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# STORMWATER HYDROLOGY AND HYDRAULICS STUDY

City of Manitowoc, WI

March 1, 2023

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# Presentation Outline

- Introduction and Project Background
- Flood Problem Areas
- Existing Condition Model  and Calibration
- Alternative Analysis
- Recommended Alternative
- Project Funding Opportunities

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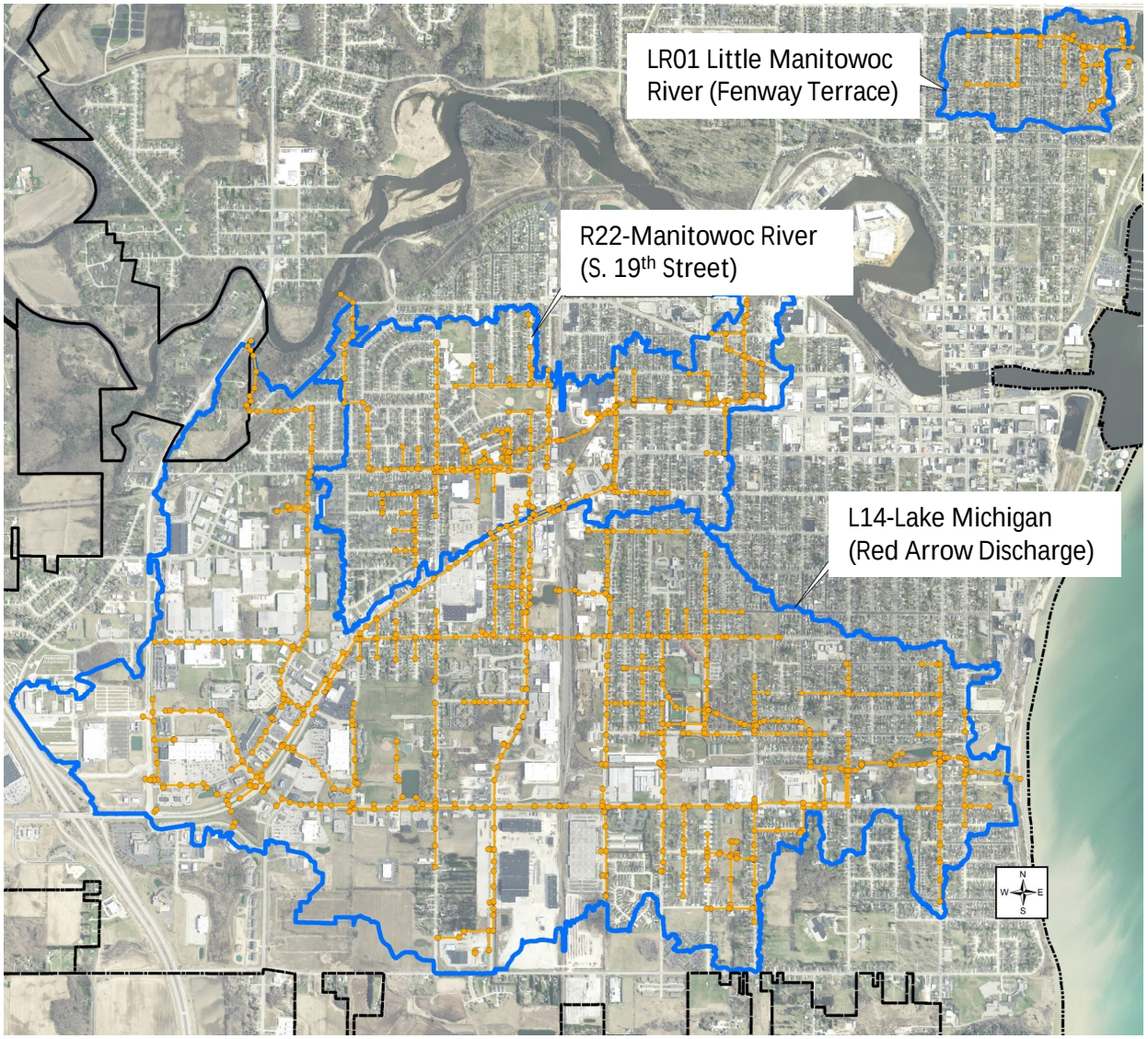
# Studied Watersheds




**Watershed Map**

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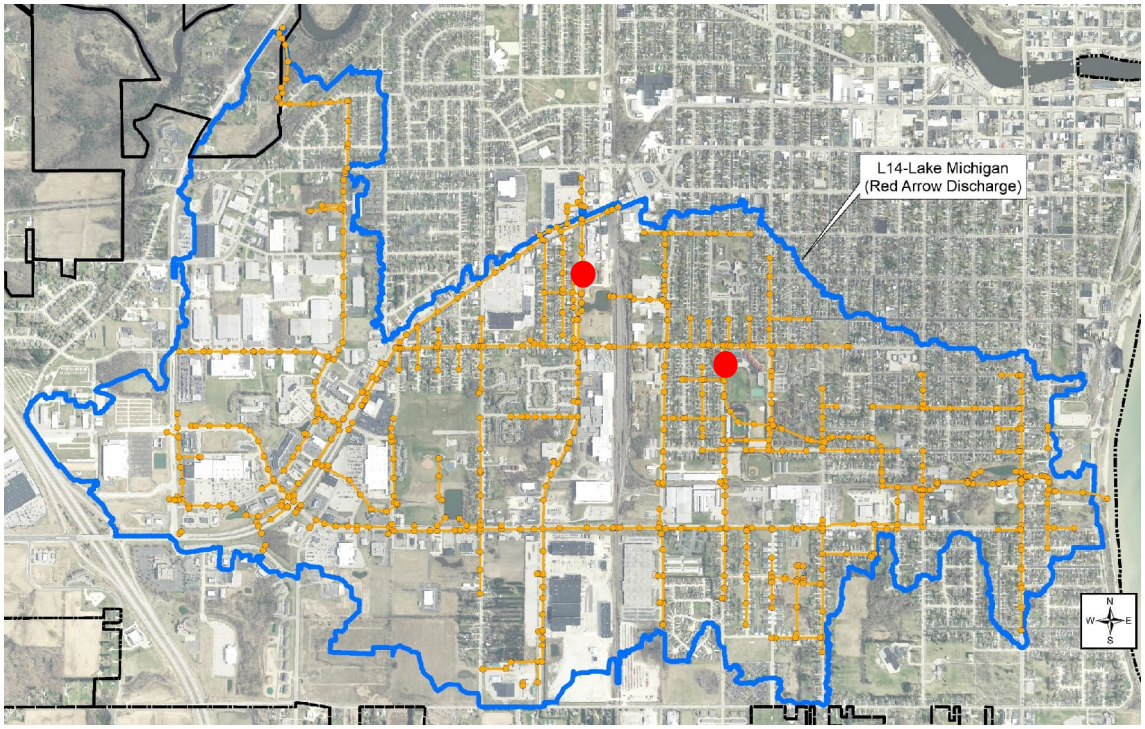
# Flooding Problem Areas

- L14 - Lake Michigan (Red Arrow Discharge)
  - 23rd Street from Division Street to Grand Avenue
  - 30th Street from HWY 42 to Division Street.




**L14 Flooding Problem Areas**

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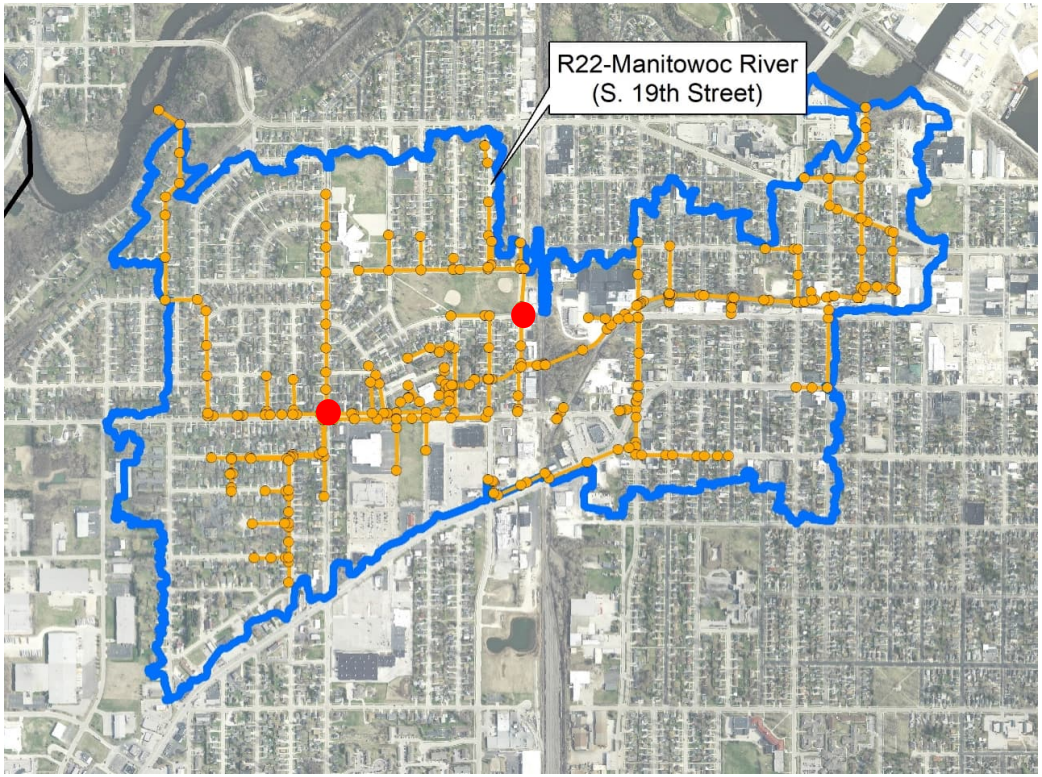
# Flooding Problem Areas

- R22 - Manitowoc (S. 19th Street) Watershed
  - Intersection of 29th Street and Mero Street
  - Intersection of Custer Street and 35th Street




**R22 Flooding Problem Areas**

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# Flooding Problem Areas

- LR01 - Little Manitowoc River (Fenway Terrace) Watershed
  - Intersection of Pine Street and 5th Street.


