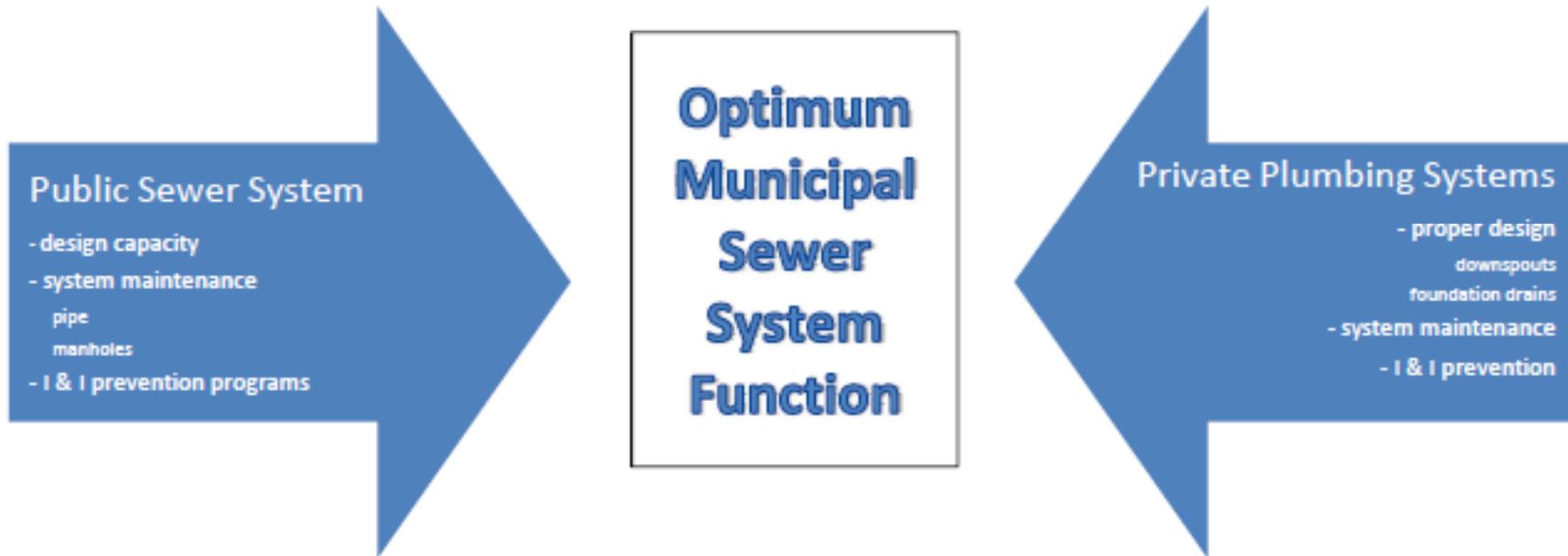


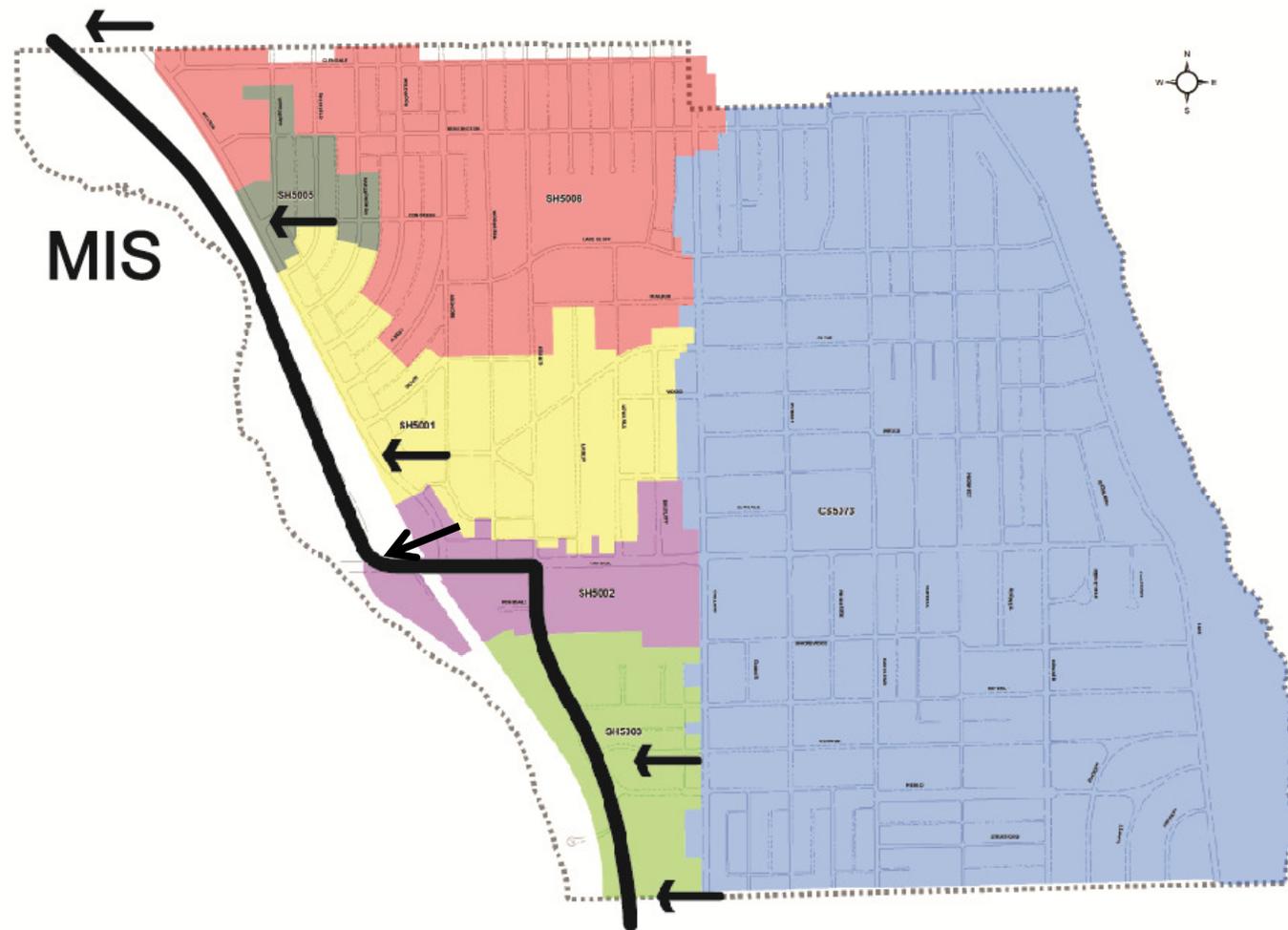
VILLAGE OF SHOREWOOD

Sewer System Information Meeting 9/30/10

