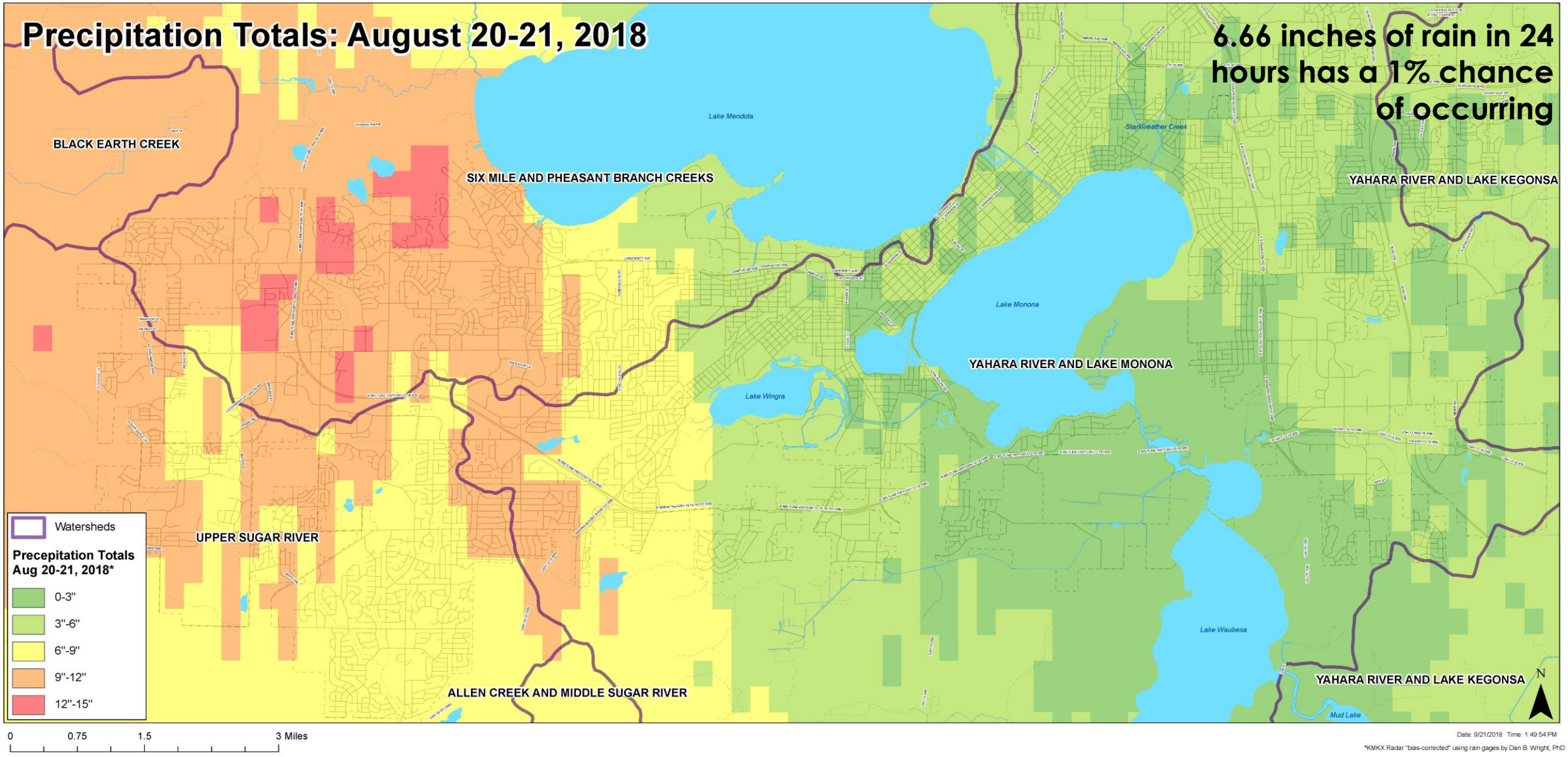
City of Madison Flooding Event

AUGUST 20TH, 2018-PRESENT

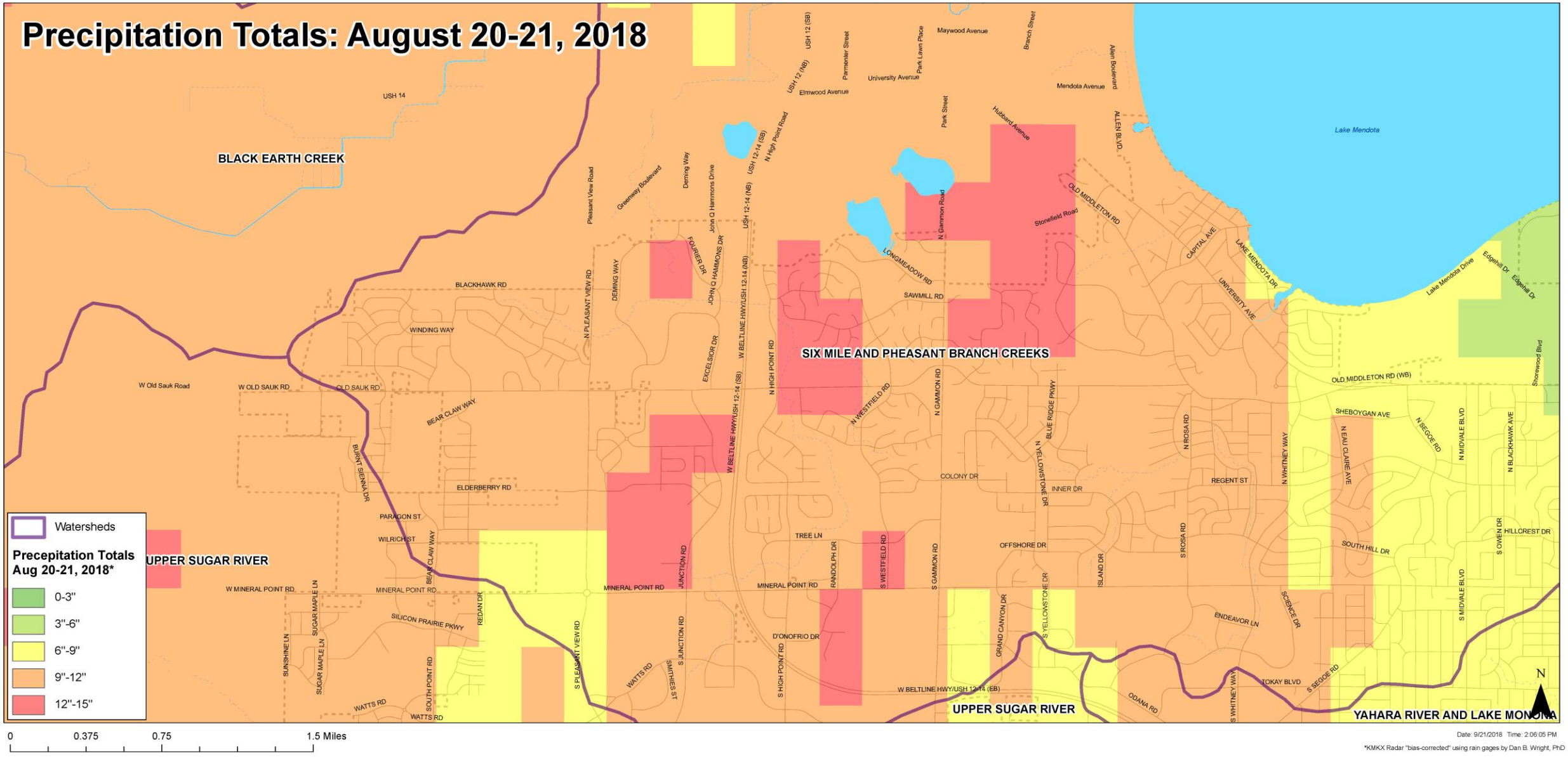
Presentation Overview

- Review of Flash Flooding and Flooding from High Lake Levels (August 20th-Present)
- Lake Level Information
- Damages
  - How did Engineering Respond?
  - Public and Private
  - Sandbag and Protective Measures
- FEMA
- How Does Engineering Plan to Proceed?
  - Moving Forward
  - New Policy
    - Short-Term Actions
    - Mid-Term Actions
    - What types of solutions will we look at???
- Next Steps

