

# Washington County Water Consortium

November 6, 2024

2 to 3:30 pm

Remote meeting - Zoom

(If you are not on the Consortium listserv, please email

[Adriana.Atcheson@co.washington.mn.us](mailto:Adriana.Atcheson@co.washington.mn.us) for the Zoom link and access code)

## Agenda

2:00 – 2:05 **Welcome**

Introductions, Announcements

2:05 – 2:45 **What's New in Water from Freshwater**

*Topic:* Michelle Stockness, Freshwater's new Executive Director, will give an update on a few new developments around water in Minnesota including: water reuse, source water protection, and a proposed revamp of the Minnesota Water Stewards program.

*Presenter:* Michelle Stockness, Executive Director, Freshwater

2:45 – 3:15 **The Threat of Climate Change to Urban Stormwater Infrastructure**

*Presenter:* Andy Erickson, Research Manager, St. Anthony Falls Laboratory/U of M

3:15 – 3:30 **Questions/Adjourn**

# Updates from Freshwater

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Washington County Water Consortium

FRESHWATER

November 6, 2024



# Topics include:



- What is Freshwater working on?
- Water Circularity
- Source water protection
- Changes to Minnesota Water Stewards



Goal: help you understand who we are



# Our mission

To inspire and empower people  
to value and protect water.



# Who are we?

- 501c3 nonprofit founded in 1968
- 14 staff and contractors
- Office in St. Paul
- Budget \$1-2M

## FRESHWATER



# Who do we work with?



Community  
Groups



Media and  
journalists



Nonprofits  
and NGOs



Local units  
of  
government



State  
government  
and policy  
makers



Federal  
government  
and Tribal  
nations



Research  
and  
educational  
institutions



Private  
businesses  
and industry

FRESHWATER



## How do we do this work?

**Education  
and  
Engagement**

**Water  
Research**

**Water Policy**



## What do we do? Three Focus Areas 2024-2025

Safe and clean water for all communities: with focused attention on improving public health and ecosystems for rural, BIPOC, and tribal communities.

Groundwater sustainability including restoration, governance, and protection.

Water system adaptation and resiliency in response to changes in climate.

# Water Circularity



# Circular Water is a key focus



- Water conservation and efficiency
- Water reuse
- Water recharge



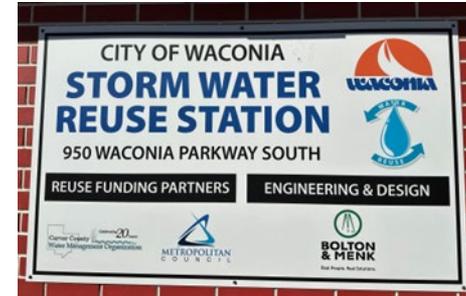
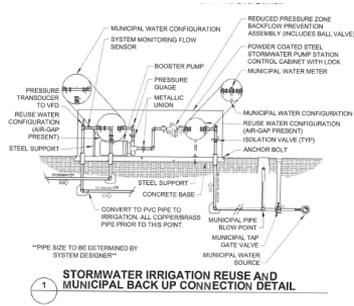
# Promoting a Circular Water Economy



- Goal: Promote best practices for water efficiency, reuse and recharge.
- Activities: State stormwater capture and use committee, June workshop, fall site visits, upcoming State of Minnesota's Circular Water Economy white paper.
- Funder: Various grants
- Partners: State agencies, cities, watersheds, businesses.
- Timeline: Ongoing



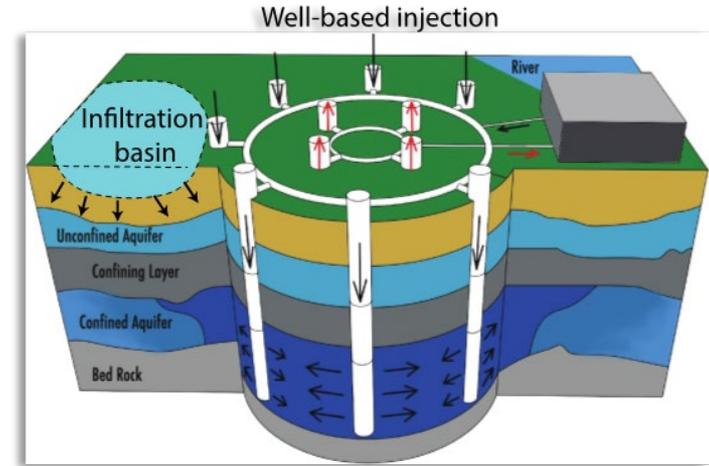
# Stormwater reuse site visits



# Managed Aquifer Recharge (MAR)



- Goal: Develop a method for mapping managed-aquifer-recharge potential through injection wells and infiltration basins.
- Activities: research and field testing.
- Funder: LCCMR to U of M, Earth and Env. Sci.
- Partners: Peter Kang (U of M, EESCI), John Nieber (U of M, BBS), John Gulliver (U of M SAFL), Tony Runkel (MGS)
- Timeline: Year 2 of 3-year project



# Source Water Protection



# Greater Lakes Promise



- Goal: Help regional land trusts achieve nutrient-reduction through land conservation in key Great Lakes watersheds.
- Funder: Great Lakes Protection Fund
- Timeline: Year 2 of 5-year project
- Partners: Black Swamp Conservancy, Landmark Conservancy, Little Forks Conservancy, Saginaw Basin Land Conservancy, Minnesota Land Trust, The Stewardship Network (fiscal sponsor)



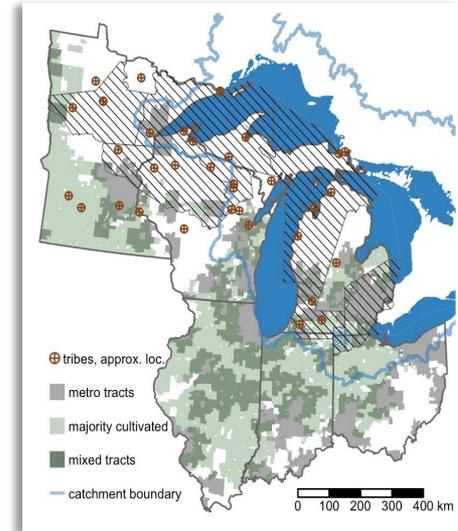
[greaterlakespromise.org](https://greaterlakespromise.org)



# Groundwater Governance



- Goal: Identify best practices for shared groundwater governance by working in “aquifer action clusters” across the states and federally recognized Tribal Nations in EPA Region 5.
- Funder: Joyce Foundation
- Timeline: 18 months, ends Feb. 2025
- Partners: Great Lakes Indian Fish and Wildlife Commission, Water 365, Chicago Metropolitan Agency for Planning



# Private Well support



# LCCMR projects starting in 2025



Rural Health and Drinking  
Water- arsenic testing in  
private wells for SE MN.



Biofilm Mediated  
Destruction of PFAS in  
Groundwater



# Minnesota Water Stewards



# Minnesota Water Stewards



- Goal: Engage and support volunteer leaders to make a difference for water in local issues throughout the state.
- Funder: Partner organizations, small grants
- Partners: 23 partners including watershed districts, counties, cities, nonprofits, +500 Steward volunteers
- Timeline: in 11<sup>th</sup> year



"Water stewards are our most important upstream leaders living in the many contributing watersheds that can positively affect so many downstream communities. They are foundational to our success!"



# Minnesota Water Stewards- today



## The curriculum and leadership development provides:

- Basic water science
- Understanding of water governance and policy
- Skills for community engagement and leadership
- Awareness of water issues
- Networking with your local watershed organizations
- Action options
- Continuing education and events



# Minnesota Water Stewards – Time for Change

## Feedback:

- Partners value and rely on their Stewards
- Recognize the impact of Stewards on boards and staff
- Limited capacity for new volunteer management
- Want to spend more time cultivating the existing partners
- Stewards are mostly from the metro.
- Metro partners are not sponsoring as many stewards.
- Funding sources have decreased over time.
- Watersheds need support across the state, especially with implementation of watershed plans.



# Minnesota Water Stewards- Proposed changes

Our goal: an updated program that is widely available across the state and region and more affordable and sustainable.



Anyone anywhere in MN  
can participate



Customizable curriculum  
based on local



Partners may still recruit,  
support, and train  
specific cohorts to meet  
their goals and gaps



# Minnesota Water Stewards- feedback



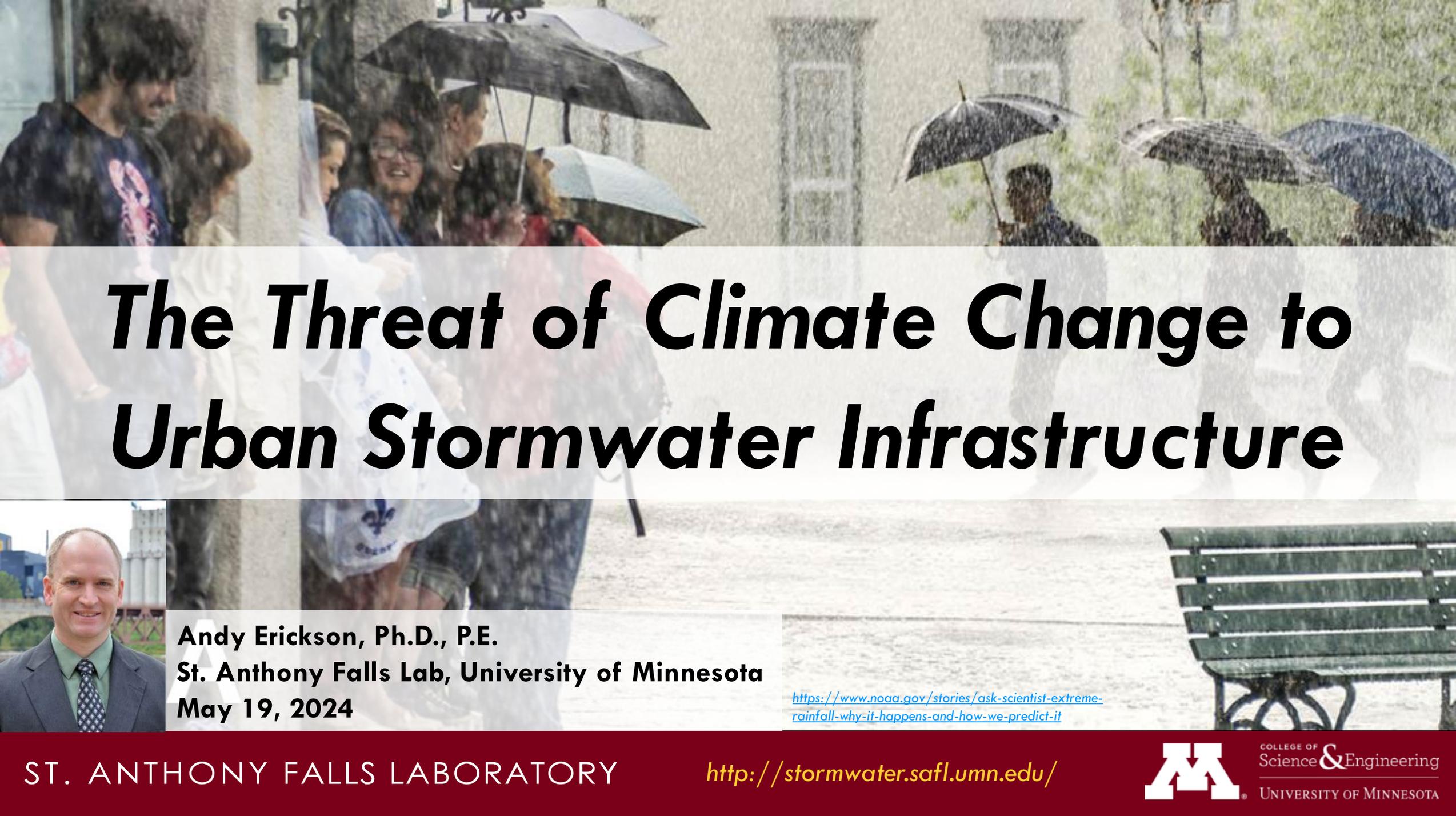
## Questions for Discussion:

