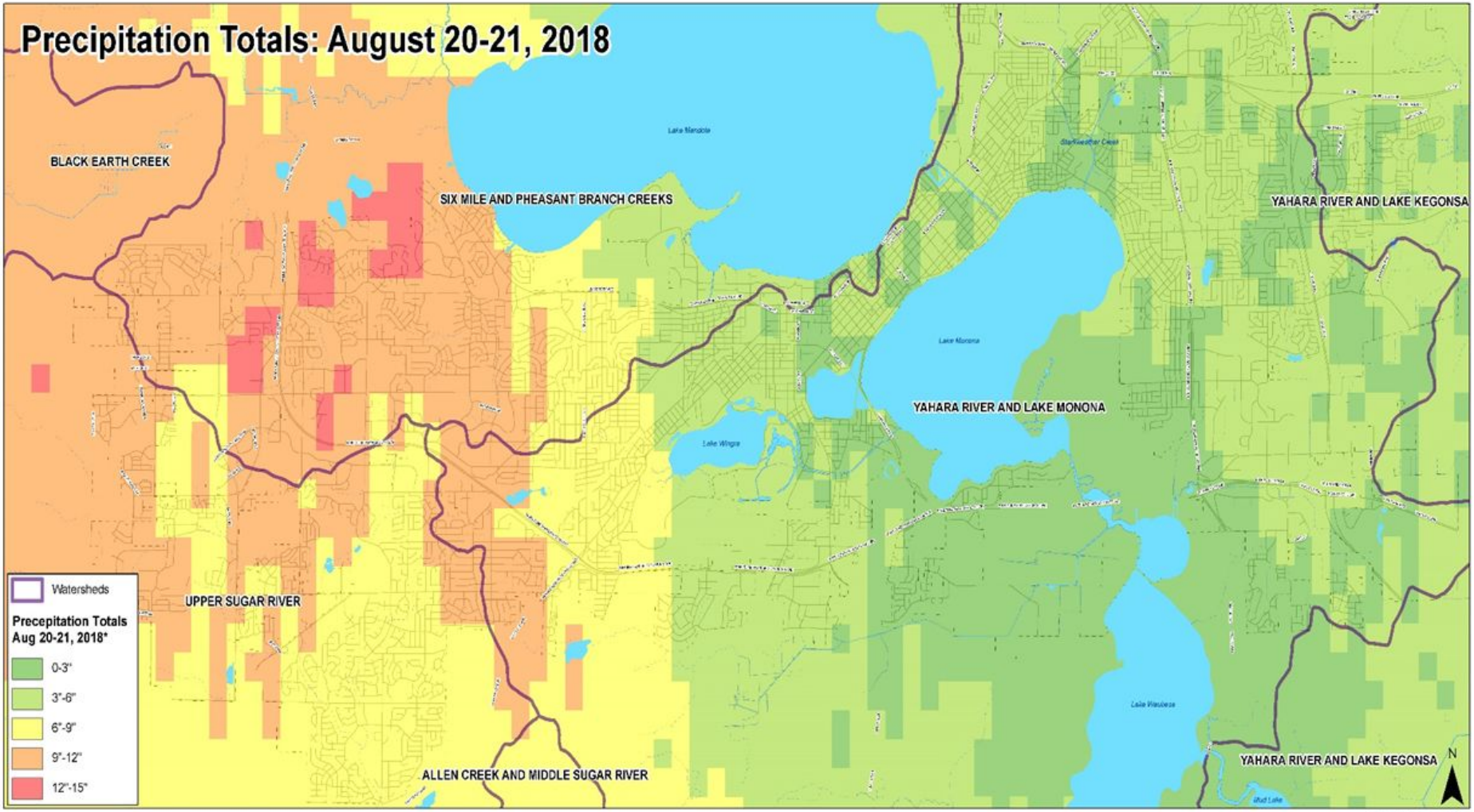
Proposed Revisions to Madison General Ordinance 37 – Stormwater City of Madison, WI

City Engineering
Greg Fries P.E.
Janet Schmidt, P.E.

Presentation Overview

- **BRIEF FLOODING REVIEW** - AUGUST 2018/19
  - Flash Flooding (2018)
- **WHAT DOES THE FUTURE HOLD**
  - Climate Change Concerns
  - Changing Rainfall Patterns
- **CITY OF MADISON ORDINANCES**
  - Design Changes
  - Existing Stormwater Ordinance
  - Proposed Ordinance Modifications
- **REVIEW OF COMMENTS AND RESPONSES**

Flash Flooding Rainfall August 20-21, 2018



KMKX Radar that was "bias corrected" using rain gauges by UW Professor Dan Wright

Historic Flooding: Flash Flooding on August 20-21, 2018

NOAA Atlas 14 Intensity Duration Frequency (IDF) Recurrence Interval

SOME AREAS RECEIVED 1,000 YEAR EVENT!

PDS-based precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.381** (0.327-0.447)	**0.437** (0.373-0.511)	**0.531** (0.453-0.623)	**0.613** (0.520-0.722)	**0.732** (0.605-0.889)	**0.829** (0.670-1.02)	**0.929** (0.728-1.16)	**1.04** (0.782-1.32)	**1.18** (0.861-1.54)	**1.30** (0.922-1.71)
10-min	**0.559** (0.478-0.654)	**0.639** (0.547-0.749)	**0.777** (0.663-0.912)	**0.898** (0.761-1.06)	**1.07** (0.886-1.30)	**1.21** (0.981-1.49)	**1.36** (1.07-1.70)	**1.52** (1.14-1.93)	**1.73** (1.26-2.25)	**1.90** (1.35-2.50)
15-min	**0.681** (0.583-0.798)	**0.780** (0.667-0.913)	**0.948** (0.808-1.11)	**1.10** (0.928-1.29)	**1.31** (1.08-1.59)	**1.48** (1.20-1.81)	**1.66** (1.30-2.07)	**1.85** (1.40-2.36)	**2.11** (1.54-2.75)	**2.32** (1.65-3.05)
30-min	**0.939** (0.804-1.10)	**1.08** (0.921-1.26)	**1.31** (1.12-1.54)	**1.52** (1.29-1.79)	**1.82** (1.50-2.20)	**2.06** (1.66-2.52)	**2.30** (1.81-2.88)	**2.57** (1.94-3.27)	**2.93** (2.13-3.81)	**3.21** (2.28-4.22)
60-min	**1.19** (1.02-1.40)	**1.38** (1.18-1.62)	**1.71** (1.46-2.01)	**1.99** (1.69-2.35)	**2.40** (1.99-2.92)	**2.74** (2.21-3.36)	**3.09** (2.42-3.85)	**3.45** (2.60-4.40)	**3.96** (2.88-5.15)	**4.36** (3.09-5.72)
2-hr	**1.45** (1.25-1.69)	**1.69** (1.46-1.97)	**2.11** (1.81-2.45)	**2.47** (2.11-2.88)	**2.99** (2.49-3.61)	**3.42** (2.78-4.17)	**3.87** (3.05-4.80)	**4.34** (3.30-5.49)	**4.99** (...46)	**5.51** (3.94-7.18)
3-hr	**1.60** (1.39-1.86)	**1.88** (1.62-2.17)	**2.35** (2.03-2.73)	**2.77** (2.37-3.22)	**3.38** (2.83-4.07)	**3.88** (3.17-4.72)	**4.41** (3.49-5.46)	**4.97** (3.79-6.28)	(4.24-...)	**6.37** (4.57-8.28)
6-hr	**1.89** (1.65-2.17)	**2.20** (1.91-2.53)	**2.75** (2.38-3.16)	**3.24** (2.79-3.74)	**3.98** (3.36-4.78)	**4.60** (3.79-5.56)	**5.26** (4.20-6.48)	**5.97** (4.60-7.51)	**6.98** (5.18-8.96)	**7.79** (5.62-10.1)
12-hr	**2.20** (1.93-2.51)	**2.52** (2.21-2.87)	**3.10** (2.71-3.54)	**3.64** (3.16-4.18)	**4.47** (3.82-5.36)	**5.19** (4.32-6.25)	**5.96** (4.81-7.31)	**6.81** (5.28-8.52)	**8.02** (6.01-10.3)	**9.02** (6.55-11.6)
24-hr	**2.51** (2.21-2.84)	**2.87** (2.53-3.25)	**3.53** (3.10-4.00)	**4.14** (3.62-4.71)	**5.08** (4.36-6.03)	**5.88** (4.93-7.03)	**6.76** (5.48-8.23)	**7.71** (6.02-9.58)	**9.08** (6.84-11.5)	**10.2** (7.46-13.0)