2 events: Flash Flooding + Flooding from High Lake Levels

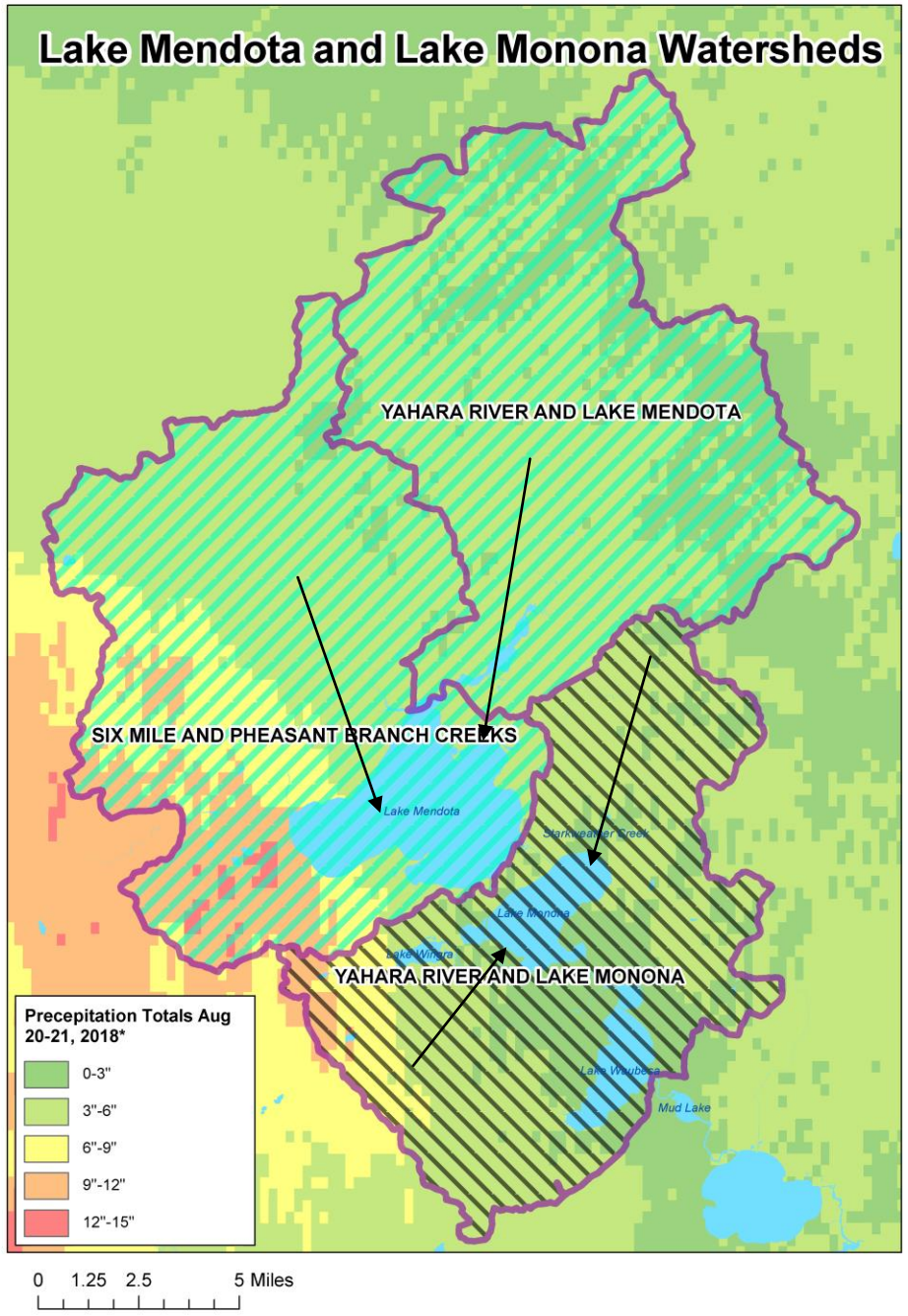


2 events: Flash Flooding

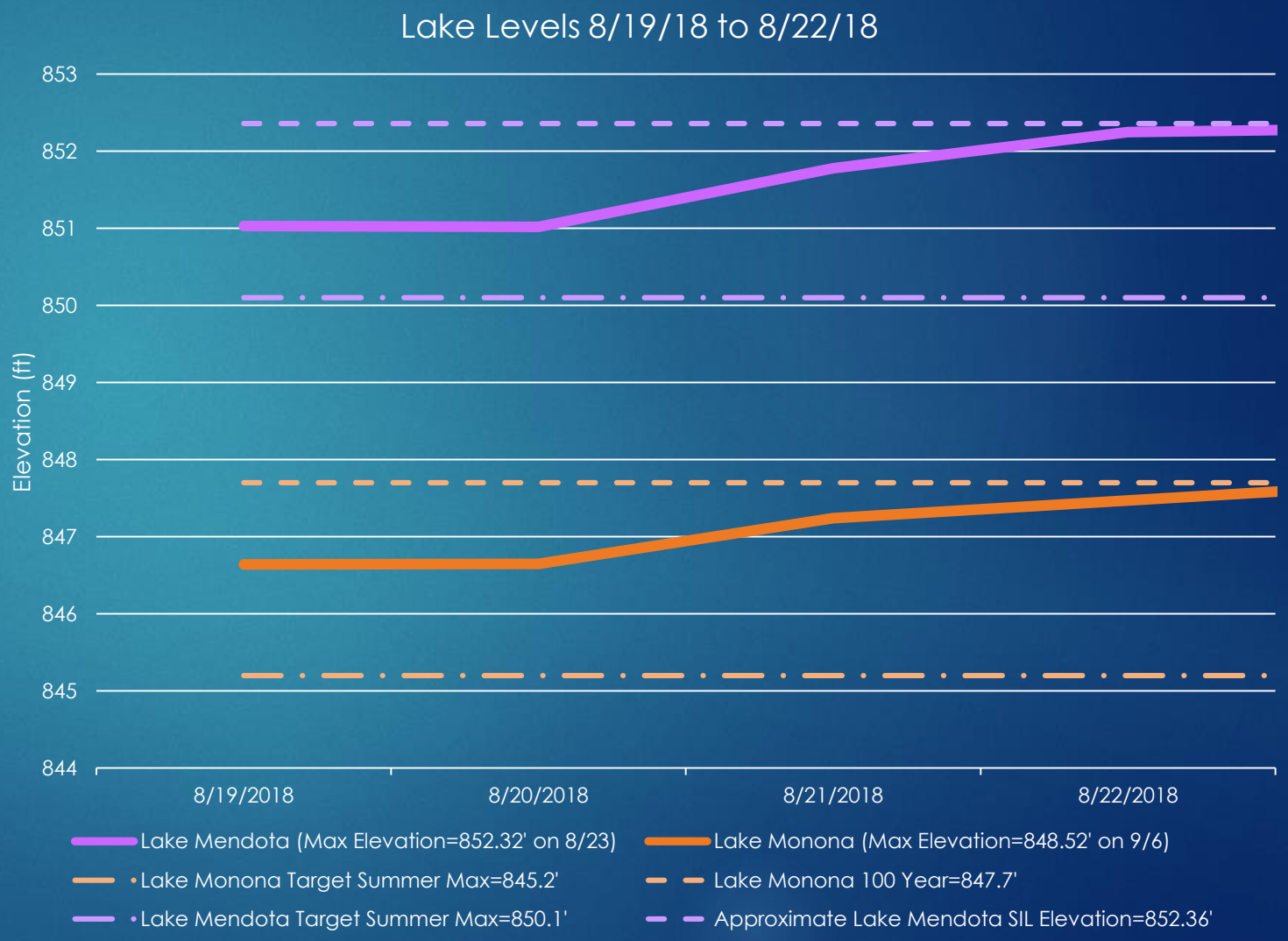


Response to Rain Event

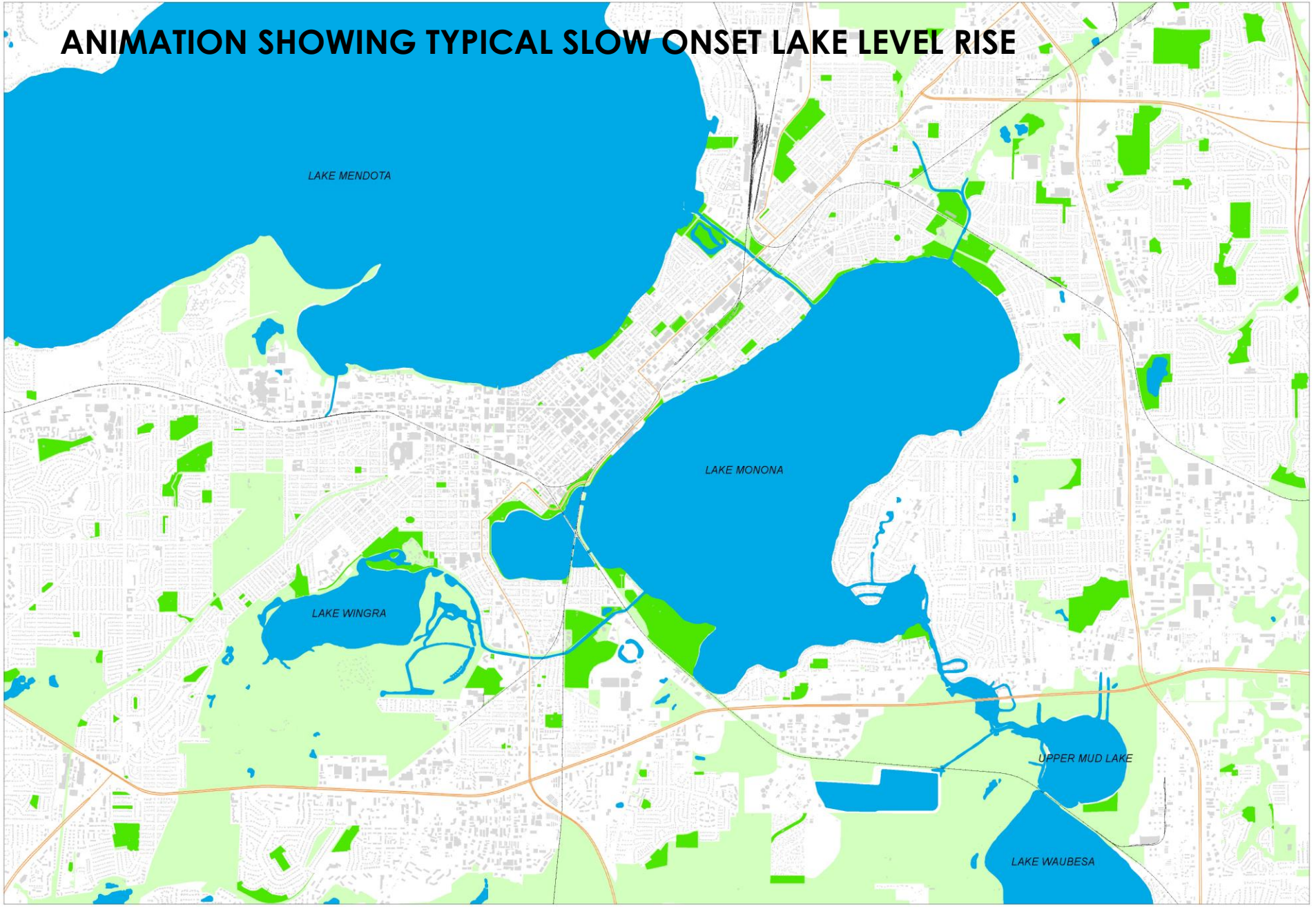
- Quick response to flash flooding
  - EOC opened
  - Damage surveyed
  - Emergency repairs
- Lake levels rise slowly
  - City was able to begin preparing the isthmus while triaging flash flooding on west side



2nd Event: High Lake Level Flooding



ANIMATION SHOWING TYPICAL SLOW ONSET LAKE LEVEL RISE



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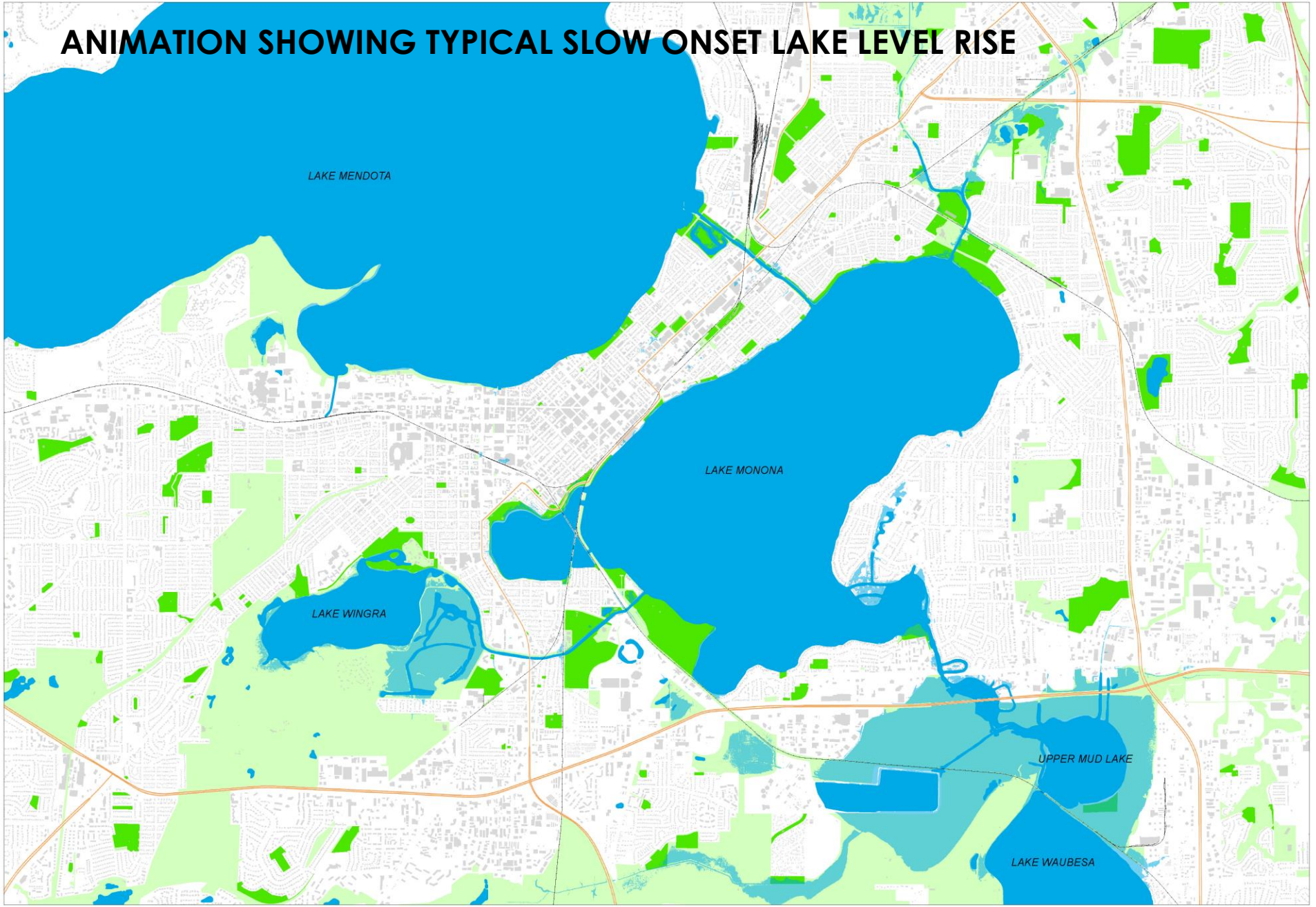