1. What are your thoughts on our proposed changes to the program?
2. Any other feedback or ideas?



**Thank you! Any questions?**





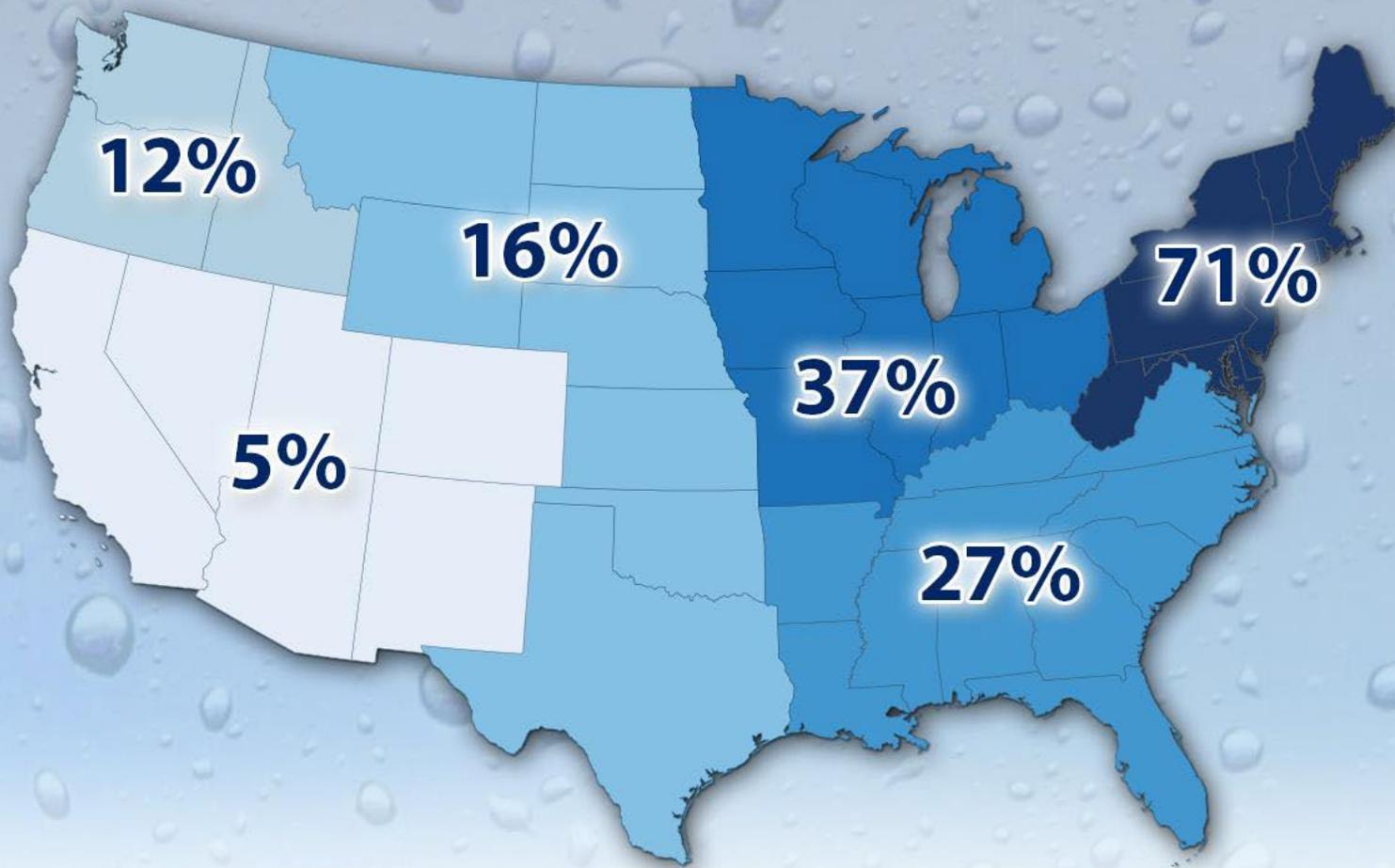
# *The Threat of Climate Change to Urban Stormwater Infrastructure*



**Andy Erickson, Ph.D., P.E.**  
**St. Anthony Falls Lab, University of Minnesota**  
**May 19, 2024**

<https://www.noaa.gov/stories/ask-scientist-extreme-rainfall-why-it-happens-and-how-we-predict-it>

# Heavy Downpours Increasing



Percent increase from 1958 to 2012 in the amount of precipitation falling in very heavy events.  
Very Heavy Precipitation is defined as the heaviest 1% of all daily events from 1958-2012.

Source: Kenneth Kunkel, Cooperative Institute for Climate and Satellites, North Carolina State University and NOAA NCDC

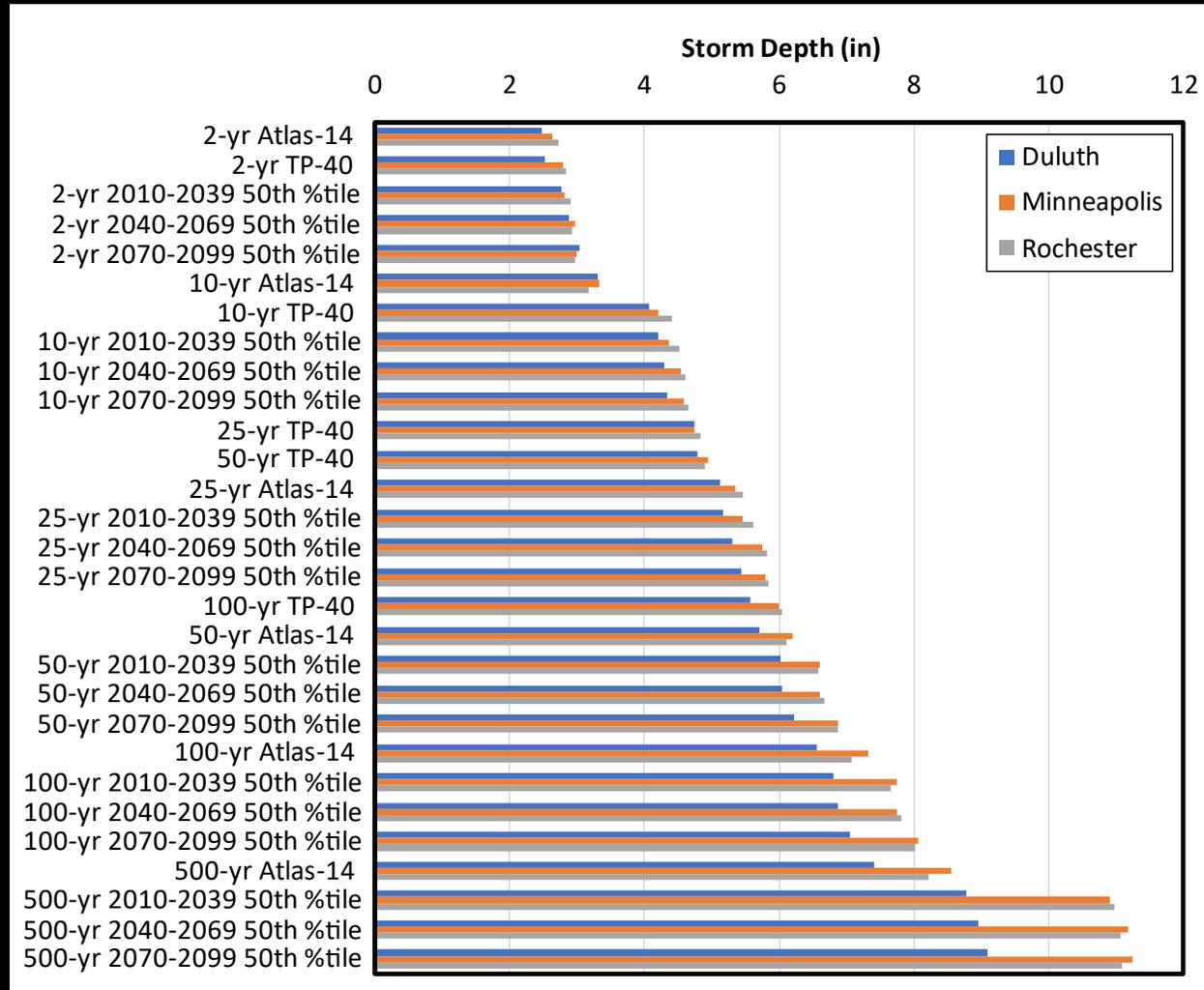
CLIMATE  CENTRAL

Climate Central: <http://104.130.239.126:8080/gallery/maps/extreme-precipitation-events-are-on-the-rise>

# Historical, Current, & Future-Predicted Precipitation

## Modeled 2-yr to 500-yr

- TP-40 (1961)
- Atlas 14 (2006 – 2018)
- 35 GCMs (50<sup>th</sup> %tile)
  - 2010 – 2039 (near)
  - 2040 – 2069 (mid century)
  - 2070 – 2099 (end century)



Erickson et al., (2023). "Climate Change Adaptation of Urban Stormwater Infrastructure." MnDOT Report no. MN 2023-21, Minneapolis, MN. June 2023.