Shorewood's response to the flooding in July is multi-faceted



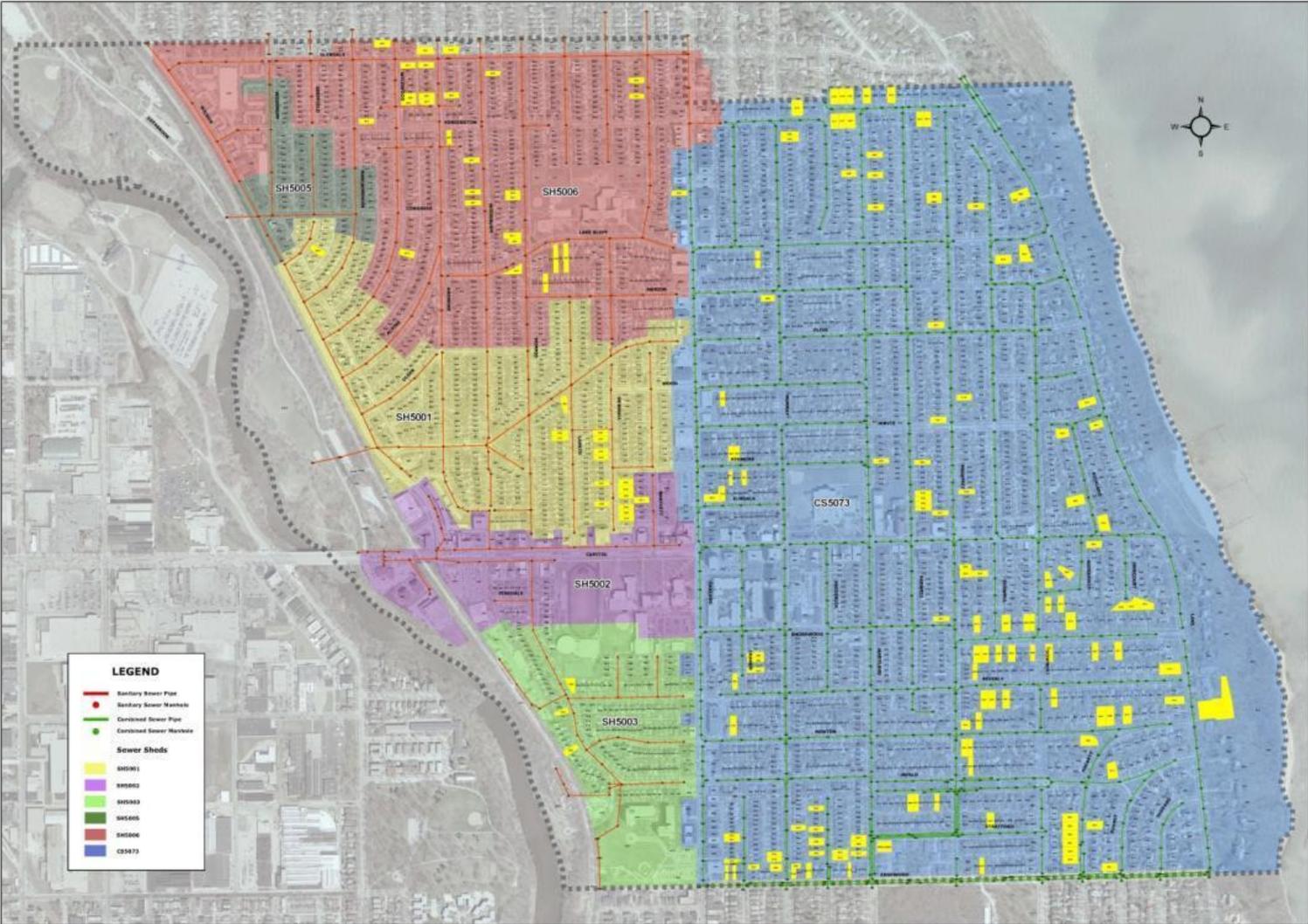
The Village Sewers Discharge into MMSD along the Milwaukee River