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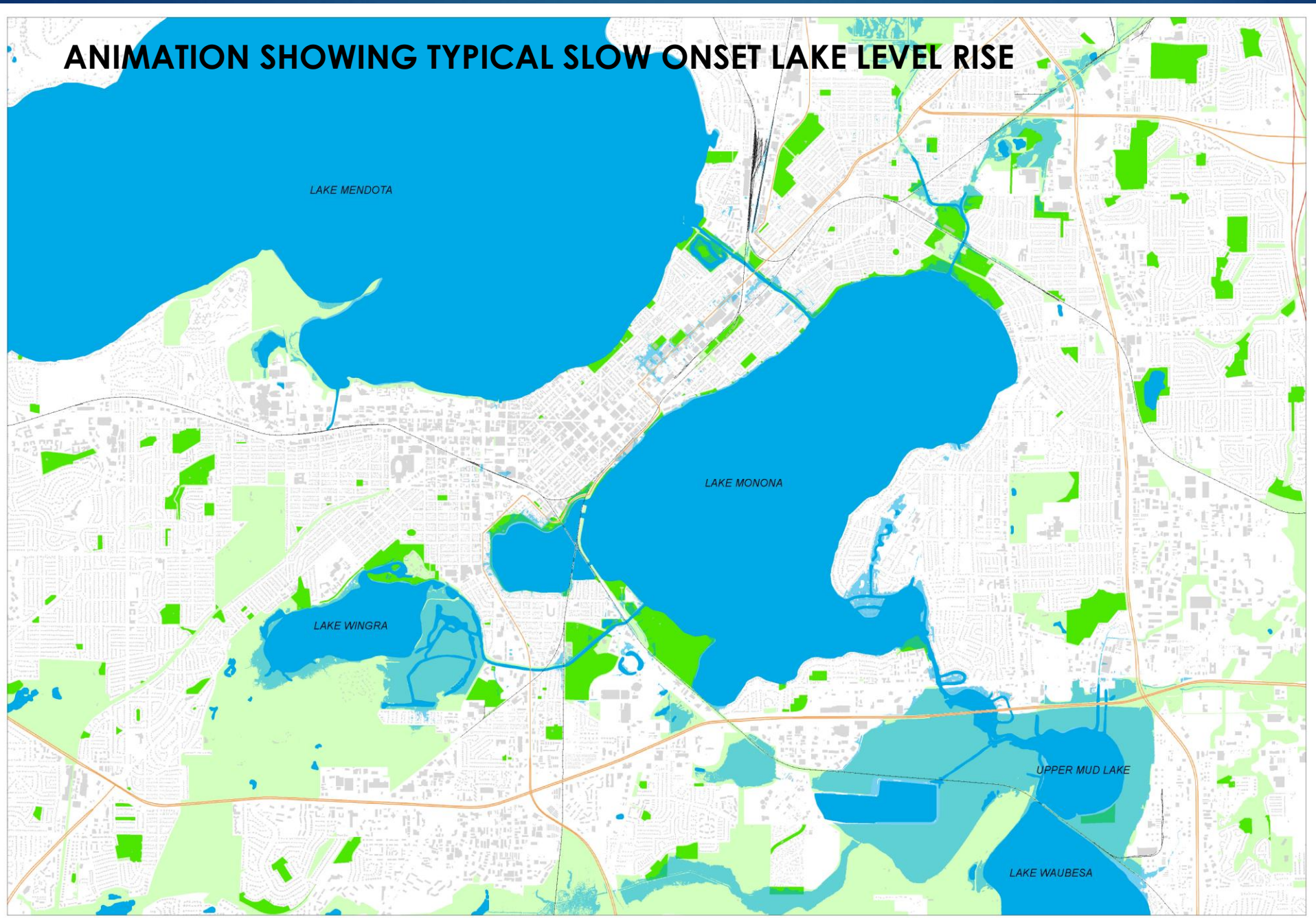
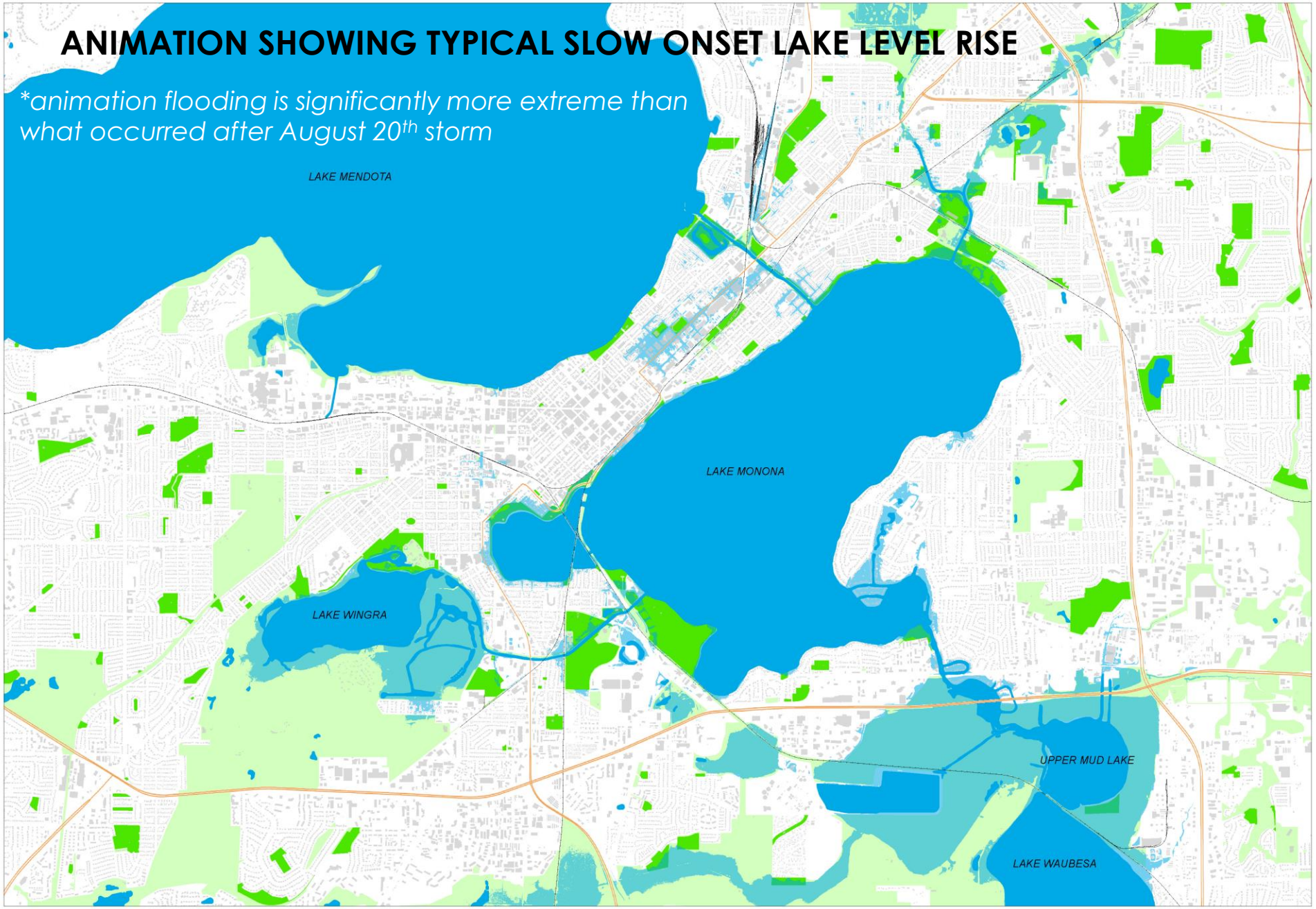
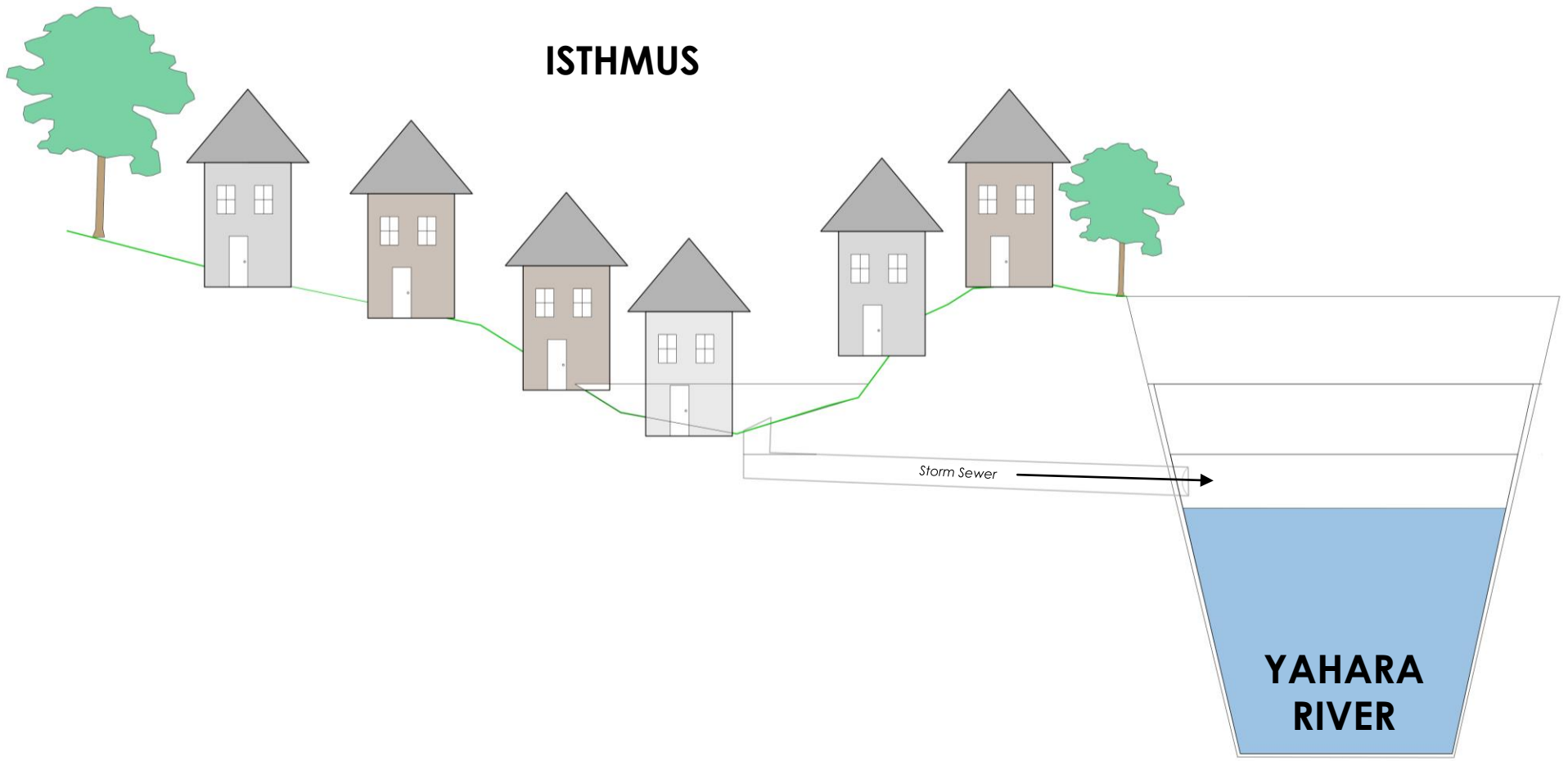