**LR01 Flooding Problem Areas**

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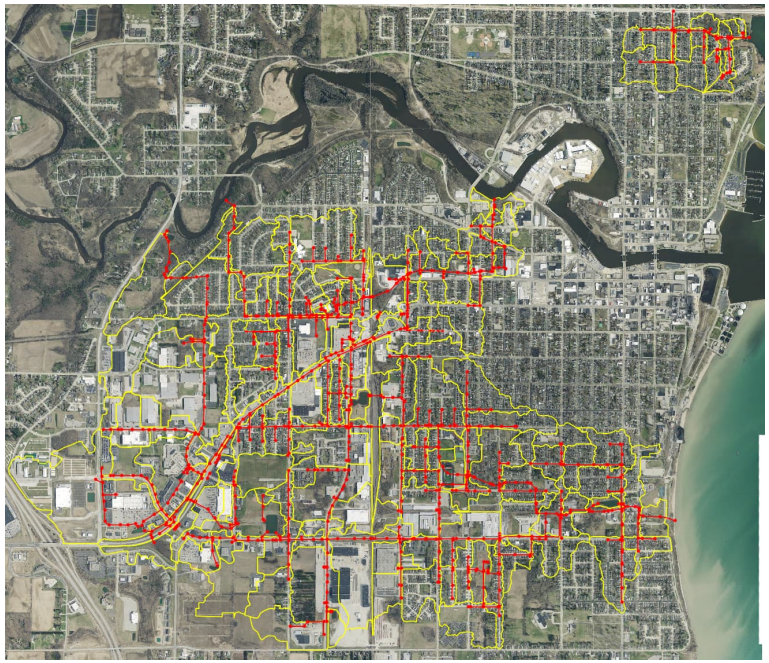
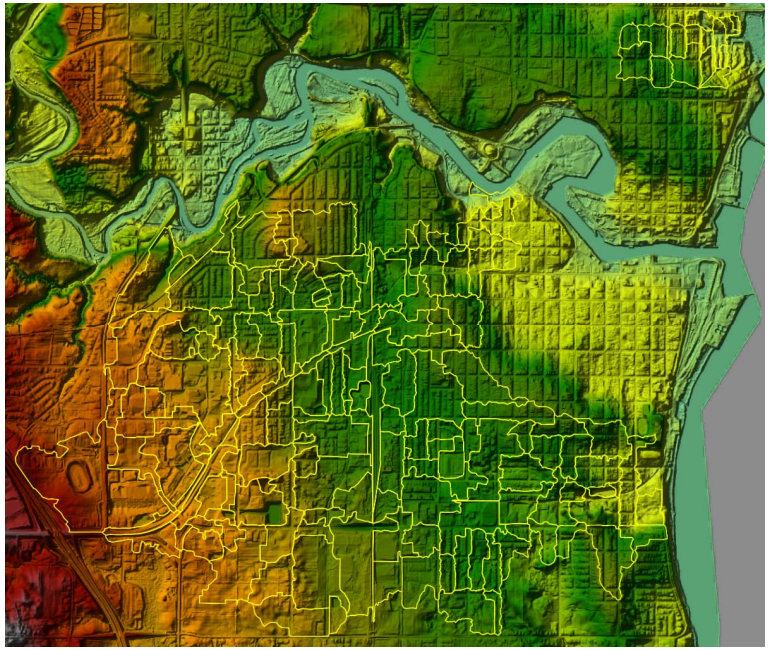
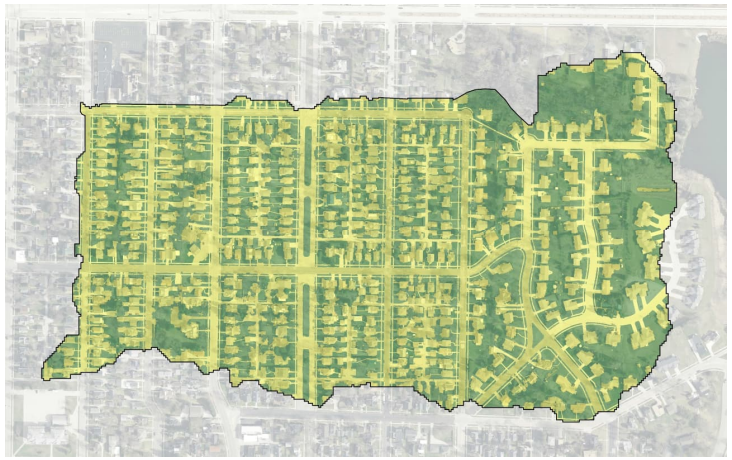
# XPSWMM 2D Modeling



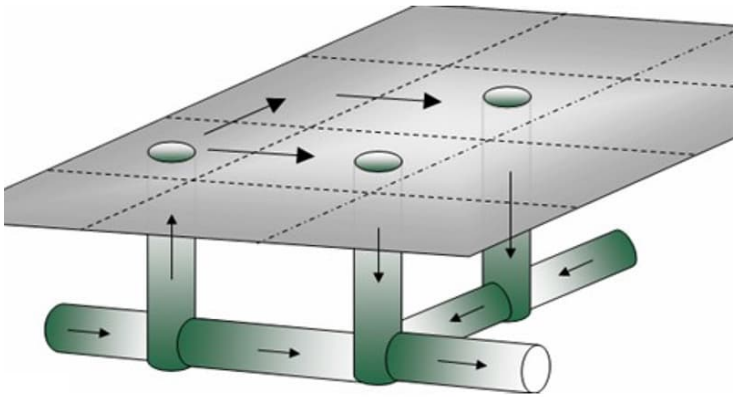
Watershed Delineation & Modeled Storm



Digital Elevation Model (Surface)



Impervious Area & Building Footprints



XPSWMM 1D & 2D

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# Existing Condition Model Calibration

- Calibration Storm Event
  - July 14 and 15, 2021
- Calibration Locations
  - 23rd Street by Rubick Field
  - 1305 31st Street
  - 35th Street and Custer Street Intersection
  - 904 29th Street
  - Sabbatical Brewery
  - Pine Street and 5th Street Intersection

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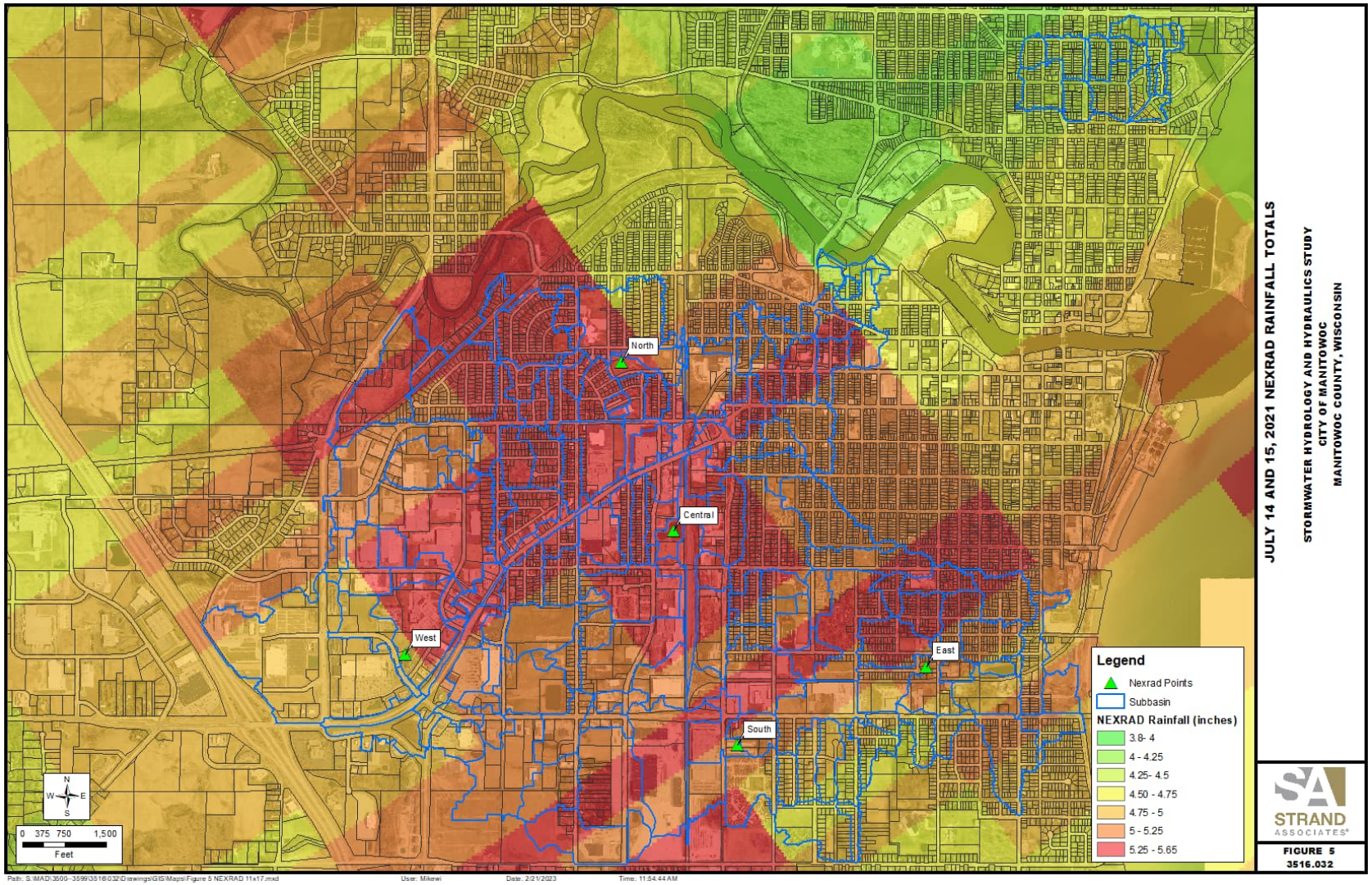
# July 14 and 15, 2021 Storm Event




