RILEY PURGATORY BLUFF CREEK
WATERSHED DISTRICT

Tree Considerations for RPBCWD's Stormwater Rule

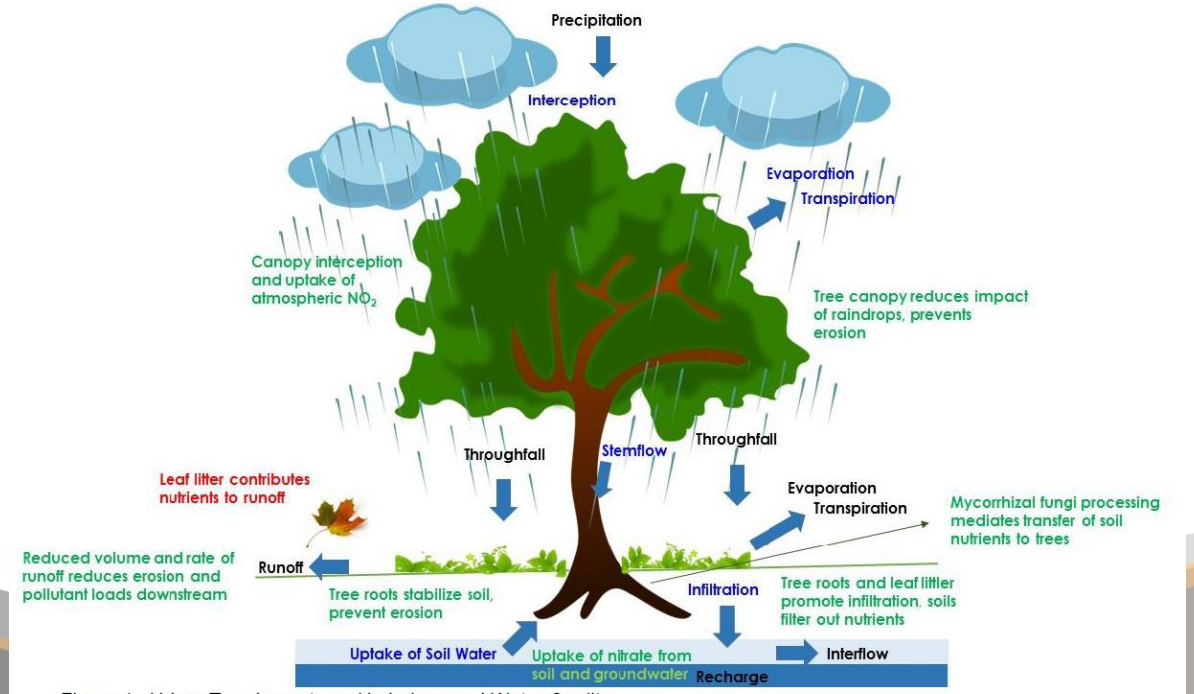

Figure 1. Urban Tree Impacts on Hydrology and Water Quality

Scott Sobiech, PE 3/8/19

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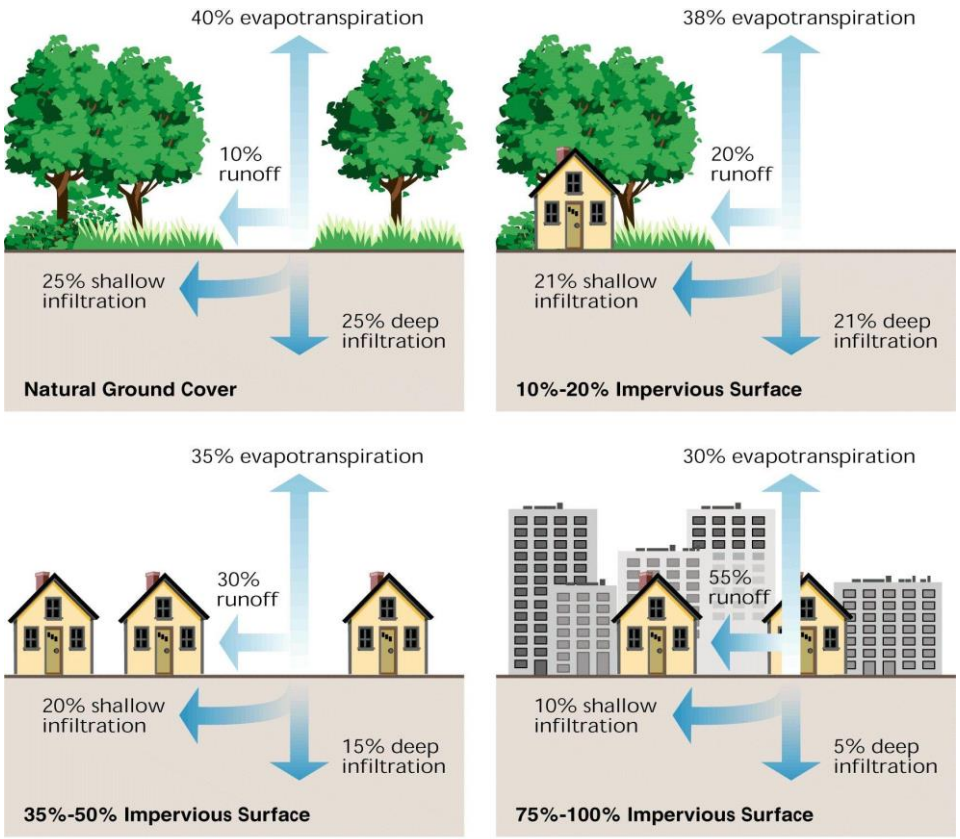
Main Regulatory Driver