Historic Flooding: Flash Flooding

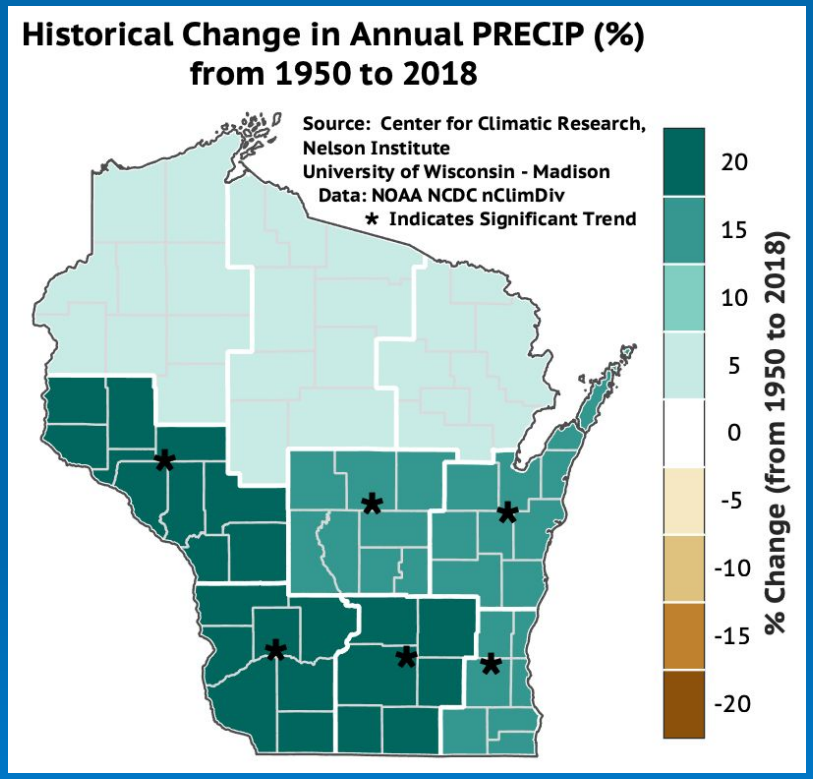
Odana Golf Course, Madison, WI

Commerce Dr, Madison, WI

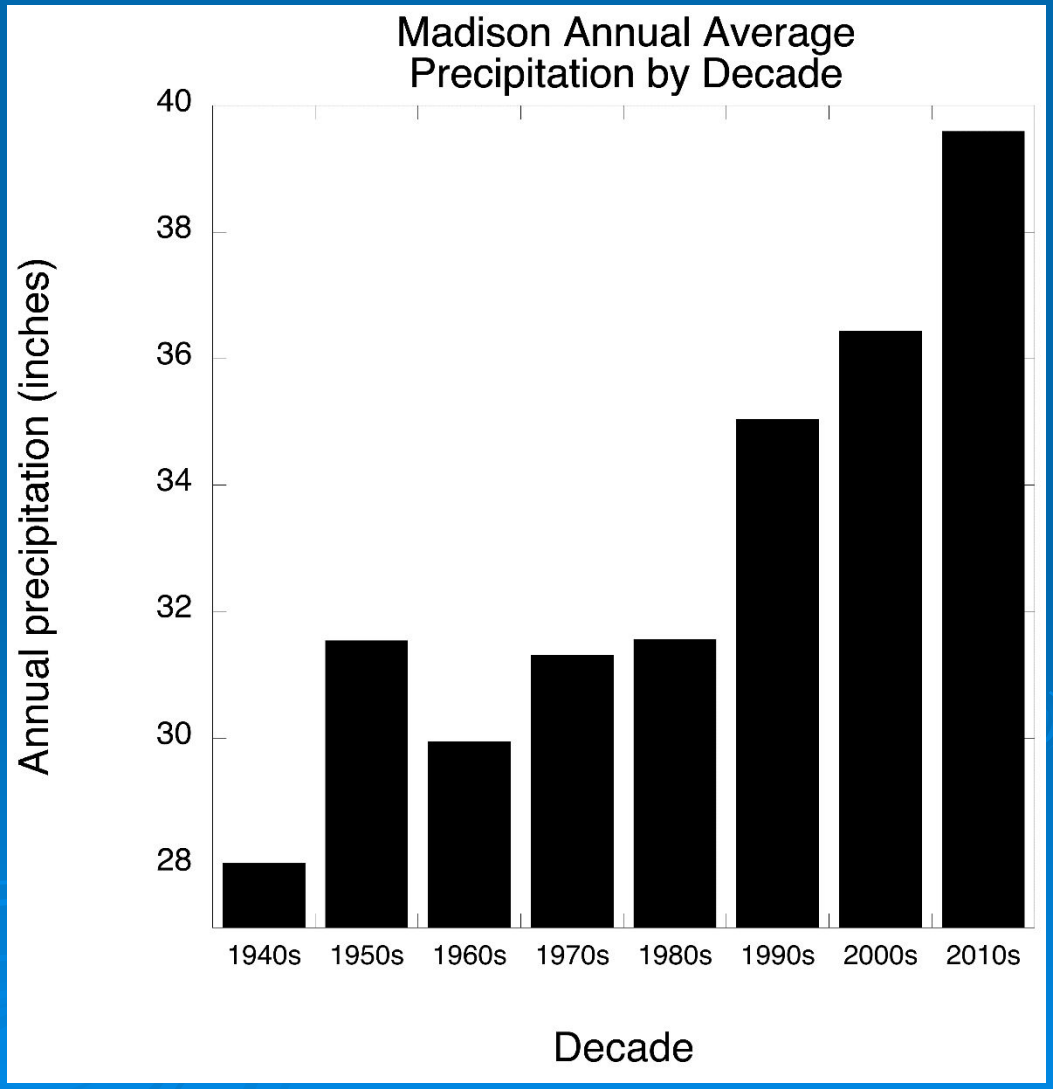
What Does the Future Hold

- The Westside of Madison experienced flash flooding events in 2016, 2017 & 2018
- The isthmus area flooded in 2018 and was very close to flooding again in 2019.
- Where does the data indicate rainfalls are headed in the future?