**Radar Precipitation Totals – July 14 and 15, 2021**

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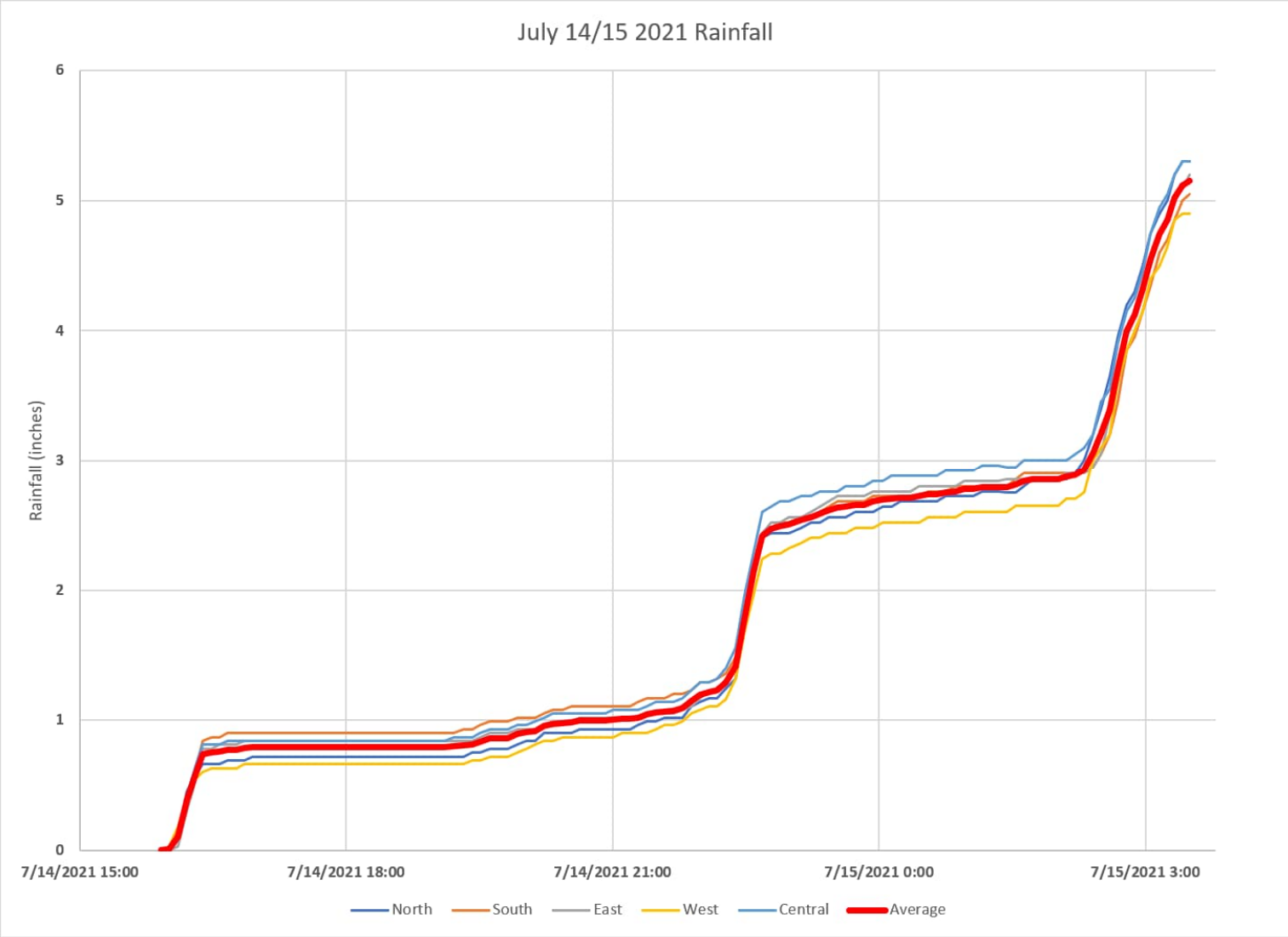
# July 14 and 15, 2021 Storm Event




**Radar Precipitation Totals – July 14 and 15, 2021**

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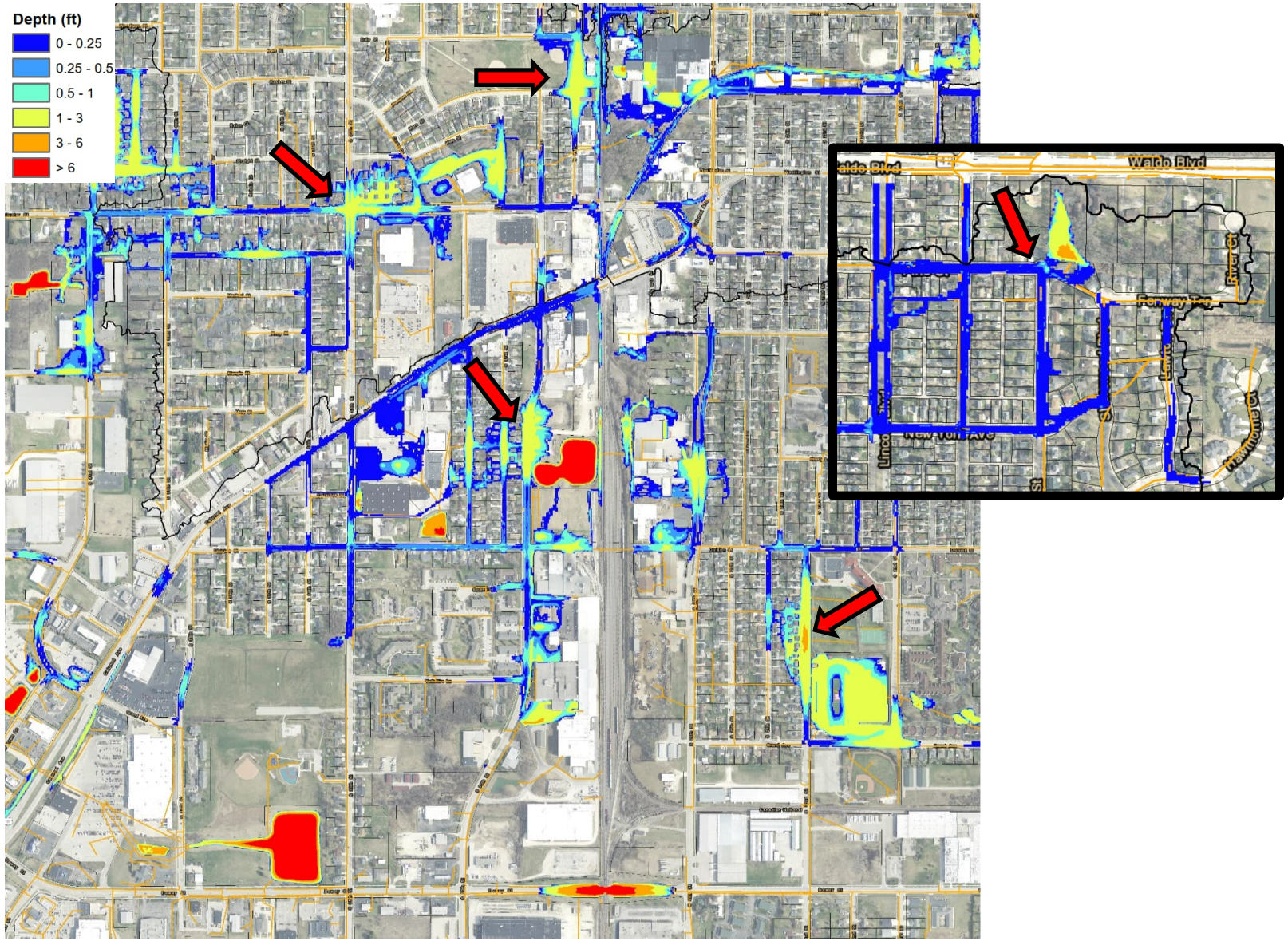
# July 14 and 15, 2021 Flood Depth