Federal Interagency Stream Restoration Working Group. 1998. *Stream Corridor Restoration: Principles, Processes, and Practices.*

Impacts to Hydrology	Impacts to Stream Morphology and Habitat
Increased volumetric flow rates of runoff	Stream widening and bank erosion
Increased volume of runoff	Higher flow velocities
Decreased time for runoff to reach a natural receiving water	Stream downcutting
Reduced ground water recharge	Loss of riparian canopy
Increased frequency and duration of discharge and wetlands inundation during wet periods	Changes in the channel bed due to sedimentation
Increased frequency of bankfull and near-bank events	Increase in the floodplain elevation
Reduced stream flows and wetlands water levels during the dry season	Degradation of habitat structure
Greater runoff and stream velocities	Loss of pool-riffle structure
Increased pollutant loadings	Reduced baseflow
Increased temperature of runoff	Increase stream temperature
	Decline in abundance and biodiversity

RPBCWD Regulatory Program

- 1/1/2015 RPBCWD Board Reinstates Regulatory Program
  - Protect and Preserve Water Resources in the District
    - Conservation of resources
    - Control erosion and siltation
    - Protect Water Quality
    - Regulate and control the use of water
    - Pollution prevention
    - Regulate the use and development of land
- 10/1/2018 RPBCWD Board Approves Rule Revisions

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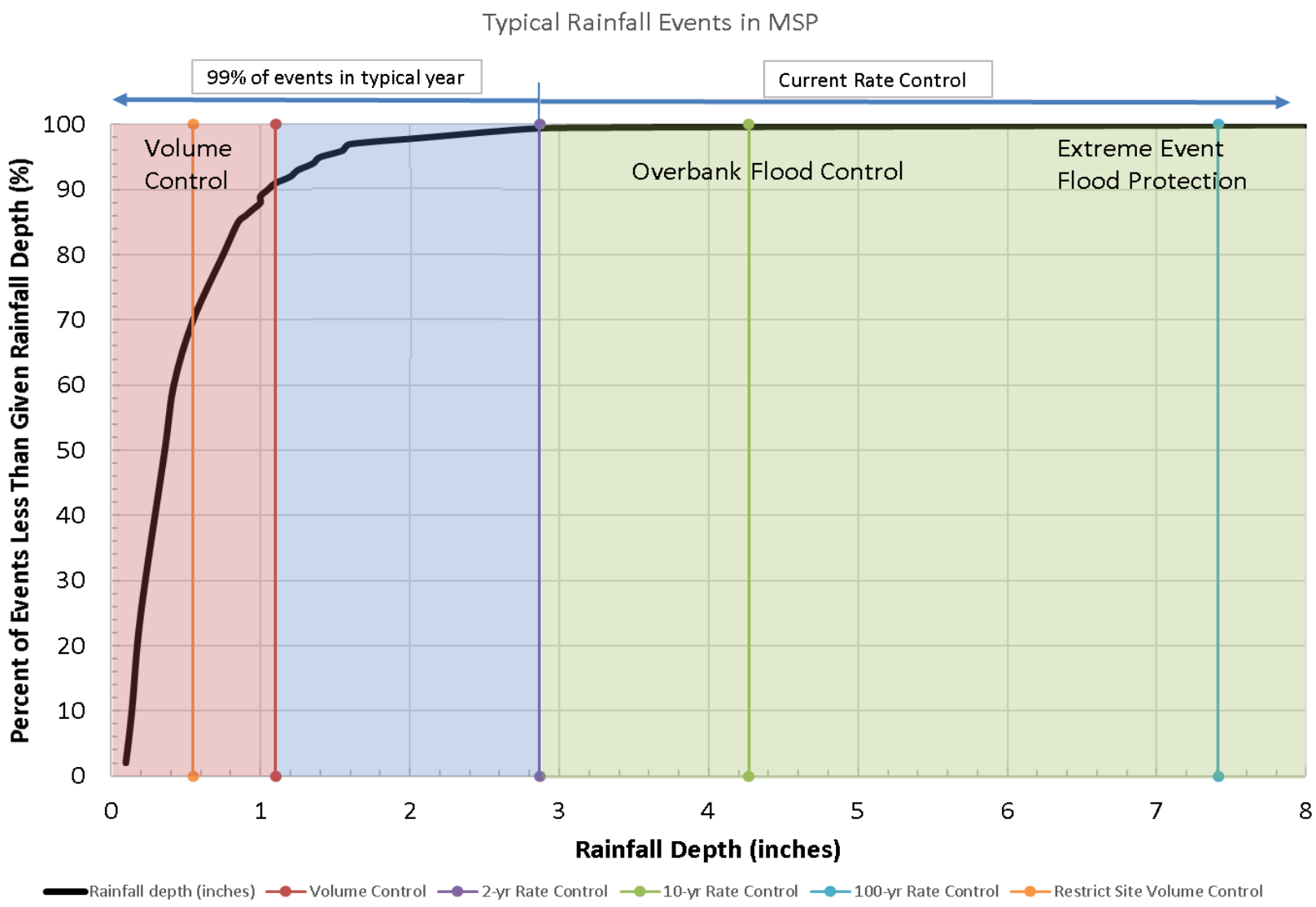
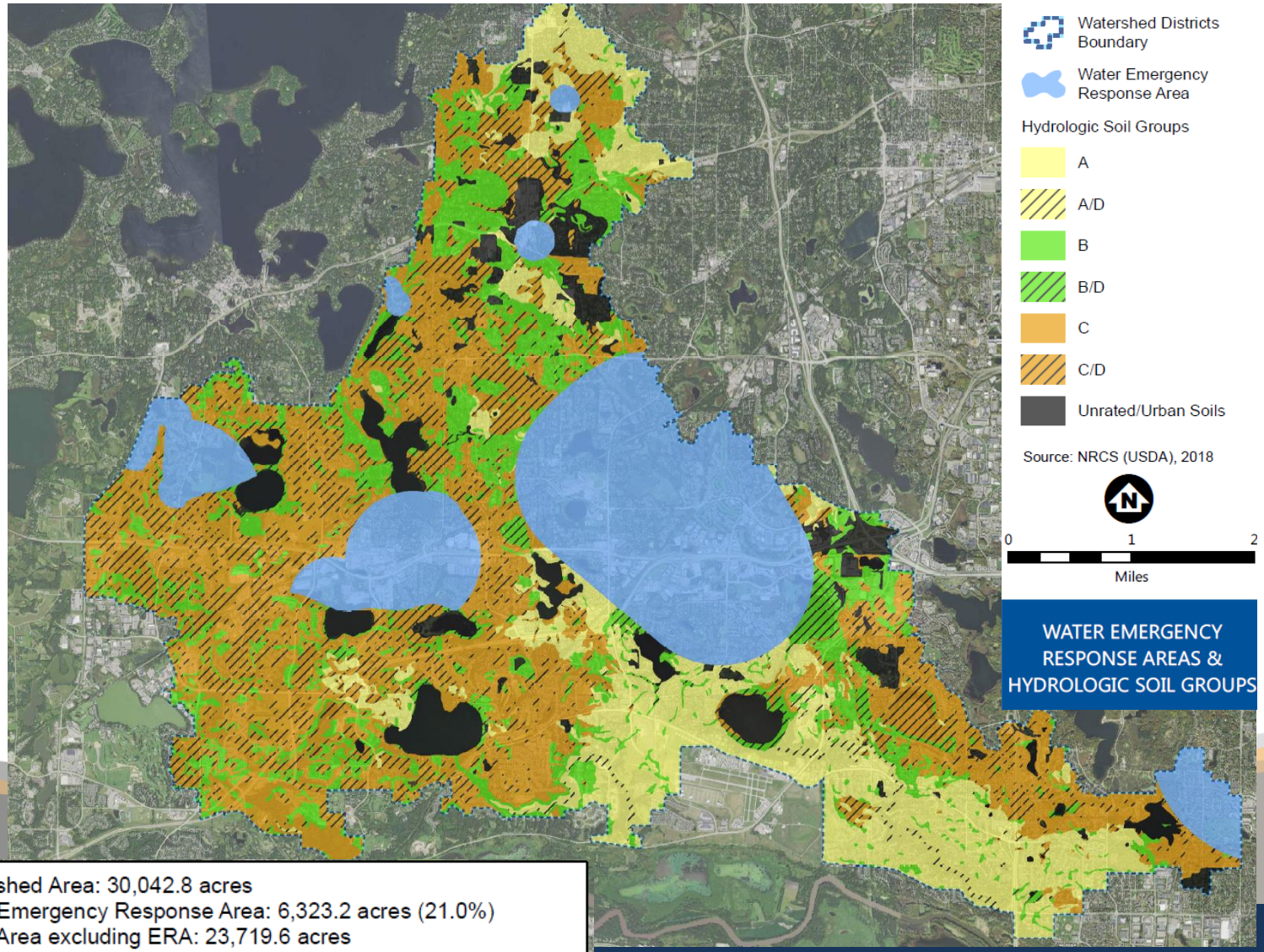
Rainfall Events Related to Current RPBCWD Stormwater Rule