What Does the Future Hold?
Climate Change Concerns



Rain and snow has increased by 15% since *1950*



WISCONSIN INITIATIVE ON CLIMATE CHANGE IMPACTS

What Does the Future Hold? Climate Change Concerns

Data Sources of Rain Events			
City of Madison, WI			
Rain Events	**Technical Paper 40 US Dept. of Commerce; Weather Bureau (1963)**	**Bulletin 71 Midwest Climate Center (1992)***	**Atlas 14; Vol 8 NOAA (2017) ***
2 yr 24 hour	2.8"	2.78"	2.82" (2.52-3.19)
10 yr 24 hour	4.1"	4.20"	4.03" (3.58-4.59)
100 yr 24 hour	6.0"	7.06"	6.54" (5.35-7.98)
* Airport			

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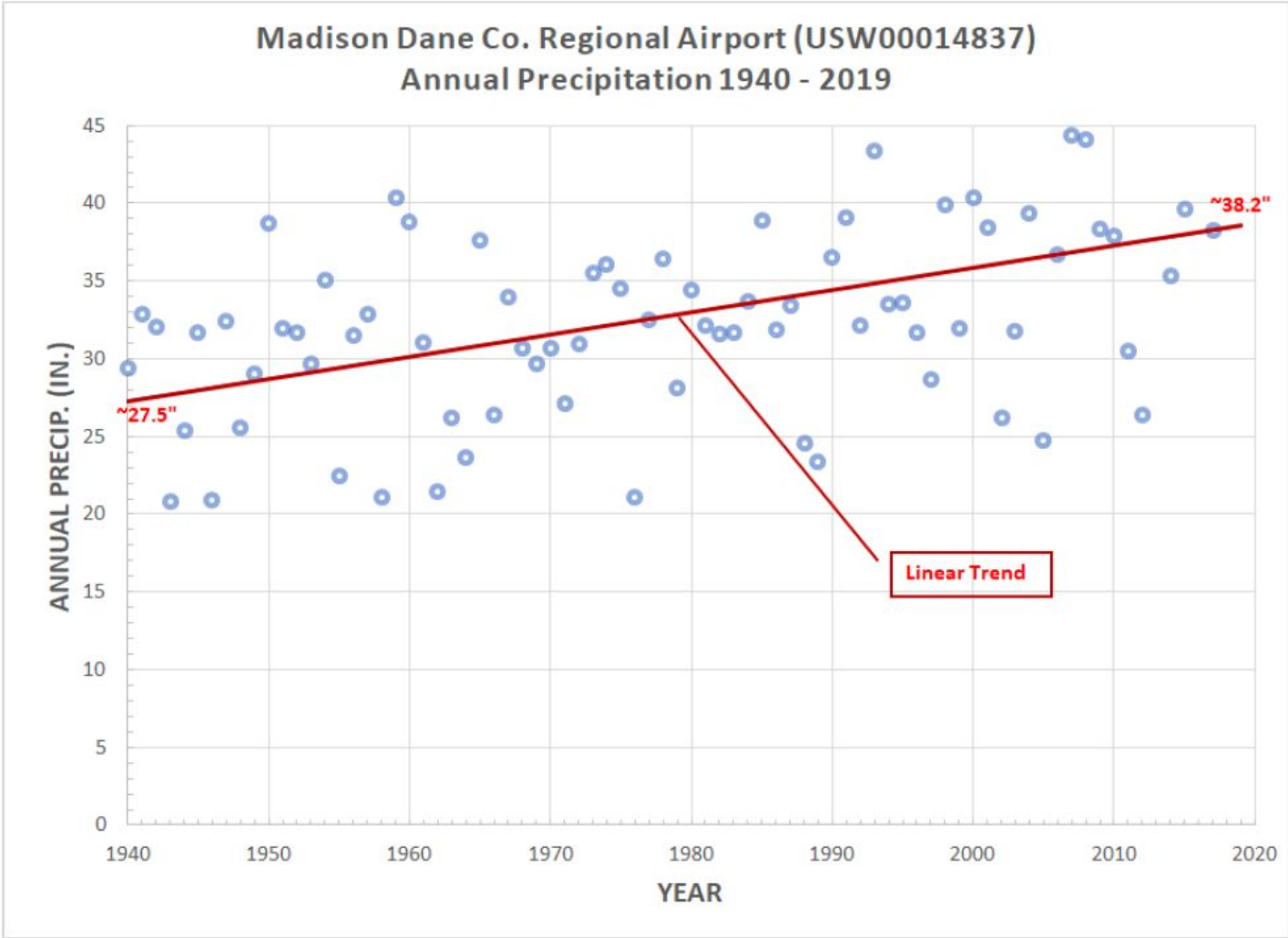
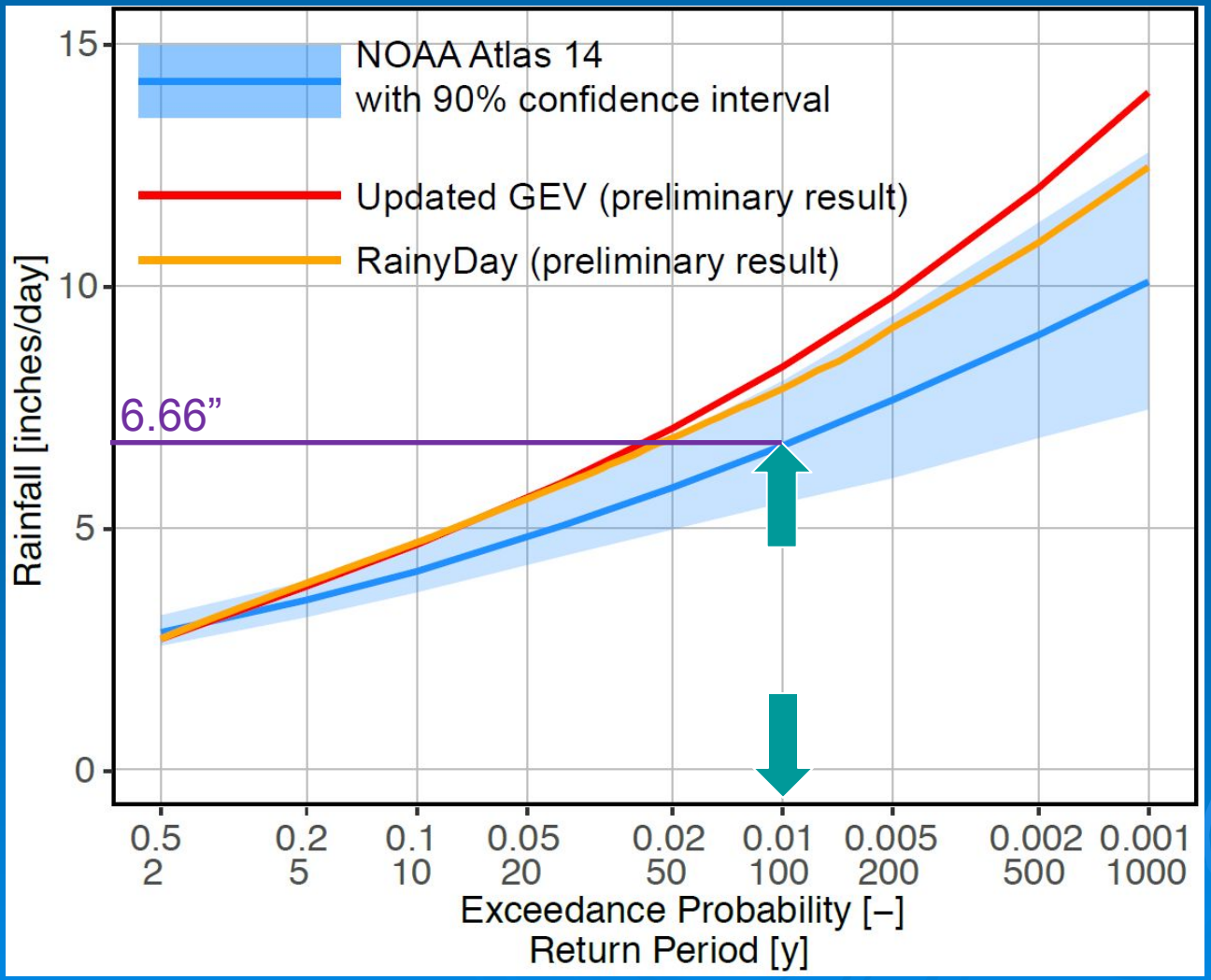


