Overview

1. Stormwater
2. Stormwater + Trees
3. Stormwater + Trees + Seattle
What is Stormwater?

- Not rain falling from sky
- Water running off impervious surface
  - 63% of Seattle is impervious
- Trees over impervious surfaces are what impacts stormwater

The Plan to Protect Seattle’s Waterways; Seattle Public Utilities, May 2015
Why Do We Care?

• Pollution
  – Carries oil, grease, and metals to our lakes, streams, rivers, and Puget Sound
• Impact to water quality
• Overflow into Combined Sewer System

The Plan to Protect Seattle’s Waterways; Seattle Public Utilities, May 2015
Why Do We Care?

The Plan to Protect Seattle’s Waterways;
Seattle Public Utilities, May 2015
Forest Standard

Forest

- 50% evapo-transpiration
- 35% surface water detained/infiltrated
- 15% surface water runoff

Organic Matter
Topsoil
Subsoil
Groundwater
Bedrock
Stormwater + Trees
Effects of Trees on Stormwater

3 Primary Processes:
- Interception
- Evapotranspiration
- Infiltration
Effects of Trees on Stormwater

3 Primary Processes:

- **Interception**
  Collection of precipitation on the tree and subsequent evaporation of moisture which would otherwise be runoff

- **Evapotranspiration**

- **Infiltration**
Effects of Trees on Stormwater

3 Primary Processes:
- Interception
- **Evapotranspiration**
  Transfer of water from the soil though leaves and eventual release (as gas) through leaves and stem
- Infiltration
Effects of Trees on Stormwater

3 Primary Processes:
- Interception
- Evapotranspiration
- Infiltration

Movement of surface water through soil, promoted by roots and duff
How Much?

Annual volume of stormwater managed by trees depends on:

• Canopy cover
• Climate
• Deciduous / evergreen
Canopy Cover

Few Trees

Abundant Trees

Arbor Day Foundation
Climate

Average Monthly Precipitation
Seattle Sea-Tac Airport, Washington

Average Monthly Precipitation
Minneapolis-St. Paul, Minnesota
Conifers Do More

• Greater biomass / surface area

• Winter vegetation

The Effects of Trees on Stormwater Runoff; Herrera Environmental Consultants, Inc., February 2008
Conifers Do More

Interception:
• 18-25% of annual stormwater on tree
• Varies depending on intensity of the storm

Transpiration: 10% annual stormwater

Total: ~ 30% annual stormwater

The Effects of Trees on Stormwater Runoff; Herrera Environmental Consultants, Inc., February 2008
Conifers Do More

The Effects of Trees on Stormwater Runoff; Herrera Environmental Consultants, Inc., February 2008
Conifers Along Streets

Conifers are difficult to fit along streets:

• Need wide planting strips; generally 10-12 feet

• Low branching habit blocks visibility
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- Need wide planting strips; generally 10-12 feet
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Deciduous is Cool Too

- Capture about ½ the stormwater volume of evergreen trees
- More available sites than evergreen trees
Deciduous is Cool Too

Maximum Benefits

Small ornamental trees
Fruit trees
Large deciduous trees
Large evergreen trees

Available Planting Space
1. Lots of rain at one time overwhelms trees

% rainfall captured by trees

Storm size

The Effects of Trees on Stormwater Runoff; Herrera Environmental Consultants, Inc., February 2008
1. Lots of rain at one time overwhelms trees
2. Atmospheric rivers will become more common

1. Lots of rain at one time overwhelms trees
2. Atmospheric rivers will become more common
3. Overall % of stormwater intercepted in a season will go down
Stormwater + Trees + Seattle
SPU Loves Trees

Trees reduce stormwater
Tree improve water quality

Seattle Public Utilities funds:
• Seattle reLeaf
• Green Seattle Partnership
• Green Stormwater Infrastructure (GSI) Efforts
What Is GSI?

“A set of distributed stormwater best management practices that use or mimic natural processes to slow, infiltrate, evapotranspire, and/or harvest and reuse stormwater runoff from impervious surfaces, on or near the site where it is generated.”

(Green Stormwater Infrastructure in Seattle, 2025 Implementation Strategy)
Urban Areas

55-70% surface water runoff (carries pesticides, silt and animal waste)

15% surface water detained/infiltrated

15-30% evapo-transpiration

0% rainfall detained

Topsoil

Subsoil

Groundwater

Bedrock
Forest Standard

Seattle reLeaf
keep the emerald city green
What is GSI?

GSI goal:
Build bioretention facilities that manage more stormwater than falls on the direct area
Stormwater + Trees Alone

Green Stormwater Infrastructure in Seattle, 2025 Implementation Strategy; Seattle Public Utilities
Stormwater + Bioretention

Is It Possible to Manage the Whole ROW?

100 sq. feet of infiltrating bioretention manages runoff from between 1075 - 2175 sq. ft of nearby impervious surface (between 11x - 22x its footprint) depending on design variables like depth, soil type, and % of annual volume managed.

Bioretention footprint required to manage polluted runoff from the whole ROW depends on soil infiltration rate and other variables — this will vary depending on site conditions.

Green Stormwater Infrastructure in Seattle, 2025 Implementation Strategy; Seattle Public Utilities
## Trees in Bioretention

### Ballard Roadside Bioretention Project

<table>
<thead>
<tr>
<th>Category</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trees removed (diseased or poorly planted)</td>
<td>4</td>
</tr>
<tr>
<td>New trees planted</td>
<td>44</td>
</tr>
<tr>
<td>Trees retained / protected</td>
<td>33</td>
</tr>
<tr>
<td>Trees transplanted</td>
<td>4</td>
</tr>
<tr>
<td>~ Gallons managed</td>
<td>1.5 million / year</td>
</tr>
</tbody>
</table>
Take Home

• Trees are important for controlling stormwater
  – Evergreens are most important in Seattle
  – Trees work best when designed along with other stormwater approaches

• Seattle invests in trees for lots of reasons, including stormwater
Stormwater + Trees + Seattle = Love