ANIMATION SHOWING TYPICAL SLOW ONSET LAKE LEVEL RISE

**animation flooding is significantly more extreme than what occurred after August 20th storm*



Isthmus Sewer Animation Example



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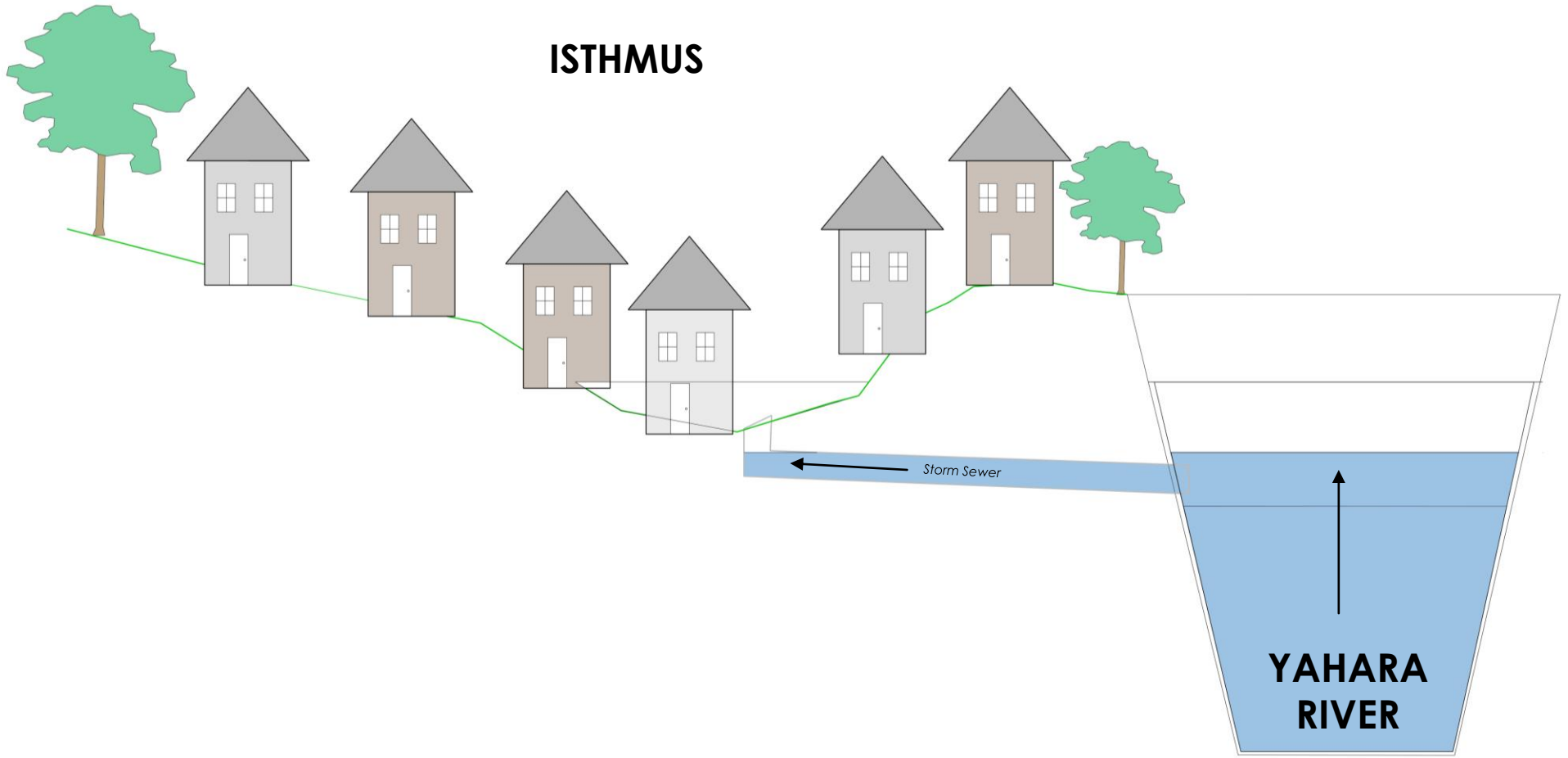
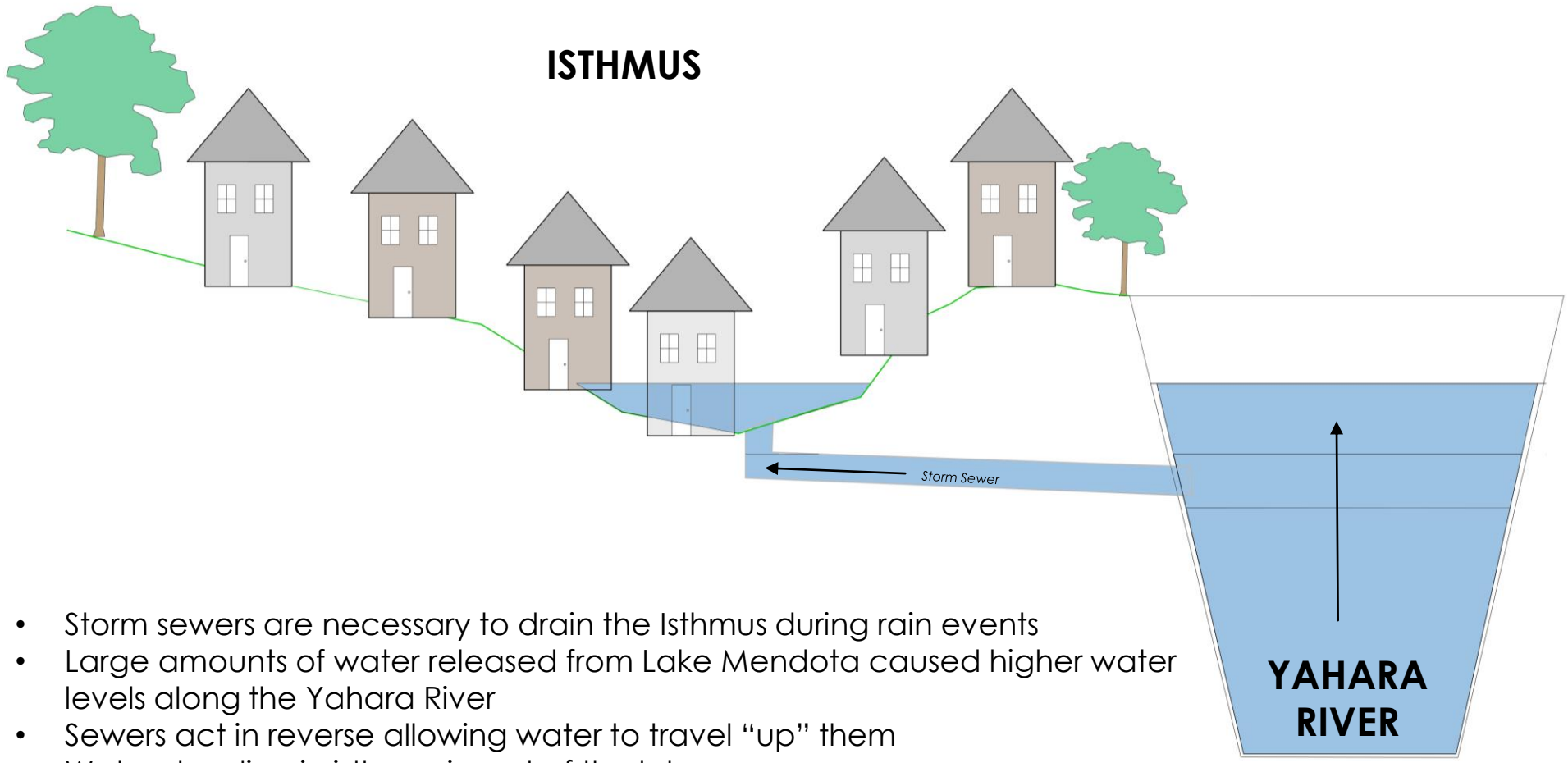
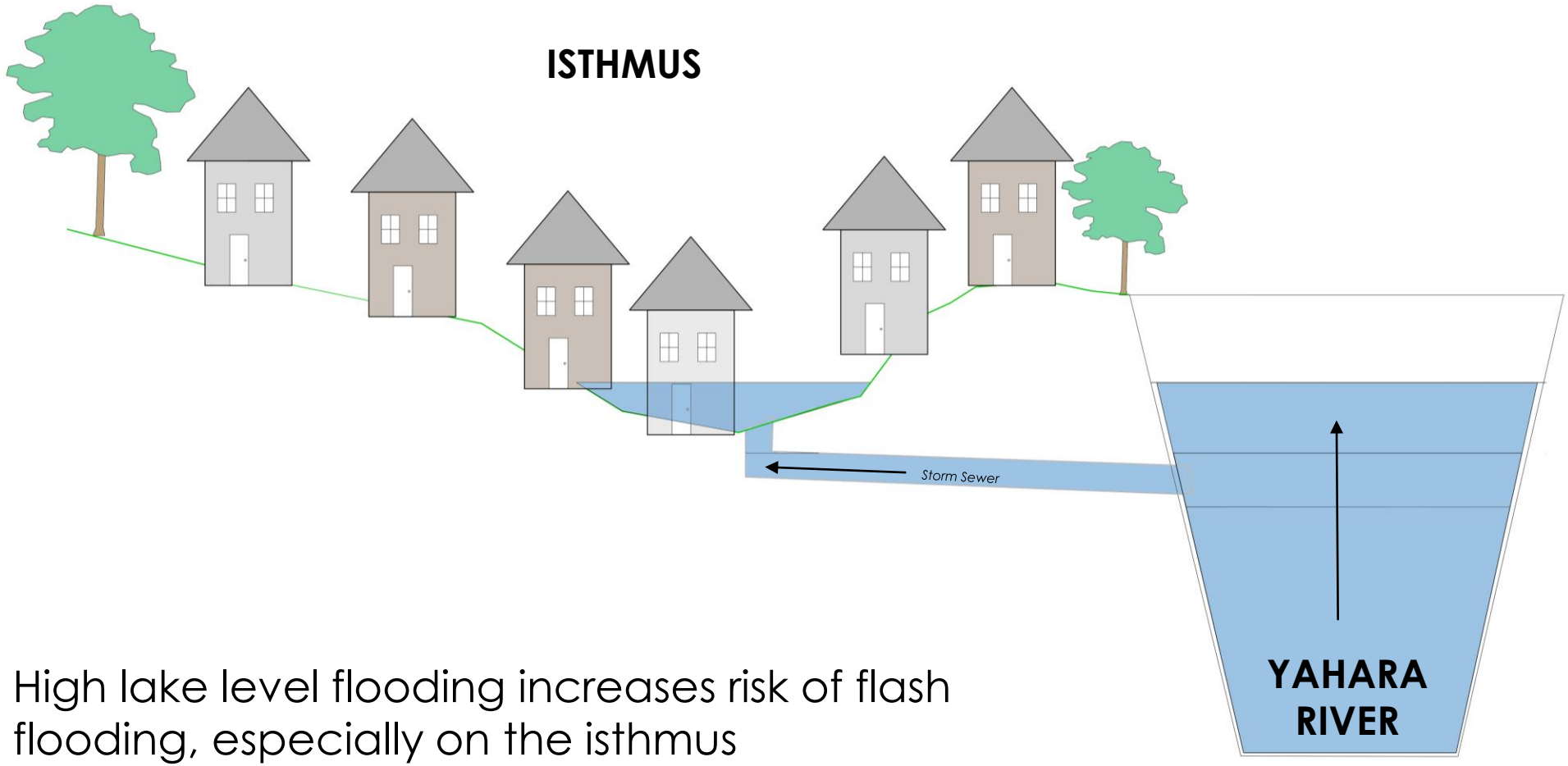


Isthmus Sewer Animation Example



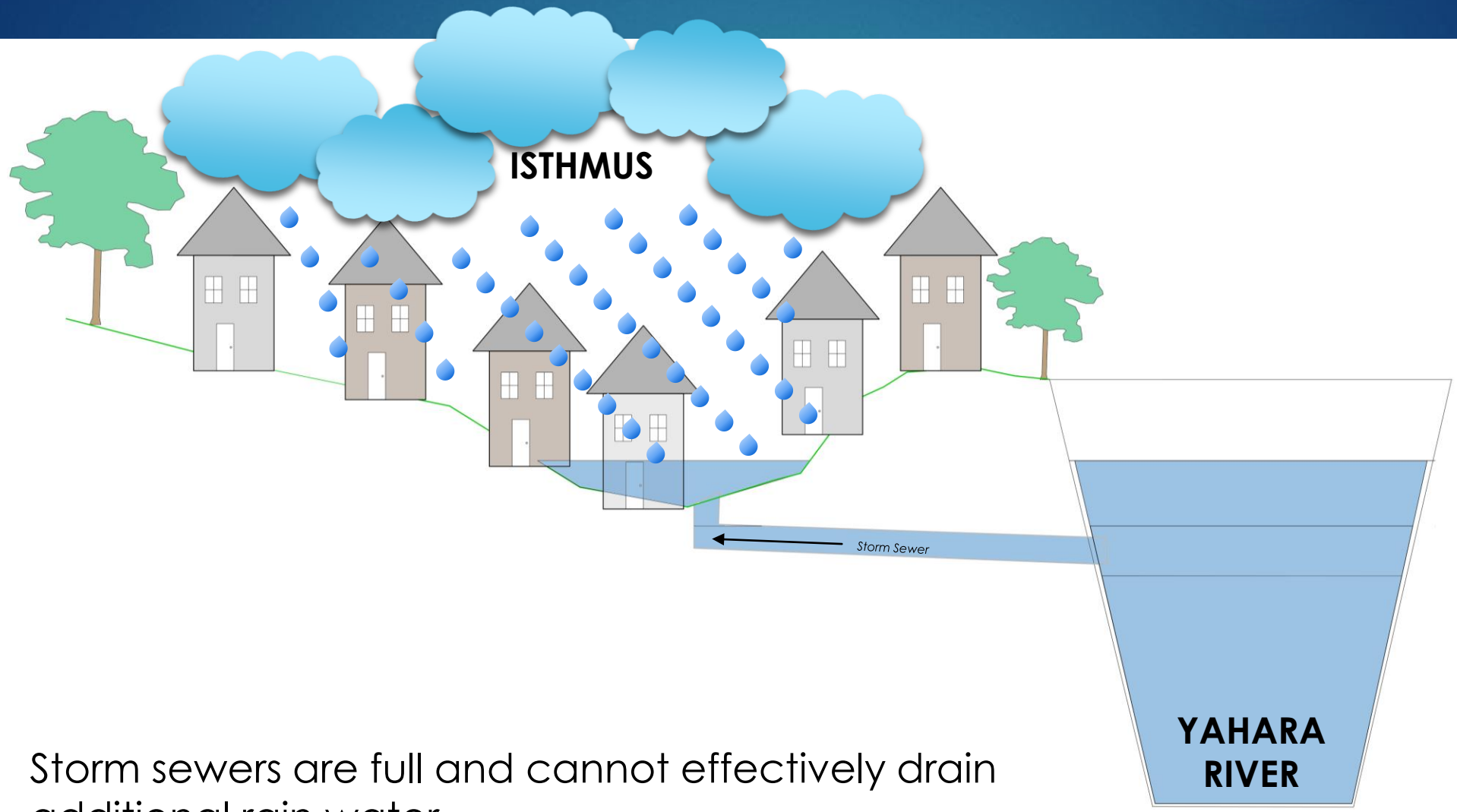
- Storm sewers are necessary to drain the Isthmus during rain events
- Large amounts of water released from Lake Mendota caused higher water levels along the Yahara River
- Sewers act in reverse allowing water to travel “up” them
- Water standing in isthmus is part of the lake