WISCONSIN INITIATIVE ON CLIMATE CHANGE IMPACTS

What Does the Future Hold? Changing Rainfall Patterns

Professor Dan Wright - RainyDay



24-hour rainfall return periods:

Blue = NOAA Atlas 14

Orange from RainyDay

Red is based on our analysis of roughly 60 years of data from the "Charmany Farm" rain gage, which is off Mineral Point near S. Rosa Rd.

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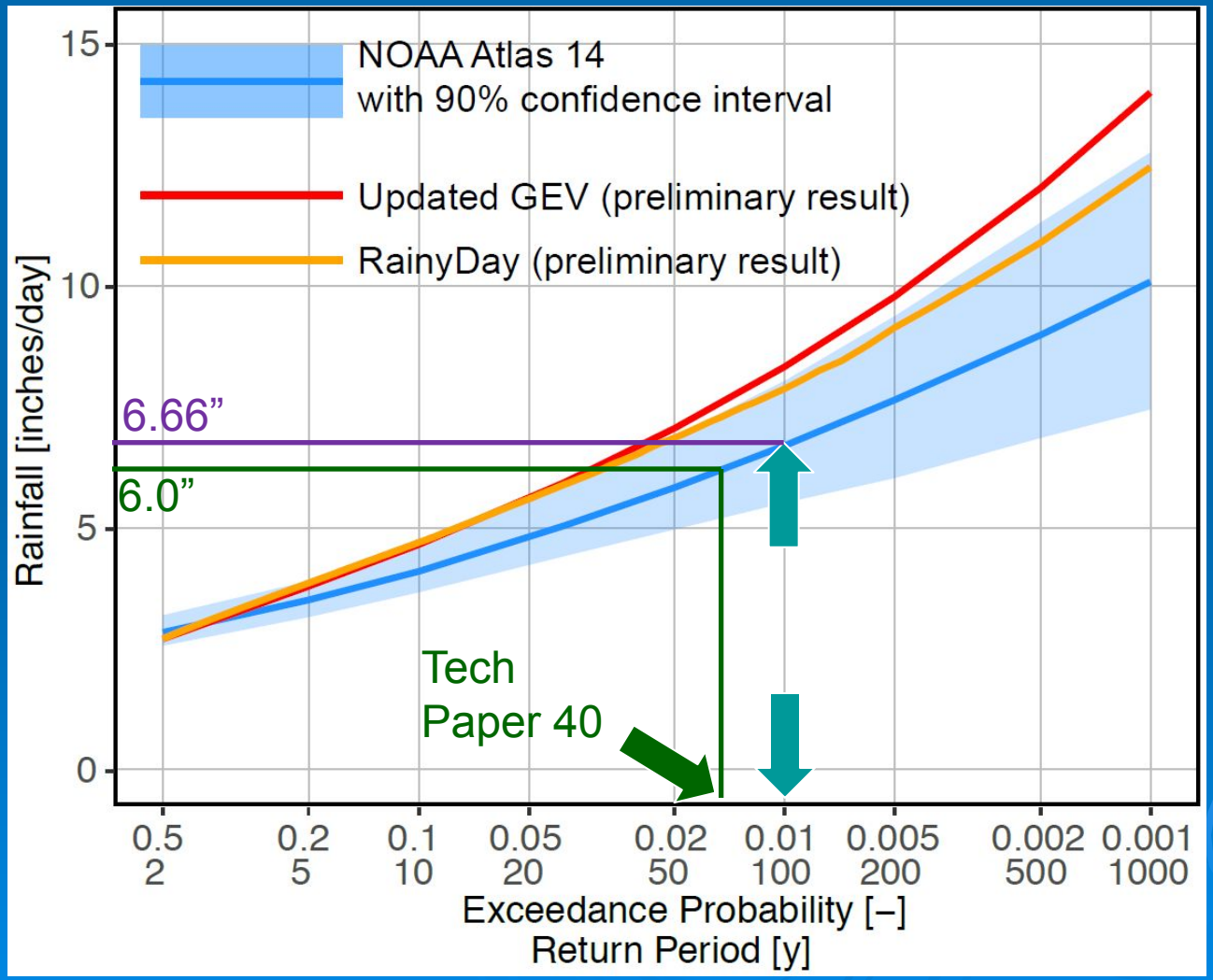