MPCA NPDES Construction Prohibitions on Infiltration



Total Watershed Area: 30,042.8 acres
Watershed Emergency Response Area: 6,323.2 acres (21.0%)
Watershed Area excluding ERA: 23,719.6 acres
Area of Hydrologic Soil Group D, A/D, B/D, C/D: 6,368.6 acres (26.9%)

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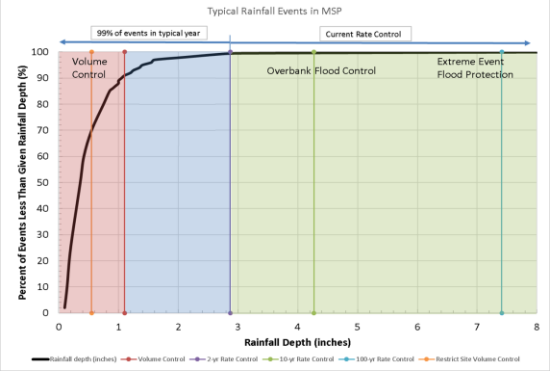
MPCA NPDES Construction Prohibitions on Infiltration

- Potentially impacts roughly 47% of area in RPBCWD
- Reduces available abstraction tools
  - Reuse
  - Green Roof
  - Evapotranspiration (native vegetation & trees)
- Results in 99% of events having limited controls (WQ only)



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RPBCWD Discussions

- Board highlights need to look at ecological systems
- Concerns expressed about the loss of ecological services provided by trees and wetlands
- Restricted site present greatest challange

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Complex Tree Functions ≠ Simplified Engineering Answer