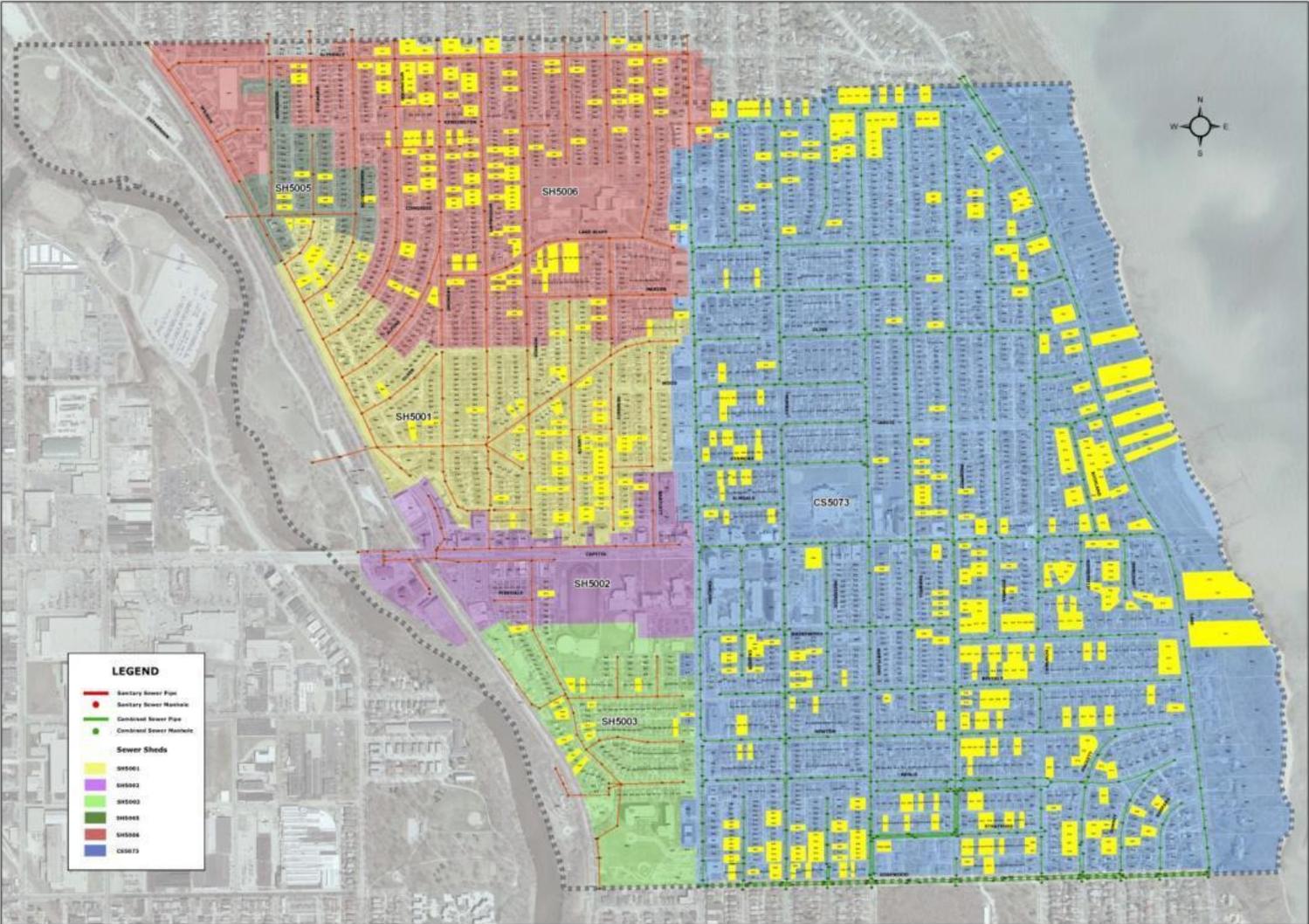
Significant rains cause basement backups

- June 21, 1997
 - ▣ 4.7" in 6 Hours
- August 6, 1998
 - ▣ 2.9" in 16 Hours
- July 21, 1999
 - ▣ 4.3" in 4 hours
- June 7, 2008
 - ▣ 8.68 in 24 hours
- July 15, 2010
 - ▣ 3.56" in 9 hours
- July 22, 2010
 - ▣ 8.5" in 8 hours
- (Saturated) Ground conditions greatly affect the impact of rain events on the sewer system.

July 15 Reported Basement Flooding



July 22 Reported Basement Flooding



Outline of the Facility Planning Process



□ SEPTEMBER 2010

- Create computer models of sanitary and storm sewer pipe networks
- Establish current sanitary sewer service levels against **basement backups**
- Establish current storm sewer service levels against **street flooding**

Outline of the Facility Planning Process



□ OCTOBER 2010

- Make a decision on how much the current level of service should be increased
- Develop solution alternatives that increase the service level
- Develop cost estimates

□ November 2010

- Decide which alternatives to pursue to design stage

Progress Update: We have a computer Model of Shorewood's Sanitary Sewers

- Complete sanitary sewer model of the west side
- Includes **all** Whitefish Bay sewers because the systems are linked
- Includes sewer improvements in Whitefish Bay
- Complete combined sewer model of the east side
- Includes storm sewers on Kensington and Wood
- Includes Milwaukee sewers that connect to Edgewood pipes

The Sanitary Sewer “Level of Service” Criteria

- The response of our sewers to various rains depends on location
- Basement backup risk is defined by comparing sewer pressures to basement floor elevations
- Sewer pressures are calculated
- How do we know the basement elevations?
 - ▣ We looked at first floor elevations at 105 homes
 - ▣ Then we deduced individual basement floor elevations
 - ▣ Then we generalized across the Village

Basement Backup Risk Definition



- West side (separated sewer area) basement floors are **6 to 7** feet below street level
- East side (combined sewer area) basement floors are **5 to 6** feet below street level

- Higher the number, the lower the basement floor
- The lower the basement floor, the more susceptible to sewer backup