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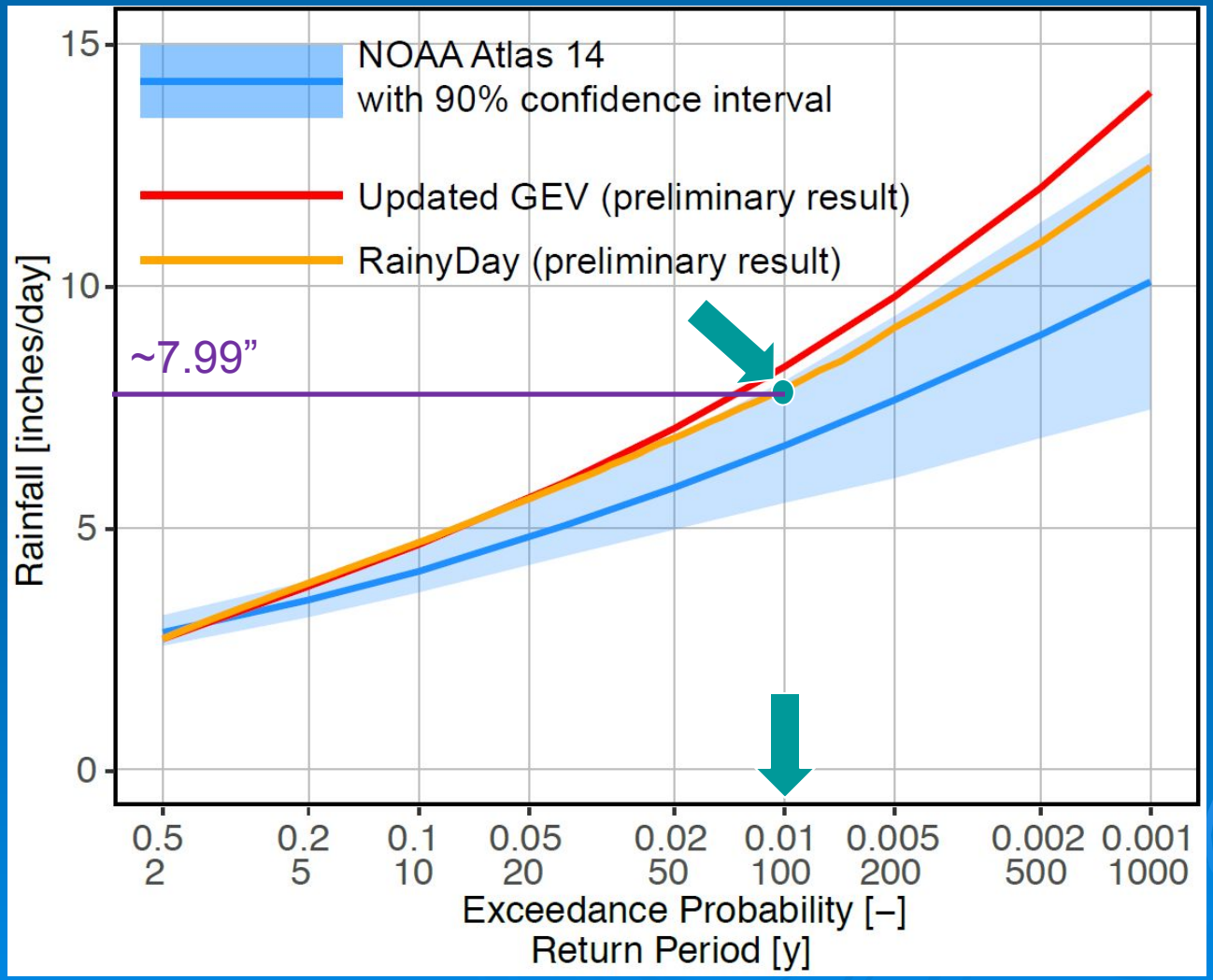

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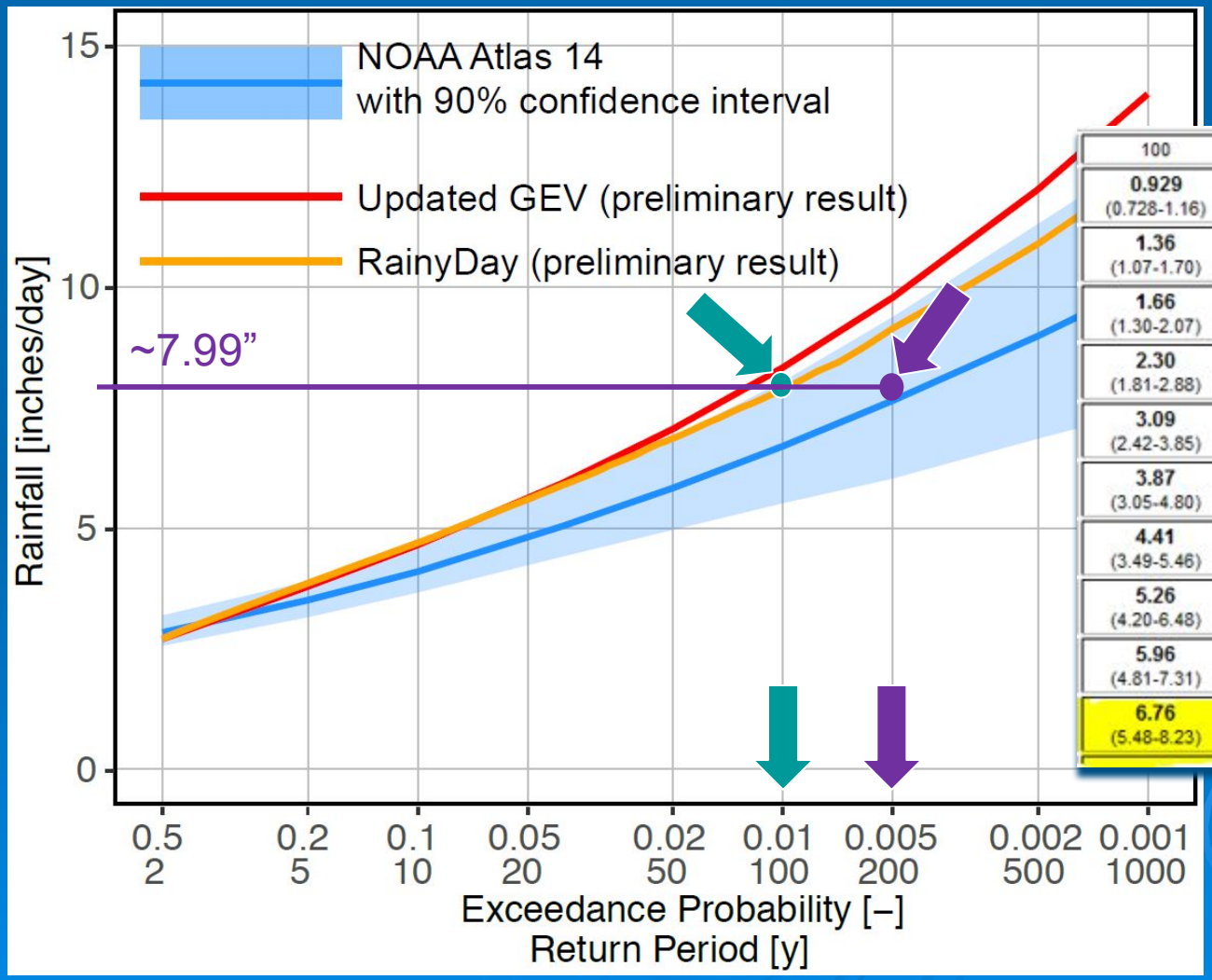