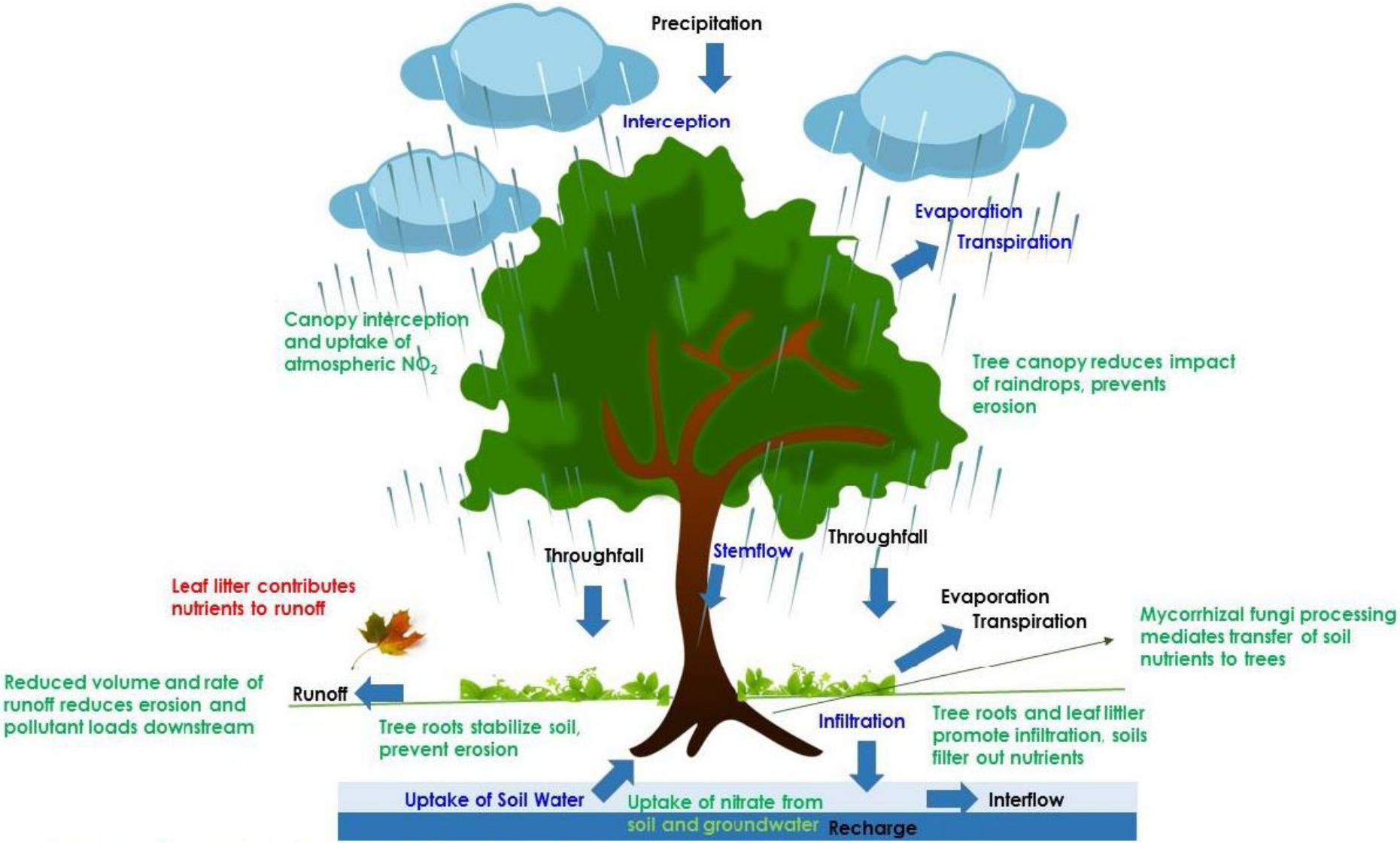
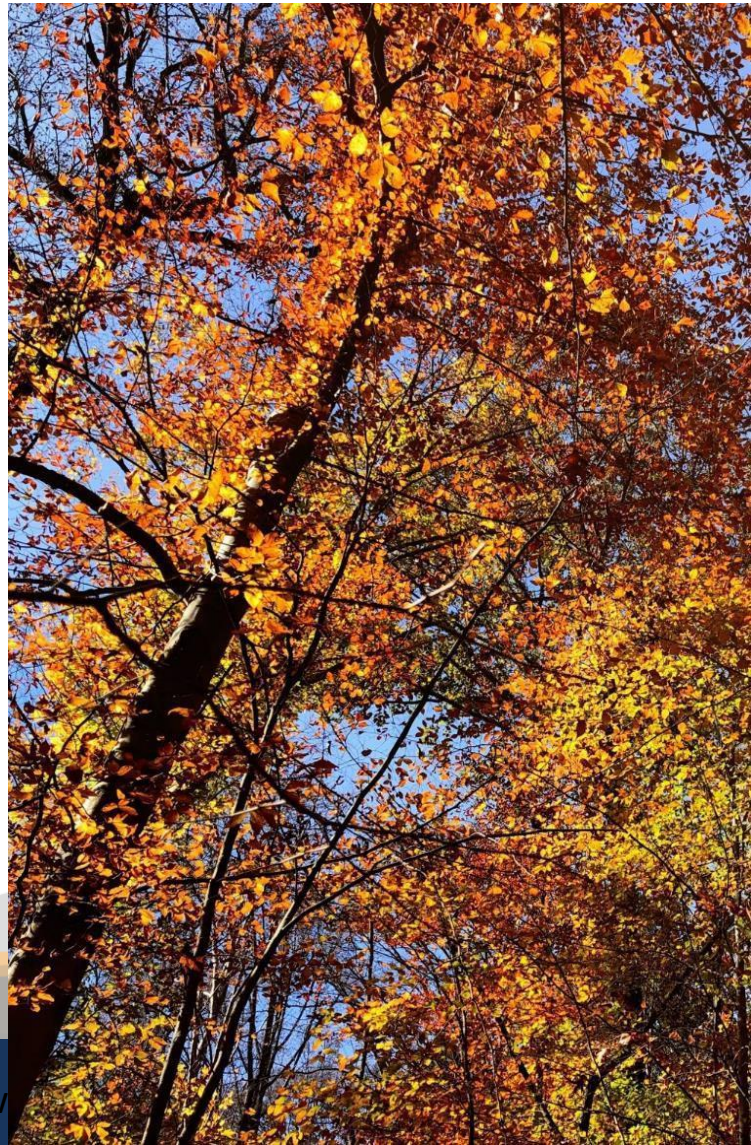