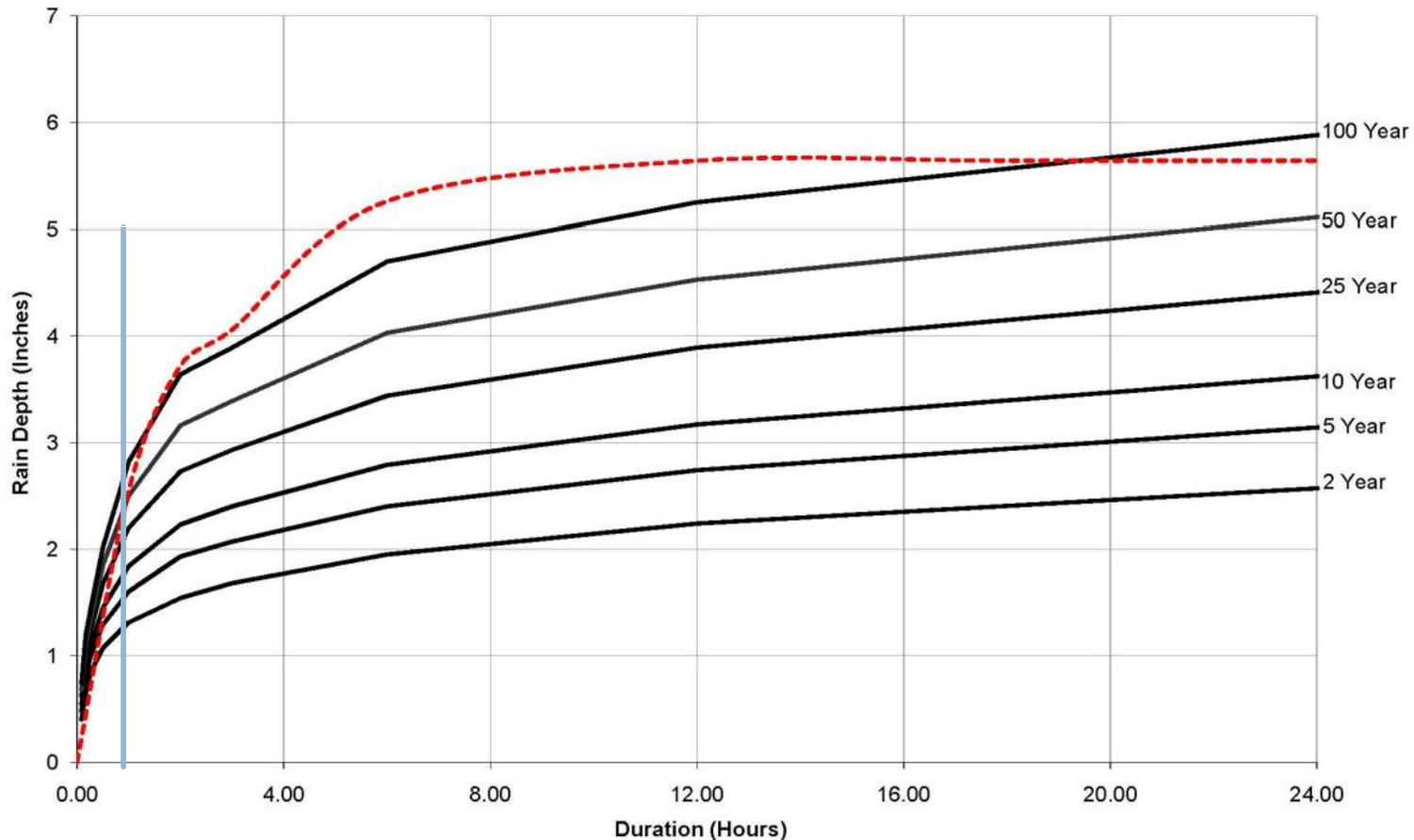
Rainfall Analysis Method



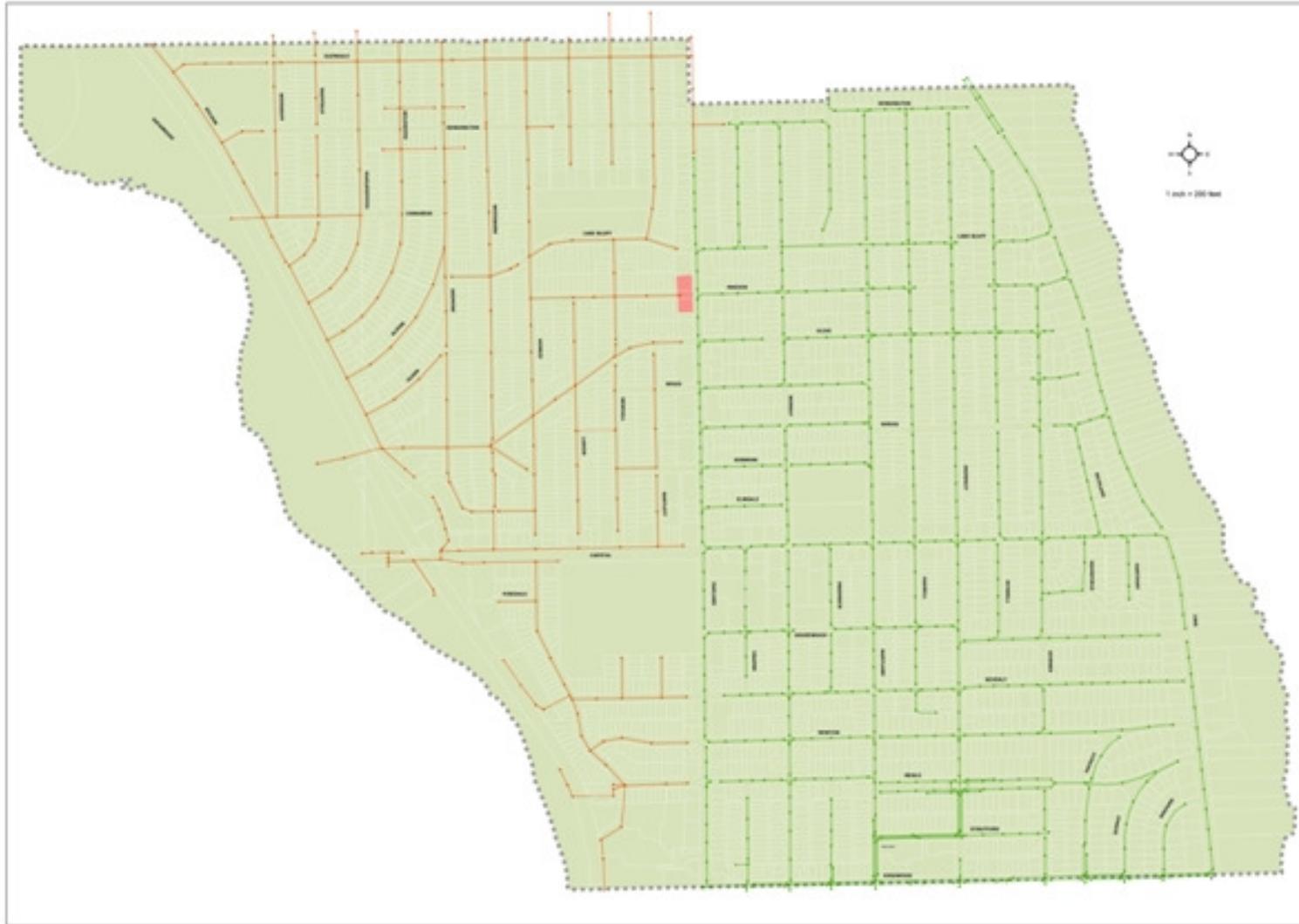
- Used successively increasing rainfall totals, from 1 inch to 5 inches
- Used a 60 minute rain – short and intense
- This is the type of rain that is historically known to cause sewer backups in Shorewood

