## Projected Changes in Extreme Precipitation *(Presenter: Guillaume Mauger, UW Climate Impacts Group)* & Climate Change Impacts on Stormwater Facility Sizing *(Presenter: Jeff Burkey, King County, Jeff.Burkey@kingcounty.gov)*

*Summary of Study Results*

Recent analysis by the King County Department of Natural Resources and Parks, University of Washington Climate Impacts Group, and Washington State Department of Ecology suggests that projected changes in heavy rain events may require larger BMPs. In short, a suite of BMPs evaluated for changes in rainfall at Sea-Tac were shown to need larger capacities to mitigate future projections of rainfall using current design standards. However, the identified relative increases needed were variable and counter-intuitive at times when considering soil infiltration capacities, levels of development, and sources of rainfall. Moreover, aside from the orographic effect of the Cascade Mountains on rainfall in the Puget Sound, a casual review of downscaled rainfall in a few other locations within King County suggests results may be different than what has been evaluated using projections associated with the Sea-Tac area. Additional research is needed to develop a more robust set of scenarios and verify these results.

## What We Will Need and What Is Currently Being Done

**The 10:45 –11:45 portion of the workshop examined current jurisdictional activities and needs related stormwater management climate resiliency (***facilitator: Peter Holte, pholte@redmond.gov)*

- Participants provided input into topic areas, processes and research needs that will help stormwater utilities prepare for and adapt to climate change impacts.

- James Rufo Hill, Seattle Public Utilities detailed how Seattle is currently using rainfall data and information on rainfall partners to better manage their system and conduct preemptive maintenance ahead of large storms.

- Several participants shared actions their utilities are taking in response to climate change. This included: the cities of Seattle, Bellevue, Sammamish, Shoreline and Renton, and Snohomish and Kitsap Counties.

**Participants offered the following topics as potential areas that need further exploration:**

- *Continued support for regional investigations and discussion on stormwater resiliency in the face of climate change*
    - Refinement, monitoring and verification of current research
    - Increasing the number of modeling simulations; use “crowd sourcing” to support this work {see related attachment from Jeff Burkey]
    - Additional forums or methods of sharing information to address technical, policy, and operational considerations

  - Integrating climate considerations into Stormwater Action Monitoring (SAM) efforts

- *Communication with various stakeholders—this includes developing support for stormwater resiliency by learning how to listen to and talk to:*
  - Utility rate payers (the public)
  - Elected officials
  - State and Federal Agencies
  - Each other

- *Looking beyond changes in stormwater volumes*
  - Changes in water temperature—impacts on habitat
  - Climate impacts that increase (or decrease) the effects of pollutants of concern in natural waterways, fish or wildlife
  - Maintenance and operation considerations

- *Climate immigration*-- Lara Whitely Binder provided context for this concern. She noted that studies have found that people's decision to move from one area to another are driven by numerous variables. At this point in time, movement of large numbers from one area to another within the US as a consequence of climate change does not seem to a pressing concern.

- *Emergency response and mapping of frequently flooded areas*
  - How will Flood Insurance Rate Maps (FIRMs) change in response to climate change?
  - Identifying and working with vulnerable populations in floodways
  - Matching the need to keep people out of harm's way vs. the need for more housing stock (Seattle)

- *Performance monitoring of stormwater BMPs*
  - "We should make sure that our models correctly predict performance" and base our response to climate change relative to how facilities are actually performing in the field
  - The role of rainwater harvesting as mitigation measure and the regulatory framework associated with this BMP

- *The process for including updated standards to stormwater manuals—*
  - How will Ecology and other manual authors respond to data and work with manual users
  - A representative from Ecology a) reminded that they supported Jeff Burkey's work, and b) said the right now they are in "information gathering and listening mode" with respect to climate change impacts and resiliency

- *Tackling jurisdictional actions*
  - Track stormwater climate resiliency work by individual jurisdictions so that we leverage information, resources and actions

- *Learning from others*
    - Are there lessons to be learned from the studies and actions conducted by other types of utilities—for example what might we learn from drinking water utilities?

## Breakout Session Notes

The following items were listed on the flip charts during the 11:40 – 12:25 breakout session. The items are provided here "as is" (i.e., as written onto the flip charts). Questions? Contact Peter Holte, City of Redmond (pholte@redmond.gov) or the listed breakout station session facilitators.

