Notes from Stakeholder Workshop 4

WRIA 9 Stormwater Retrofit Plan

February 27, 2014, Tukwila Community Center

Attendees

Last Name	First Name	Organization
Brandt	Julie	Parametrix
Buckley	Kevin	SPU
Carlaw	Tim	Auburn
Carlson	Carla	Muckleshoot
Carlstad	Cynthia	Carlstad Consulting
Coccoli	Holly	Muckleshoot
Crane	Paul	Everett
Crawford	Curt	King County
de Leon	Dana	Tacoma
DeGasperi	Curtis	King County
Dettelbach	Anne	Ecology
Dillon	Patty	NHC
Duffner	Bob	Port of Seattle
Funke	David	King County
Gates	Tim	Commerce
Gilbertson	Shawn	Kent
Gold	Sam	NHC
Hartje	Toni	King County
Horner	Richard	UW
Istanbulluoglu	Erkan	UW
James	Andy	UW
Jones	Larry	King County
Jonson	Claire	King County
Kellogg	Tamie	Kellogg Consulting
Keune	Jennifer	King County
Knutson	Chris	King County
Lamensdorf-Bucher	Jane	King County
leDoux	Beth	King County
Lee	Arthur	Snohomish County
Lenth	John	Herrerra
Lyon	John	King County
Marshalonis	Dino	EPA
McCracken	Holly	SPU
McCrea	Rachel	Ecology
Miller	Ken	Federal Way
Milne	Mike	Brown & Caldwell

Mojor	Paul	Port of Seattle
Navetski	Douglas	King County
Nix	Aaron	Black Diamond
Nolan	Joan	Ecology
Obrien	Dan	Burien
O'Brien	Ed	Ecology
Ostergaard	Elissa	King County
Palmer	John	EPA
Peloza	Bill	Auburn
Rapin	Nancy	Muckleshoot
Rasmussen	James	DRCC
Roberts	Mindy	Ecology
Robertson	Dennis	Tukwila
Robinett	Don	Seatac
Schaffner	Larry	WSDOT
scott	cathie	King County
Shular	Ryan	King County
Simmonds	Jim	King County
Smith	Dan	King County
Srilofung	Ken	Maple Valley
Straka	Ron	Renton
Stuart	Derek	NHC
Thorn	Chris	Auburn
Trim	Heather	Futurewise
Walker	Natasha	Kellogg Consulting
Wertz	Ingrid	SPU
White	Dave	King County
Wilcox	Michelle	EPA
Wilgus	Mark	King County
Wright	Olivia	King County
Wulkan	Bruce	PSP

Introductions

Tamie Kellogg (facilitator) did the following:

- Introduced the three elected officials in attendance.
- Asked people at each table to introduce themselves.
- Discussed the purpose of the workshop: To summarize and get feedback on the results presented in five draft reports. Four of the reports are ready for stakeholder review. The other report will be ready soon.

Jim Simmonds of King County gave recognition to the project team members.

Materials for workshop presentations can be found at http://www.kingcounty.gov/environment/watersheds/green-river/stormwater-retrofit-project/documents.aspx.

Project Overview and Modeling Results

Jim Simmonds presented an overview of the project. Highlights of the presentation are as follows:

- The paradigm for stormwater management has changed over the years. Before 1992, the focus was on drainage—to efficiently convey water downhill. From 1992 through 2013, harm from new development was mitigated through flow control and treatment. The future will focus on reducing impacts from both new and existing development through detention, infiltration, and treatment to protect and rehabilitate receiving waters.
- Stormwater control in the Puget Sound area could cost an estimated $3–15 billion (capital costs, not including land and operation/maintenance costs).
- The project is funded by a grant from the Environmental Protection Agency (EPA) and matching funds from King County, University of Washington (UW), and the Cities of Auburn, Covington, and SeaTac. The Washington State Department of Ecology (Ecology) is contributing staff time.
- The project objectives were to model stormwater retrofit needs in WRIA 9 and review cost-effectiveness of mitigation options, work with stakeholders, present retrofit options to the WRIA 9 Watershed Ecosystem Forum, and extrapolate costs to the Puget Sound area.
- Stormwater retrofits are defined as construction projects to control stormwater in developed locations that are not part of redevelopment and where existing controls are inadequate.
- The project focused on streams in WRIA 9. Some areas are not included: Seattle, headwaters of Howard Hanson Dam, and Vashon Island.
- Benefits of the project include planning-level estimates of facility and funding needs, cost in relation to stream improvement, demonstration of use of modeling tools, and input for project planning, funding discussions, and future NPDES permits.
- The four-year project started in 2010 and will end in 2014. Watershed modeling was done using HSPF (Hydrologic Simulation Program-Fortran), and retrofit modeling using SUSTAIN (System for Urban Stormwater Treatment and Analysis Integration).
- Indicators used to determine the efficacy of best management practices (BMPs) were as follows:
    - Three hydrologic indicators: high pulse count (HPC), high pulse rate (HPR), and two-year peak mean winter base flow ratio (PEAK:BASE)
    - Water quality indicators: total suspended solids (TSS); total and dissolved metals (copper and zinc) and turbidity, for which there are state water quality criteria, are extrapolated through statistical relationships with TSS
    - Biological indicator: benthic index of biotic integrity (B-IBI)
- Five types of BMPs were modeled: cisterns, rain gardens, roadside bioretention, and stacked wet/dry ponds. They were grouped into treatment trains.
- Results indicate that redevelopment improves stormwater management. Nearly one-half of the project area is projected to have new or redevelopment by 2040. The trend is expected to continue beyond 2040.
- The project also assessed the impacts of climate change on modeling results. Three approaches were used. The effects of climate change on precipitation are uncertain. The need for flow control could increase by 10 percent, but the model variability is large.
- The modeling predicts that stormwater facilities will be built on one-half of the project area in the next 30 years, that stormwater facilities are needed for roads and highways, and that the

remaining needed facilities can be built as part of a public program in the next 30 years or as part of new and redevelopment by 2100.

- B-IBI with all controls in place by 2040 will be good to excellent, depending on the area.
- Estimated stormwater program capital costs for new and redevelopment are $100 million per year over 30 years for regional facilities; inspection costs for private facilities (paid by owners) increase over the period to over $100 million per year. Road and highway program costs are estimated to be $20 million per year (capital) and up to $20 M per year (operating). Costs for remaining developed land are the same as for new and redevelopment.
- The big questions that the study raises include the following:
    - How quickly do we want to improve stream flow and quality—and to what degree?
    - What are sources of capital and operating funding?
- Stakeholder input is an important part of the project. Four reports are available for review now (http://www.kingcounty.gov/environment/watersheds/green-river/stormwater-retrofit-project.aspx). Comments are due by March 20. Comments on the fifth report (posted in March) are due in April. Comments will be incorporated and all reports will be made final by the end of spring 2014.

Questions:

- Q: It will cost $100 M per year for inspection?
  A: This is the cost to inspect all facilities that are needed.
- Q: Does the data reflect existing zoning (impervious surfaces)?
  A: We used 2007 satellite interpretations for existing land uses and then used Puget Sound Regional Council (PSRC) data and the UrbanSim model to predict change over time.
- Q: Do inspection costs include maintenance?
  A: It was assumed that private owners would maintain their systems.
- Q: Was it assumed that facilities will be funded and that they will work efficiently?
  A: What is actually constructed may be different than in the model. The study estimated what is needed. It did not look at potential inefficiencies.
- Q: Were pre- and post-2040 rates of development compared?
  A: The rate of growth after 2040 was not analyzed. We are assuming that growth will continue.