# Historical, Current, & Future-Predicted Precipitation

For 2-yr & 10-yr (typical design):

Atlas-14 < TP-40 < GCMs

10-yr mean = 2.6 in < 2.7 in < 2.9 in

For 25-yr & greater:

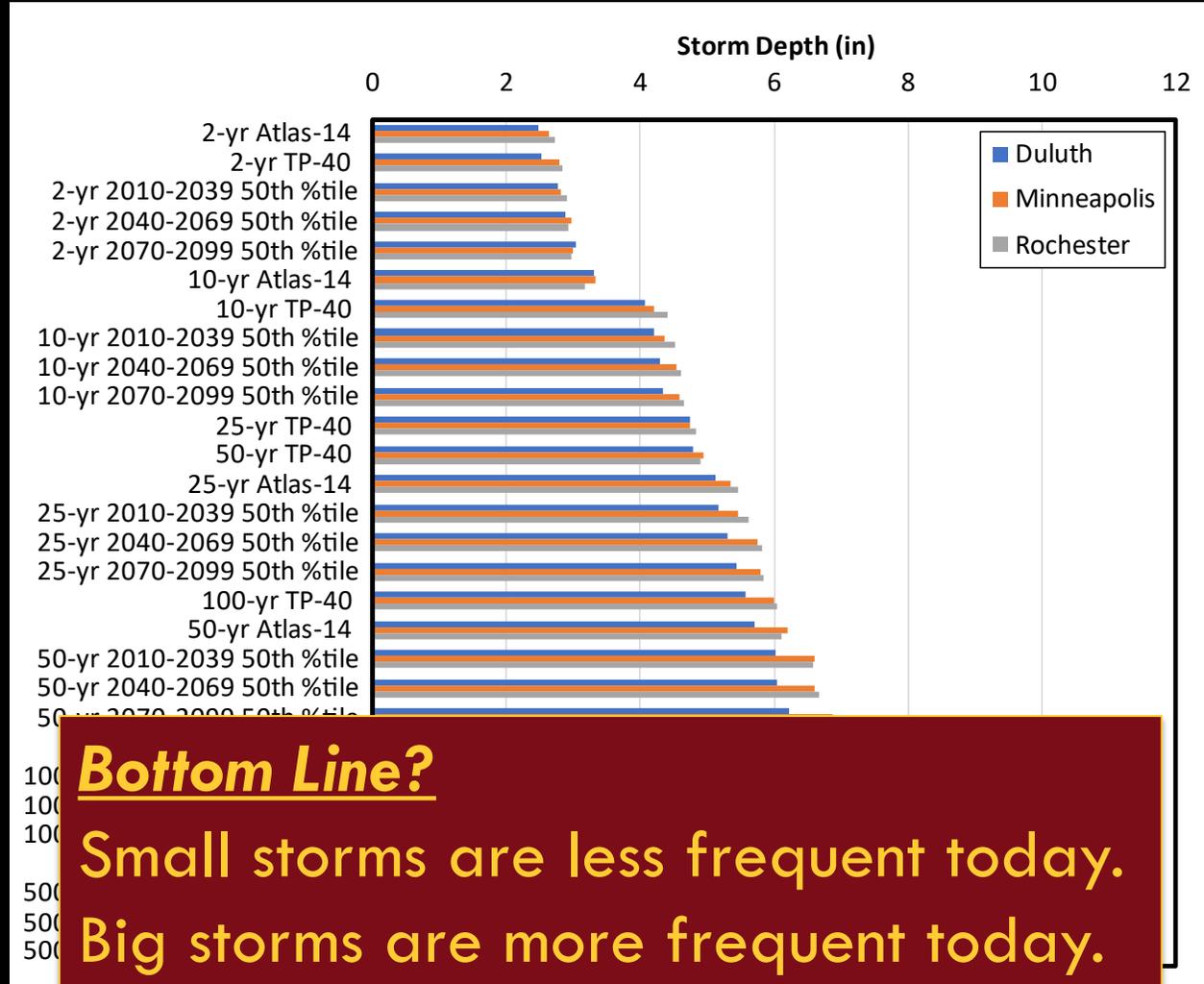
TP-40 < Atlas-14 < GCMs

100-yr mean = 5.9 in < 6.98 in < 7.5 in

## Bottom Line?

Small storms are Smaller today.

Big storms are Bigger today.



## Bottom Line?

Small storms are less frequent today.

Big storms are more frequent today.

Erickson et al., (2023). "Climate Change Adaptation of Urban Stormwater Infrastructure." MnDOT Report no. MN 2023-21, Minneapolis, MN. June 2023.

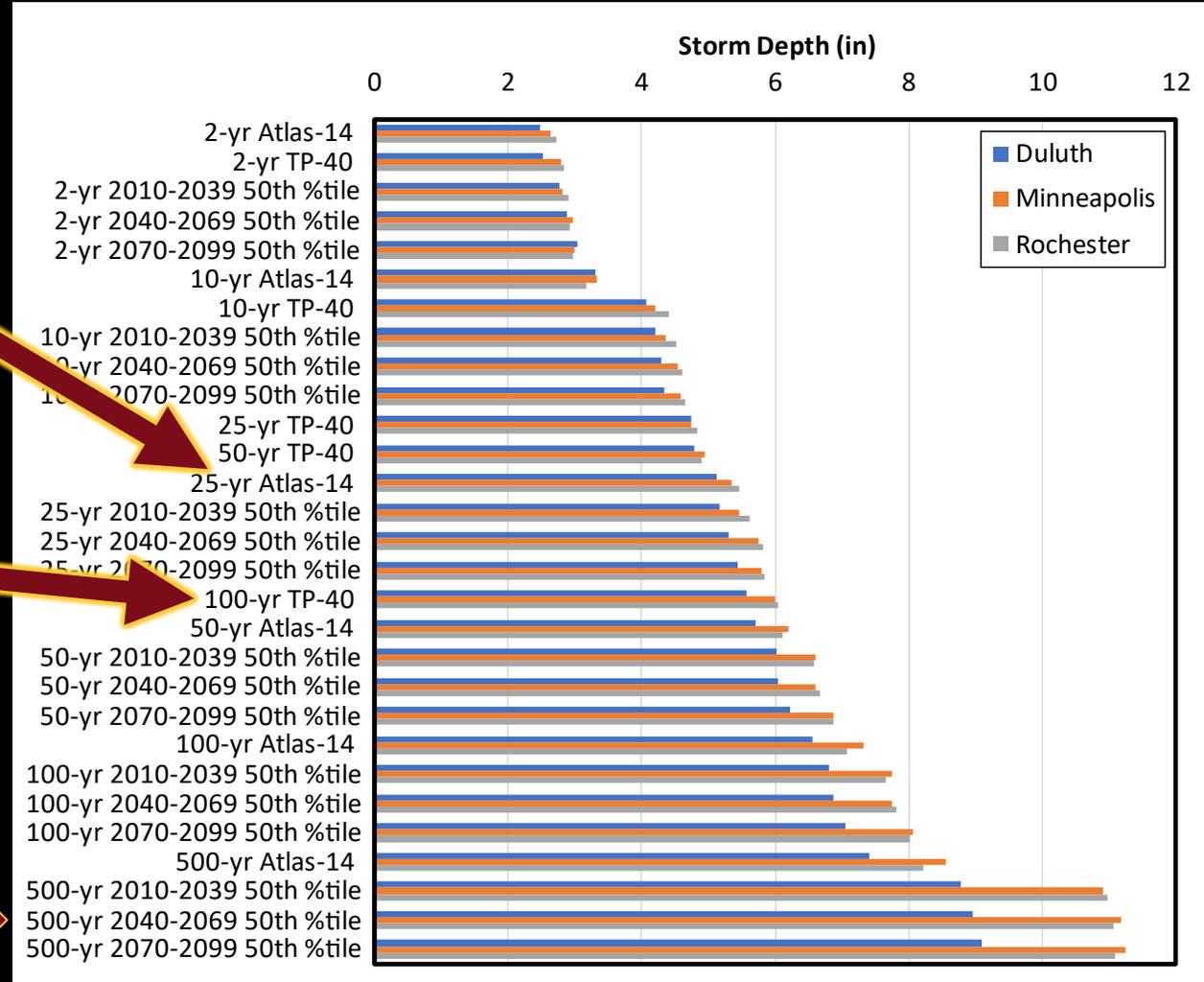
# Historical, Current, & Future-Predicted Precipitation

2% storm TP-40 < 4% storm Atlas 14  
 50-yr TP-40 < 25-yr Atlas 14  
 mean = 4.9 in < 5.3 in

1% storm TP-40 < 2% storm Atlas 14  
 100-yr TP-40 < 100-yr Atlas 14  
 mean = 5.9 in < 6.98 in

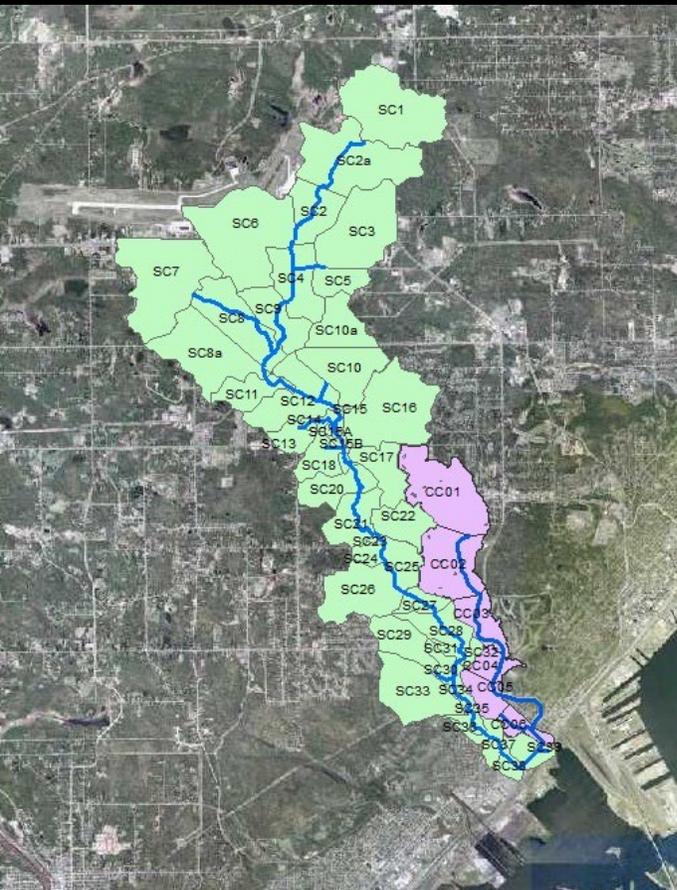
100-yr Atlas-14 = TP-40 + 20 to 30%

Should we plan for 500-yr storms??  
 100-yr + 30 to 40%



Erickson et al., (2023). "Climate Change Adaptation of Urban Stormwater Infrastructure." MnDOT Report no. MN 2023-21, Minneapolis, MN. June 2023.