**July 14 and 15, 2021 Flood Depth Map**

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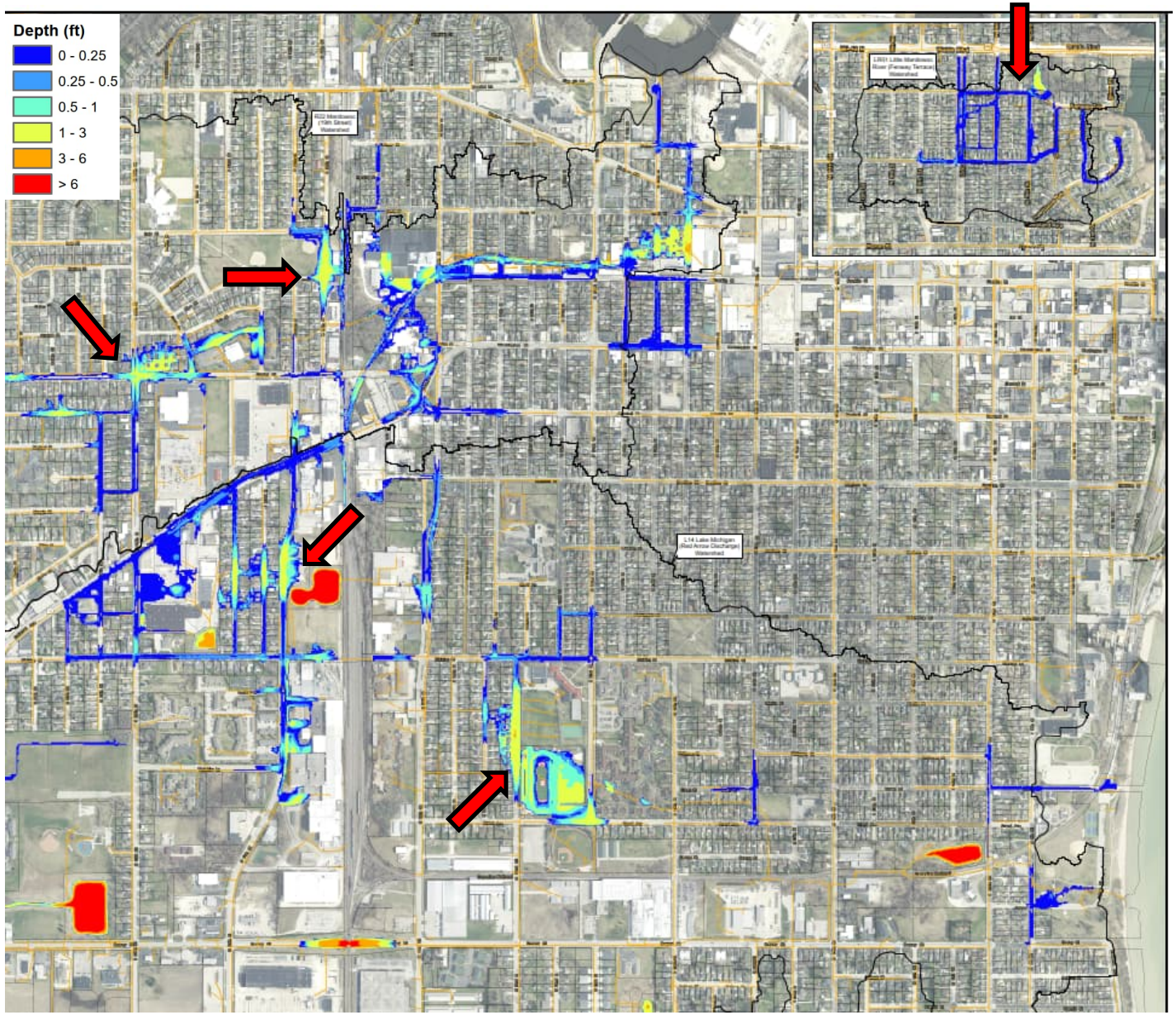
# Existing Condition Flood Depth Mapping




**100-Year Flood Depth Mapping (Existing Condition)**

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# Alternative Analysis Design Criteria

- 100-year design storm flooding contained within the right of way.
- In areas with an overland flow route the storm sewer system shall be designed with a conveyance capacity of a 25-year design storm.
- In areas with a lack of an overland flow route the storm sewer system shall be designed with a conveyance capacity of a 100-year design storm.
- Do not create/increase other flooding problems within the watershed.

# Alternative Analysis

- 10 Alternatives Analyzed

- L14 – Lake Michigan (Red Arrow Discharge)
  - Alternative 1 - 4
    - Components – Underground Detention Basin, Dry Detention Basin, Expanded Detention Basin, Storm Sewer Upsizing
- R22 - Manitowoc (S. 19th Street) Watershed
  - Alternative 1 - 3
    - Components – Wet Detention Basin, Storm Sewer Upsizing
- LR01 - Little Manitowoc River (Fenway Terrace) Watershed
  - Alternative 1 - 3
    - Components – Storm Sewer Upsizing, Easement Regrading, Road Regrading

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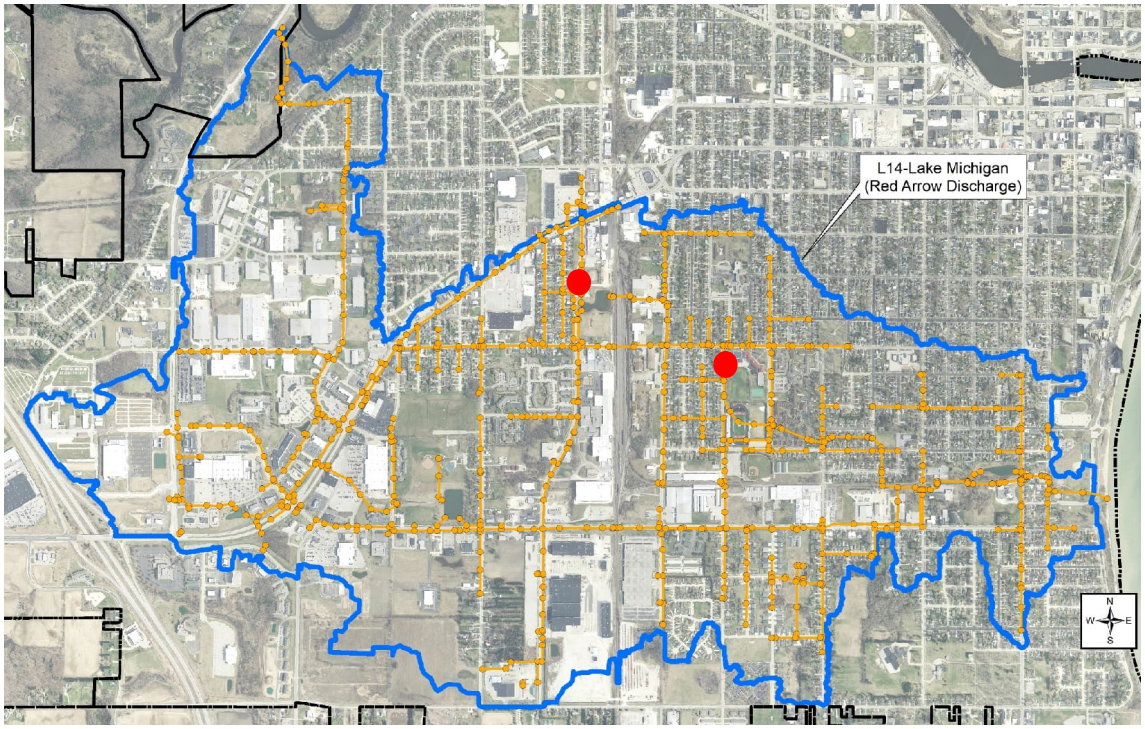
# Flooding Problem Areas

- L14 - Lake Michigan (Red Arrow Discharge)
  - 23rd Street from Division Street to Grand Avenue
  - 30th Street from HWY 42 to Division Street.




