

# MEQUON STORMWATER MODELING



FRESHWATERENG.COM

# Outline

- FreshWater Engineering overview
- 1999 CDM study & long-term plan
- Site visit & model development
- Alternative analysis
- Results
- Discussion

# FreshWater Engineering

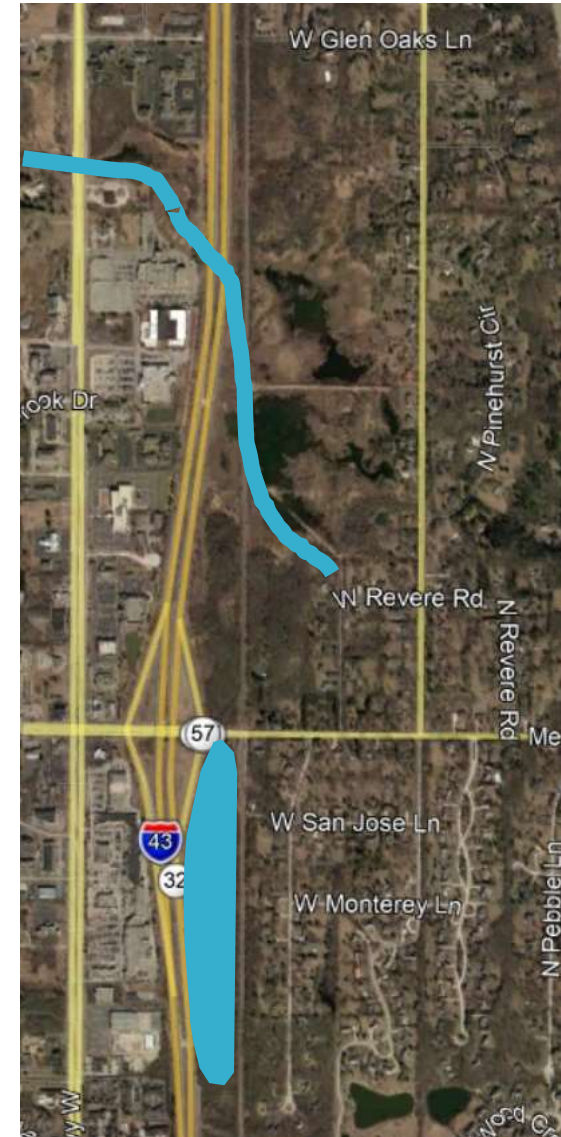
- Woman-owned small business with offices in Milwaukee and Madison, Wisconsin
- Specialize in:
  - Water resources engineering
  - Stormwater management
  - Green infrastructure
  - Field data collection
- Stormwater modeling projects
  - Parks
  - Housing developments
  - Watershed analyses





# 1999 Study by CDM

- Large-scale stormwater management study for Mequon
- Created stormwater model
- Determined increasing storage was most effective management strategy
- Developed long-term management recommendations
  - Large detention basin along I-43
  - Stream channel rehabilitation



# Site Visit



- Visited site 02 SEP 20
  - Gathered elevation point data
  - Measured culvert dimensions
  - Photographed site conditions