# Modeled Watersheds



## Duluth's Miller Creek

~10 square miles (6,400 acres)

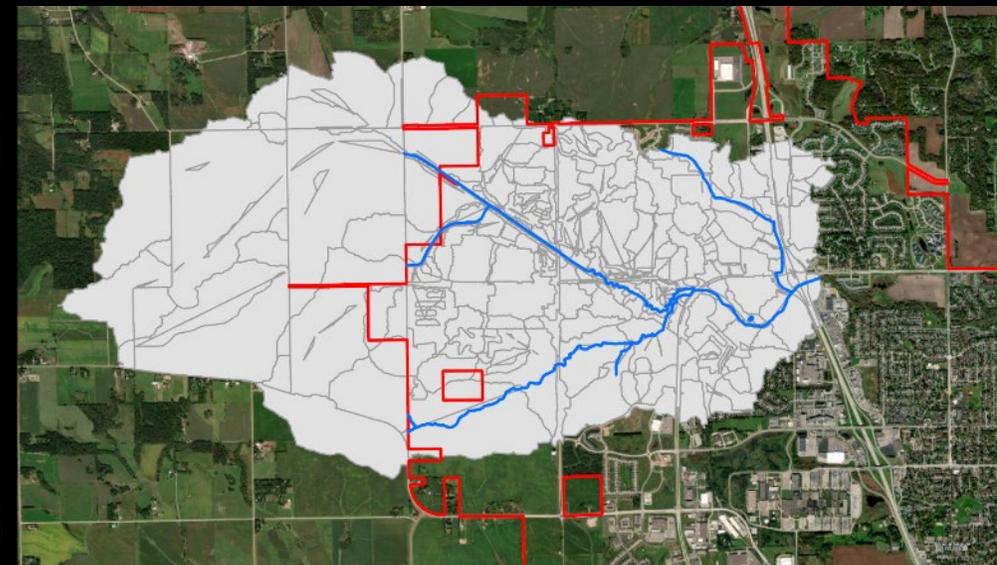
23% impervious



## Minneapolis's 1NE

~3.25 square miles (2,100 Acres)

47% impervious



## Rochester's Kings Run

~8.75 square miles (5,600 Acres)

17% impervious

*Erickson et al., (2023). "Climate Change Adaptation of Urban Stormwater Infrastructure." MnDOT Report no. MN 2023-21, Minneapolis, MN. June 2023.*

# Stormwater Adaptation Strategies Results

- 1. Baseline:** Existing stormwater infrastructure: Ponds treating
  1. ~50% connected impervious surface (Duluth),
  2. ~11% connected impervious surface (Minneapolis),
  3. ~40% connected impervious surface (Rochester)
- 2. Extra Ponds:** new stormwater ponds were installed for untreated connected impervious (i.e., 100% connected impervious treated by ponds)
- 3. Infiltration:** infiltration basins (aka **green infrastructure**) were installed for untreated connected impervious
- 4. Smart Ponds:** existing stormwater ponds retrofit to be 'smart'
- 5. More Smart Ponds:** combination of extra ponds (#2) and smart ponds (#4)
- 6. Pipe Upsizing:** increase existing conduits' cross-sectional area by 30%

*Erickson et al., (2023). "Climate Change Adaptation of Urban Stormwater Infrastructure." MnDOT Report no. MN 2023-21, Minneapolis, MN. June 2023.*

# Stormwater Adaptation Strategies Results

1. **Baseline:** Existing stormwater infrastructure: Ponds treating

1. ~50% connected in
2. ~11% connected in
3. ~40% connected in

## We considered:

- Existing Infrastructure
- More Storage
- Smart Storage
- Green Infrastructure
- Bigger Pipes

2. **Extra Ponds:** new  
impervious (i.e., 10

3. **Infiltration:** infiltra  
untreated connect

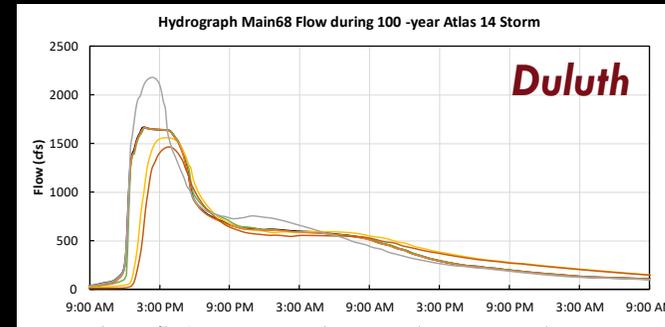
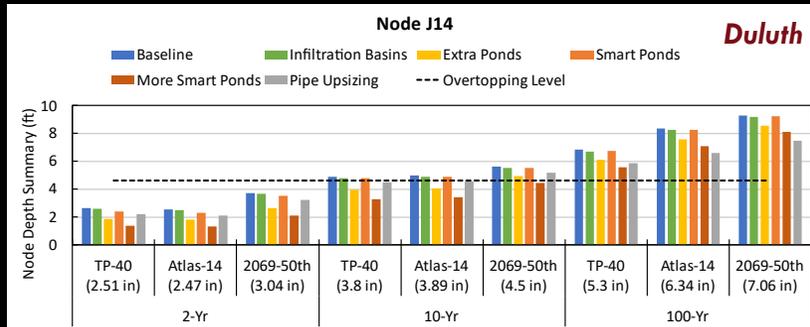
4. **Smart Ponds:** exist

5. **More Smart Ponds:**

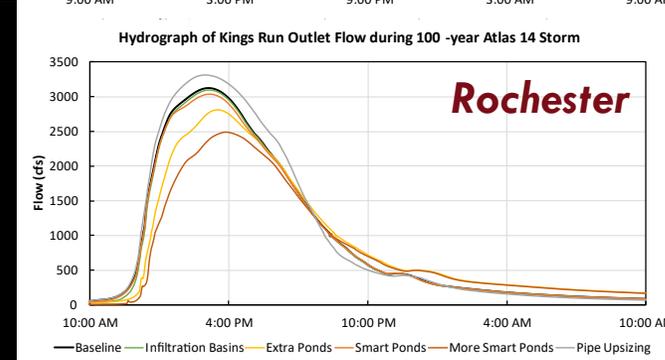
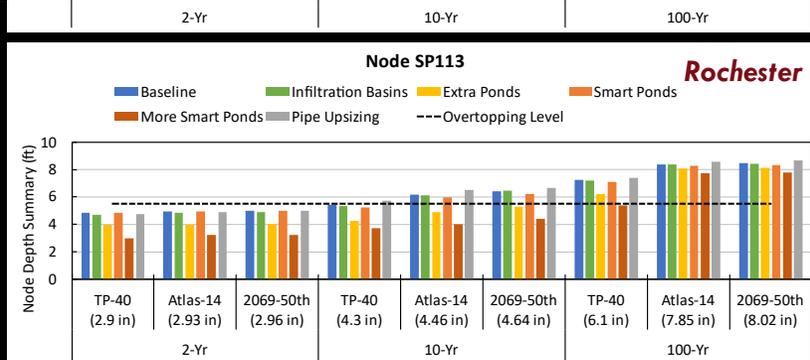
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*Erickson et al., (2023). "Climate Change Adaptation of Urban Stormwater Infrastructure." MnDOT Report no. MN 2023-21, Minneapolis, MN. June 2023.*

# Node Depth & Hydrographs (flood depth) & (peak flow and timing)



**CONVENTIONAL DESIGN IS NOT ENOUGH TO PREVENT FLOODING!**

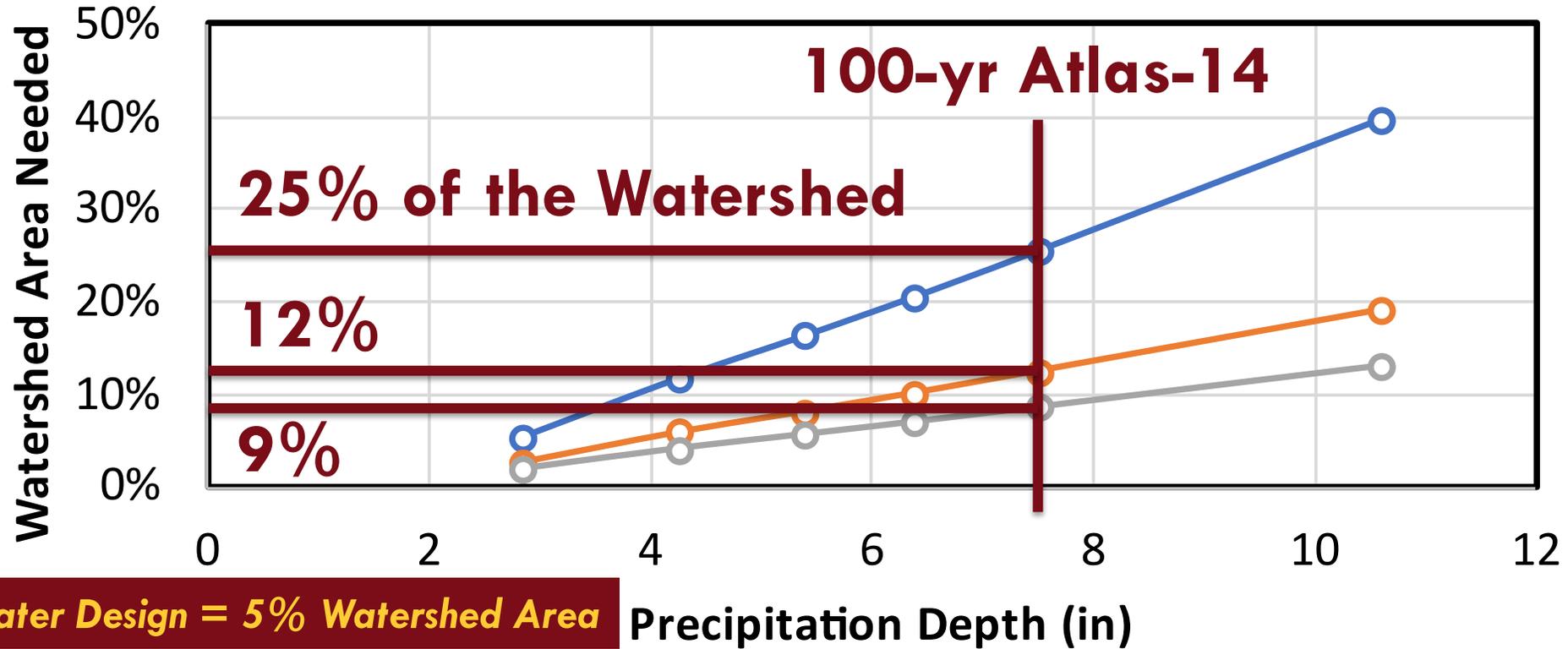


Erickson et al., (2023). "Climate Change Adaptation of Urban Stormwater Infrastructure." MnDOT Report no. MN 2023-21, Minneapolis, MN. June 2023