**L14 Flooding Problem Areas**

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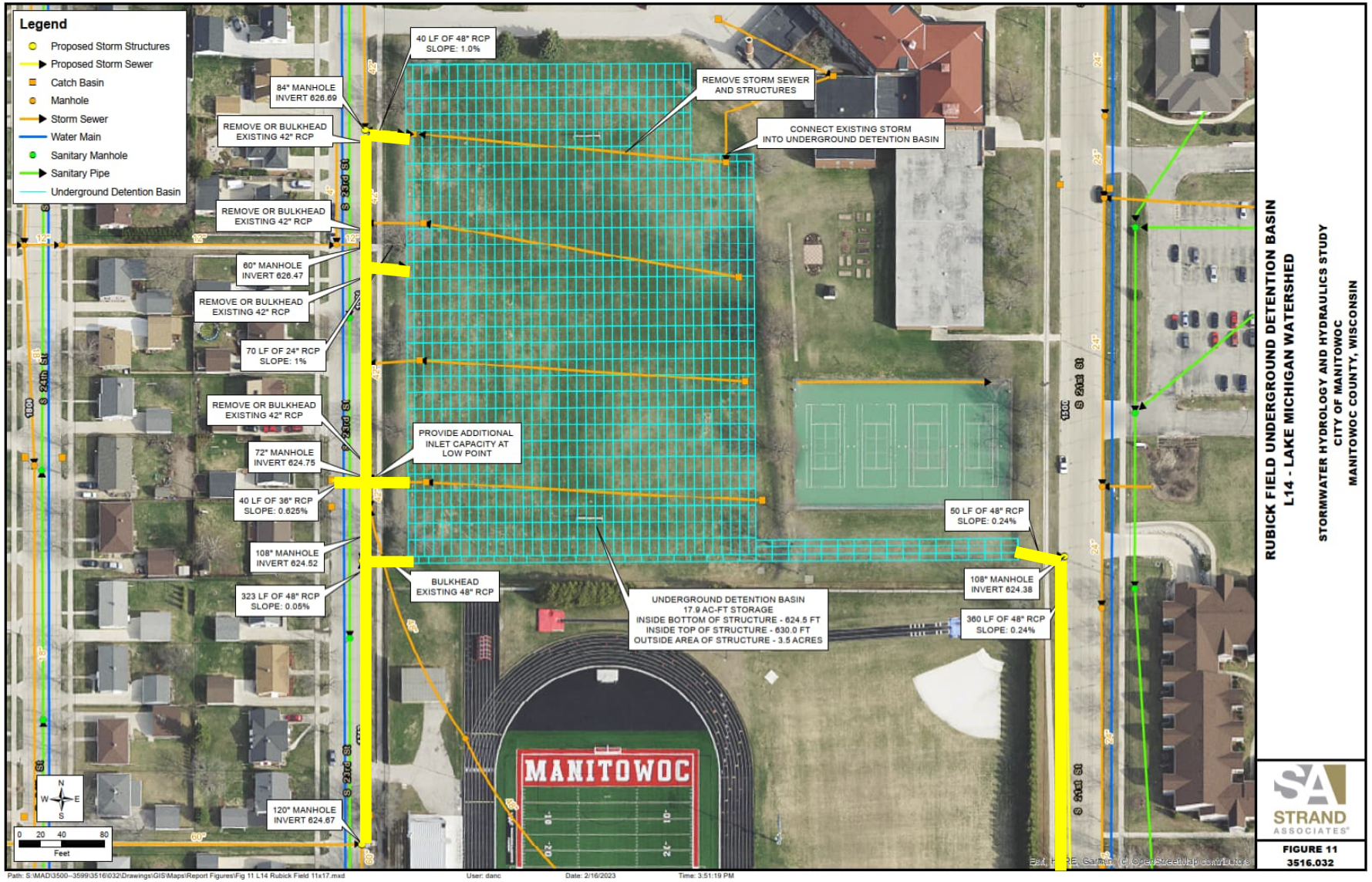
# L14 Alternative 1




**Rubick Field Underground Detention Basin**

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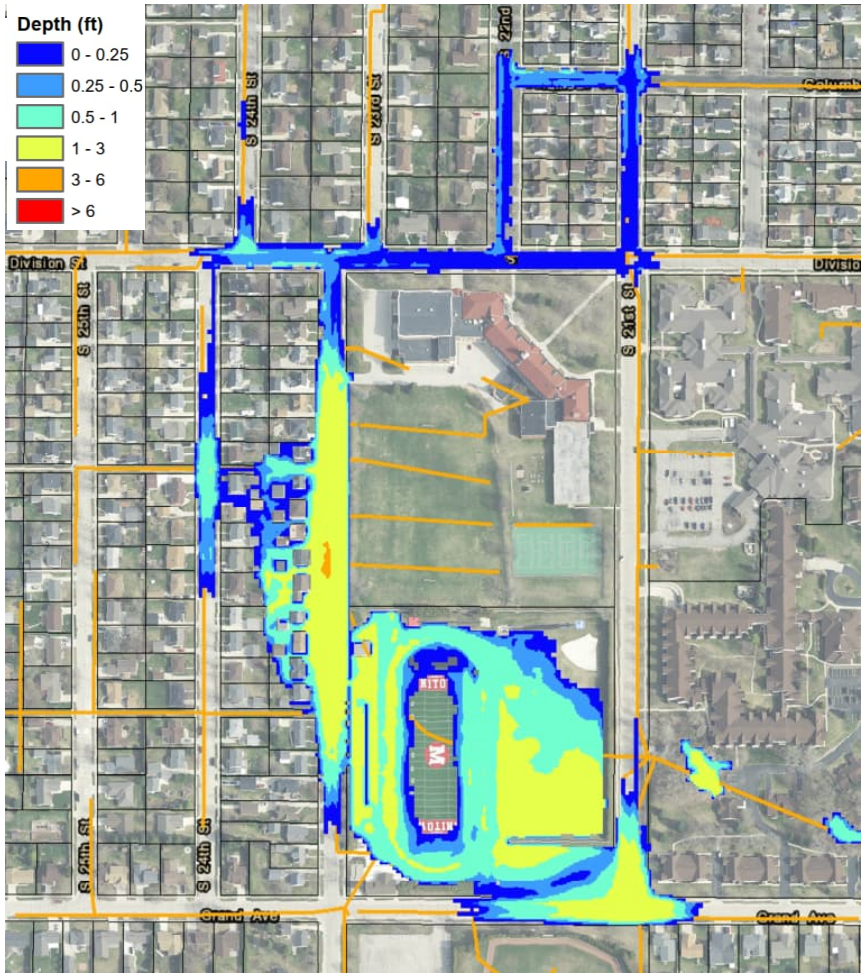
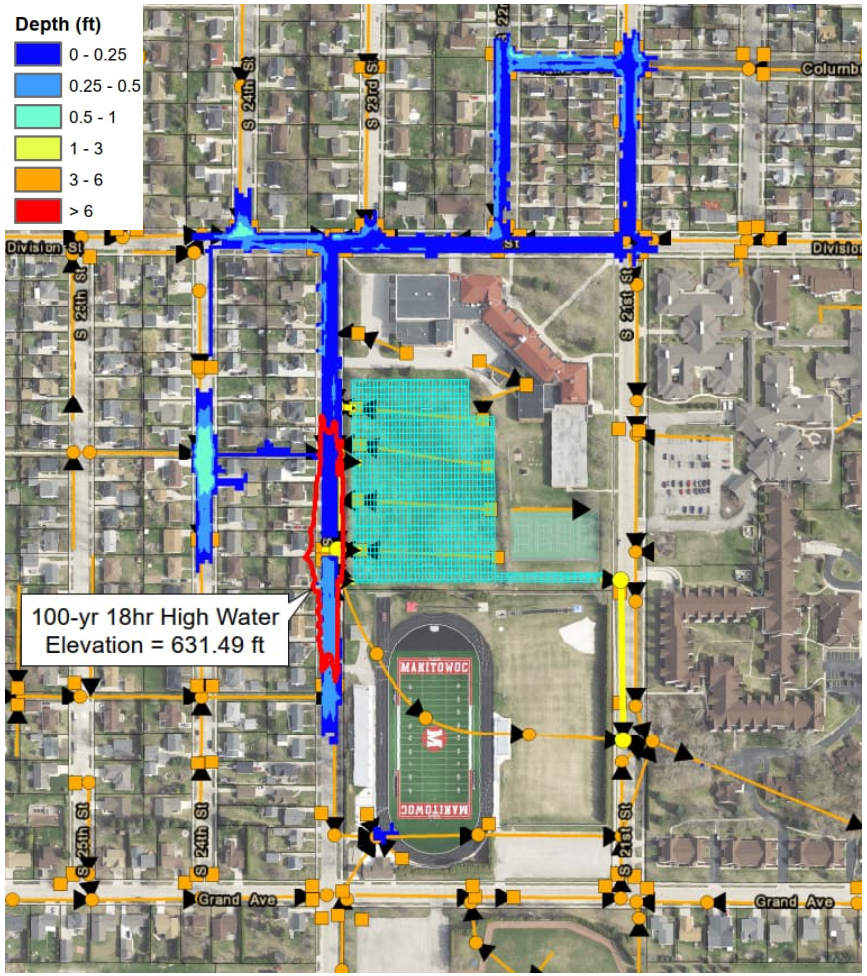
# L14 Alternative 1




Existing Condition 100-Year Flood Depth




Alternative 1 100-Year Flood Depth

- The 100-Year flood depth on 23rd Street goes from 3.42 feet to 1.52 feet for a reduction of 1.9 feet.