Figure 1. Urban Tree Impacts on Hydrology and Water Quality https://www.cwp.org/making-urban-trees-count/

Complex Tree Functions ≠ Simplified Engineering Answer

- Interception alone is impacted by:
  - Rainfall intensity
  - Duration and frequency of rainfall
  - Leaf area
  - Leaf angle distribution
  - Leaf surface characteristics
  - Meteorological factors (wind speed, vapor pressure, etc.)
  - Tree type (evergreen versus deciduous)
  - Season/time of year
  - Age of tree



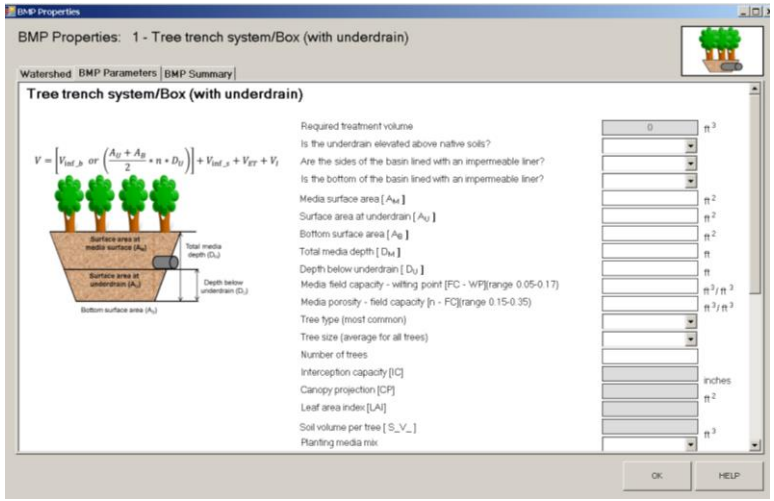
https://w

RPBCWD Tree Discussions

- Difficult to quantify benefits
- Benefits INCREASE over time
- Concerns about maintenance
- Consequently, lack of incentive to use them unless there are available ‘credits

RPBCWD Stormwater Rule

- Criteria are for abstraction of imperious area runoff rather than site runoff
  - Intended to be simplified engineering approach
  - Trees not explicitly credited in the stormwater rule unless using MIDS
- Water quality criteria are related to site runoff
  - Tree preservation accounted for in land use (ie CN)
- Trees used to support
  - Restricted site determination
  - Variance request
  - Runoff computations (CN, Ia, Tc adjustments)



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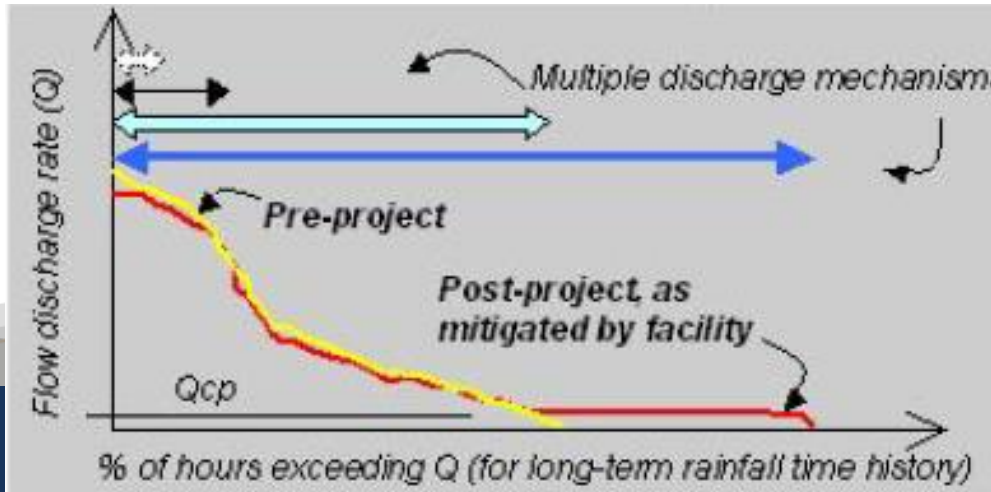
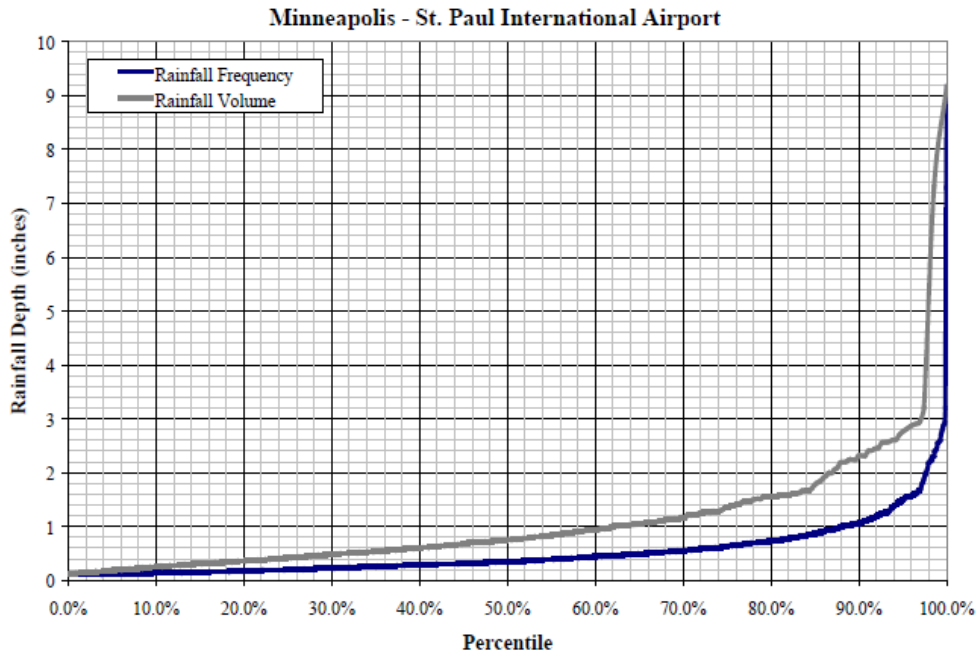
RPBCWD Stormwater Rule

