3               | 3       | 3           | 3           | 3             | 3                    | 3              | 3                      | 3                | 3                    | 3             | 3               | 1             | 2                  | 2            | 2               | 3                | 2.54               | 2.54            | 2.50      |
| 5        | Sand Filter Vault BMP                                                              | 2                | 2                | 1            | 3             | 2               | 2       | 2           | 2           | 1             | 3                    | 1              | 1                      | 1                | 3                    | 2             | 2               | 2             | 2                  | 1            | 3               | 3                | 2.54               | 2.04            | 2.04      |
| 6        | BMP Inspection and Maintenance Responsibilities                                     | 2                | 3                | 3            | 3             | 3               | 3       | 3           | 2           | 1             | 3                    | 1              | 3                      | 2                | 1                    | 1             | 1               | 2             | 3                  | 1            | 2               | 1                | 2.00               | 2.00            | 2.00      |
| 7        | Seasonal Differences in Street Sweeping Material Removal                           | 2                | 2                | 2            | 1             | 1               | 1       | 1           | 1           | 2             | 3                    | 2              | 2                      | 1                | 1                    | 1             | 1               | 3             | 3                  | 3            | 2               | 3                | 2.00               | 2.04            | 2.00      |
| 8        | Catch Basin Retrofit Device Placement                                              | 2                | 2                | 3            | 1             | 2               | 2       | 2           | 2           | 3             | 2                    | 3              | 2                      | 1                | 2                    | 1             | 2               | 2             | 2                  | 1            | 3               | 2                | 2.00               | 2.00            | 2.00      |
| 9        | Stormwater BMP Owner Awareness                                                     | 2                | 3                | 3            | 1             | 2               | 2       | 2           | 2           | 3             | 2                    | 3              | 2                      | 1                | 1                    | 1             | 1               | 1             | 1                  | 3            | 1               | 3                | 2.00               | 2.00            | 2.00      |
| 10       | Determining Pollutant Contributions from Municipal Stormwater in EWA using GIS    | 1                | 2                | 1            | 1             | 2               | 2       | 2           | 2           | 1             | 2                    | 1              | 2                      | 1                | 2                    | 1             | 3               | 3             | 3                  | 2            | 1               | 1                | 1.92               | 1.79            | 1.78      |
| 11       | 27a Media Thickness Study                                                           | 3                | 3                | 1            | 1             | 2               | 2       | 2           | 2           | 1             | 2                    | 1              | 2                      | 1                | 2                    | 1             | 3               | 3             | 3                  | 2            | 1               | 1                | 1.92               | 1.79            | 1.78      |
| 12       | Sharp Ave Porous Pavement Study                                                    | 2                | 1                | 1            | 1             | 1               | 1       | 1           | 1           | 2             | 2                    | 2              | 2                      | 3                | 3                    | 2             | 2               | 2             | 2                  | 2            | 1               | 2                | 1.67               | 1.67            | 1.67      |
| 13       | Biochar Media Stormwater Treatment Study                                           | 2                | 3                | 1            | 1             | 2               | 2       | 2           | 2           | 1             | 2                    | 1              | 2                      | 1                | 3                    | 2             | 1               | 1             | 1                  | 1            | 2               | 1                | 1.67               | 1.67            | 1.67      |
| 14       | Long-term Permeable Pavement Sidewalk Infiltration Performance                     | 2                | 1                | 1            | 1             | 1               | 1       | 1           | 1           | 1             | 2                    | 1              | 2                      | 1                | 1                    | 2             | 1               | 1             | 1                  | 1            | 2               | 1                | 1.42               | 1.42            | 1.42      |
Public Comments:

Now: Check out posters around the corner and down the hall past the registration desk.

Online: Goto www.spokanevalley.org and search “Effectiveness” click on Detailed Study Design Proposals.

Fill out form(s) and either place in box at ends of tables at the conference or send to:

ajenkins@spokanevalley.org
or call 509-720-5018
Modernizing Education & Outreach Strategies

- **Study Goal**: determine the effectiveness of various new communication technologies (NCT) to convey messages that protect stormwater

- **Conceptual Study Approach**:
  - assess effectiveness of different methods for communicating information (existing & NCT)
  - define message
  - deploy message through various NCT
  - evaluate reception of message

- **Data Collection**: Data will be collected through surveys (multiple choice and yes/no questions) disseminated using mailers, websites, social media, apps, etc.
BMP Inspection & Maintenance Responsibilities

- **Study Goal:** Determine effective ways that municipalities ensure that privately owned BMPs that flow to municipal systems are maintained.
- **Conceptual Study Approach:** A survey and/or interview will be conducted of 10 to 15 municipalities in Washington State to determine how they address the long-term needs of privately-owned structural BMPs.
- **Data Collection:** Survey/Interview questions will focus on: inspection strategies and frequency, funding, access, etc.
Mobile Contractor Illicit Discharge Education

- **Study Goal:** Evaluate the effectiveness of education and outreach to mobile contractors (refined to target carpet cleaners Spring 2017) on allowable collection and disposal practices for their wastewater.