Perspective on Probability of Rain

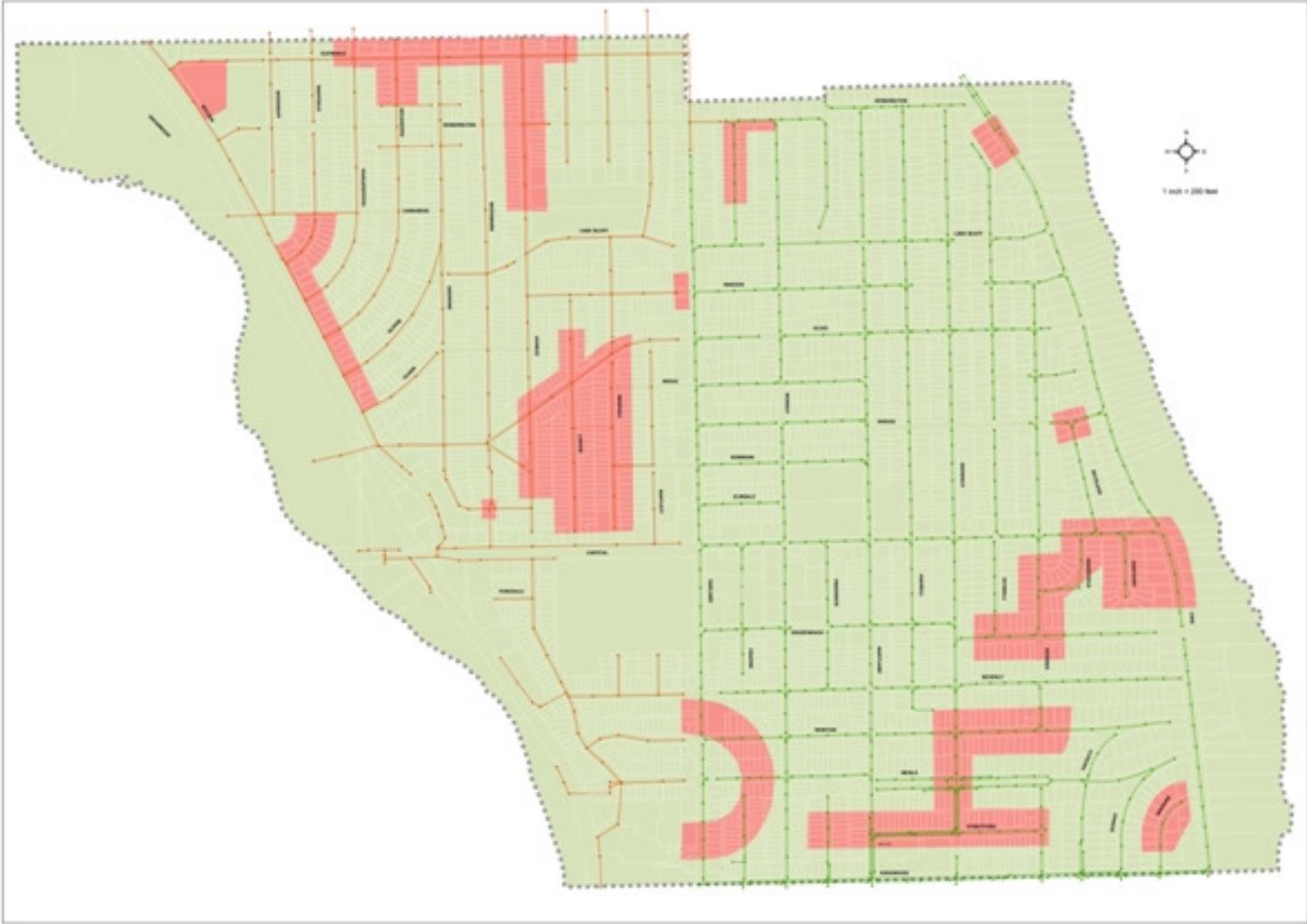
Depth Duration Frequency Curve
July 14-15, 2010
Based on SEWRPC Technical Report 40 May 2004
With Rainfall Data from Gauge WS1206 @ 3626 W. Fond du Lac Ave.
Reported to MMSD