Projections of Stormwater Mitigation To Be Constructed by 2040

Jeff Burkey of King County presented the methodology for predicting the amount of stormwater mitigation that will occur in the study area by 2040 and the resulting predictions:

- The study assumed that current regulations will persist in the future; however, the regulations have already undergone five evolutions and more may be coming.
- Land use will need to absorb projected population growth. The landscape can adapt in three ways: converting forests and pastures, for example, to accommodate new development, increasing footprint size or density of existing development, and making little to no change.
- PSRC population forecasts by traffic analysis zone (TAZ) for 2035 were used. About 50 percent of the growth between 2010 and 2035 in the study area will occur in unincorporated King County; 12 percent in Kent; 7 percent in Auburn; and less than or equal to 4 percent in other parts of the study area. Overall, a 25 percent increase will occur.
- UrbanSim was used to predict future (2040) land uses based on existing (2007) uses. About 84 percent of the area within jurisdictional boundaries was developed in 2007, and 92 percent will be developed by 2040. Development in the entire study area will increase from 65 to 77 percent.

- Mitigation will be required if more than 2,000 ft^2 is added, either new or replaced; more than 35,000 ft^2 is converted from forest; new impervious surface greater than 50 percent of existing impervious surface is added; or improvements increase property value by greater than or equal to 50 percent of existing value. Exceptions include variations depending on jurisdiction, different water quality criteria, and the less than 0.1 cfs threshold.
- The study identified five disturbance categories that could trigger mitigation. If land use jumps one or more categories, then future mitigation was assumed.
- Given the exceptions to current mitigation requirements and assuming one jump in land use category, it is predicted that only 47 percent (1.5 percent per year) of future development will be mitigated and that 30 percent (1 percent per year) will still need to be mitigated by 2040. This is an optimistic projection. The numbers would be reversed for two jumps in category.

Questions:

- Q: What is the basis for this pessimism?
  A: There are many exceptions and loopholes in the rules; piecemeal development can fall through the cracks.
- Q: What does the King County manual require?
  A: 5,000 ft^2 ???
- Q: Development could go up (vertically) without an increase in impervious surface?
  A: An increase in retail floor space triggers mitigation. Flow control BMPs are required for increases of 2,000 ft^2. There is an exception for 10,000 ft^2 of new facilities.

Discussions on this topic took place at each table. See Attachment B.

Results of SUSTAIN Modeling of WRIA 9 Stormwater Facility Needs

Olivia Wright of King County presented the results of the SUSTAIN modeling effort:

- SUSTAIN was used to identify the most cost-effective stormwater management strategies (combinations of BMPs for various land uses and soils) in the WRIA 9 study area; scale the results to future (2040) development; and estimate public and private program costs considering stormwater management options.
- The study area encompasses 278 square miles, divided into 28 model domains and 446 catchments.
- The modeling approach consisted of creating 135 hypothetical catchments, 100 acres each, representing combinations of land uses, soil types, slopes, precipitation zones, and land costs in the study area. Treatment trains were created based on conceptual BMP unit design assumptions: 3,000-gallon cisterns, 100 ft^2 rain gardens and roadside bioretention, 100 ft^2 pervious pavement, and 12,000 ft^2 detention ponds (average volume).
- Lifecycle cost estimates were developed for the 30-year period using 2013 dollars and a 5 percent real discount rate. It was assumed that construction of BMPs would be evenly distributed throughout the 30 years. Distinctions between private and public costs are as follows:
  - Private costs include construction and operation/maintenance of BMPs (cisterns, rain gardens, porous pavement) on private property.
  - Public costs include construction and operation/maintenance of BMPs (roadside bioretention, detention ponds) on public property, land costs for detention ponds, and inspection and enforcement costs of private and public BMPs.
- Three stormwater management options were used to scale hypothetical catchment results to future land use of the study area: (a) required stormwater management occurs with new and

redevelopment, (b) roads and highways are retrofitted with stormwater facilities, and (c) the remaining developed area is retrofitted with stormwater facilities. The combination of all options is defined as “full stormwater management.”