- Considered Hydromodification approach to stormwater rule (hydrology)
  - Accounts for actual precipitation over long duration
  - Credits land use changes (reduced impervious and pervious area) toward volume control
  - Entire site volume considered not just runoff from impervious surface
  - Not a cookbook approach
  - Technically demanding



Other ideas

- Consider switching from impervious runoff abstraction to:
  - 90th or 95th percentile storm volume matching
  - Annual runoff volume matching



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Tree Credit Summary

Community	Type of Credit	Credit for a Deciduous Tree
Sacramento, San Jose and Santa Clara Valley, CA; Portland, OR; Indianapolis, IN; Philadelphia, PA	Impervious surface reduction (ISR)	**100 ft^2**
Seattle, WA	ISR	**20 ft^2**
Pine Lake, GA	Volume	**<12" DBH: 10 gallons/in; >12" DBH: 20 gallons/in**
Washington, DC	Volume	**10 ft^3**
Vermont	Volume	**5 ft^3**
Minnesota	Volume and P load	**Depends on soil volume and other factors**
Chesapeake Bay Program	**N, P and S load**	**Pollutant load reduction associated with conversion of 144ft^2 to tree canopy land use**

Making Urban Trees Count: A Project to Demonstrate the Role of Urban Trees in Achieving Regulatory Compliance for Clean Water

Center for Watershed Protection

December 2017

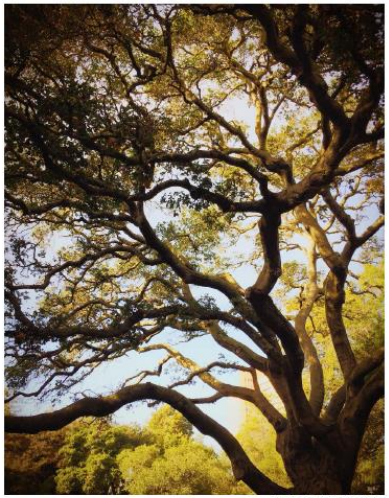

Photo by Victor Zambrano

CREDITING FRAMEWORK PRODUCT #7:

Documentation for Stormwater Performance-Based Credit

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Adapted from Stone Environmental (2014)