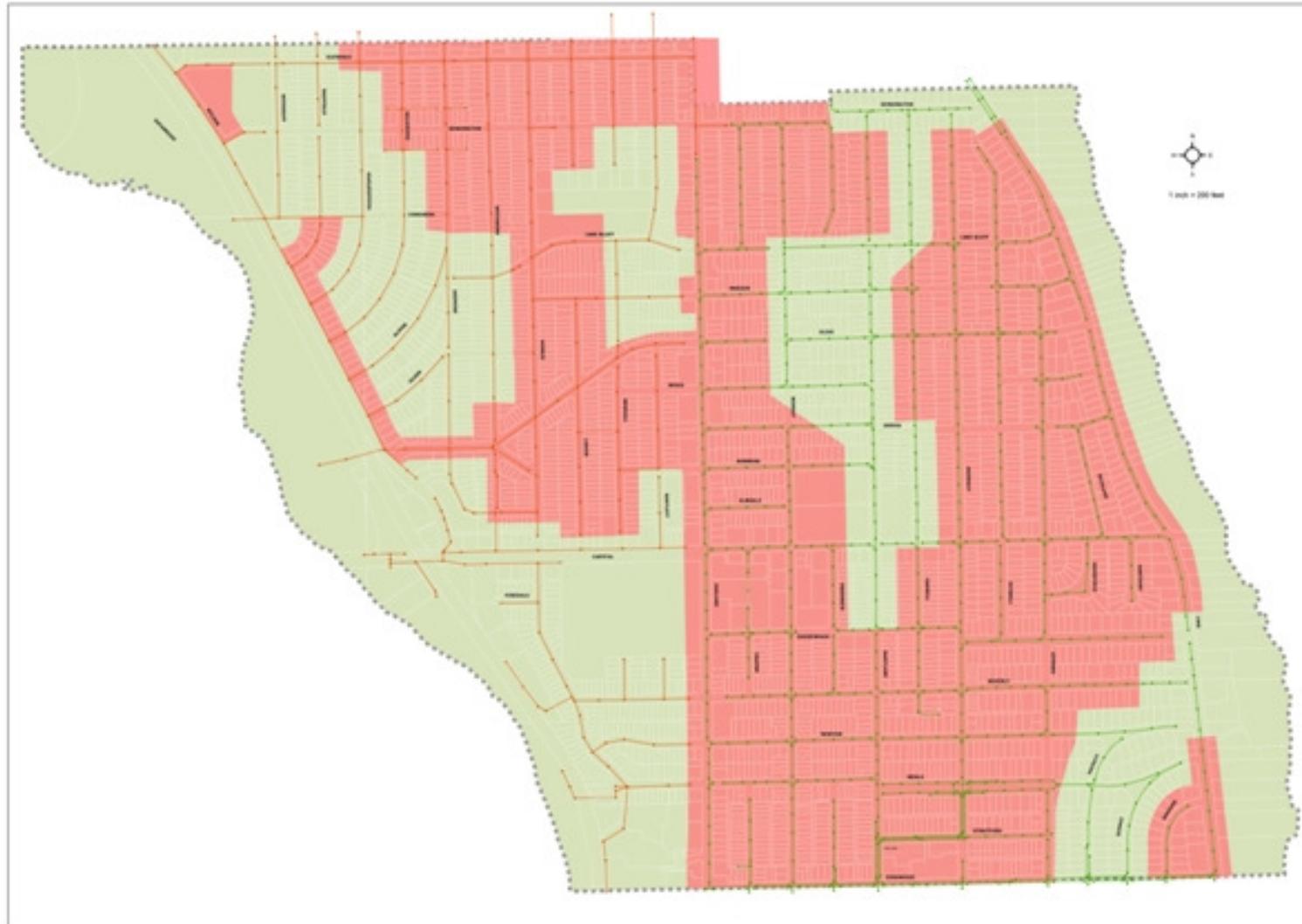
1 inch rain



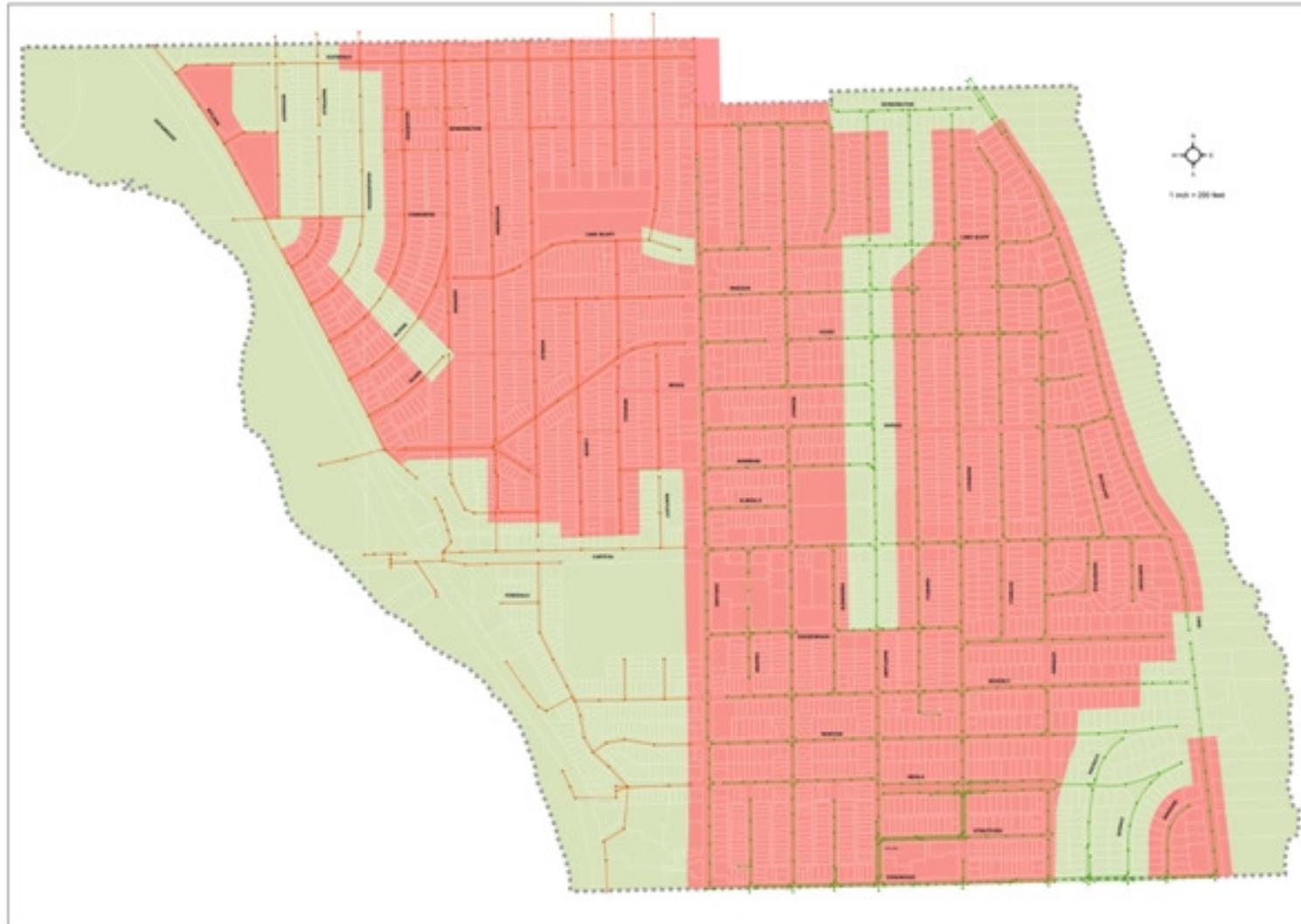
2 inch rain



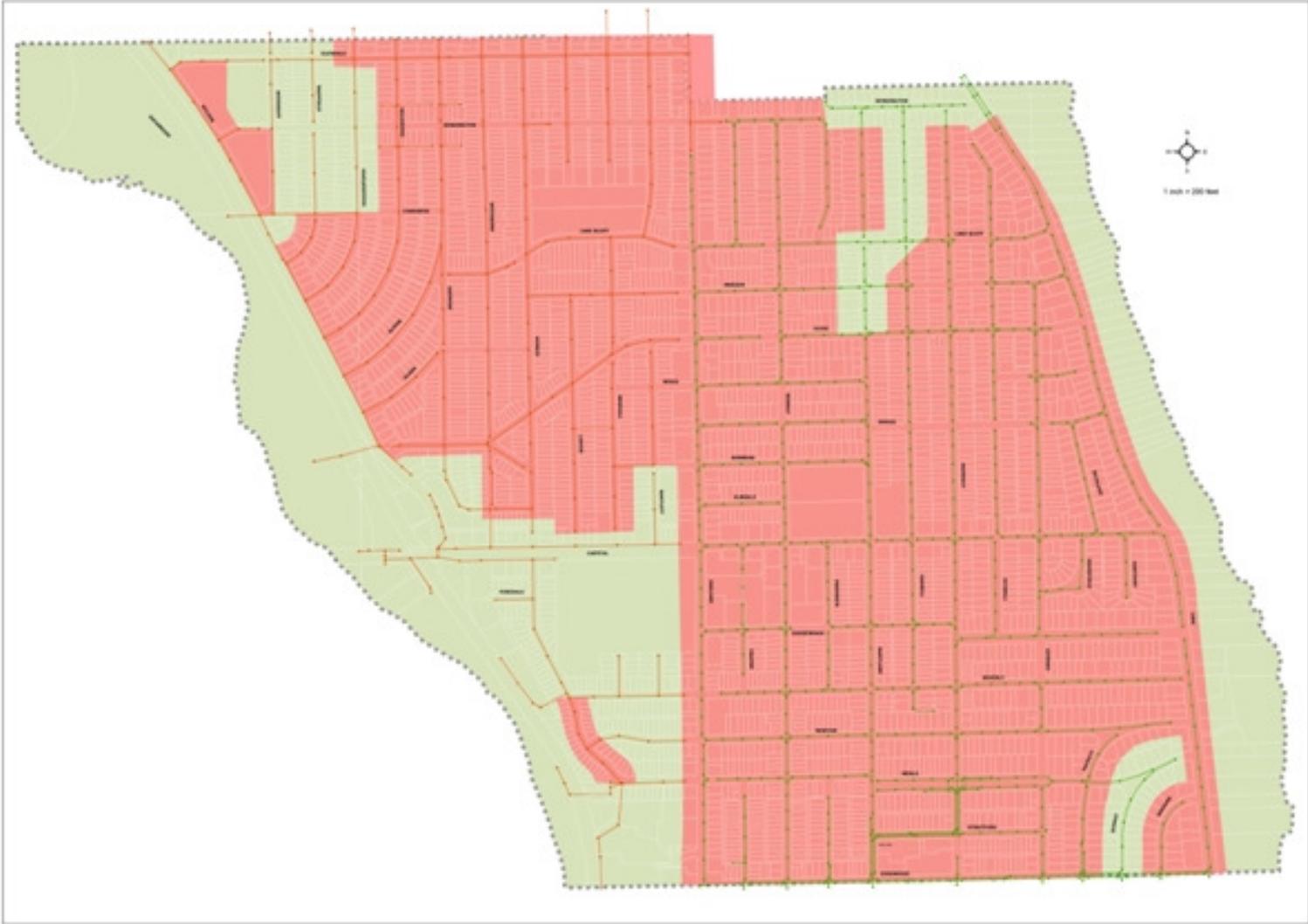
3 inch rain



4 inch rain



5 inch rain



Sanitary Sewer Level of Service Improvement Considerations

- All municipalities, including Shorewood, have discharge limits to MMSD system
 - ▣ This means we cannot simply collect all the rainwater in our sanitary sewers and hand it over to MMSD
- High levels of protection from basement backups will require a three pronged solution:
 - ▣ Improve public sewers for better flow
 - ▣ Reduce flows from public system components