# What would it take? (aka Future-Proof)

b)

Minneapolis 1NE



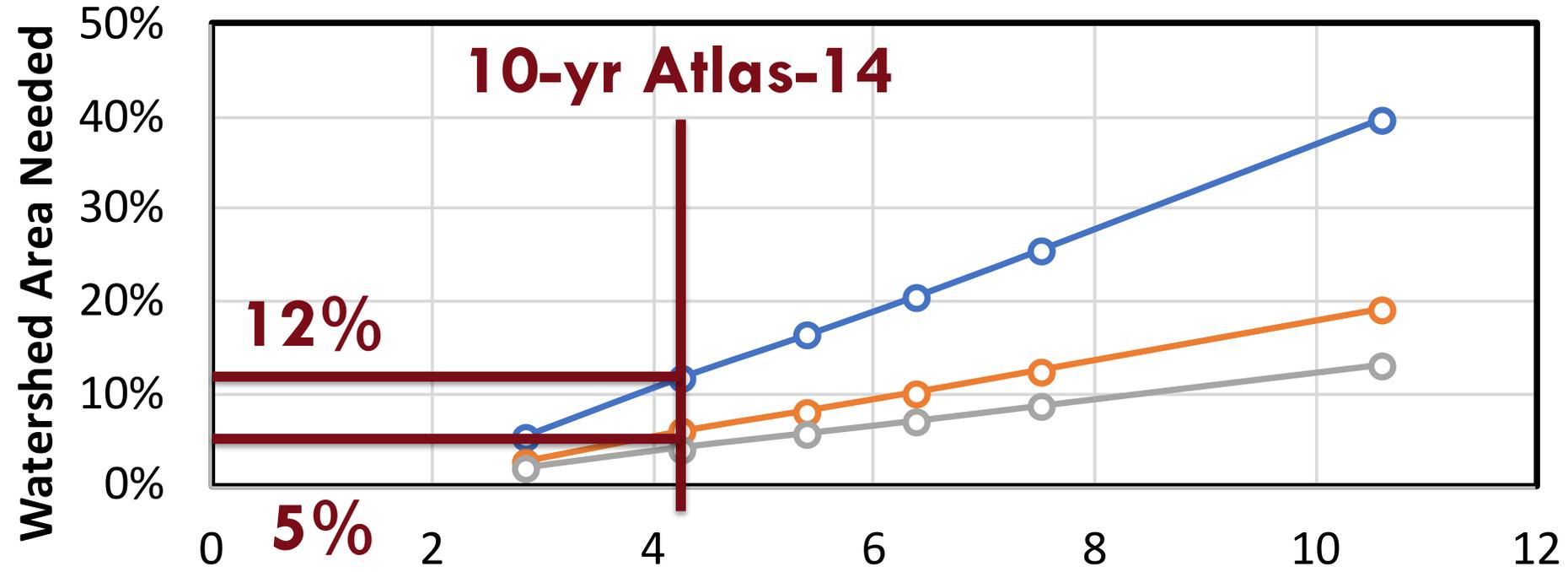
—○— Infiltration Basins    —○— Extra Ponds    —○— More Smart Ponds

Erickson et al., (2023). "Climate Change Adaptation of Urban Stormwater Infrastructure." MnDOT Report no. MN 2023-21, Minneapolis, MN. June 2023.

# What would it take? (aka Future-Proof)

b)