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Closing thought

Tree may not be the stormwater silver bullet but provide a multitude of benefits

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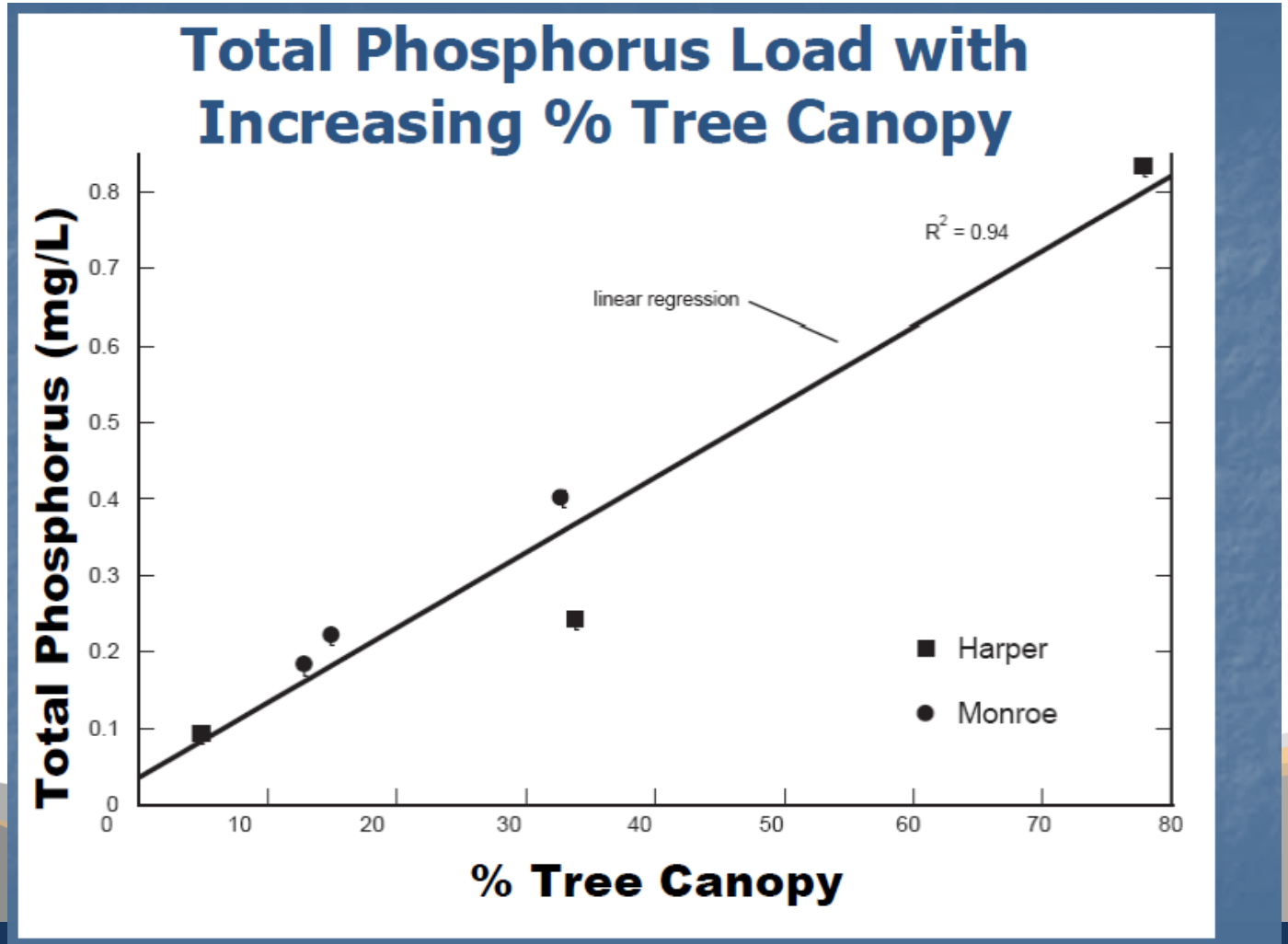
But can present other challenges



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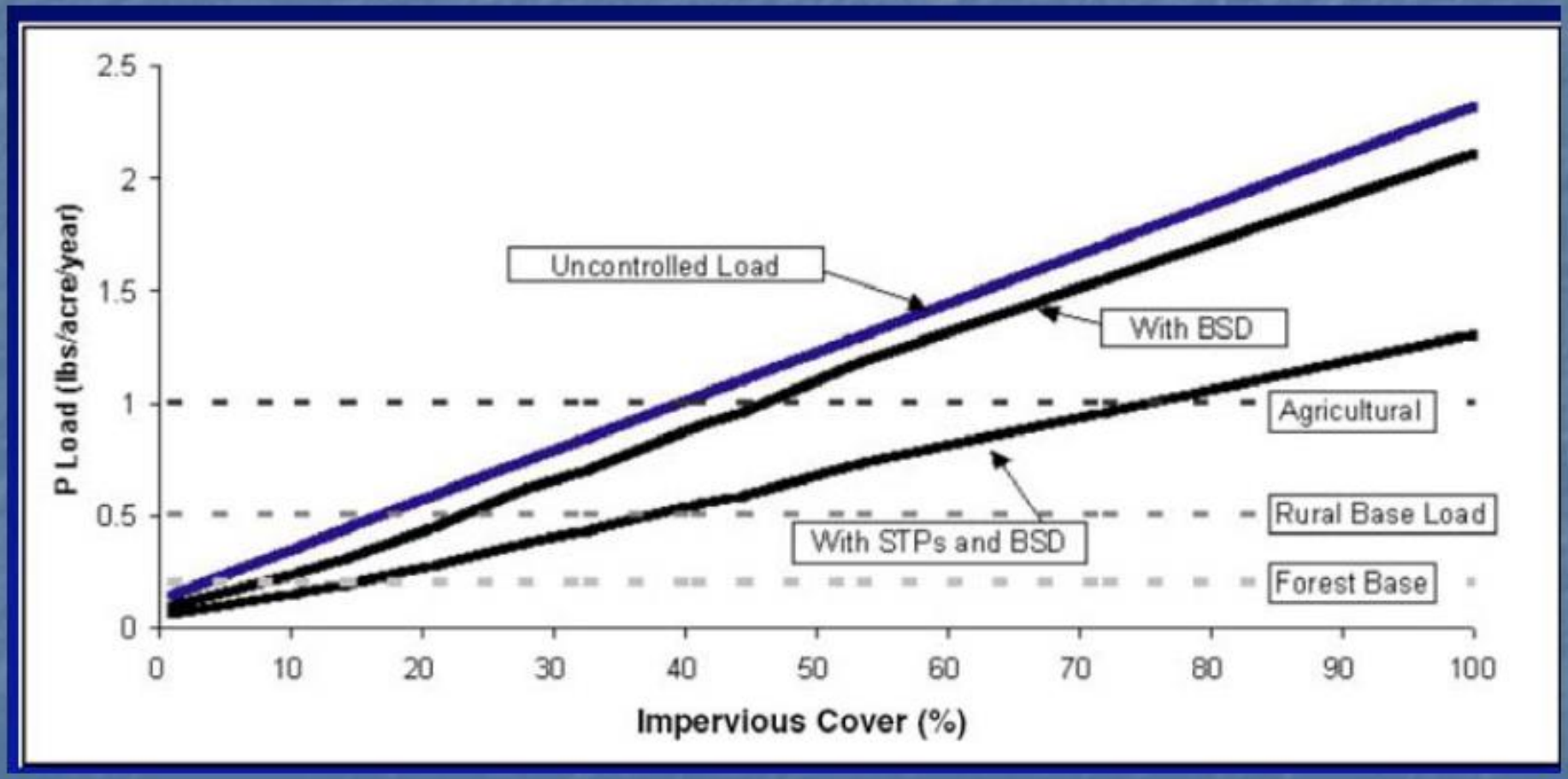
Phosphorus Load with Increasing % Imperviousness