- **Conceptual Study Approach:** evaluate the “Dump Smart” program in the Wenatchee area and compare to other areas of Eastern Washington, which used social marketing strategies to develop and deliver a targeted E&O program.

- **Data Collection:** information regarding mobile contractors will be collected through surveys, interviews, and/or focus groups.
Stormwater Best Management Practice (BMP): Owner Awareness

- **Study Goal:** assess BMP owners’ general knowledge of the type of structural BMP on their property, proper operate/maintain

- **Conceptual Study Approach:** Survey residential, commercial, and industrial owners of different BMP types: filters, detention ponds, vegetated filter strips, and bioretention swales.

- **Data Collection:** responses to survey questions to gauge owner’s awareness BMP M&O requirements
Street Sweeping & Catch Basin Cleaning Comparison

- **Study Goal:** Determine if street sweeping and/or catch basin cleaning is more effective at removal of road solids during certain times.

- **Conceptual Study Approach:**
  - 8 months from Spring through Fall
  - Arterial street with no trees or parking
  - Swept on one side/month
  - Other side only catch basins are cleaned/month

- **Data Collection:**
  - Scuppers at each outfall to measure sediment bypass
  - Catch basins outfitted with gauges on four sides
  - Measurements monthly
Seasonal Differences in Street Sweeping Material Removal

- **Study Goal**: evaluate seasonal and/or regional differences in sediment and pollutant accumulations to optimize street sweeping programs
- **Conceptual Study Approach**:
  - Selected roadways in participating communities would be tested and swept on a periodic (monthly) basis.
  - Street dirt would be collected from test strips just prior to and directly after sweeping.
- **Data Collection**: amount of street dirt prior to and directly after sweeping, material gradation, organic vs inorganics, street type and conditions, land use, region, street/location
Determining and Comparing Pollutant Contributions from Program Cost Effectiveness using GIS

- **Study Goal**: estimate the contribution of stormwater pollutants from various municipalities’ outfalls to receiving surface waters of the state.

- **New Study Goal**: compare the cost effectiveness of areas where stormwater bmps infiltrate to ground, versus UIC, versus outfall to surface waters of the State.

- **Conceptual Study Approach**:  
  - Collect existing mapping of storm sewer systems and outfall locations
  - Input data to a GIS database along with characterizing the contributing basins area

- **Data Collection**: Stormwater system mapping, information on land use(s), topography, basins discharging to surface waters, climate, etc.
Long-term Permeable Sidewalk Infiltration Performance

- **Study Goal:** Determine the long term effectiveness and durability of permeable pavement sidewalks in Eastern Washington.

- **Conceptual Study Approach:**
  - Segments of permeable pavement sidewalks would be tested in participating communities in similar land use areas. No maintenance would occur during the testing even if a decrease in infiltration rates occurs.

- **Data Collection:**
  - The infiltration rate would be measured twice a year for up to a 10 year period at multiple locations.
  - A qualitative visual assessment would also be completed annually to track pavement durability.
Catch Basin Retrofit Device Placement

- **Study Goal:** determine pollutant removal effectiveness of catch basin insert at multiple catch basins in a system versus one at the end of the system prior to discharge

- **Conceptual Study Approach:**
  - Select 2 Similar catchments to evaluate and compare
  - In one catchment, each catch basin would contain an insert;
  - In the other, only the final catch basin in the series would receive an insert.

- **Data Collection:** At specific intervals the quantity of oil and grease, solids, floatables, and other associated pollutants will be estimated in the catch basins in both test catchments. The total amount of material removed would be quantified for each system and compared.
Use of Non-vegetative Swale with Native Soils

- **Study Goal:** test ‘no plants’ option for BMPs that are typically vegetated, determine pollutant treatment in non-irrigated locations
- **Conceptual Study Approach:** A non-vegetated soil mix will be compared to a soil mix with vegetation
- **Data Collection:** Water quality samples taken below the treatment columns of BMPs will be compared to water quality samples of incoming stormwater to determine the treatment effectiveness of each BMP
Biochar Media Stormwater Treatment Study

- **Study Goal:** evaluate stormwater treatment performance of bioretention soil media mix amended with biochar

- **Conceptual Study Approach:** a bioretention soil media mix was installed in the Cochran Basin of Spokane which will be field monitored