Minneapolis 1NE

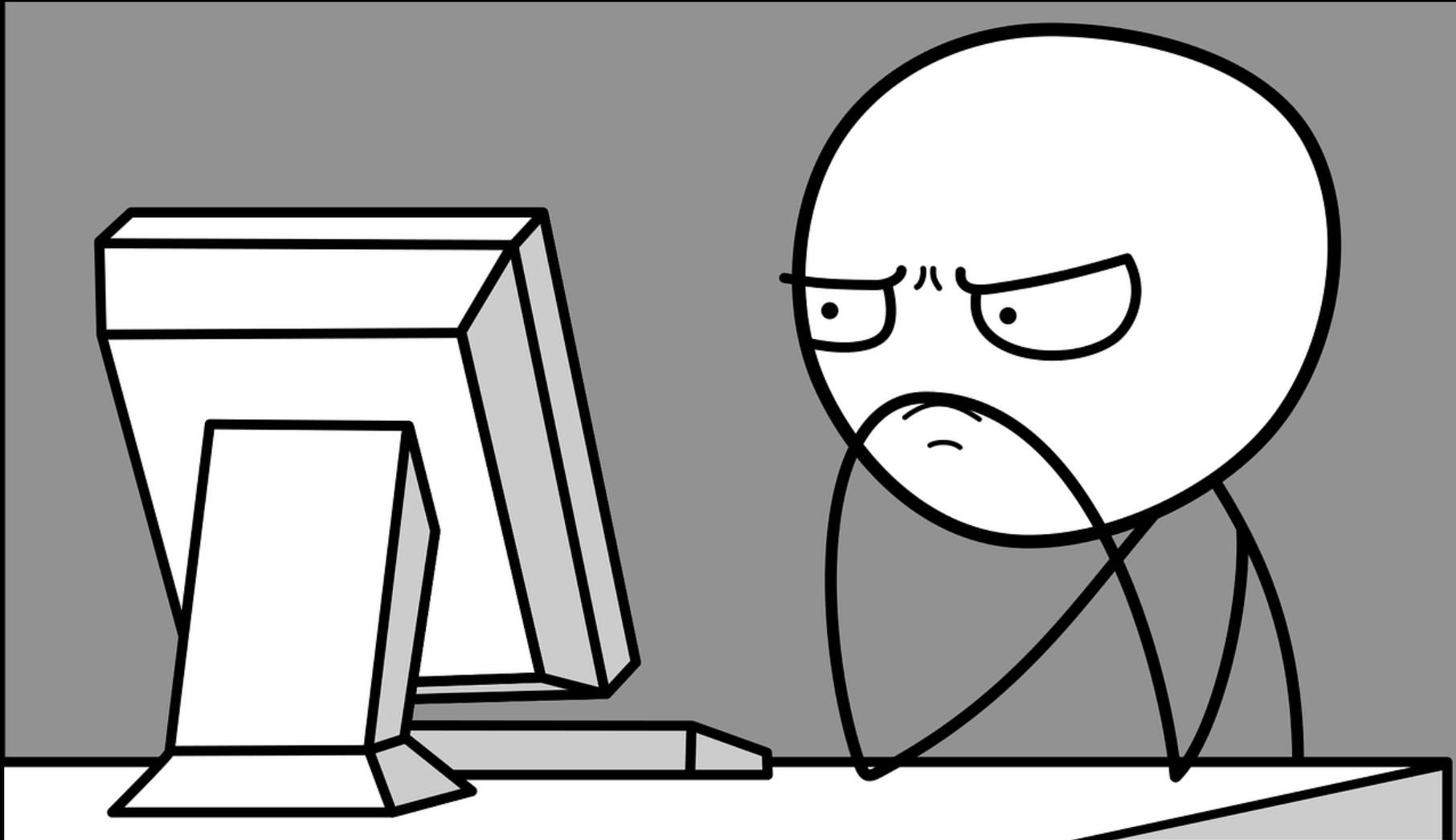


Typical Stormwater Design = 5% Watershed Area

—○— Infiltration Basins    —○— Extra Ponds    —○— More Smart Ponds

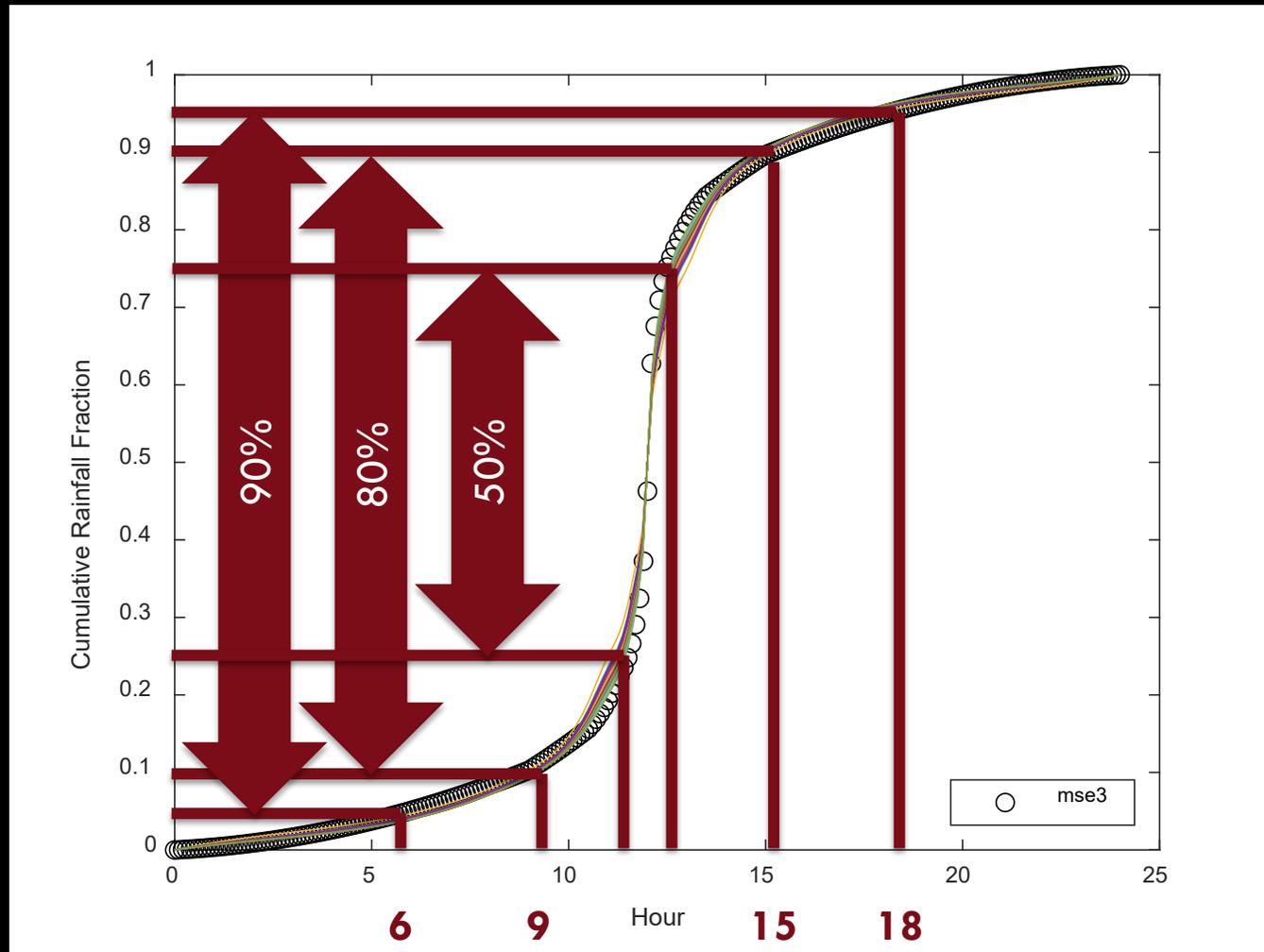
Erickson et al., (2023). "Climate Change Adaptation of Urban Stormwater Infrastructure." MnDOT Report no. MN 2023-21, Minneapolis, MN. June 2023.

# Is our Modeling Correct?



<https://bcacademictchnology.wordpress.com/2020/11/05/basic-troubleshooting-faqs-from-the-renegade-hub/>

# Influence of Rainfall Distribution



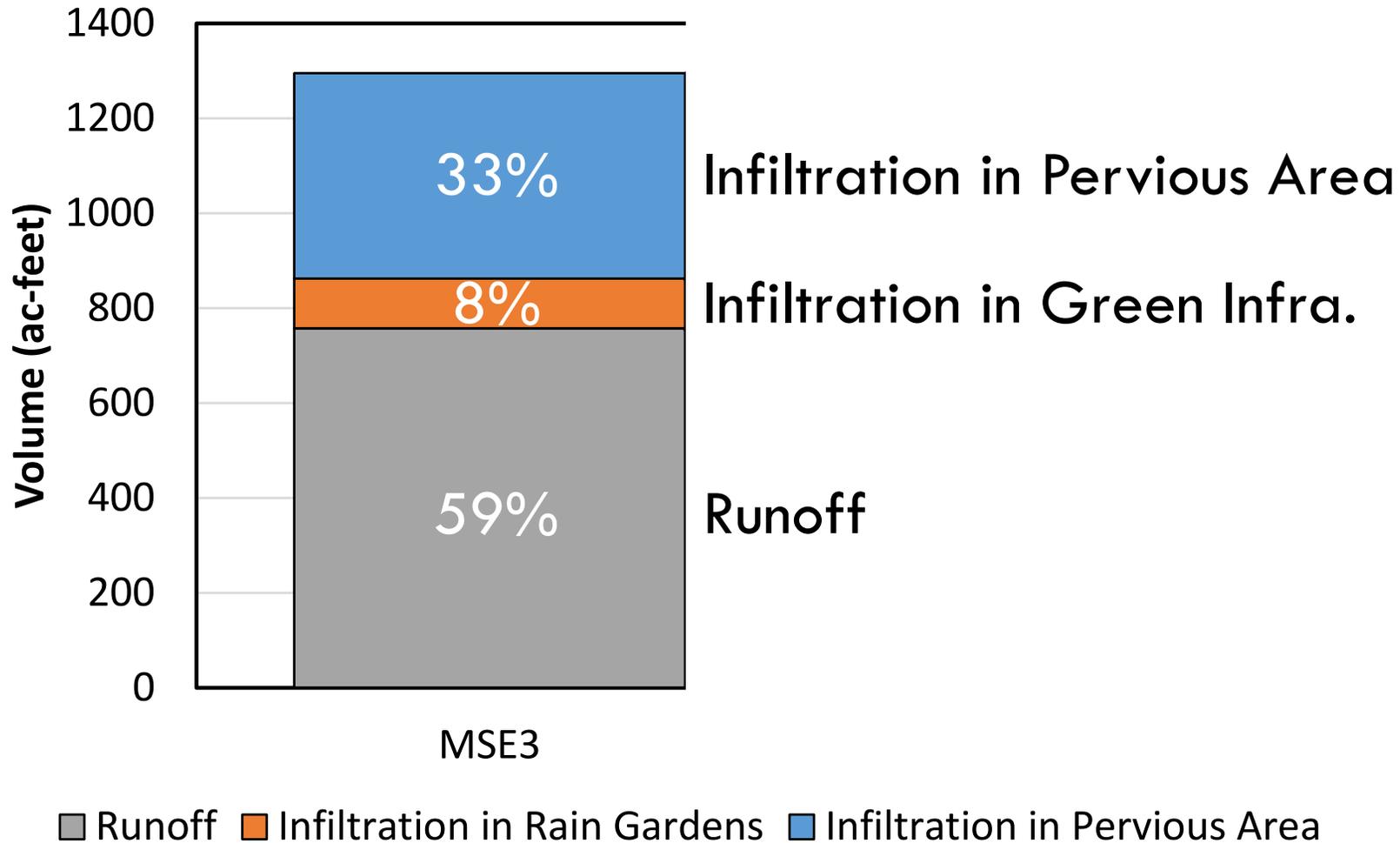
90% of rainfall  
occurs in ~12 hours

80% of rainfall  
occurs in ~6 hours

50% of rainfall  
occurs in ~1 hour

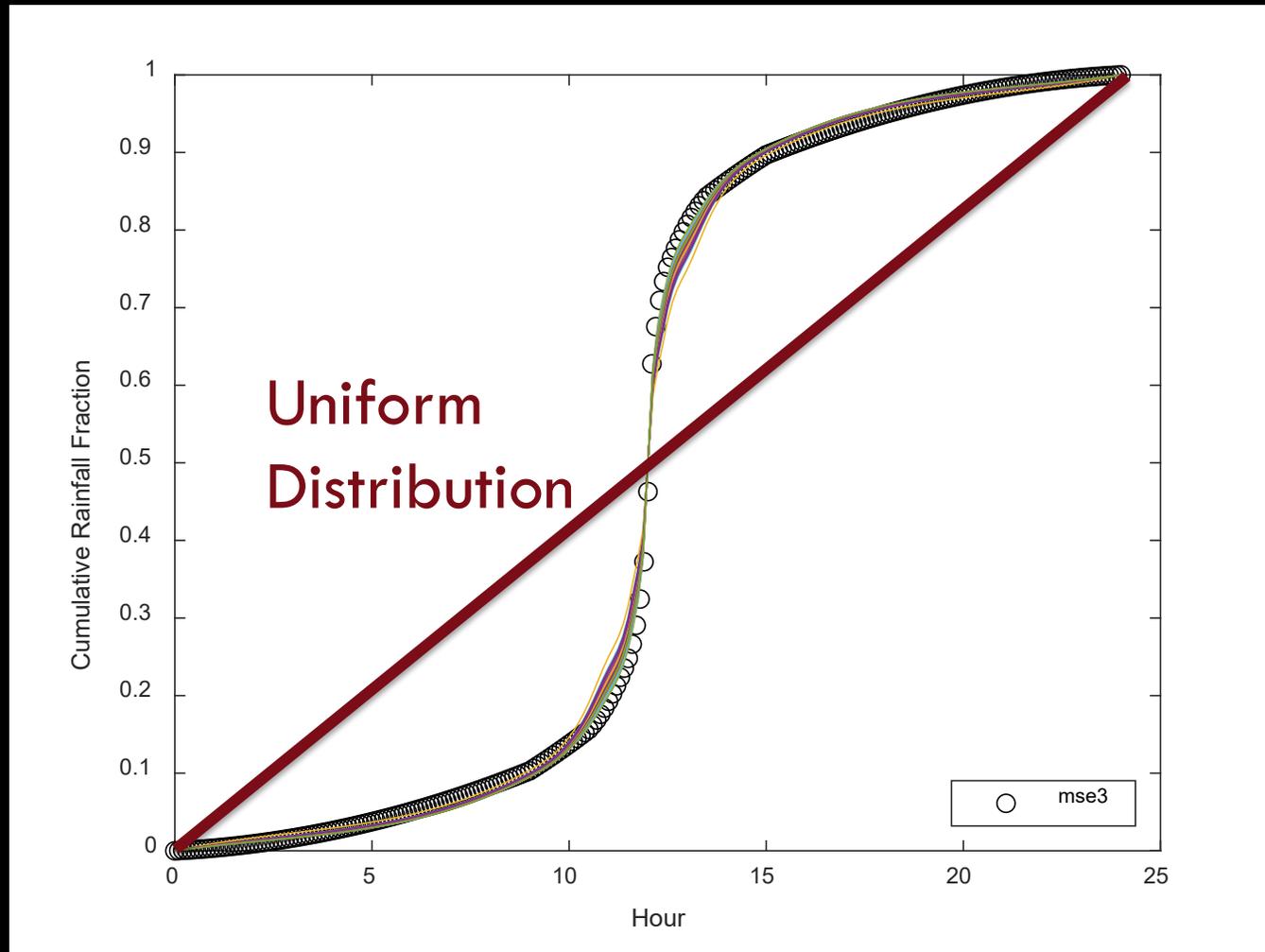
Erickson et al., (2023). "Climate Change Adaptation of Urban Stormwater Infrastructure." MnDOT Report no. MN 2023-21, Minneapolis, MN. June 2023.