- The number of each type of BMP needed in 2040 and private and public costs were estimated for each option. Total public 30-year lifecycle costs could range from $3.9 billion (Option a) to $8.4 billion (full stormwater management).
- SUSTAIN predicts that for expected development without stormwater management, the biological health of streams will degrade from existing conditions through 2040. Full stormwater management is estimated to achieve 2.8 inches of flow control for development in the study area and to improve the biological health close to that of forested conditions. The risk of exceeding turbidity, dissolved copper, and dissolved zinc water quality standards is low.
- Retrofit of roads and highways is important for improving flow and water quality to conditions supportive of biological health, even though retrofit areas make up only a small portion of the study area.

Questions:

- Q: Does the conclusion regarding the low risk of exceeding water quality standards apply to all options?
  A: Yes.
- Q: The jump in costs between Options b and c is high, considering that there seems to be little improvement from retrofitting roads and highways.
  A: The options were developed based on cost-effectiveness curves.
- Q: Was the combination of Options a & c modeled?
  A: No. The model does not distinguish between total and effective impervious surface.
- Q: Did you do a sensitivity analysis on _____?
  A: The output from the 135 hypothetical catchments was quite different. Weighted averages were used for impervious areas.
- Q: How transferrable is the output to other watersheds?
  A: It is very transferrable for most of the Puget Sound area, except for places with different conditions (like Sequim).
- Q: How is B-IBI linked to hydrology? Is it driven by water quality and flow?
  A: We looked at what B-IBI could be sustained by what flow conditions.
- Q: Do costs for road and highway retrofits include land acquisition costs?
  A: Land acquisitions costs were included for detention but not for bioretention.
- Q: Is B-IBI better under full mitigation than fully forested conditions?
  A: ????
- Q: How can we use the SUSTAIN results as a tool to apply to other catchment areas?
  A: This was a planning-level study. You would need to do site-specific analyses.
- Q: What were the infiltration rate assumptions:
  A: ???
- Q: Why does full mitigation show better-IBI than fully forested in some areas?
  A: We don’t know why.
- Q: Is the difference in B-IBI statistically significant to warrant the difference in costs between options?
  A: The HPC will improve in some catchments better than in others—and more cost-effectively.

The range of HPC with full mitigation is similar to fully forested conditions. Conversion to B-IBI is where the 90 percent upper confidence limit comes in. The B-IBI was modeled based on the relationship with HPC; it is not the actual B-IBI.

Discussions on this topic took place at each table. See Attachment B.

Potential Impact of Climate Change on Stormwater Management in WRIA 9

Jeff Burkey described an assessment of the possible effects of predicted climate change scenarios on the SUSTAIN modeling results:

- The study tried to characterize local conditions based on data from existing climate change models.
- The models were consistent in their predictions of temperatures, snow pack, and water supply, but not for rainfall.
- The annual maximum daily rainfalls for all modeling scenarios were compared using relative percent difference (future − historical/historical * 100).
- Generally, the models predicted that storms would get larger but not increase in frequency. The results, however, varied widely, from -21 to +68 percent increase in volume.
- To accommodate the range in predictions, it was estimated that size of detention ponds in WRIA 9 should increase from 1 to 11 percent over sizes in the SUSTAIN modeling results.
- In terms of HPC, the study found that forested HPCs would increase. Developed landscapes may see little or no increase in frequency, just bigger storms.
- There is much uncertainty associated with using and downscaling the model results, including the emission scenarios on which the models were based and the downscaling methodology used.
- Incorporating the upper range of impact (about 10 percent) in planning for stormwater management may be an imperfect but good precautionary approach. This conclusion could be revisited when downscaled climate change modeling scenarios become available.