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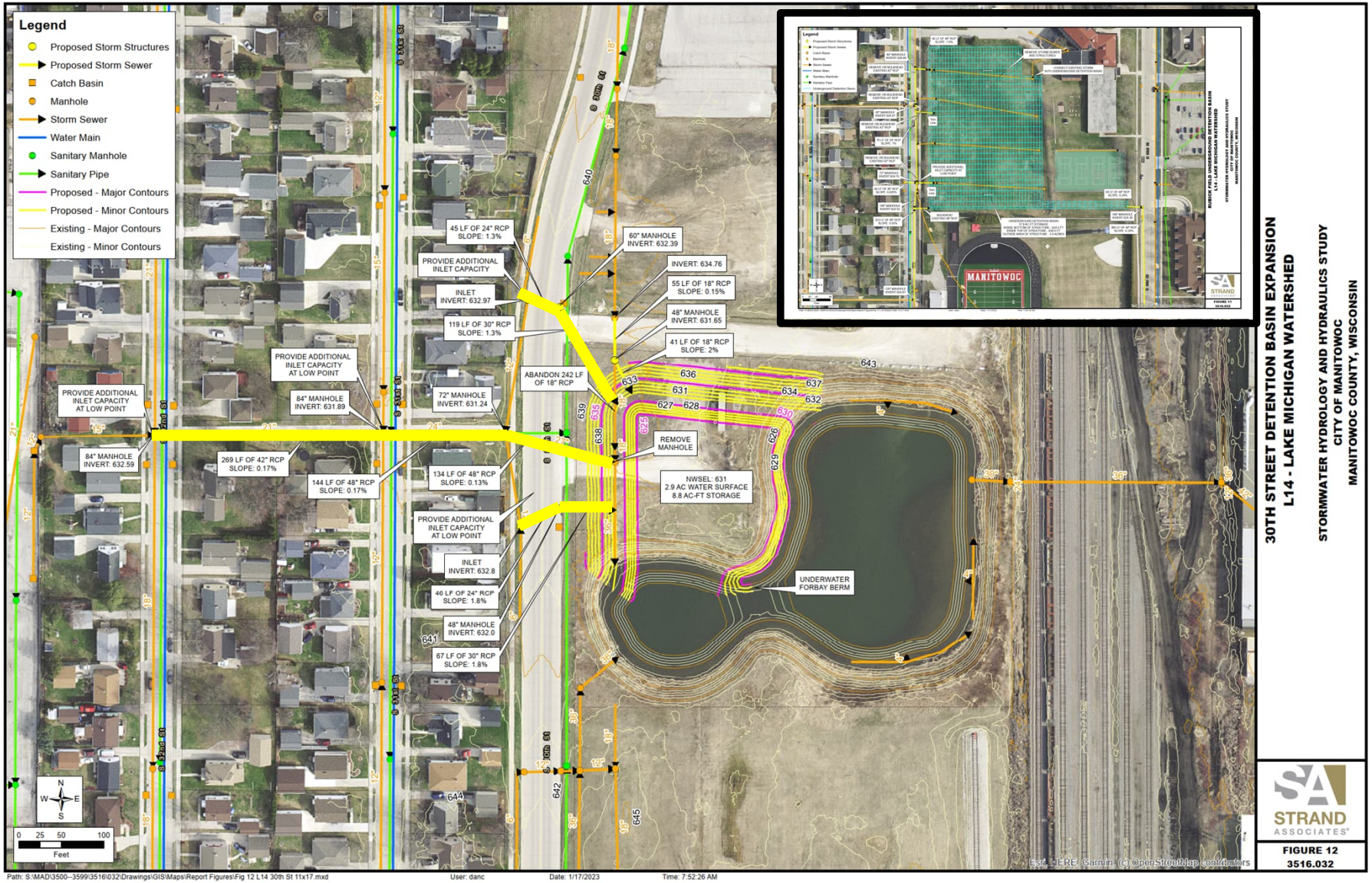
# L14 Alternative 2




**30th Street Detention Basin Expansion**

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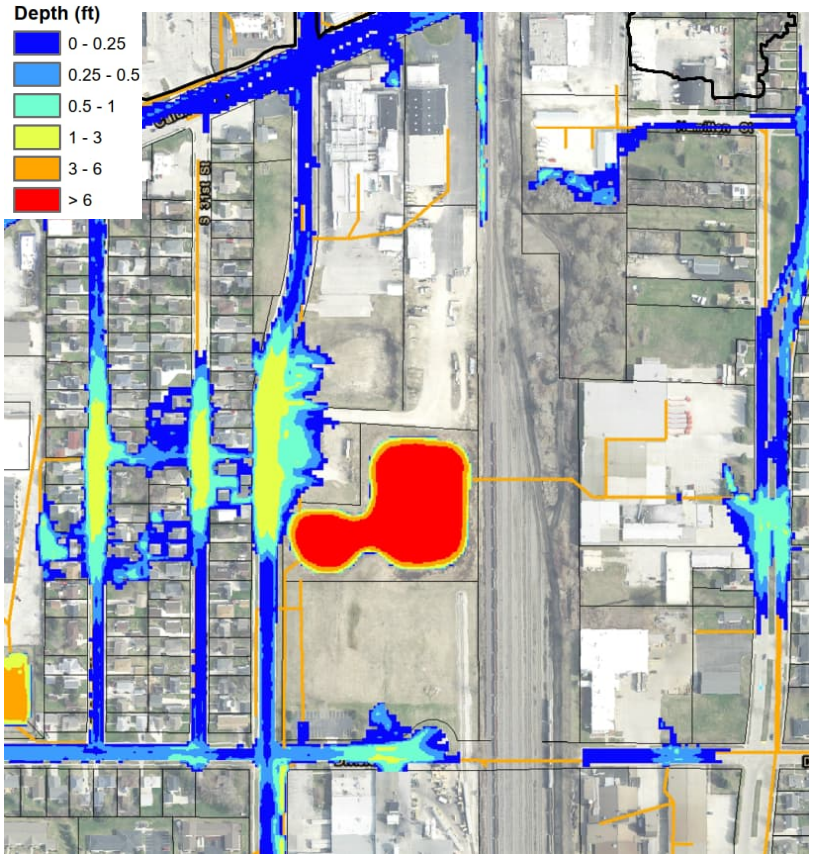
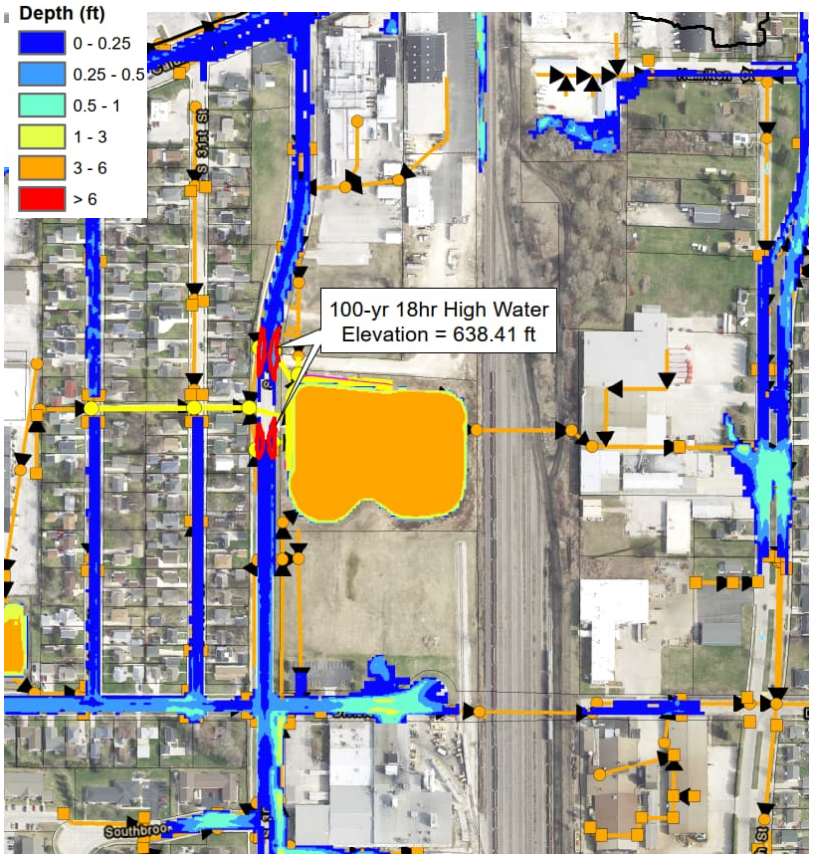
# L14 Alternative 2




Existing Condition 100-Year Flood Depth




Alternative 2 100-Year Flood Depth

- The 100-Year flood depth on 30th Street goes from 2.21 feet to 0.32 feet for a reduction of 1.89 feet.
- The 100-Year flood depth on 23rd Street goes from 3.42 feet to 1.34 feet for a reduction of 2.08 feet.