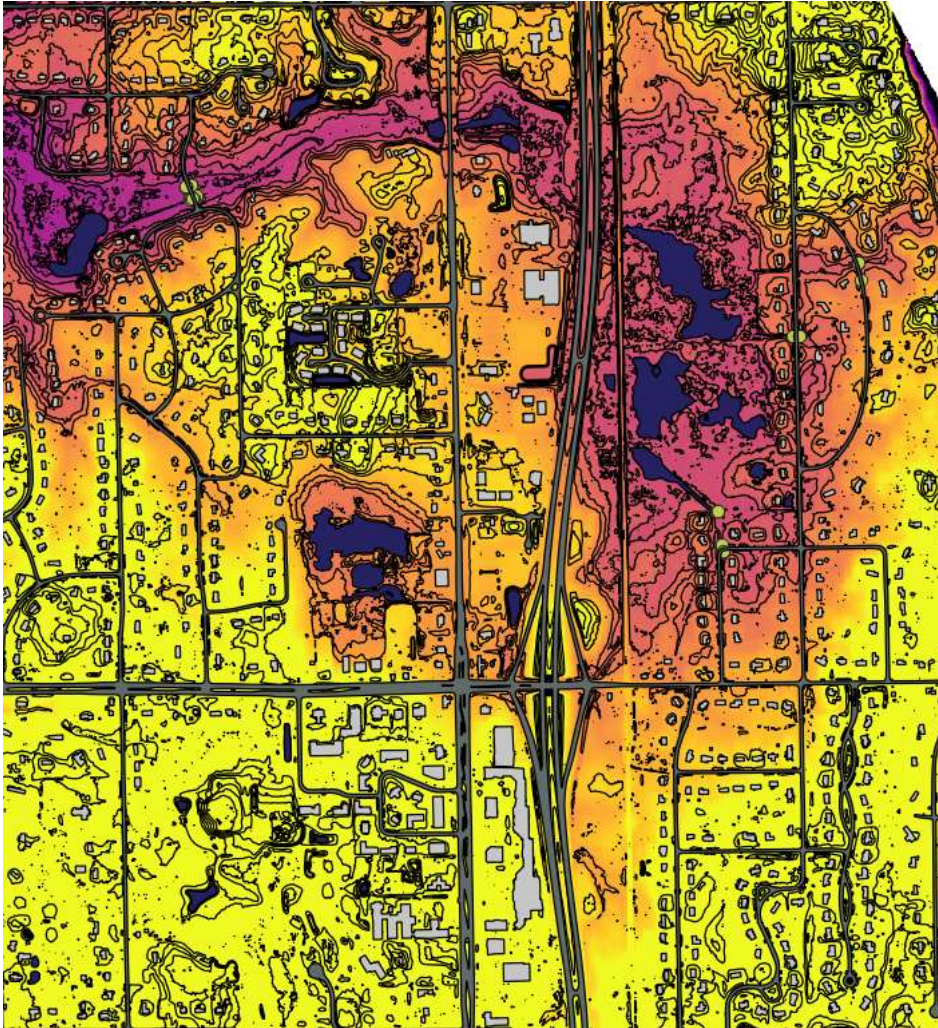
# Model Setup



## HydroCAD Stormwater Model

- 20 Nodes
  - 6 Sub-catchments
  - 8 Reaches
  - 4 Catchbasins
  - 2 Ponds
- 4 Rainfall events (from [NOAA's Milwaukee North Side, Station #47-5477](#))
  - 2-year 2.64 in
  - 10-year 3.75 in
  - 25-year 4.60 in
  - 100-year 6.16 in