 - ▣ Reduce flows from private system components

Progress Update: East Side Storm Sewer model Completed

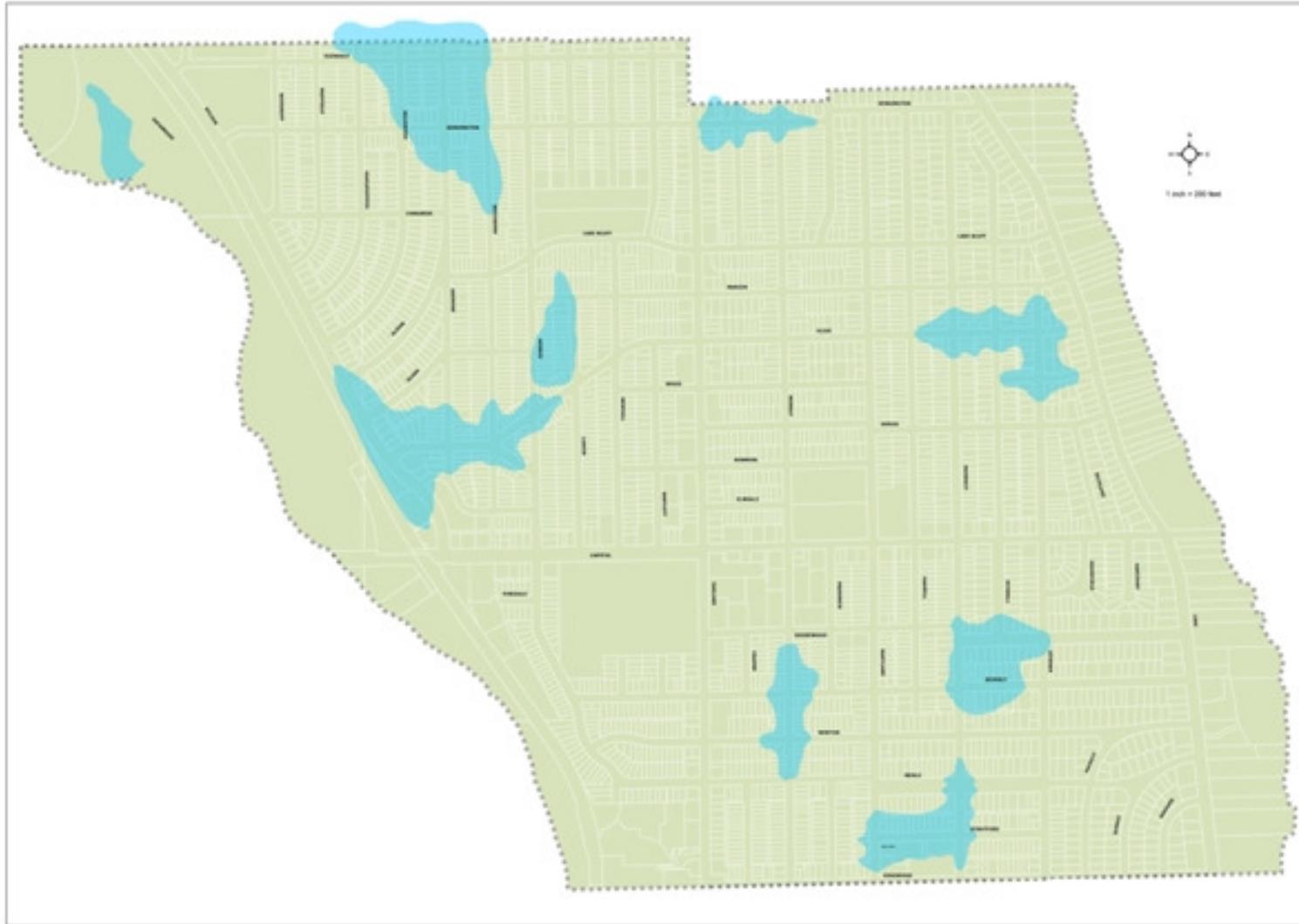


- Both Kensington and Wood storm sewers able to handle up to 2 inches of precipitation in one hour.
- Street flooding should occur at about 2 inches and more.
- Identified 5 “depressions” without overland flow up to 4 feet of inundation

Progress Update: West Side Storm Sewer model is behind schedule

- West side analysis delayed by missing information
- Field measurements have been performed and Village's infrastructure records updated
- Drainage analysis is currently a 5 to 7 days behind schedule
- Expected to catch up and results available by the end of week of October 4.
- **Identified 4 "depressions" without overland flow up to 4 feet of inundation**

Locations of Topographic Depressions



Next Month



- Finish west side storm sewer model
- Develop improvement alternatives that increase protection against basement backups
- Develop improvement alternatives that increase protection against street flooding
- Assist in the decision on how much the current level of service should be increased
- Develop cost estimates