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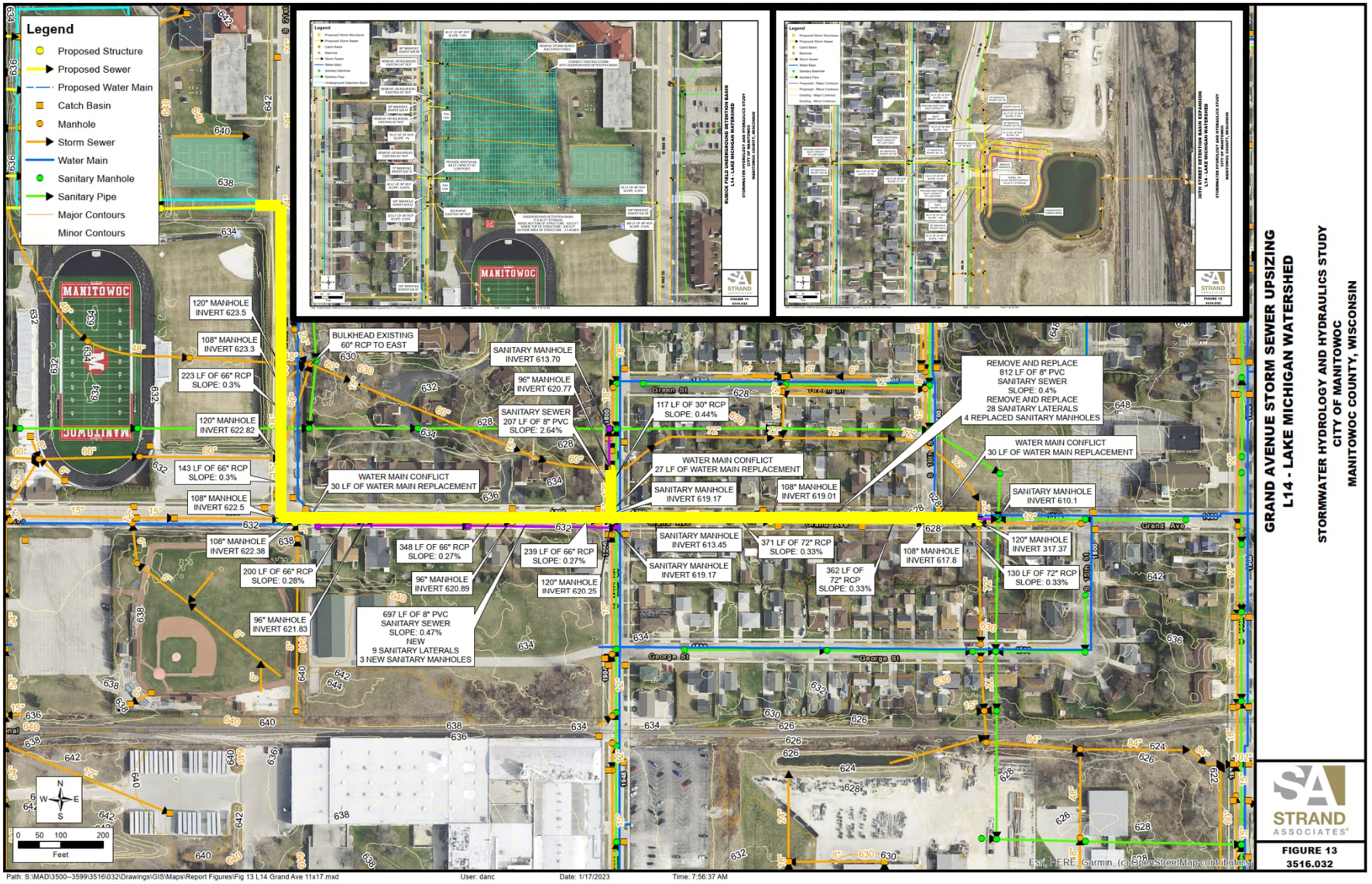
# L14 Alternative 3




**Grand Avenue Storm Sewer Upsizing**

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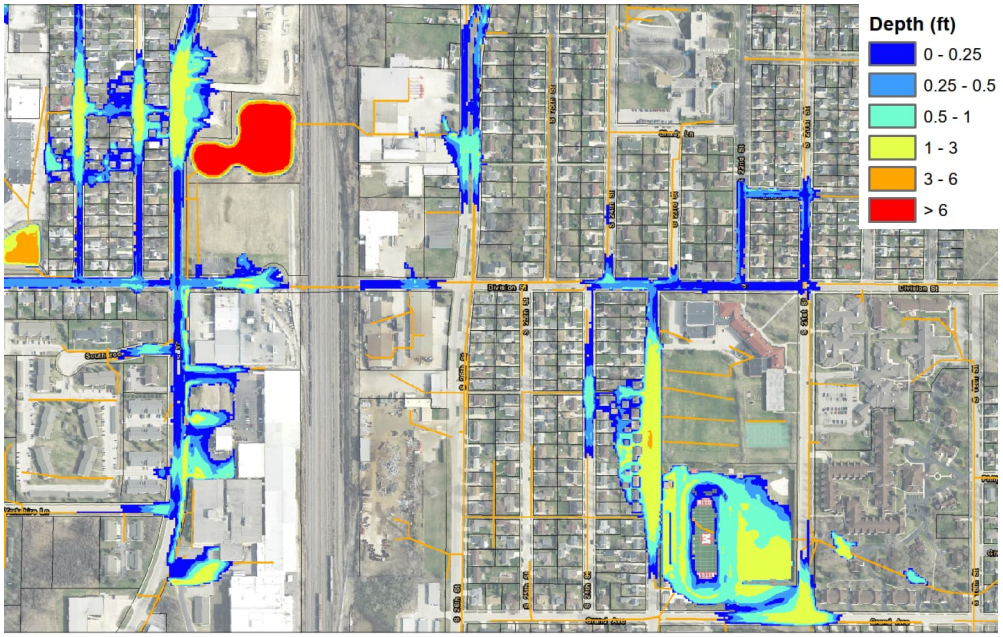
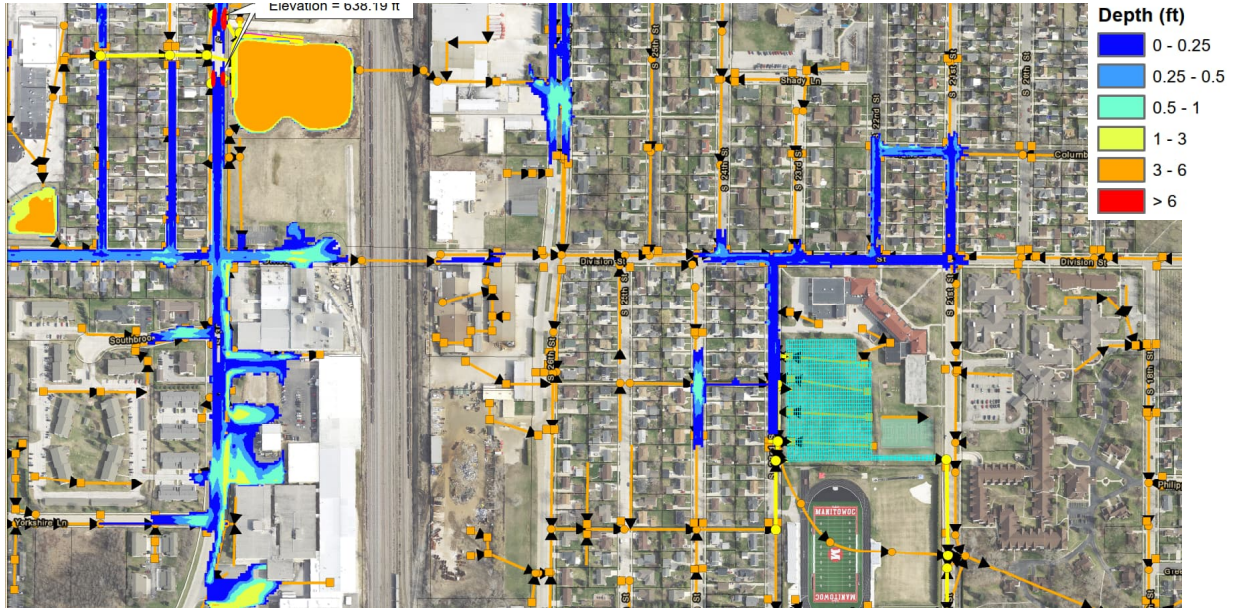
# L14 Alternative 3




**Alternative 2 100-Year Flood Depth**

- The 100-Year flood depth on 30th Street goes from 2.21 feet to 0.18 feet for a reduction of 2.03 feet.

- The 100-Year flood depth on 23rd Street goes from 3.42 feet to 0.00 feet for a reduction of 3.42 feet.




**Alternative 3 100-Year Flood Depth**

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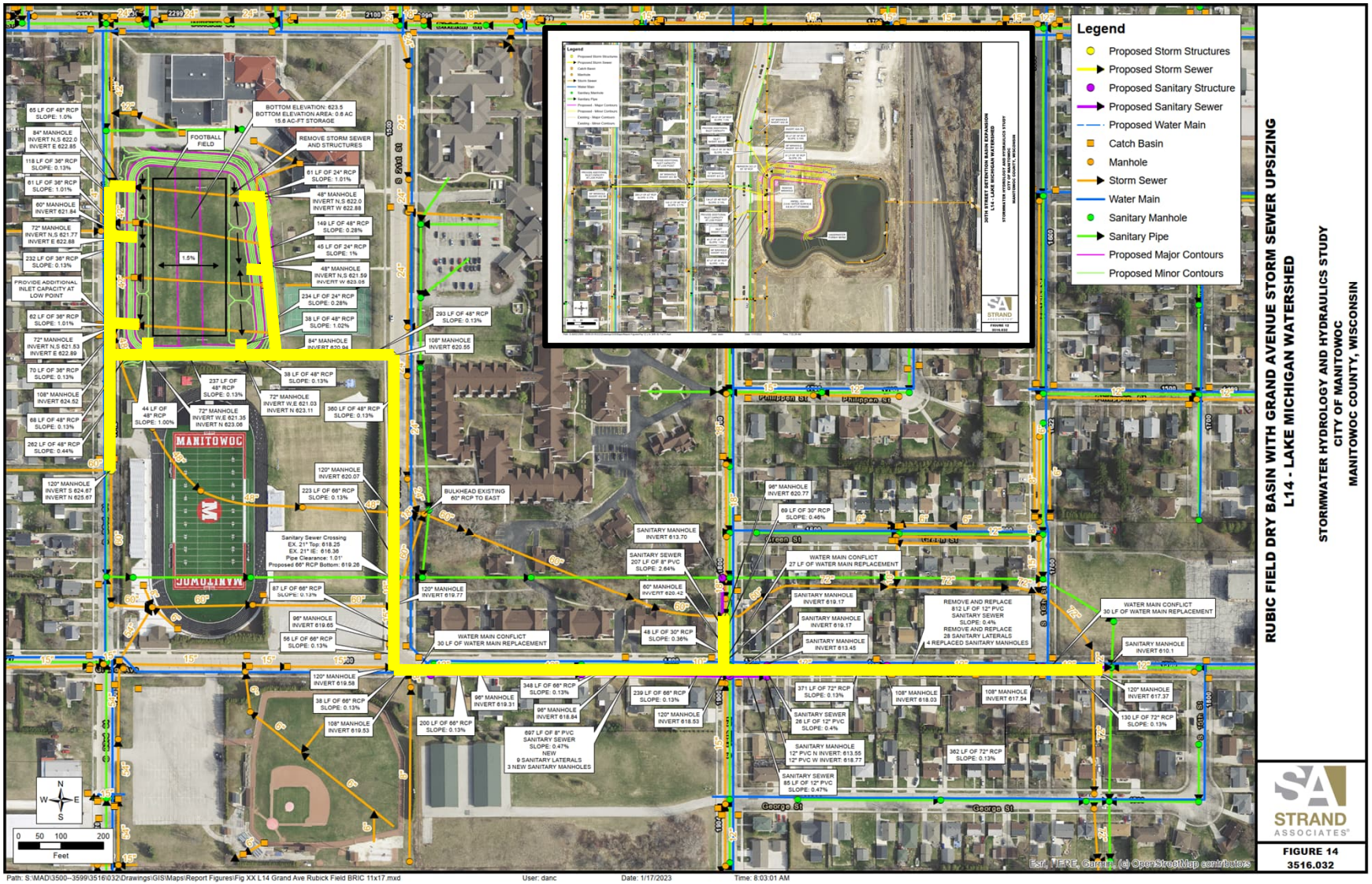
# L14 Alternative 4