Isthmus Sewer Animation Example-Flash Flooding



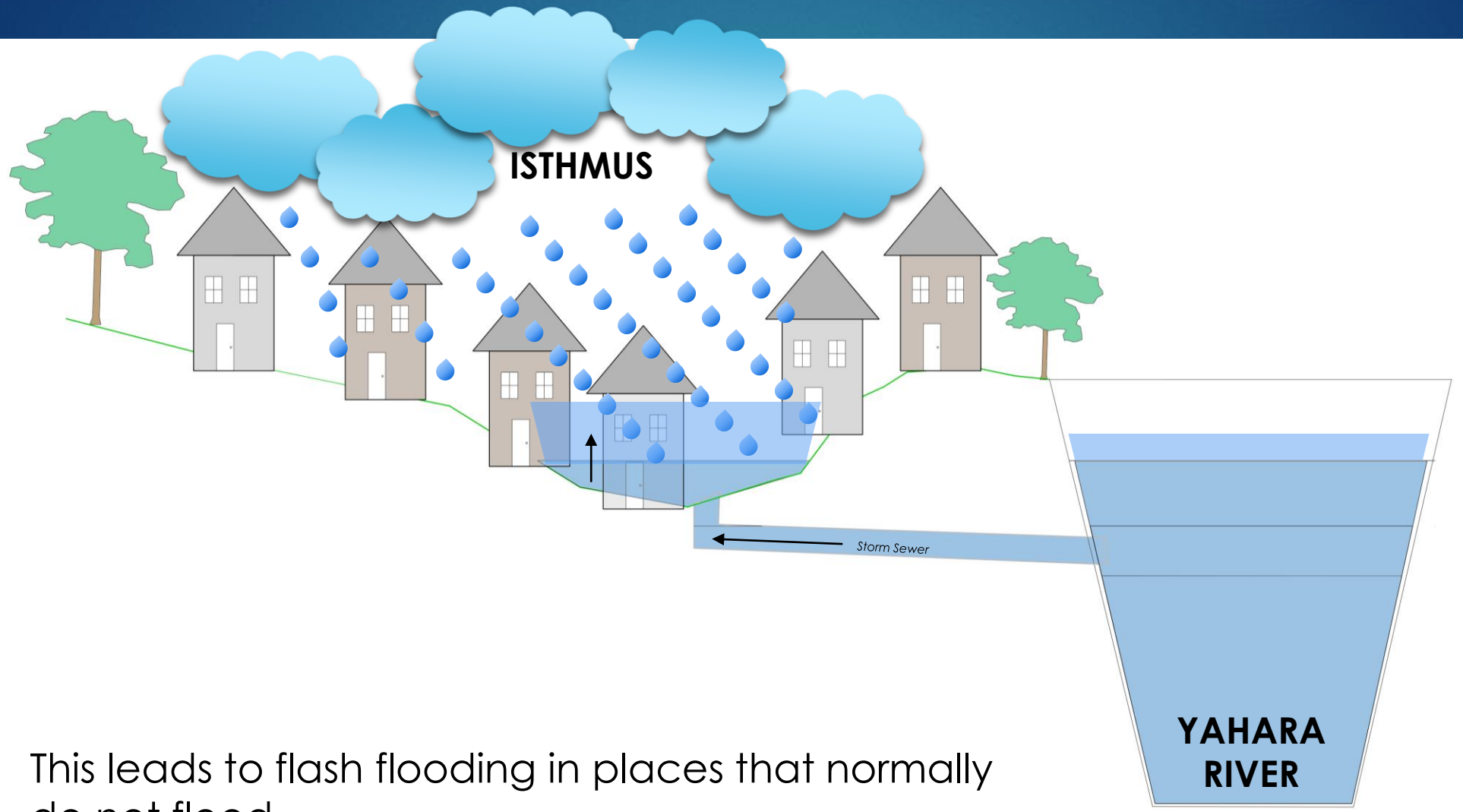
High lake level flooding increases risk of flash flooding, especially on the isthmus

Isthmus Sewer Animation Example-Flash Flooding



Storm sewers are full and cannot effectively drain additional rain water

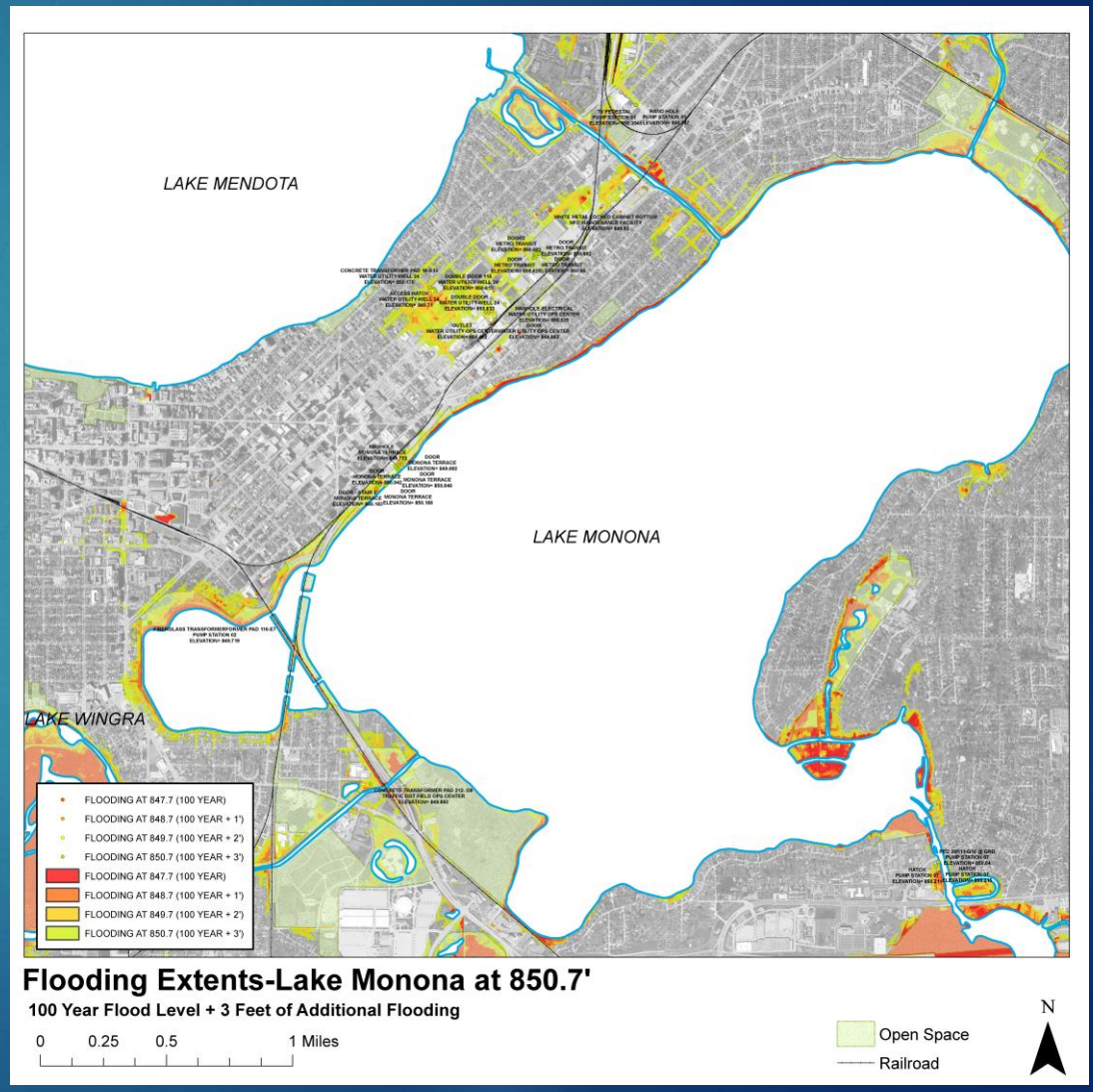
Isthmus Sewer Animation Example-Flash Flooding



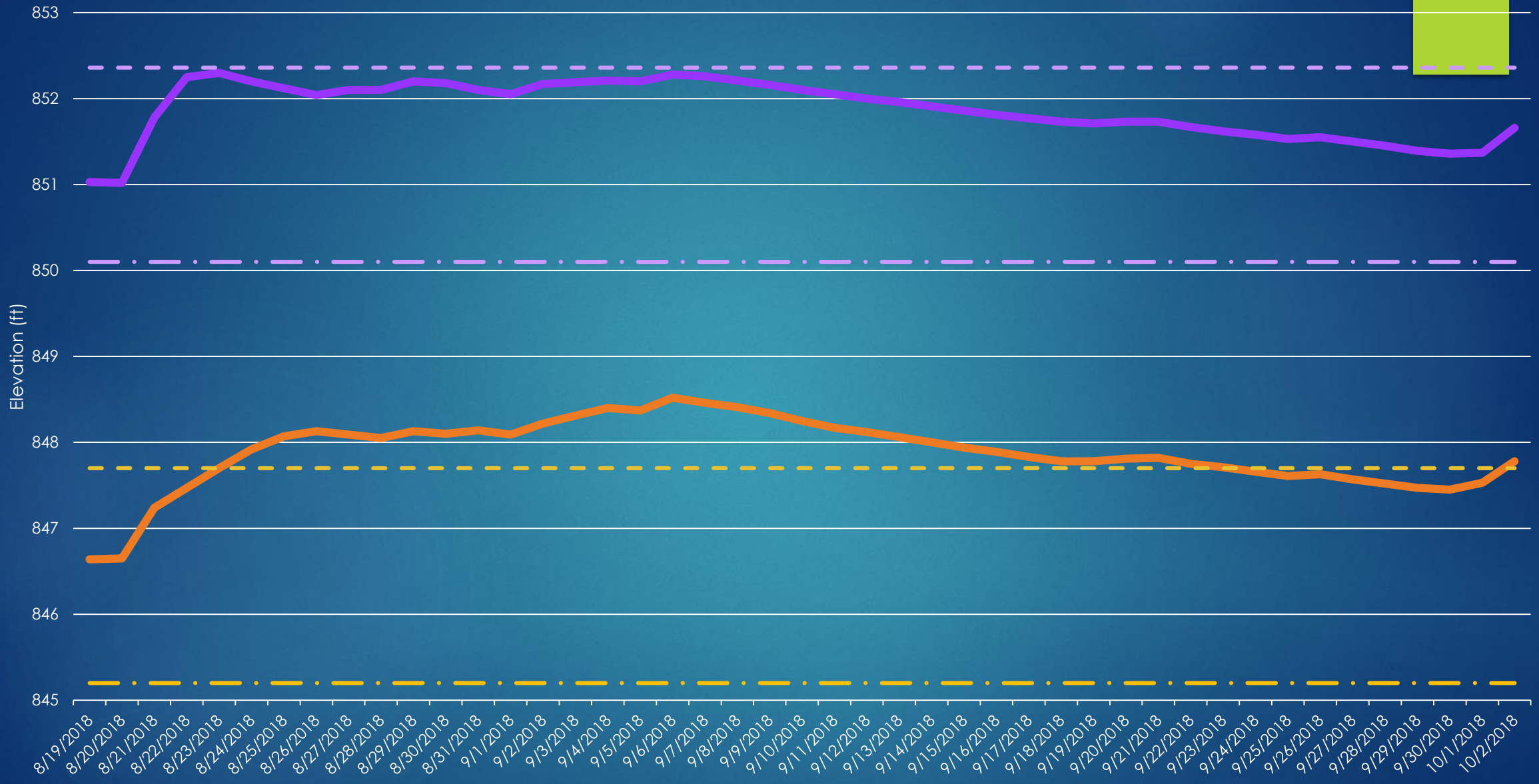
This leads to flash flooding in places that normally do not flood

City Amid Preparations for High Lake Level Flooding (2017-present)