# Model Data

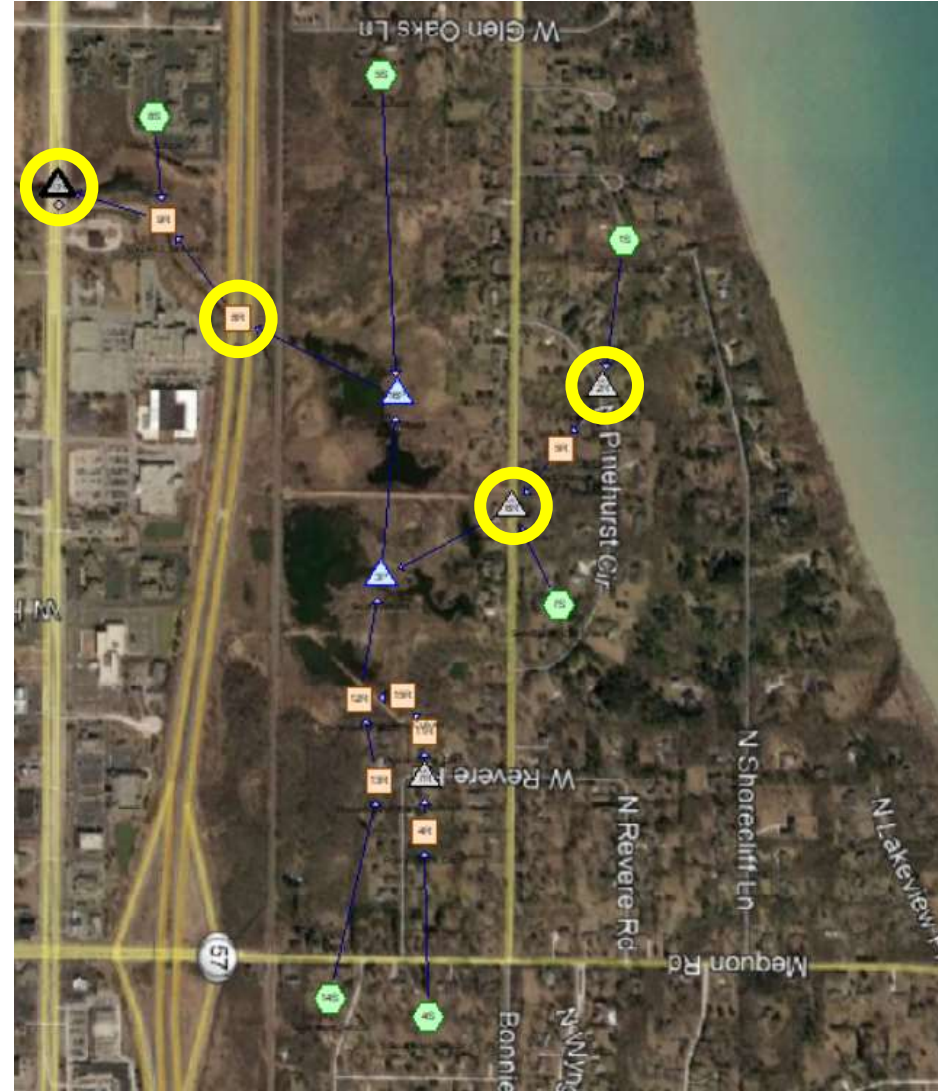


- Elevations
  - Culvert inverts from RTK-GPS data
  - Other information from 2010 LiDAR
- Lengths
  - Aerial photographs in GIS software for ditches, streams
- Drainage Areas
  - Measured from topographic data in GIS software
- Slopes
  - Lengths and elevations from LiDAR and GIS software



# Model Calibration

- 4 culvert locations with reported data from previous study
  - Pinehurst Circle
  - Lake Shore Drive
  - I-43
  - Port Washington Road





# Challenges

- Wetlands
- Interstate 43 widening
- Drain tile



# Wetlands

- Indicate poorly-drained areas
- Difficult to obtain permits for earthwork or drainage improvements within wetlands
- Limited ability to increase conveyance or storage





# I-43

- Widening will affect impervious surface area
  - May impact wetlands
- Water management is legally required as part of project
  
- Unknown plans and details for I-43



# Drain Tile

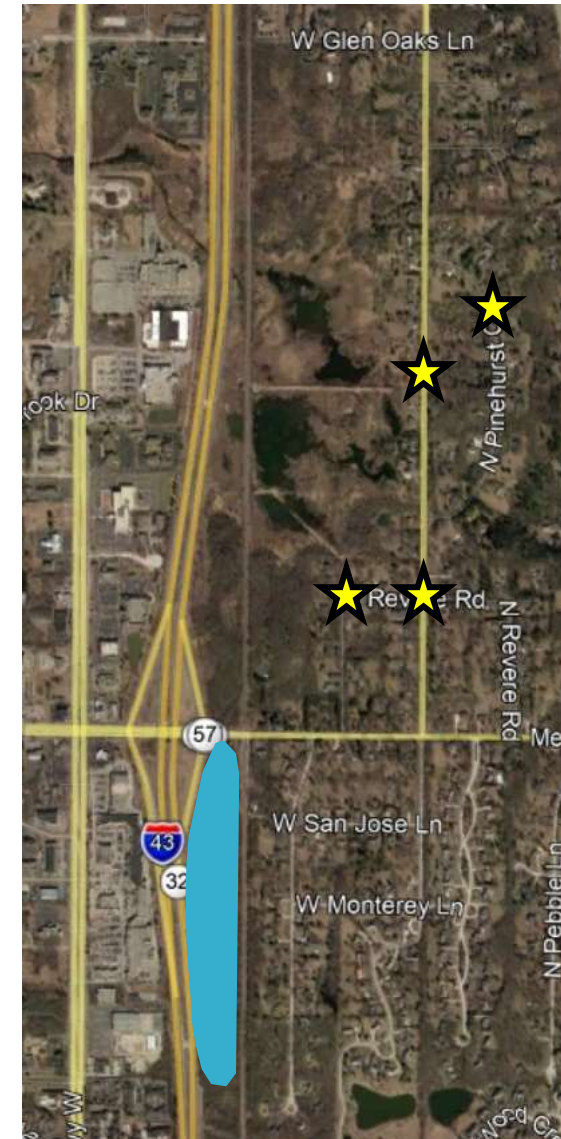
- Approximate location shown
- Unknown information
  - Invert elevation
  - Size
  - Condition
- Impossible to assess
  - Starting water surface elevation
  - Discharge through drain tile