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City of Madison Ordinances:
NEW DEVELOPMENT

	NEW DEVELOPMENT	EXISTING REQUIREMENTS	PROPOSED CHANGES
Quality	Total Suspended Solids (TSS)	Reduce by 80%	NONE
	Oil and Grease	Treat from parking lots, drive thrus or sensitive areas	NONE
	Infiltration	Infiltrate 90% of predevelopment infiltration on an average annual basis (not rain event)	NONE
Quantity	Detention	1, 2, 10 & 100 year detention	1, 2, 10, 100 & **200** year detention
	Storm Sewer Pipes	10 Year	10 year
	Culverts under roads	25 or 50 year	**100 year**
	Enclosed depressions	25 year	**100 year**
	Detention basins	100 year	**200 year**
	Grandfathering old detention requirements	Allowed until 2018 flooding occurred	**Prohibited**
	Roadways are expected to act as overflows	Events not modeled	**Events are modeled**
	Overflow and access	Easement or Outlot	**only outlots accepted**
	100 Yr Routing	None	**No water leaves ROW or public property 100 year**
	500 Yr Routing	None	**500 year is routed through development Water allowed to leave ROW or public lands but no structural flooding**
	Minimum elevations	None	**Deed restrict properties with minimum opening elevations in critical areas**

City of Madison Ordinances: REDEVELOPMENT

	REDEVELOPMENT	EXISTING REQUIREMENTS	PROPOSED CHANGES
Quality	Total Suspended Solids (TSS)	Reduce by 60% from new pavement or 40% for entire site within the TMDL	NONE
	Oil and Grease	Treat from parking lots, drive thrus or sensitive areas	NONE
	Infiltration	NONE	NONE
Quantity	Detention	NONE	NONE
	Storm Sewer Pipes	10 Year	**10 year**
	Peak run-off*	NONE	**Reduce by 15% compared to existing conditions during a 10-year design storm**
	Run-off volume*	NONE	**Reduce by 5% compared to existing conditions during a 10-year design storm**
	Green Infrastructure*	NONE	**Required rate and volume reductions using green infrastructure for at least the first 1/2 inch of rainfall**
	Minimum elevations	Isthmus 851.0	**Isthmus 852.0; other areas may have minimum opening elevations prescribed in flood prone locations**

* if redevelopment has proposed impervious cover **exceeding 80%** of the existing site impervious cover, the site shall meet peak run-off, run-off volume and green infrastructure requirements

So what do the proposed changes do?

- **Madison had this historic rain on Aug 20, 2018, but…**
- **The Westside has also experienced storm events exceeding the NOAA 100-year flood event in 2016, 1017 and twice in 2018**

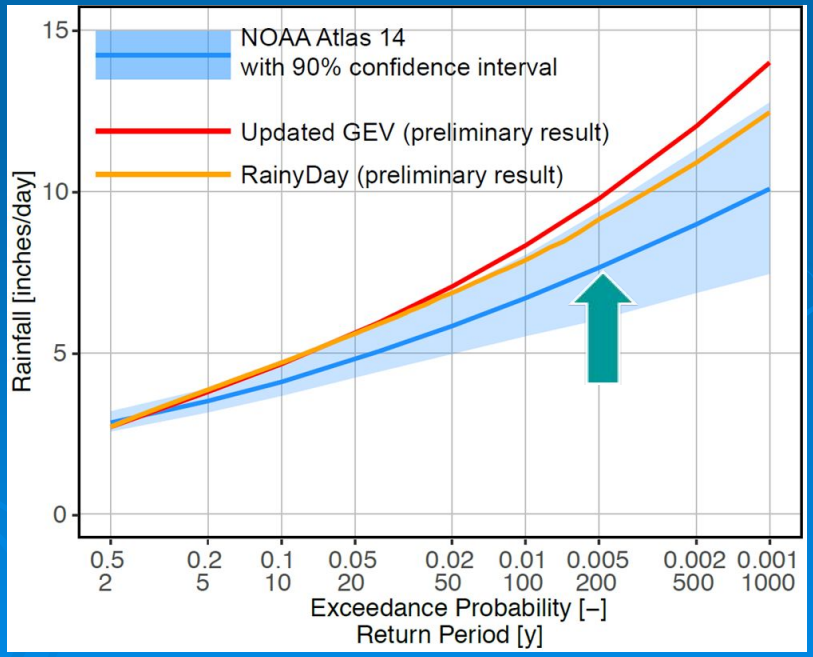
Odana Road (above), Madison, WI

So what do the proposed changes do?

- **Will this Ordinance fix all of the recent flash flooding?**
  - **NO – the areas that flooded in these events have drainage systems that are already compromised. The changes to the ordinance will not solve an existing problem.**
  - **Existing drainage issues not easily solved with the ordinance updates will be looked at as part of the City's comprehensive watershed studies.**
  - **The proposed ordinance changes WILL help to not make an existing problem worse.**
  - **We can't beat Mother Nature! If the August 2018 rain event were to occur again, areas designed to the new standards would do much better than if those standards were not in place.**

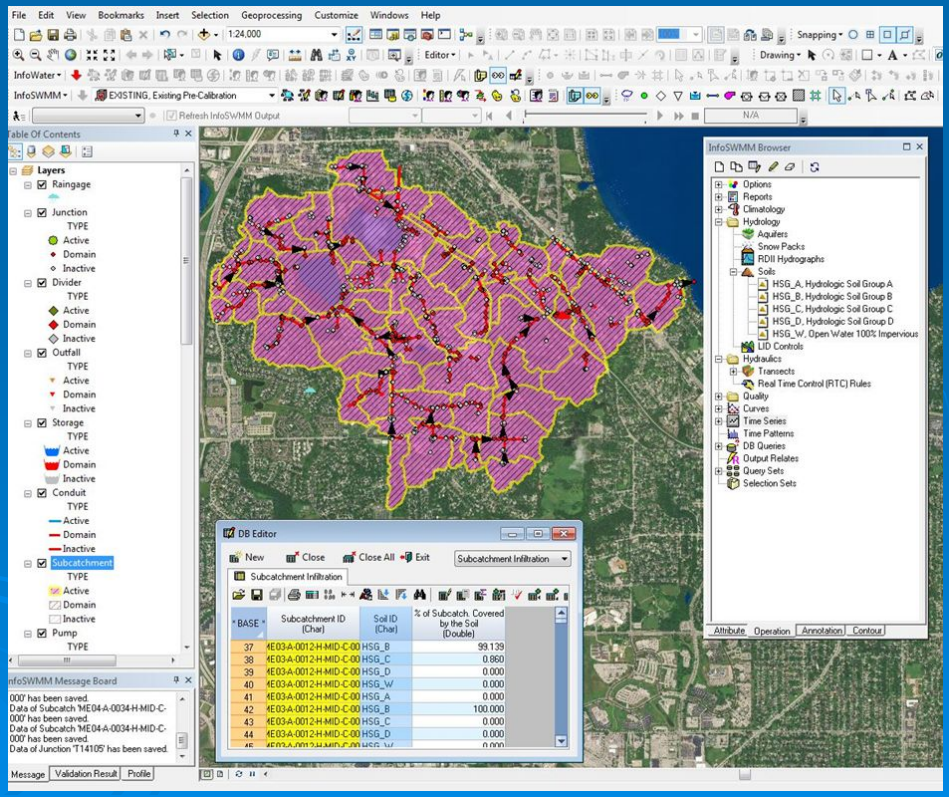
City of Madison Ordinances: What did we not propose??