1. **How do we maximize existing asset performance given the uncertainties around resizing for climate change?** *(facilitator: Jessica Engel, King County, Jessica.Engel@kingcounty.gov)*

    - Retrofits the existing assets
        - Prioritize, reverse engineer
    - Understand flows coming out of the retention and detention
        - Look at capacity
        - Categorize performance and prioritize what needs most attention
    - Proactive maintenance before storm hits
    - Developers should be aware of these issues
    - Monitoring/stay on top of maintenance
    - WSDOT- don't retrofit to design standards
    - Asset management- wrap in climate change?
    - Look at criticality factors- what assets prioritized first?
        - Build in climate change as a part of ranking
    - Look at other subdivision, model current performance and bring up to current standards considering future conditions
    - Sediment management
    - Knowing where you will have flooding- change use of area to avoid development or certain uses+ allow it to flood
    - What do we do with info to get at implementation if there is no requirement from ECY yet?
    - Model in WWHM with new rain data, what modifications to control structures to assist with capacity
    - Analysis of current facility to see if capacity issues exist and has to increase capacity now
    - Change law (?) + outlaw structures in ponds to ensure pond is holding water during storms and not bypassing
    - Allowing certain infrastructure like pushing lots to flood or use the roads for storage
    - Land use changes
        - De-pave
        - Building up instead of out

2. **How do we build more capacity and support for addressing climate change impacts on stormwater management?** *(facilitator: Peter Holte, City of Redmond, pholte@redmond.gov)*

- Policy: how to incorporate climate impacts into all decision making (like equity)
    - Increase cultural value on climate resiliency planning
        - ex: all CIP must include climate considerations
    - Appeal to 'action orientated' or 'green' identity of elected/citizens
    - Find specific items/ actions aka 'SMART' objectives
    - Bringing reforestation/ other non-gray infrastructure into capital projects trade-offs (ex: meandrins vs. ponds)
    - Include new staff to consider climate change
    - Look at lessons learned/ planning processes of other utilities (wastewater/water)
    - Consider how to get beyond the growth mitigation mindset
- Potential Action:
    - Talk with council about climate change
    - Education others about system loading of CO2 in atmosphere
    - 'sell up' to decision makers about climate change, provide real solutions
    - Quantify uncertainty for projects (ex: Seattle Ballard tunnel)
    - Present as risk management
        - Look at Denmark- Cloud Burst program
        - Look at cost of damage in large events to leverage funds and allow decisions makers to make long-range decisions
    - Be transparent about uncertainty, it could leverage elected desire to decrease uncertainty
- Lacey Drinking Water example: sold an odd/even watering policy to avoid infrastructure development

3. **What are the technical assessment and science needs that we should be prioritizing?** *(facilitator: Jeff Burkey, King County, Jeff.Burkey@kingcounty.gov)*

- If you had to move forward now with the information you have today, what would you need to make that happen?
- Awareness- increase understanding trust. Limiting on models
    - "Stress testing"
- Increase social science + elected. Delays now increase public understanding
- What connects the public?
- How does 2080 designs impact now?
- Restoration design
- What landscape features are more sensitive?
- How about geographic/time for future? Trade space for time?
- Performance monitoring
- Cost/ benefit/ now vs. later

    - Area and land, increase floods, local services
    - Instead of more GCM/ WRF
    - How do we use current observations?
- Evaluate zoning change
- Hi-Flo bypass to receiving waters
- Water quality? Nutrients?
- Fund wholistic way, cross departments, multilevel solution
- Water support-shift from show→ rain. Keep at source (Infiltrate)

4. **How much do you plan for now versus later given the tradeoffs between costs and uncertainty (and what actions would you pursue)?** *(facilitator: Lara Whitely Binder, King County, lwbinder@kingcouny.gov)*

- Need actions that have clear benefits now (multi-use/benefits facilities)→ allows you to make that higher investment now
- Present performance as a non-binary decision (ex: 70% probability now, 50% prob in future). Prompts discussion of what else can be done now (SPU Experience)
- Actions that allow for incremental progress while maintaining options
- Look for the small & (extras) that could go a long way if done now (keep options open)→ more integrated planning
- Need to get better data that help people understand the scope and scale of the problem in ways that connect with residents (and in flood frequency)- 100 years→ 25 years
    - Need to ask the question to start with→ often not as big of a change as you think
        - How would an X% increase affect Y
- More scrutiny on life-cycle cost analysis and benefit/cost assumptions. May be more benefit than we realize; may be discounting the future too much (discount rate)
- Would need to present quantifiable costs and risks for different actions. Have to show the investment now will offset future costs
    - Supports because changes idea
- Don't frame decision as 30% bigger because rain 30% more; think about and talk about ranges (where are we on the bell curve now vs later?)
- Projected flood maps → tools to help visualize the changes and related implications
- Need equitable ways to fund and account for decision costs