# Effective Management Alternatives

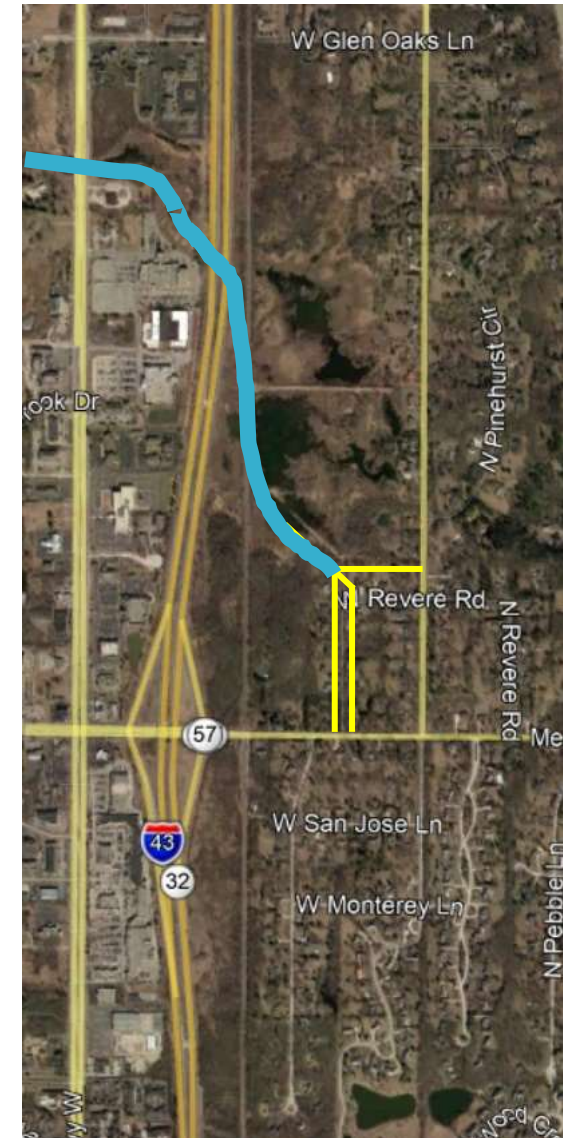
- Adding large detention pond
- Opening culverts





# Ineffective Management Alternatives

- Additional options
  - Widening stream channel
  - Opening ditches
  - Adding small detention ponds





# Revere Rd & Prairie View Ln

- Flood reduction
  - Most effective at reducing flood levels was culvert modification
  - Small change with large detention pond

Flood Level Reduction from Existing Conditions [ft]			
Model	Large Pond	Culvert	Combined
2-Year Event	0.0	1.3	1.7
10-Year Event	0.1	0.1	0.3
25-Year Event	0.0	0.1	0.2
100-Year Event	0.1	0.1	0.3