Center for Watershed Protection - Schueler and Caraco 2001

Tree Planting Credit Summary

Community	Type of Credit	Credit for a Deciduous Tree
Sacramento, San Jose and Santa Clara Valley, CA; Portland, OR; Indianapolis, IN; Philadelphia, PA	IC	**100ft^2**
Seattle, WA	IC	**20ft^2**
Pine Lake, GA	Volume	**<12" DBH: 10 gallons/in; >12" DBH: 20 gallons/in**
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Adapted from Stone Environmental (2014)

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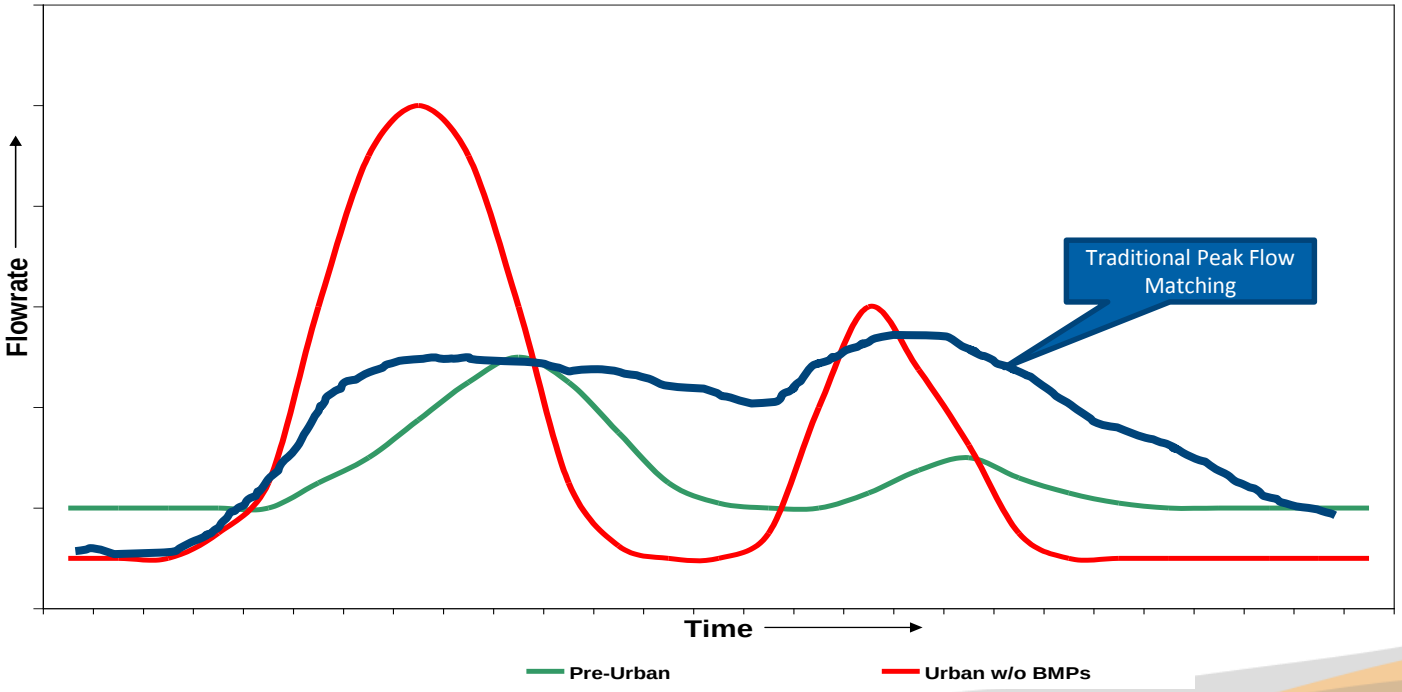
Development Impacts Flow



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Tree provide numerous benefits

- Habitat
- Direct removal of greenhouse gases
- Reduce temperatures
- Improve air quality
- Stormwater management
- Promote pride in the community
- Street trees can calm traffic and lower traffic speed by reducing the perceived width of street
- Reduce noise levels
- Reduce workplace stress.
- Enhance property values
- ……..

How Forest Vegetation Supports Healthy Streams	
Vegetation	***Benefits***
Tree and shrub canopy overhanging the channel	• Stable water temperature improves conditions for desirable game fish • Source of large and fine plant debris • Source of terrestrial insects that fish eat
Leaves, branches, and other vegetative debris in stream channel (in proper amounts)	• Help create pools, riffles, and cover • Provide food source and stable base for many stream channel aquatic organisms
Roots in the streambank	• Increase bank stability • Create overhanging bank cover
Stems and low-growing vegetation in the floodplain	• Retard movement of water, sediment, and floating debris in floodwater
Source: Adapted from Craven, S.; Jackson, G.; Swenson, W.; and Webendorfer, B. 1987. *The Benefits of Well-managed Stream Corridors* G-3404. Department of Agricultural Journalism, University of Wisconsin–Madison	