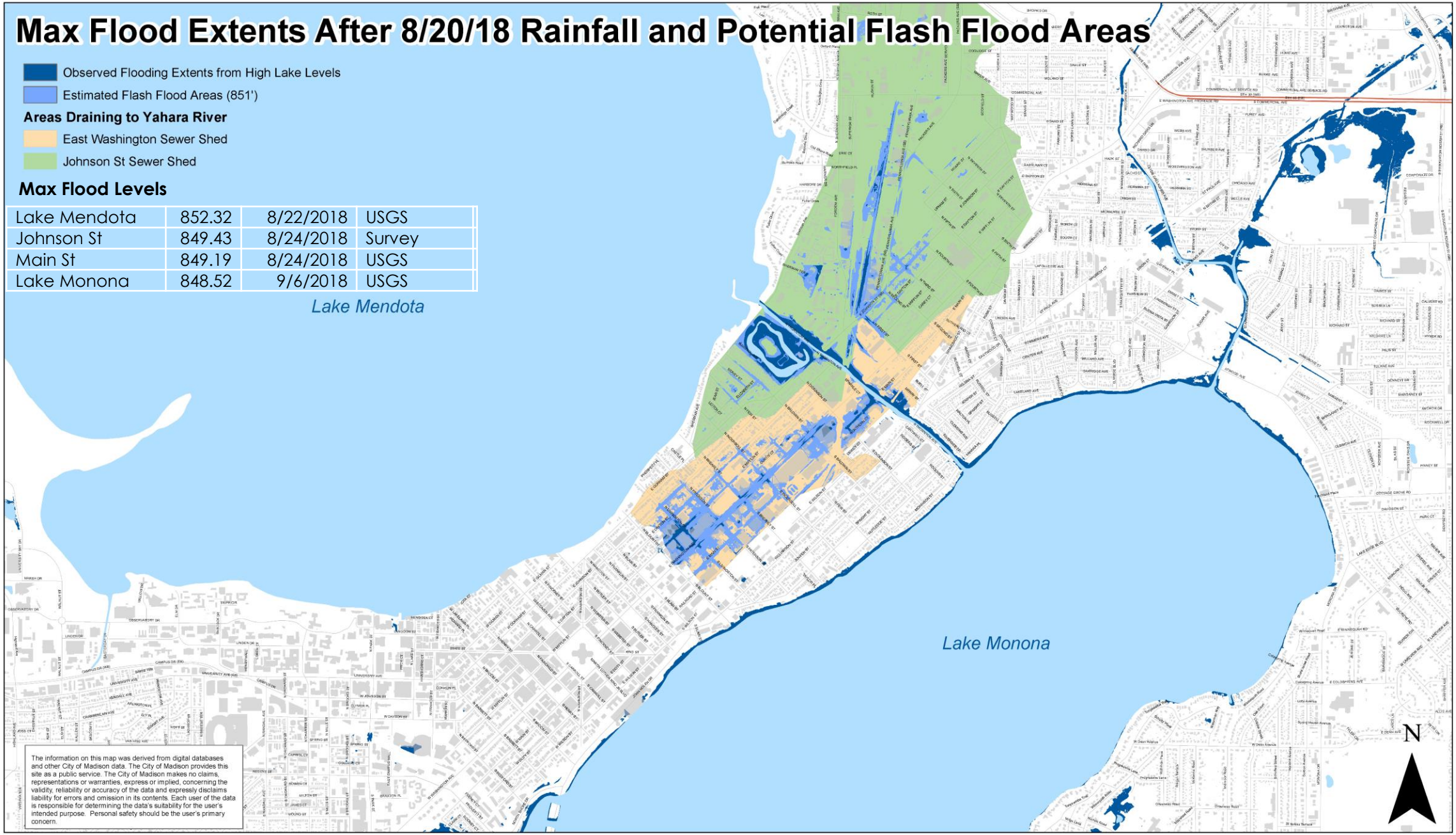
- Table Top (11/17)
- Utility Plan-identifying vulnerabilities and creating contingency plans
  - Installed generators above max flood stage to pump stations
- Sanitary System Study-impact of extreme I&I
- Fire Dept AASPIRE Intern - developing public information
- Critical Elevations Survey
  - 33 + locations (Water Utility, Monona Terrace, Metro Transit, MMSD Schools, Pump Stations)
- Debris Management Planning



Lake Levels 8/19/18 to 10/2/18



Max Flood Extents After 8/20/18 Rainfall and Potential Flash Flood Areas

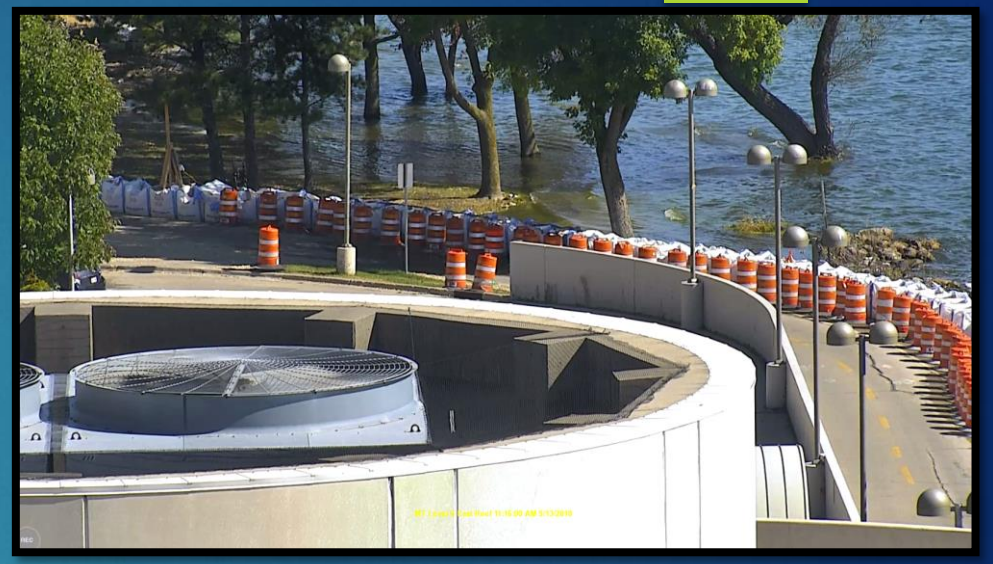


Max Flood Levels

Lake Mendota	852.32	8/22/2018	USGS
Johnson St	849.43	8/24/2018	Survey
Main St	849.19	8/24/2018	USGS
Lake Monona	848.52	9/6/2018	USGS

High Lake Levels: August 20th -Present

- What can we control?
  - City of Madison
    - Protect critical infrastructure
      - Sand bagging, rubber "sealing" manhole covers
    - Effective public messaging + coordinating volunteer efforts
  - Dane County
    - Weed cutting to increase flow out of lower lakes
- What can't we control?
  - Monona outlet or downstream lake levels
  - Quantity of water coming into the system
    - Either stored in Mendota, or passed onto downstream lakes
- Protection of Tenney Locks
  - Lake Mendota operated in a manner to prevent dam failure
  - Need enough storage for upcoming rain events
    - Water was released in a controlled manner (1-3"/day allowed people to prepare)



Traditional Lake Level rise for 1" rain
→2.5" rise of Mendota
→3" rise of Monona
→3-3.5" rise of Waubesa

Damages – How did Engineering respond?

- Engineering staff received over 250 calls and emails.
- Staff continues to get calls and emails
- Field reviews were completed of all greenways and shorelines immediately following the event.
- Crews were on 24/7 to respond to emergencies.
- Leveraged approximately 2,000 volunteer hours for sandbagging efforts.
- National Guard assisted with sandbagging efforts for 3 days.

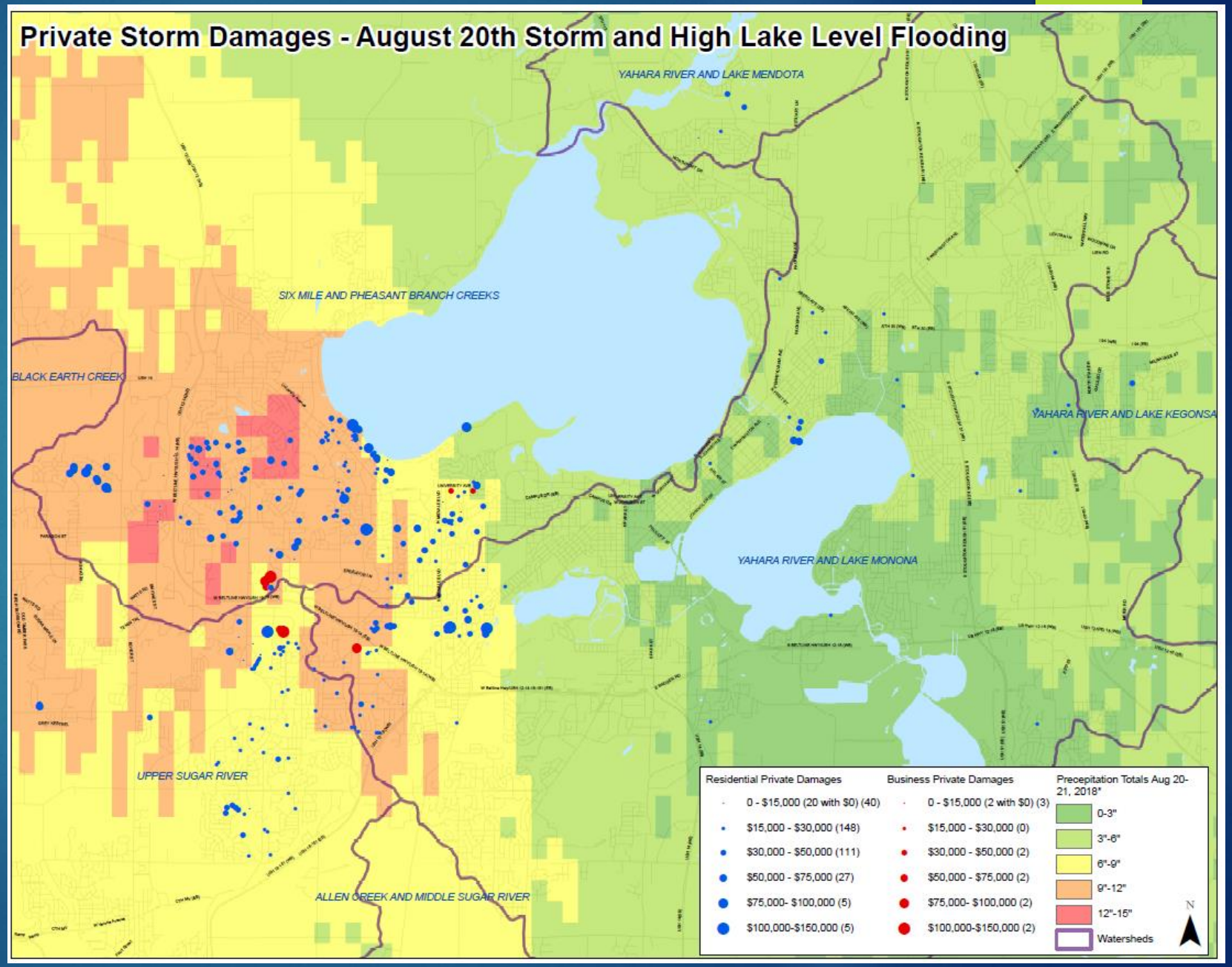
Damages

336 Residential - $15.1M
11 Businesses - $2.4M

Total reported private damages were **$17.5M+**

Public damages $3.94M

There are many more that didn't report!