- We opted to go to detention of the **200 yr event** in new development using the **NOAA Atlas 14** vs using the “Rainy Day” Intensity Duration Frequency curve.

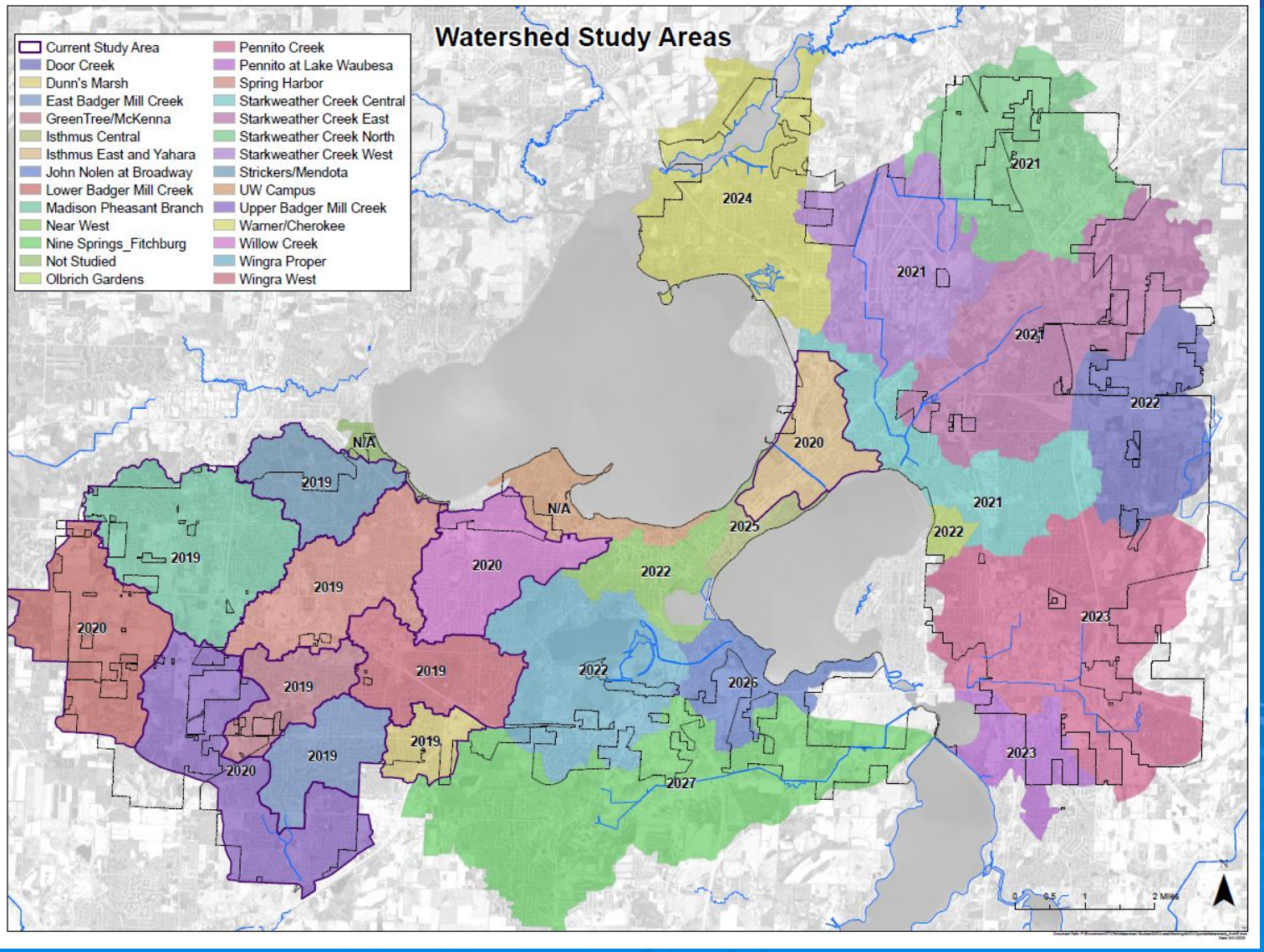


Results of flooding Citywide Watershed Studies

- 2019 Starting 7 Studies ($2M +)
  - 2020 Adding 4 Studies ($1M)
- Continue Studies for next 5-8 years
- Total 23+ Studies for Madison



Continued Efforts: Watershed Studies



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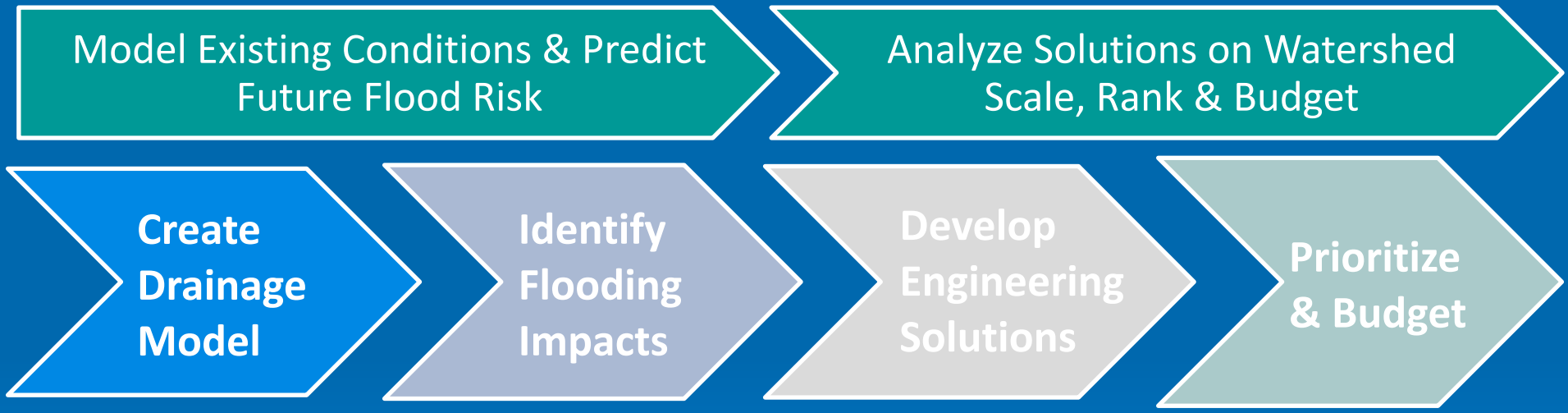


