Impacts of Rainfall Projections
Designing King County Stormwater Facilities

Science Seminar
November 2018
Water and Land Resources Division
Rainfall Patterns

Cascade Mountains Have Influence

Example:
• Mean Annual = 33 – 173 inches per year
Downscaling Global to Local
Atmospheric Rivers
(aka “Pineapple Express”)

[Embedded image of a weather map showing atmospheric rivers]
RCP 4.5
- 2050s Shorter, more intense
- 2080s Longer, more intense

RCP 8.5
- 2050s Very short, less intense
- 2080s More intense!
Downscaled Locations

- 24 WRF Locations
- 65 King County
- 20 Seattle
- Sea-Tac Used
Stormwater is the most significant source of pollutants to our receiving waterbodies!
Types of Stormwater Facilities Evaluated:

- Detention Ponds
- Infiltration Ponds
- Water Quality Wetponds
- Sand Filters
- Bioswales
- Bioretention
Sizing BMP facilities
### Number of BMPs Designed

- **Using 1 Location**
- **2 Land Cover Scenarios**
- **7 BMPs**
- **2 Soil Types**

= **140 BMPs Designed & Evaluated**

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<thead>
<tr>
<th>Land Cover</th>
<th>BMP</th>
<th>Soil Type</th>
<th>Historical</th>
<th>RCP 45 1980-2010</th>
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Relative % Change to 1990s
(Low Permeability)
Relative % Change to 1990s (High Permeability)

RCP 4.5 - 2080s vs 1990s
- Basic Sand Filter (dn) (sq ft): 300+% increase
- Bioretention Cell (cu. Ft): Small increase
- Detention (acre*feet): Small increase
- Wet biofiltration swale (dn) (sq ft): Small increase
- Wet biofiltration swale (up) (sq. ft): Small increase
- Wetpond (acre*feet): Small increase

RCP 8.5 - 2080s vs 1990s
- Basic Sand Filter (dn) (sq ft): 1200% increase
- Bioretention Cell (cu. Ft): Small increase
- Detention (acre*feet): Significant increase
- Wet biofiltration swale (dn) (sq ft): Small increase
- Wet biofiltration swale (up) (sq. ft): Small increase
- Wetpond (acre*feet): Small increase
Why do we compare relative to 1990s?

Model Bias!!

RCP 4.5

RCP 8.5
Summary

- Extreme Rainfall Intensities Increase Overall
- Till Soils – BMPs Generally Increase 20-40%
- Outwash Soils – BMPs Generally Increase 50-200%
- A More Disturbed Landscape has less effect on BMP designs
- RCP 8.5 Resulted in a Larger Range of BMP sizes from little difference to very large
- Substantial Model Bias Sizing BMPs when comparing Model 1990s to Historical 1990s
Recommendations in Discussion

- Guidance for Stormwater Design Manual Updates (KCSWDM)
- Require using available climate time series (bigger BMPs)
- Fee in Lieu (hold line)
- Lower redevelopment thresholds (accelerate recovery)
- Require Climate Risk Analysis (larger / riskier)
- Reserve land for future expansion of BMPs
Recommendations in Discussion

- **Incentives**
  - SWM fee discount
  - Climate Resiliency Incentive

- **Alternative Solutions**
  - Fee in Lieu (Retrofitting w/LIDs)
  - Habitat/Riparian restoration
  - High Flow By-pass
  - Land Conservation / Tree Planting / Overbank Flooding
  - Reduce TIA / Clustering
  - Bluewater BMPs (targeted flooding/storage)
Need to Know More

- Evaluate using more climate scenarios
- Evaluate at more locations
- Evaluate different Time Periods
- Evaluate more strategies
  - Design Adapt BMPs
  - Reduced TIA
  - Tree Planting / Forest Retention
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