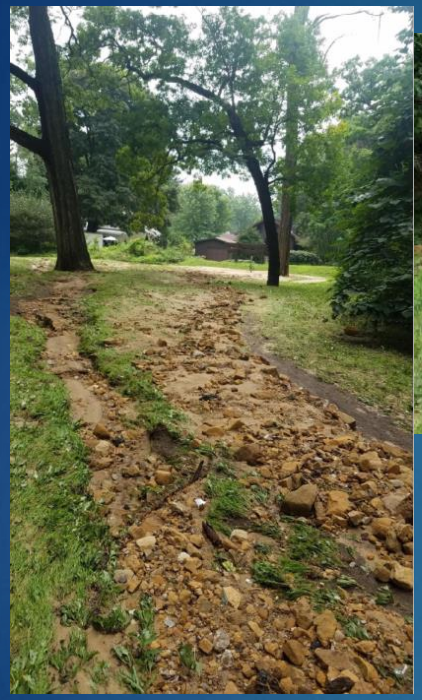


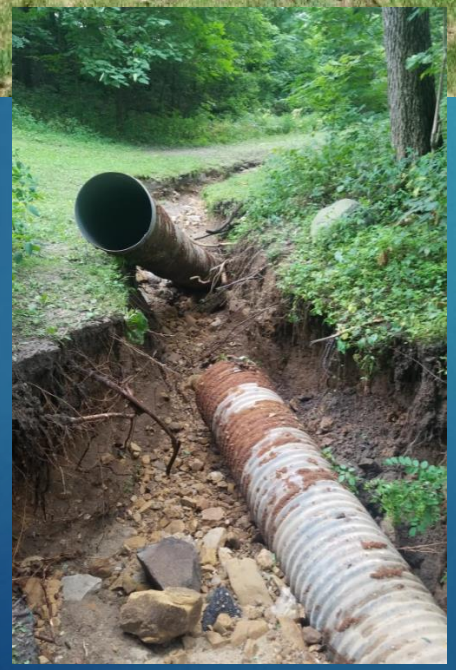
Damages - Roadways

Deming Way, Regent Street, Baker Ave

Damages – Drainage ways and Parks

Public Easement in Wexford Village





Glenwood Children's Park

Damages – Odana and West Town Ponds

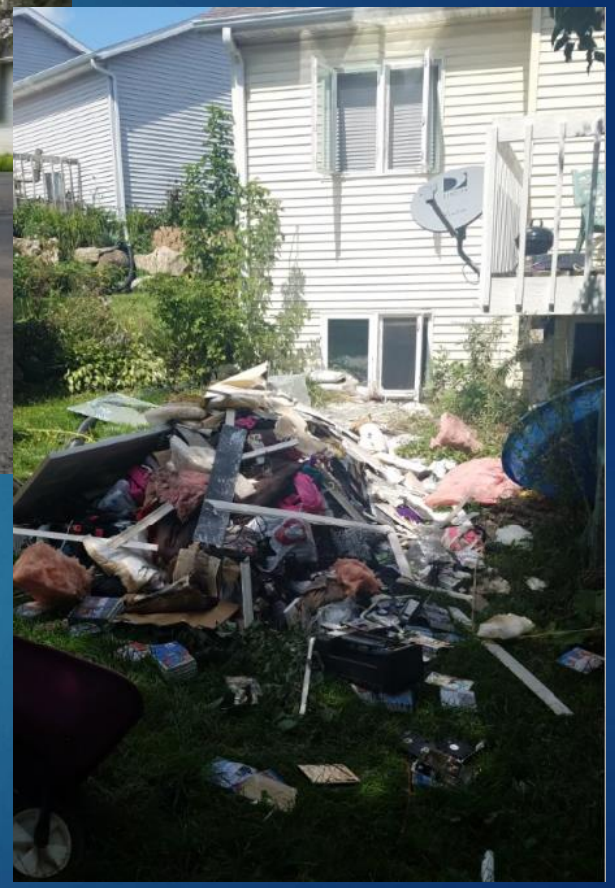
Damages – Flooding and Clean Up

Attic Angel Greenway at Junction Rd;
John Nolen Drive Bike Path Flooding

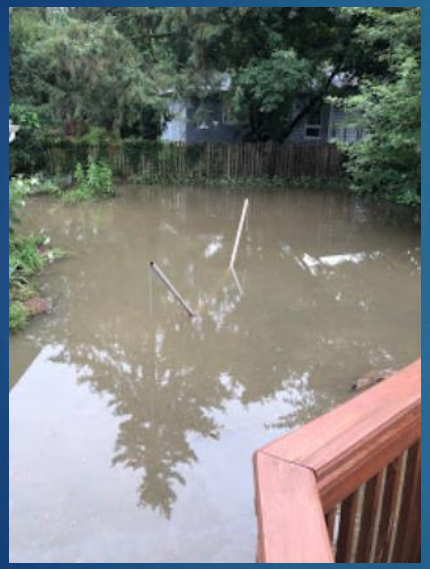
Damages – Private Damage

Wexford Village & Commerce Dr near Menards West

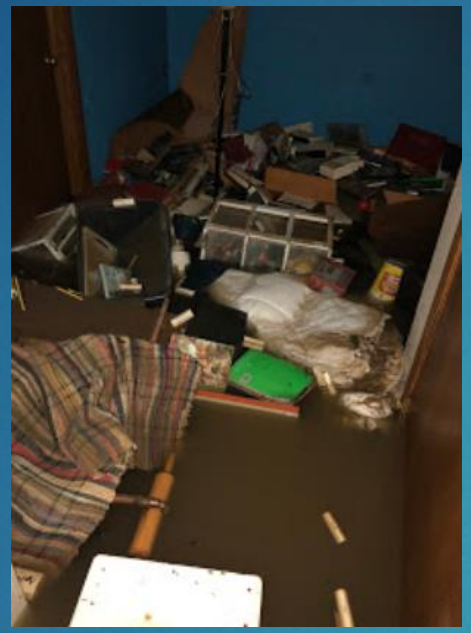
Damages – Private Damage

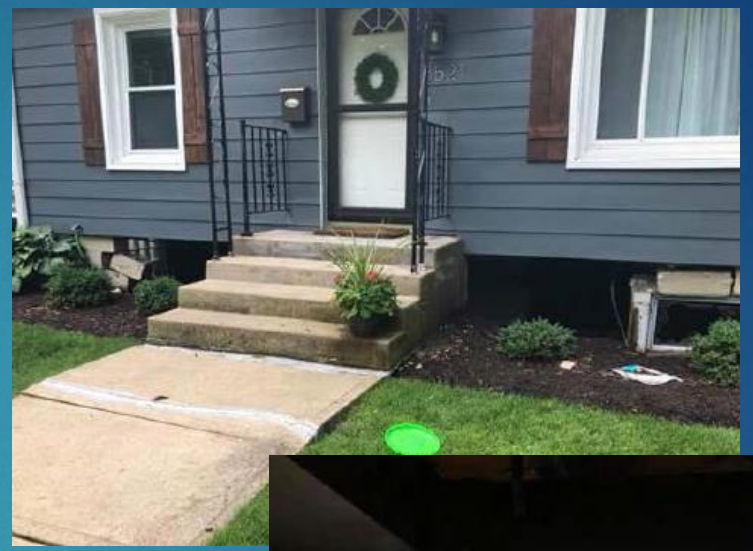


Damages – Private Damage



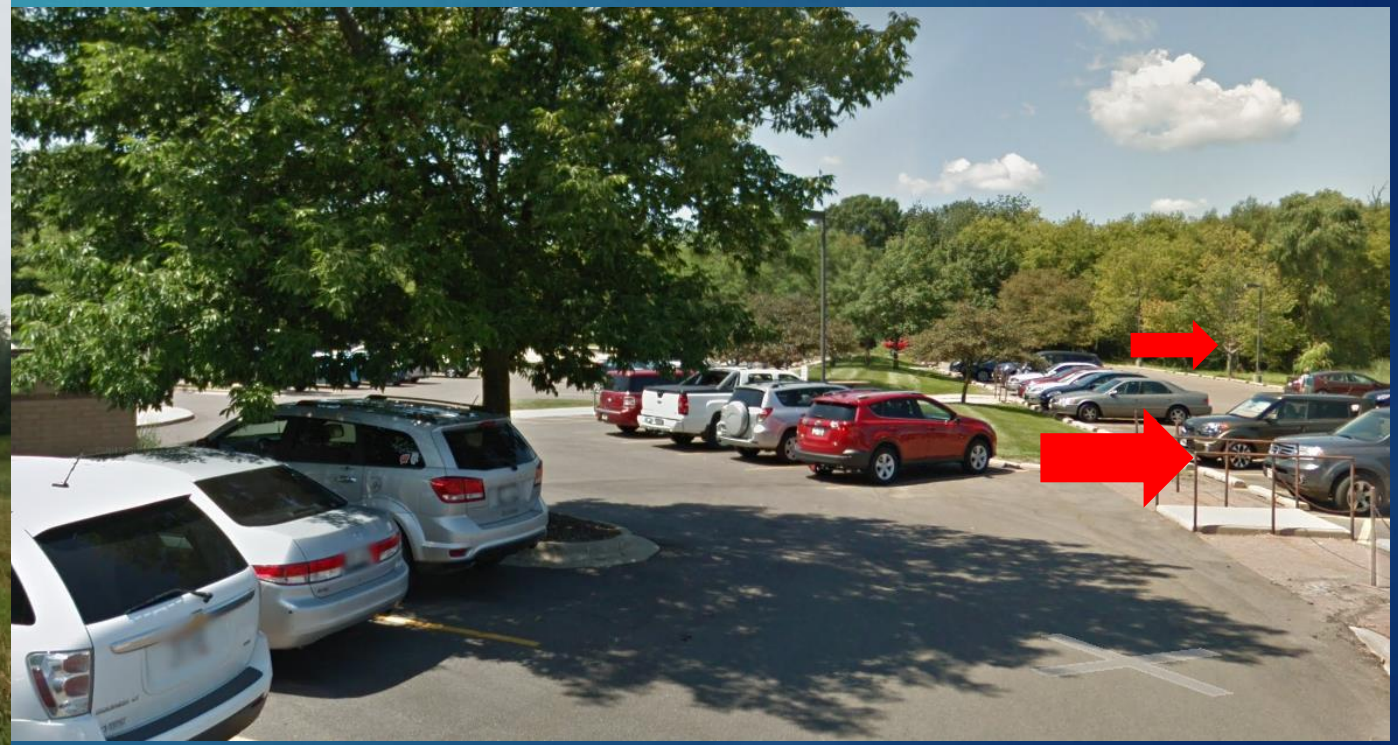
Elder Place near Bordner Park





Gettle Ave near Bordner Park

Damages – Private Damage

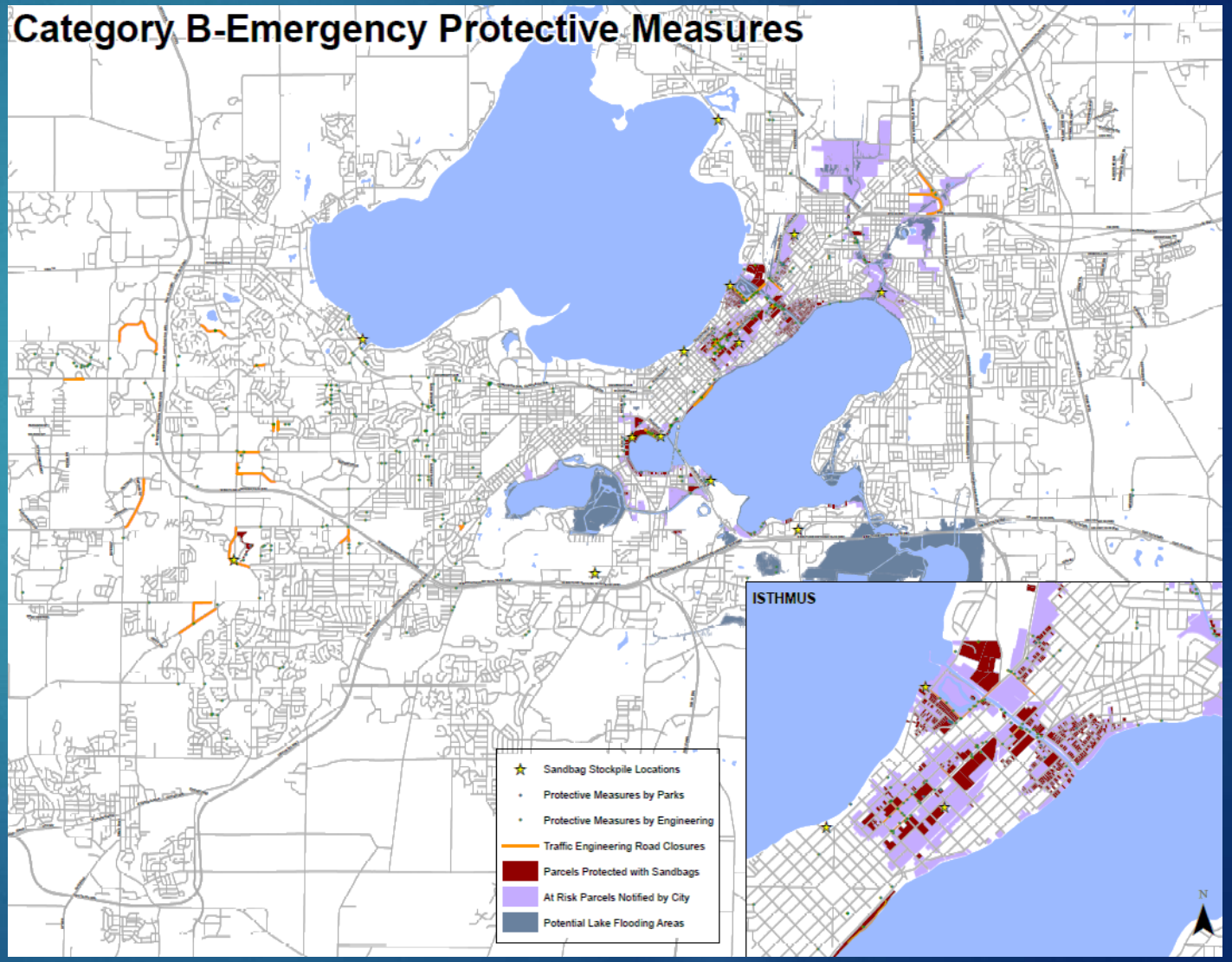


GHC Sauk Trails Clinic

Damages – Isthmus Flooding

SANDBAGS

- 225,000 Sandbags Provided
- City Staff worked 13 days, 24/7 on protective measures
- National Guard Deployed
- Estimated cost to date $907,000 +
- More City resources required for removal



SANDBAGS

SANDBAGS – Removal Plan

- Streets, Engineering and Parks to lead sandbag removal efforts
- Mayor's office, PIO and IT will prepare message on removal plan and necessary outreach via social media, email lists and text messaging
- 3- week curbside collection window will be established for residents
- An email sign up and a phone line will be set up for reporting sandbags for collection

FEMA

- The City provided documentation on damages.
- City, County, WEM, DNR and FEMA staff visited public and private sites on Sept 25th and 26th including 20-30 damaged homes on west side.
- FEMA will make determination if there will be a disaster declaration towards early November.
- If disaster declared further documentation will be required to determine any funding.
- **THERE IS STILL A LOT MORE TO DO**

FEMA – Funding Request Breakdown of Public Infrastructure

- Debris Removal - $164,900+
- Protective Measures - $970,000+
- Roadways - $231,200+
- Water Control (Storm sewer and drainage systems) $647,800+
- Buildings and Equipment $31,100+
- Utilities $12,900+
- Park and Rec $1,889,000
- ***TOTAL: $3.94M+***

Note: not all issues have been identified

How does Engineering plan to proceed??