# Revere Rd & Prairie View Ln

- Evaluated peak discharge
  - Large detention pond provided significant reduction in peak flows
  - Other options had limited or no effect individually
  - Combined effects further decreased peak discharge

Model	Existing	Lg Pond	Combined
2-Year Discharge [cfs]	16.6	12.5	11.6
10-Year Discharge [cfs]	44.7	33.5	31.3
25-Year Discharge [cfs]	71.8	53.9	50.3
100-Year Discharge [cfs]	129.3	97.0	90.5



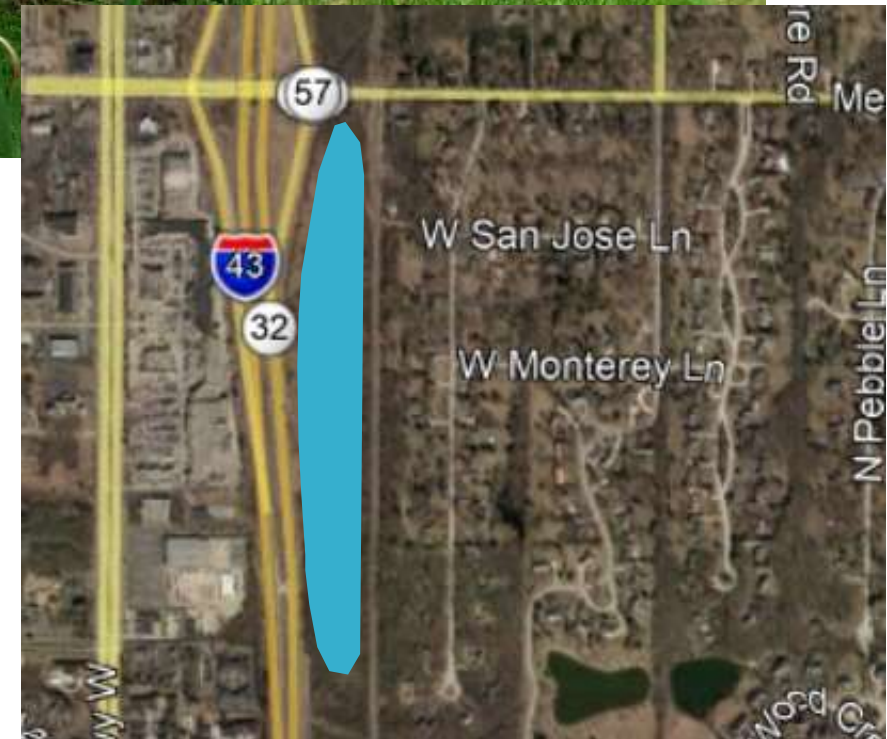
# Other Culverts

- Flood reduction
  - Only effective option for reducing flood levels was culvert modification

Flood Level Reduction from Existing Conditions [ft]			
Model	Revere & Lake Shore	Lake Shore & MMSD	Pinehurst
2-Year Event	0.3	0.0	0.0
10-Year Event	0.1	0.1	0.1
25-Year Event	0.0	0.4	1.1
100-Year Event	0.1	0.9	0.7

# Discussion

- Culvert Modification – Highest Priority
  - Allows flow through what is currently chokepoint
    - Still overwhelmed at larger events
  - Could be coupled with ditch modifications
- Large Detention Pond – Second Priority
  - Has significant impact on peak discharge
  - Would require substantial excavation
    - Inflow ~671 ft NAVD88
    - Most of area is above that level, max ~677 ft NAVD88
    - No other feasible location
- Stream Modification – Third Priority
  - Limited effect on flooding, peak discharge; difficult permitting
- Small Detention Ponds – Not Feasible
  - Limited effect on flooding, peak discharge
  - Would require support from many residents





# Summary

- 1999 CDM study suggested two long-term solutions
  - Large detention pond
  - Stream rehabilitation
- FreshWater developed stormwater model
- Evaluated CDM recommendations & other alternatives
- Most effective flood-reduction is culvert modification
- Detention pond would reduce flood flows, no significant reduction in flood elevations
- Other alternatives have limited effect on flooding at project site