Questions:

- Q: ???
  A: The study assumed full capture of runoff from properties.
- Q: Summertime HPC?
  A: Two times the long-term mean.
- Q: How was evaporation incorporated?
  A: We used the modeled historical evapotranspiration.

Discussions on this topic took place at each table. See Attachment B.

Assessment of Existing Flow Control Facilities in WRIA 9

Dr. Richard Horner discussed the methods and results of an effort to estimate types and volumes of existing flow control facilities in portions of the study area:

- The Des Moines, Miller/Walker, and parts of Jenkins and Soos (Covington area) creek basins were examined to get a sense of a sample area for estimating BMPs in the whole study area.
- Flow control facilities investigated included ponds, vaults, tanks, infiltration basins and trenches, and airport runway filter strips. The study did not investigate water quality facilities. Information on flow control facilities was found in jurisdiction files, as-built drawings, design plans, and GIS output.
- Both low and high volume estimates were made:
  - Low estimates were based on the assumptions that the storage capacity equals the volume of all flow control structures and that airport runway filter strips can store 0.5 inch of rain falling on runways and strips.
  - High estimates assumed that natural-bed structures can store more than their volume and that airport runway strips can store 1 inch of rain falling on runways and strips.
- Pond and vault depths were assumed to be 5 feet when only GIS areal data was available.
- The estimated total structure storage volume ranged from 0.40−0.53 inch in Des Moines Creek basin, 0.52−0.67 inch in Miller/Walker Creek basin, and 0.39−0.49 inch in the Covington area. The average for the areas is about 0.5 inch. The estimated flow control storage requirements for various percentages of development density (impervious area) range from 1.6 inches for low urban density to 4.8 inches for intensive commercial development. The SUSTAIN model used 2.8 inches for WRIA 9.
- Estimates could be too high or too low for a number of reasons, including insufficient or missing data, water quality facilities that also provide storage, poorly maintained facilities, and dual-purpose ponds that also include wet pools for treatment.

Questions:

- Q: Could runoff be double counted in the calibration?
  A: ???

Discussions on this topic took place at each table. See Attachment B.

Summary and Key Issues

Jim Simmonds summarized findings and next steps:

- WRIA 9 needs almost 4 inches of flow control plus some treatment for all developed land.
- Feasibility studies need to be done. The length of the planning horizon is critical.
- Existing flow control facilities and new and redevelopment greatly reduce public capital needs, but the estimated capital public stormwater program costs are still high over the next 30 years

($200 million per year for capital). Operating costs will increase over time to $100 million per year with all facilities in place. Inspection/enforcement costs would also come to about $100 million per year.

- Big questions that need to be answered are as follows: (1) How quickly and to what extent do we want to improve stream flows and water quality? (2) Where does capital and operating funding come from?
- In the near term, jurisdictions need to secure money to improve knowledge about existing facilities, identify priority problems such as local flooding, assess road and highway stormwater management needs and rights-of-way for regional facilities, identify projects, and conduct feasibility studies.
- Comments are due on the four draft reports by March 20; comments on the draft existing facilities report (to be issued in March) are due in April.

Questions:

- Comment: Experience in another area indicates that it will cost about $250,000 to conduct feasibility studies and complete predesign on three to five projects.
- Q: Where are we going to get the money for an unfunded mandate? Jurisdictions and projects are competing for money in the region.
  A: One way is to set priorities on the watershed level and pool funds.
- Q: Can we achieve improved B-IBI from retrofitting alone?
  A: Probably not.
- Q: How were rain gardens determined in the modeling?
  A: We used rain garden "units."
- Q: How much is saved through wholesale cistern implementation?
  A: Economy of scale.
- Q: We are competing not only with other stormwater management projects but with other needs like public health. People are experiencing sticker shock.
  A: We have to set a goal and start somewhere, even if we make only small progress.
- Q: Would better maintenance of existing facilities improve water quality?
  A: ????

Discussions on this topic took place at each table. See Attachment B.