- To ensure we proceed uniformly and predictably we have DRAFTED/REVISED two policies for response to flooding concerns.

There are two (2) typical types of problems that Engineering responds to:

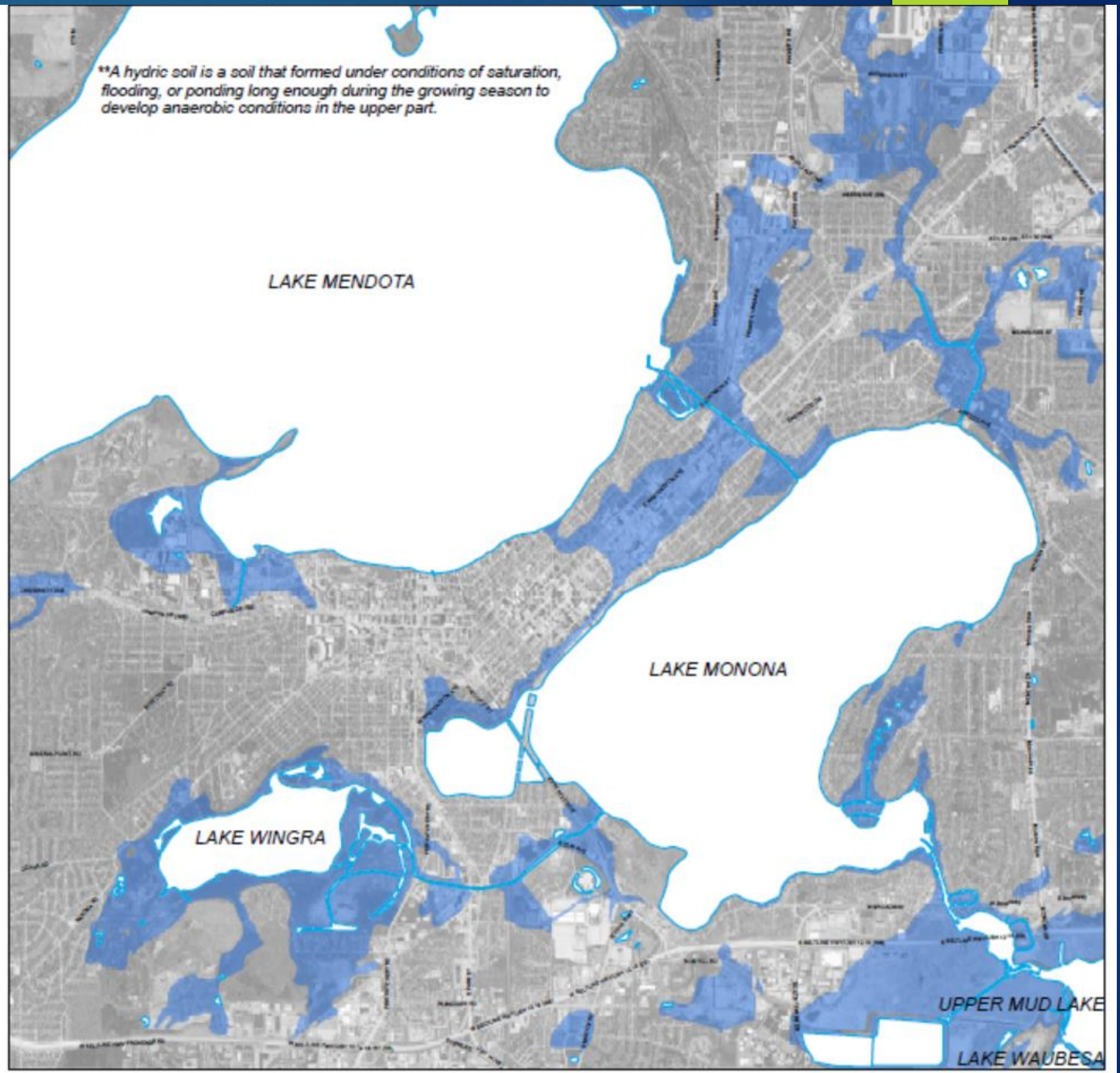
- Public problems – where stormwater runoff from the street or greenway leaves public land and enters private property causing damage.

- Private problem – stomwater runoff draining from one private property to another without ever entering public land causes damage to a downstream private property.

Public problems are the focus for this discussion. There are two main types to focus on:

- Flash flood problems
- Isthmus and surrounding area flooding from lake backwater.

Isthmus Drainage Problems



Flash flooding can be the result of varying public design standards over the years combined with limited private design standards.

HISTORIC DESIGN STANDARDS

Storm design and the standards used for that design have changed over the years. A brief history of design follows: pre-1960, only very large pipes were sized using rigorous engineering methods while smaller pipes were sized using rules of thumb and often only shown in the plan view on plan sets and final design was completed by construction staff.

From the 1970's to early 1980's most pipes were designed using what is now considered basic hydrologic and hydraulic engineering techniques however NO DETENTION or water quality was considered.

Pipe sizing criteria from approximately the 1970's to the current time has been pipes leading to a culvert road crossing are sized to convey the 10-year design storm.

Culverts at channel or greenway crossings have been designed for the 10-year design storm up to about 2011 when that design standard was increased to the 25-year design event.

Standards for the sizing of pipes/inlets serving enclosed depressions did not exist until the mid-2000's when a standard of the 25-year storm event was set. In 2016 that standard was raised to the 100-year design storm.

1983 marked the first year that stormwater detention (rate control) was required by the City of Madison and design standards were such that the 10-year storm event was the design storm to be controlled. Smaller events passed through detention basins largely un-detained and storms exceeding the 10-year event overflowed the basins but the location of that overflow was not "rigorously" designed.

1993 – 2001 detention standards were revised to include water quality standards and overflow was more rigorously reviewed to assure that the overflow took place on public property but it was not "routed" or modeled to determine approximate elevations of the water. 2004 marked the first year that stormwater control of any type was required at a state level. Infiltration standards were also brought on line at that time.

2009, marked the requirement in City code for new development to meet 100-year detention standards citywide.

As a result of varying design standards over the years, available solutions to drainage problems can be limited and expensive especially in the case of retrofits to the existing infrastructure.

MOVING FORWARD

FIXING VS MOVING THE PROBLEM

The August 20th event impacted the far west side of the City particularly hard and highlighted some serious systematic problems that require a larger perspective to resolve in a responsible manner.

For example:

The Greentree Greenway system on the far southwest side of Madison had approximately five (5) road overtoppings associated with the Aug 20th storm event. As we proceed to reduce the frequency of these road overtopping locations we need to be very careful that improving one road crossing does not simply make the next downstream crossing worse in terms of overtopping.

POLICY DESIGN

Engineering recently completed a Racial Equity Social Justice (RESJ) analysis to help determine an improved method to work on flood mitigation programs. Recommendations of the RESJ process include:

1) enhanced engagement
2) education for property owners, builders and developers
3) targeting flood prone areas for land acquisition
4) investigating the possibility of a reduced rate loan program for use where the problem does not involve public water but rather would be responded to under the private drainage problem policy and could require the response of only the property owner with no City involvement other than guidance
5) enhanced data collection
6) placing elevation restrictions on new and developing properties
7) for new development ensuring that the roadway system functions as a safe overflow for the 100-year storm event and that the design of major greenway systems accommodate the 500 year event

Many of these practices are already being followed (2, 5, 6, & 7). It is our intent to utilize these recommendations along with the below process to proceed to prioritize projects.

1) SHORT-TERM ACTIONS:

a. Data collection – Engineering continues to take reports of drainage problems and property damaged by flooding as a result of both the August 20th event and the resulting lake flooding. These problems are logged to the database of drainage problems that have been collected for a number of years.
b. Immediate response to public safety concerns (either barricading off damaged or hazardous areas or repairs such as pavement patching to get the area functional in the short term) noting that long term repairs and upgrades will be needed in the future.
c. If the area is barricaded off and short term repairs are beyond the capability of Engineering' staff, a contract or Purchase Order (PO) will be issued to a contractor to make immediate repairs to the area via the Public Works Emergency that has been declared.
d. If the problem reported is not deemed to be a public safety concern but has resulted in flooding of private property or damage to public property that is not critical, the problem is added to our list of repairs that will be prioritized for action in accord with the priorities below.
e. If the problem that is reported is related to an adjacent property and not caused by public water, meaning water from the street or public drainage system, the resident or owner that is reporting the issue will be advised that the City can only intervene in accord with our private drainage problem policy **(here)**

2) MID-TERM TERM ACTION:

a. Outreach – in accord with the RESJ process, Engineering will work with other agencies to reach out to the community to request reporting of additional problem areas. Once outreach is completed and Engineering has what it believes to be a comprehensive list of flooding problems, each problem will be reviewed and prioritized for action based on the following criteria:

i. Amount of public and private property damage potentially avoided compared to the cost of potential public project to meet the design standard. Priority shall be given to projects with a higher multiplier of benefits.
ii. Public safety concern (flooding of arterial routes needed for emergency response). Priority shall be given to projects that have a positive impact on emergency response routes.
iii. Is the damage being experienced during the design event or is it related to the extreme event experienced on Aug 20th 2018. Priority shall be given to projects that resolve flooding impacts at lower recurrence interval events and properties that have flooded multiple times.
iv. Can the problem be resolved independent of other downstream negative impacts? Priority shall be given to projects that can be resolved independent of other downstream actions or that include improvements that mitigate downstream impacts.
v. Is the problem a result of an action taken by the property owner of their own volition? Priority shall be given to projects that solve problems that are not a direct result of a property owners direct actions.
vi. Proximity of the problem site to currently planned projects. Priority shall be given to projects that can be incorporated with work that is already programmed.
vii. Priority shall be given to properties that are within a Neighborhood Resource Team area.

1) Can an improvement in pipe or inlet capacity be made that will rectified the problem? Is it possible to make this improvement without causing additional damaging flood problems downstream? Will this solution protect the impacted properties in events up to and including the 100 Year Storm? If it is too costly to safely pass the 100 Year Storm, what storm event will this improvement protect the impacted properties to and what is the difference in cost? If not…
2) Is there a problem with the system overflow such that when the street is overtopped or the pipe system reaches capacity, the excess flow leaves publicly owned lands and damages private property? If so can a physical change be made in the street/channel such that the overland flow can be rerouted to resolve this problem? Will this solution protect the impacted properties in events up to and including the 100 Year Storm? If it is too costly to safely pass the 100 Year Storm, what storm event will this improvement protect the impacted properties to and what is the difference in cost? If not…
3) Is there a means to increase storage/detention upstream of the problem area that can be implemented to decrease flows in the impacted area? Is there a means to increase storage downstream to temper the increased flows from upstream improvements? Can this project be completed without causing new/additional flooding problems in the areas where the storage is to occur? Will this solution protect the impacted properties in events up to and including the 100 Year Storm? If it is too costly to safely pass the 100 Year Storm, what storm event will this improvement protect the impacted properties to and what is the difference in cost? If not…
4) Is there a solution on private property that would not significantly adversely impact the property owner that could be made at low cost? Will this solution protect the impacted properties in events up to and including the 100 Year Storm? If it is too costly to safely pass the 100 Year Storm, what storm event will this improvement protect the impacted properties to and what is the difference in cost? If not…
5) Is there a major change that can be made to private property that would resolve the problem but would negatively impact the homeowner? Examples of this could include but are not limited to: Closing off exposed windows/doors, reconstruction of full exposures from wood frame to concrete walls, construction of berms, retaining walls and flood walls on private property. Will this solution protect the impacted properties in events up to and including the 100 Year Storm? If it is too costly to safely pass the 100 Year Storm, what storm event will this improvement protect the impacted properties to and what is the difference in cost?

What types of solutions will we look at???

NEXT STEPS:

- BPW approval of public and private drainage policies
- Meeting with Alders
- Creation of a Flood Control / Pond and Greenway group and review appropriate staffing levels for said group
- Watershed analysis in priority locations
  - Public Informational meetings on specific projects once analysis completed
  - Public engagement / website creation

QUESTIONS?

Works Cited

- Flood mapping data from City 2016 LiDAR data
- Rain accumulation data from KMKX Radar that was "bias corrected" using rain gauges by UW Professor, Dan Wright
- The information on the maps was derived from digital databases and other City of Madison data. The City of Madison provides this site as a public service. The City of Madison makes no claims, representations or warranties, express or implied, concerning the validity, reliability or accuracy of the data and expressly disclaims liability for errors and omission in its contents. Each user of the data is responsible for determining the data's suitability for the user's intended purpose. Personal safety should be the user's primary concern.