# Influence of Rainfall Distribution



Erickson et al., (2023). "Climate Change Adaptation of Urban Stormwater Infrastructure." MnDOT Report no. MN 2023-21, Minneapolis, MN. June 2023.

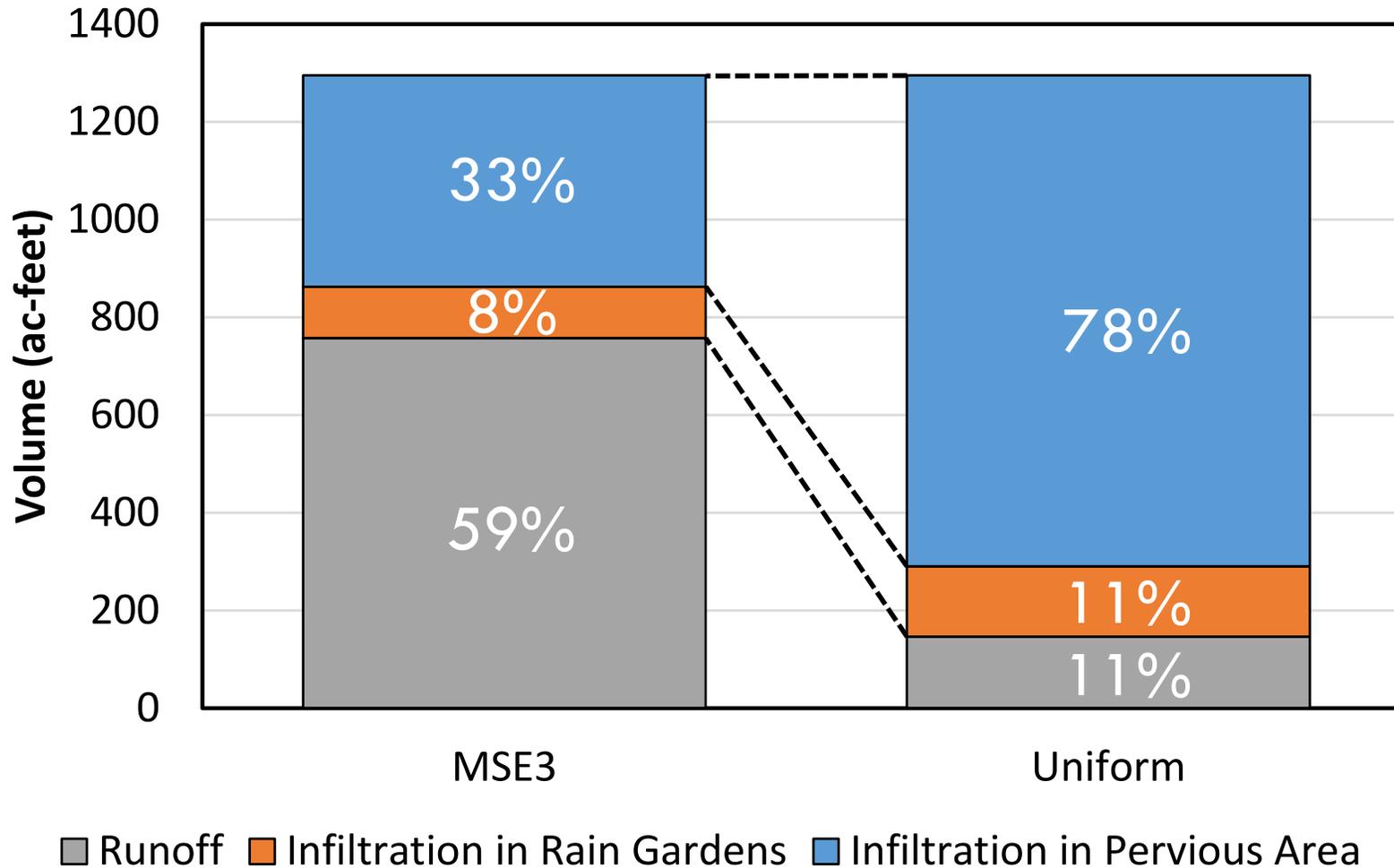
# Influence of Rainfall Distribution



Uniform distribution  
assumes **constant**  
**rainfall** throughout

Erickson et al., (2023). "Climate Change Adaptation of Urban Stormwater Infrastructure." MnDOT Report no. MN 2023-21, Minneapolis, MN. June 2023.

# Influence of Rainfall Distribution



**+132%** infiltration  
in pervious areas

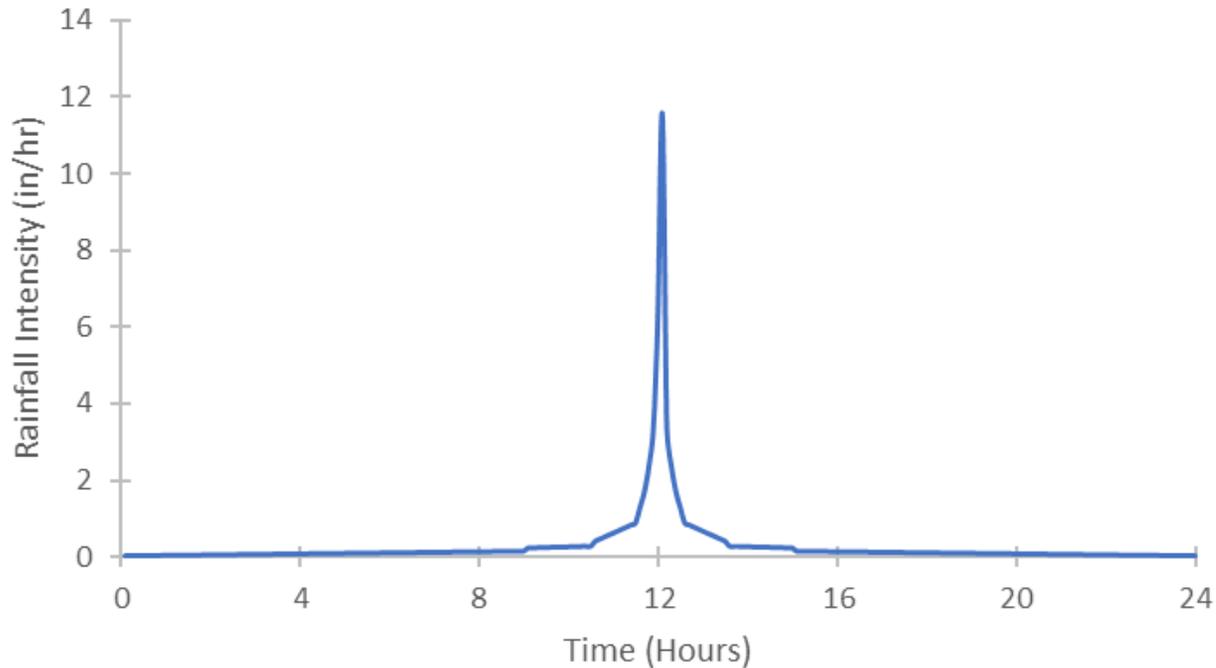
**+37%** infiltration  
in rain gardens

**-81%** Runoff

*Erickson et al., (2023). "Climate Change Adaptation of Urban Stormwater Infrastructure." MnDOT Report no. MN 2023-21, Minneapolis, MN. June 2023.*

# How do Real Storms Compare?

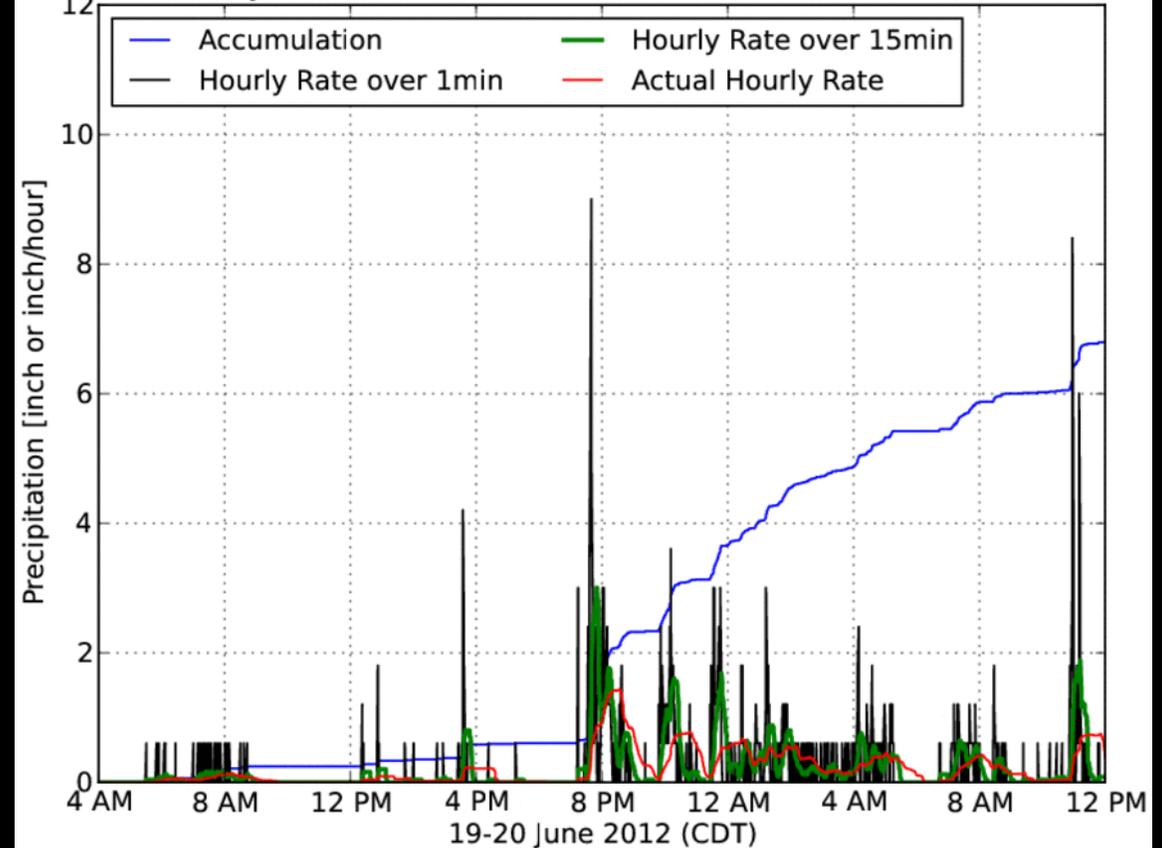
Precipitation Intensity of a 7-inch event following the MSE3 24-Hour Storm Distribution