Continued Efforts: Watershed Studies

- Design Solutions:
  - Must be holistic
  - Not “move the problem elsewhere”
  - Account for climate change
    - Look at **trending increases** in storm frequency and intensity
  - Includes Green Infrastructure analysis options
  - Consider long term maintenance needs
  - Provide benefits relative to cost

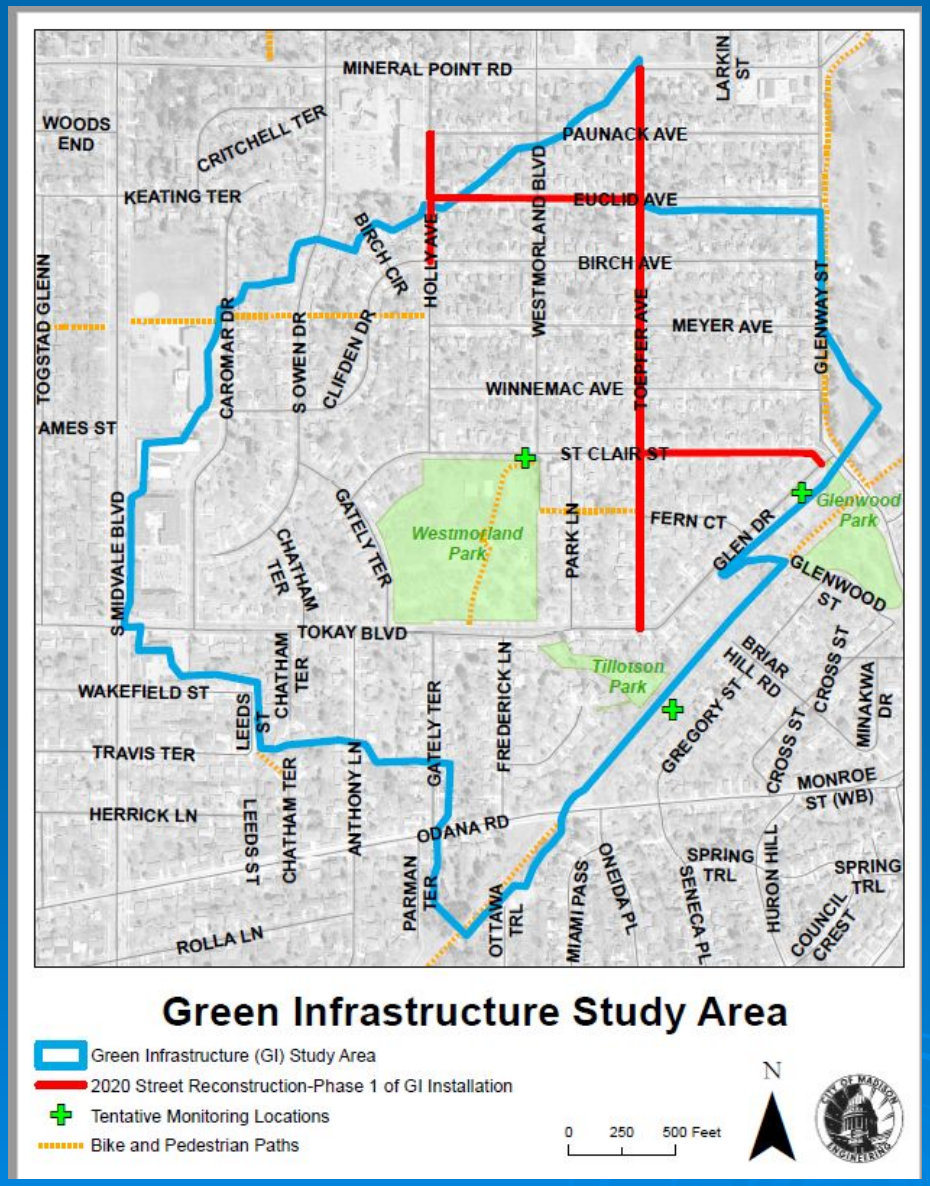
Continued Efforts: Watershed Studies

- General options with Grey Infrastructure:
  - Improve pipe and/or inlet capacity
  - Safe overflow paths
  - Reroute flow
  - Increase storage

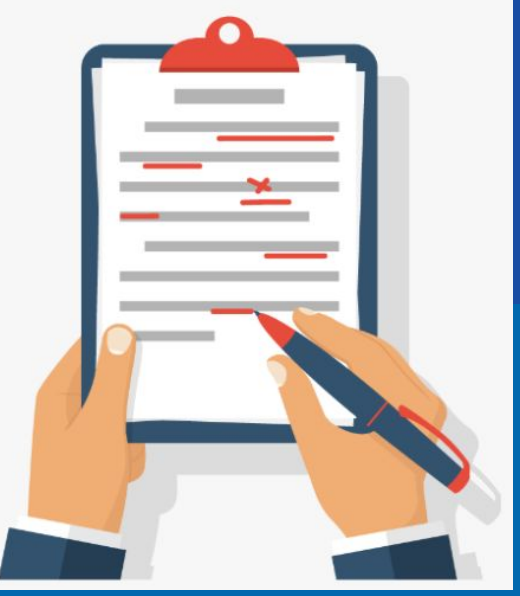
Continued Efforts: Green Infrastructur

- Options for Green Infrastructure
  - Rain Gardens, infiltration trenches, green roofs, etc
- Flood studies – Proposed Solutions
  - Green Infrastructure
  - Grey Infrastructure
  - Paired solutions
  - Incentivize private GI with rate SWU structure
- Code Review
  - RFP to look at ordinances, policies, grants
  - Grant Program

Continued Efforts - Green Infrastructure



- City of Madison is partnering with the USGS
- 5 year study
- Watershed-wide implementation of Distributed Green Infrastructure



Continued Efforts: Green Infrastructure

- RFP to review code impacts to new ordinance changes
- PR program to help roll out Green Infrastructure installations
- Will investigate grant programs / rate structure changes to support Green Infrastructure

Continued Efforts: Green Infrastructure

- Watershed studies
  - Determine the "**VALUE of GI**" in each watershed
- Resulting "**VALUE**" will inform grant programs on private property
  - Raingarden
  - Green Infrastructure

Need to engage the public – City can't achieve flood mitigation goals solely on public property.

Continued Efforts: Funding Impacts

- Nothing if free…
- Storm Water Utility Bill Increase
  - 2018 increased 2.3% (avg. residential increase of $2.15/year)
  - 2019 increased 10.1% (avg. residential increase of $9.60/year)
  - 2020 increased approximately $12-13%

  - **<u>Will continue to increase to fund infrastructure improvements in the future.</u>**

Proposed Ordinance Revision Schedule

1. Introduce to the Common Council: May 5, 2020
2. Refer to the Planning Commission: May 18, 2020
3. Refer to the Board of Public Works: May 20, 2020
4. Common Council final approval: June 2, 2020

Questions and Discussion