- **Data Collection:** Collect and analyze influent and effluent stormwater; evaluate effectiveness of bioretention soil mix for meeting Ecology performance standards
Sharp Avenue Permeable Pavement Study

- **Study Goal**: assess the effectiveness with respect to durability, water quality, and long term infiltration performance

- **Conceptual Study Approach**: Construct permeable pavement test sections on an urban arterial and conduct field monitoring

- **Data Collection**: sample data collection will include durability, water quality (influent and effluent), and infiltration rates
Sand Filter Vault BMP

- **Study Goal**: to develop a sand filter media mix that can be installed in vaults and catch basins to reduce stormwater pollutants

- **Conceptual Study Approach**: to evaluate the media mix using runoff from 24,000 square feet of a high ADT urban arterial roadway

- **Data Collection**: The influent and effluent concentrations will be analyzed and compared to determine the reduction of each pollutant using 12 rainfall (qualifying) events.
Media Thickness Study

- **Study Goal**: determine optimal media depths for maximizing performance and cost effectiveness for bioinfiltration BMPs in Eastern Washington

- **Conceptual Study Approach**:
  - A bioinfiltration BMP pond was constructed with 2 cells each with a different media depth: 12 and 18 inches.
  - Determine treatment efficiency of each cell; and the treatment efficiencies of each cell will be compared.

- **Data Collection**: Influent and effluent from each of the treatment cells will be collected during qualifying storm events using automated sampling techniques and analyzed for pollutants of concern
Media Component Study

- **Study Goal:** develop a soil media mix suitable for EWA climatic conditions; composed of materials readily available in the area

- **Conceptual Study Approach:**
  - Utilize existing test-site from Study 27a.
  - Media in each of the cells could be replaced to test the relative effectiveness of different media types

- **Data Collection:** Influent and effluent from each of the treatment cells will be collected during qualifying storm events using automated sampling techniques and analyzed for pollutants of concern
Search: “effectiveness”
EW Effectiveness Studies - Spokane Valley, WA
www.spokanevalley.org/content/6335/6914/6301/.../default.aspx
Determining the Effectiveness of Municipal Stormwater Practices and Activities in Eastern Washington. Stormwater management programs are required by the ...

Determining the Effectiveness of Municipal Stormwater Practices ...
www.spokanevalley.org/.../Public_Open_House_16_June_2016_Announcement.pdf
File Format: PDF/Adobe Acrobat
Determining the Effectiveness of Municipal Stormwater Practices & Activities in Eastern Washington. Save the Date: 16 June 2016, 10:00 am to Noon.

2014.04-21 RFQ Effectiveness Study Development - Laserfiche ...
laserfiche.spokanevalley.org/WebLink8/0/doc/12/0050/Pages1.aspx
Apr 17, 2014 ... Washington Effectiveness Study Development —Phase 1. STATE of WASHINGTON County of Spokane AFFIDAVIT of PUBLICATION NO.

News Feed
www.spokanevalley.org/controls/NewsFeed.aspx?FeedID=1007
Apr 4, 2014 ... REQUEST FOR QUALIFICATIONS (RFQ) #14-023. Planning and Engineering Services for the Eastern Washington Effectiveness Study ...

June 18th, 2016 EWSG Agenda
www.spokanevalley.org/.../June_18th_2016_EWSG_Agenda.pdf
File Format: PDF/Adobe Acrobat
Determining the Effectiveness of Municipal Stormwater Practices and Activities in Eastern Washington. Meeting called by Eastern Washington Stormwater ...

Human Resources Manager
www.spokanevalley.org/filestorage/6962/6927/.../HR_Manager.pdf
File Format: PDF/Adobe Acrobat
determines the effectiveness of the program and recommends modifications to the policies...
Determining the Effectiveness of Municipal Stormwater Practices and Activities in Eastern Washington

Stormwater management programs are required by the Washington State Department of Ecology (Ecology) to choose and implement practices and activities, many of which are presumed to be effective at minimizing or eliminating pollution to surface waters of the State. Municipal stormwater managers from various cities and counties in eastern Washington are working to prioritize and answer questions about the effectiveness of these presumed practices and activities.

Ecology regulates 18 cities and 6 counties in eastern Washington for municipal stormwater discharges to surface waters of the State through a permit. The permit requires collaboration and implementation during the next several years to develop stormwater effectiveness studies. The City of Spokane Valley Stormwater Utility applied to Ecology and received grant funding to help the City and other communities in Eastern Washington develop meaningful effectiveness studies and meet permit requirements.

Key Documents

- Public Open House June 16th, 2016
- June 16th, 2016 EWSG Agenda
- Implementation Plan
- Phase 1 Study Report
- Phase 2 Ranked List of Study Ideas
- Ecology Permit
Any questions?