## Design Storm = MSE3 Distribution

- Single Intense Peak
- 80% of Rain in 6 hours; 50% in 1 Hour

19-20 June 2012 Duluth, MN (KDLH) One Minute Rainfall



Source: Daryl Herzmann, [https://www.weather.gov/dlh/june2012\\_duluth\\_flood](https://www.weather.gov/dlh/june2012_duluth_flood)

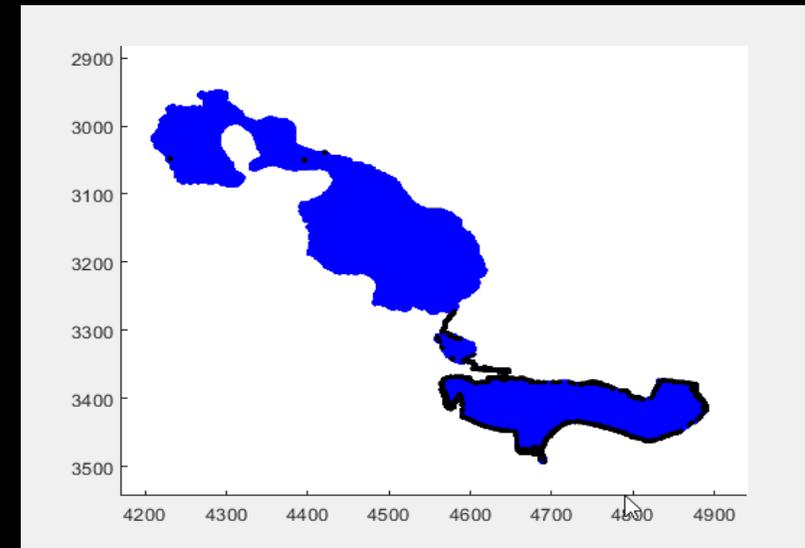
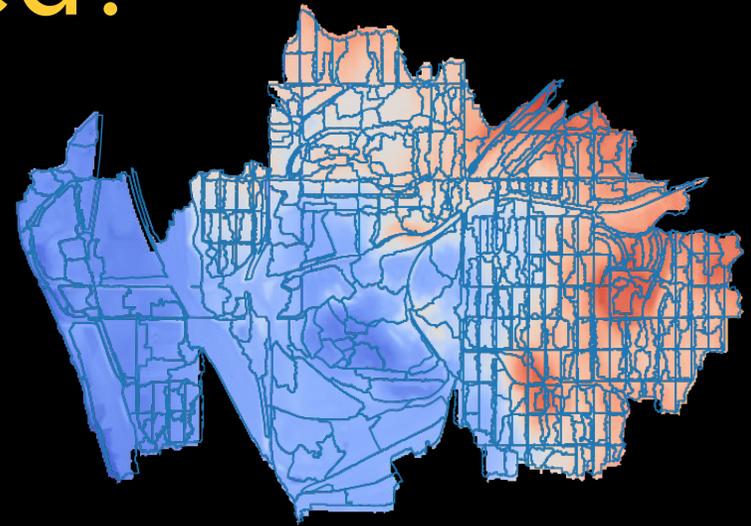
## Real Storm = 2012 Duluth Storm Distribution

- Multiple Intense Peaks
- Longer duration, antecedent dry time, low intensity

# What have we learned?

## Modeling Implications:

- Current models were **not calibrated for large, low frequency, extreme events** (surface storage, routing, and flood depth)
  - good relative comparison, not predictive accuracy
- **Overland flow paths misrepresented** in existing models (see previous bullet)
  - current research into GIS tools to improve surface storage and routing
- **Type II and MSE3 disadvantages** the benefits of **pervious infiltration and green infrastructure**

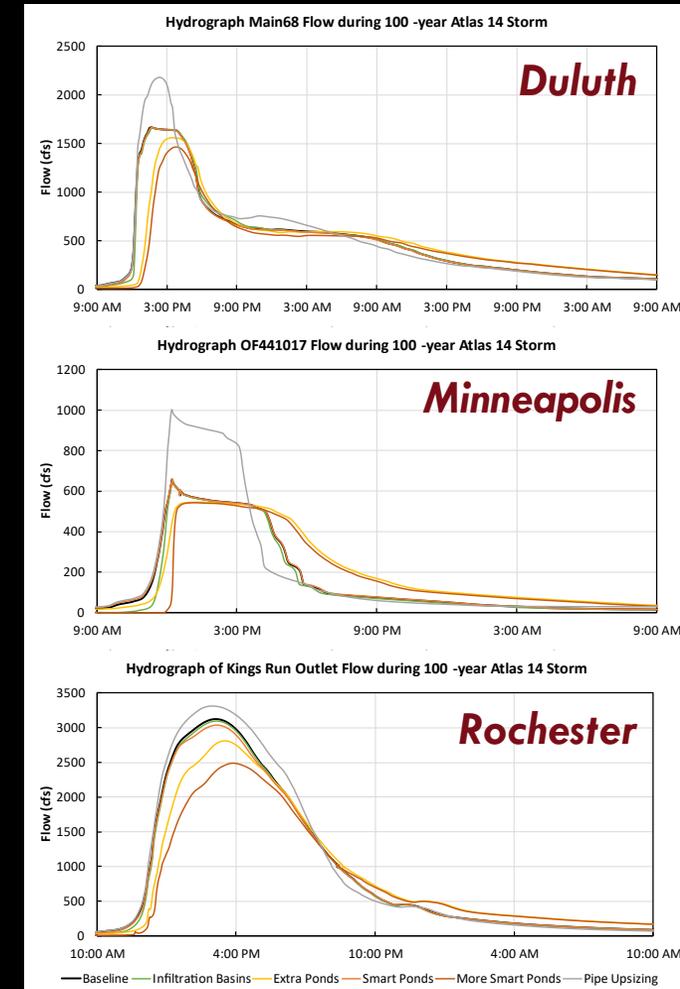


Erickson et al., (2023). "Climate Change Adaptation of Urban Stormwater Infrastructure." MnDOT Report no. MN 2023-21, Minneapolis, MN. June 2023

# What have we learned?

## Adaptation Strategies

- Current design philosophy is not sufficient to prevent flooding from 10-year and larger design storm events
- The most cost-effective climate change adaptation strategy = **more storage** for untreated impervious surfaces (Extra Ponds Scenario)
- Property in fully developed watersheds for new stormwater infrastructure may be costly
- Smart Ponds do not require new land → relatively **low-cost alternative** for watersheds with existing wet ponds



Erickson et al., (2023). "Climate Change Adaptation of Urban Stormwater Infrastructure." MnDOT Report no. MN 2023-21, Minneapolis, MN. June 2023

# Stormwater UPDATES Newsletter



**Stormwater UPDATES**

## Climate Change Adaptation of Urban Stormwater Infrastructure

Three Case Studies of Stormwater Infrastructure in Minnesota Watersheds



In June 2023, we released a report of interest to stormwater managers in Minnesota. Using past, present, and future climate model-based predictions, along with population growth predictions, we analyzed the current stormwater management infrastructure of three urban watersheds in Minnesota to see how they would hold up in future "peak flooding" events.

Our intention was not to develop specific adaptation plans for Minneapolis, Duluth, and Rochester, but to generate guidelines for Minnesota watersheds in general, as we face climate

**Stormwater UPDATES**

## Minnesota Stormwater Seminar Series: Defining the footprint of sediment in green stormwater infrastructure

Please join us THIS WEEK [in person or online](#) on **December 14, 2023 at 10am CST** for the next Minnesota Stormwater Seminar Series event - a monthly experience featuring national, state, and local experts on stormwater and green infrastructure. This seminar series is a partnership between the [University of Minnesota's St. Anthony Falls Laboratory](#) and [Water Resources Center](#), and the [Minnesota Pollution Control Agency](#), and made possible through the [Minnesota Stormwater Research and Technology Transfer Program](#) in collaboration with the [Minnesota Stormwater Research Council](#).

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Received from a friend? Sign up yourself!!

**Title:** [Defining the footprint of sediment in green stormwater infrastructure](#)

**Speaker:**

- **Dr. Virginia Smith**, Associate Professor of Civil and Environmental Engineering and a principal investigator in the Villanova Center for Resilient Water Systems, Villanova University.



**Invited Panelists:**

- **Ab Fleming**, Sustainable Landcare Manager + Lead Trainer, Metro Blooms.

**Stormwater UPDATES**

## Upcoming Stormwater Conferences, Presentations, Workshops, and Webinars

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Photo Courtesy: ASCE EWR!

We hope you can join us at any (or all) of the upcoming knowledge transfer events over the next few months! The following is a list of events at which stormwater and water

**Stormwater UPDATES**

## How to Grow Plants in Biofiltration Basins while Minimizing Phosphorus in Runoff



When seeking to solve problems caused by built environments, mimicking natural environments is a logical way to go. For example, we look to plants—especially native species with their deep root systems—to help control erosion and filter contaminants in urban biofiltration basins. But the organic materials (compost) needed for plants to thrive can actually increase phosphorus in runoff, leading to harmful algae blooms (HABS) in our lakes.

Signup at <http://stormwater.safl.umn.edu/>

# Minnesota Stormwater Seminar Series

YouTube Channel: <http://z.umn.edu/swsrecord> or  
<https://www.youtube.com/@MNStormwaterSeminar/videos>



## Past National Speakers:



Bill Hunt    Bridget Wadzuk    Bill Selbig    Jamie Houle    Marcus Quigley    Elizabeth Fassman-Beck    Scott Struck    Jenn Drake    Jon Hathaway    Allen Davis    Seth Brown    Stephanie Hurley    Jane Clary    Rob Traver    Tom Scheuler & David Wood    Michelle Simon    Nina Bassuk    Ryan Winston



Jim Lenhart    Bob Pitt    Mike Dietz    Harry Zhang    Chingwen Cheng    David McCarthy    Steve Corsi    Ken Schiff    Joel Moore    Bill Hunt    Jamie Houle    Virginia Smith    Seth Brown    Ashlynn Stillwell    Shirley Clark    Ryan Winston    Chris Kloss    Aditi Bhaskar

*...and more to come!*



# Thanks for your attention! Questions?

Andy Erickson [eric0706@umn.edu](mailto:eric0706@umn.edu)



SAFL

ST. ANTHONY FALLS LABORATORY

<http://stormwater.safl.umn.edu/>



COLLEGE OF  
Science & Engineering  
UNIVERSITY OF MINNESOTA