**Rubick Field Dry Detention Bains and Grand Avenue Storm Sewer Upsizing**

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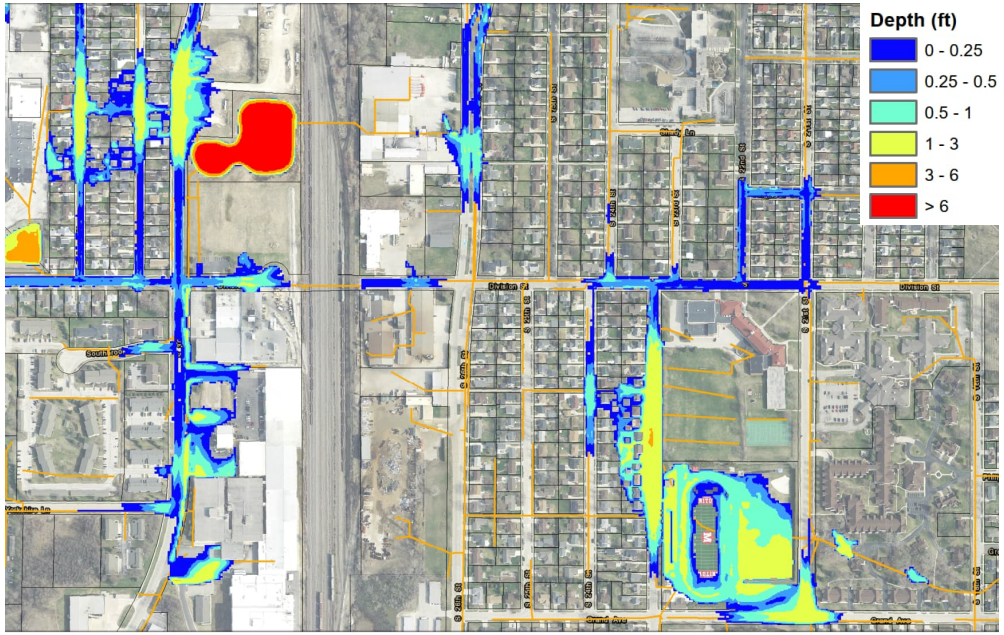
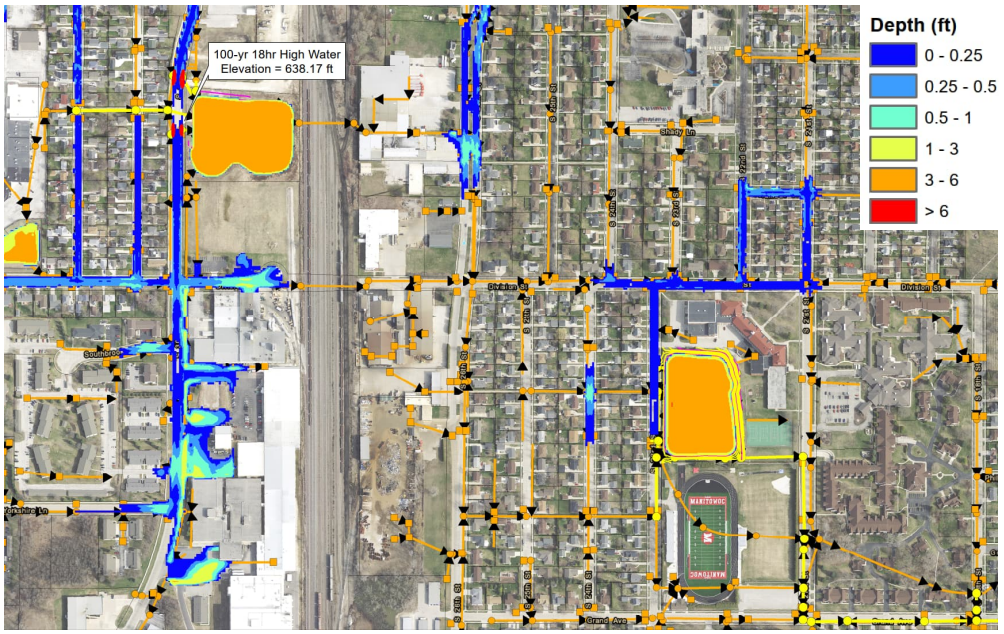
# L14 Alternative 4




**Existing Condition100-Year Flood Depth**

- The 100-Year flood depth on 30th Street goes from 2.21 feet to 0.14 feet for a reduction of 2.07 feet.

- The 100-Year flood depth on 23rd Street goes from 3.42 feet to 0.00 feet for a reduction of 3.42 feet.




**Alternative 4 100-Year Flood Depth**

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# L14 Opinion of Probable Construction Cost

| Project Descriptions | OPCC |
|---|---|
| **L14 Alternative 1** | |
| Rubick Field Underground Detention Basin | $13,336,300 |
| L14 Alternative 1 Total | $13,336,300 |
| | |
| **L14 Alternative 2** | |
| Rubick Field Underground Detention Basin | $13,336,300 |
| 30th Street Detention Basin Expansion | $1,788,300 |
| L14 Alternative 2 Total | $15,124,600 |
| | |
| **L14 Alternative 3** | |
| Rubick Field Underground Detention Basin | $13,336,300 |
| 30th Street Detention Basin Expansion | $1,788,300 |
| Grand Avenue Storm Sewer Upsizing | $4,338,500 |
| L14 Alternative 3 Total | $19,463,100 |
| | |
| **L14 Alternative 4** | |
| Rubick Field Dry Detention Basin | $3,749,700 |
| Grand Avenue Storm Sewer Upsizing | $4,437,500 |
| 30th Street Detention Basin Expansion | $1,788,300 |
| L14 Alternative 4 Total | $9,975,400 |

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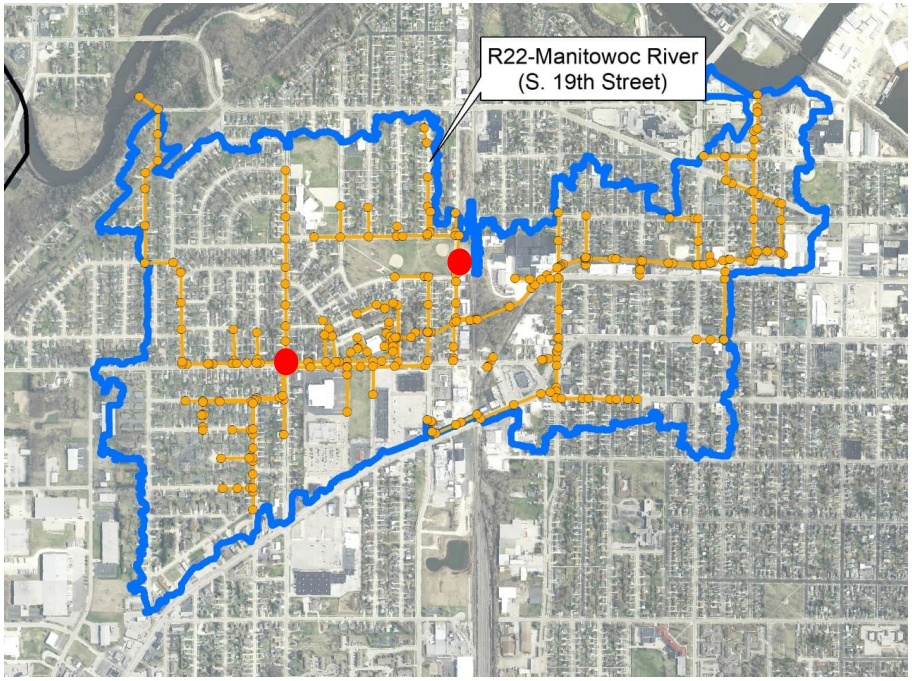
# Flooding Problem Areas

- R22 - Manitowoc (S. 19th Street) Watershed
  - Intersection of 29th Street and Mero Street
  - Intersection of Custer Street and 35th Street




**R22 Flooding Problem Areas**

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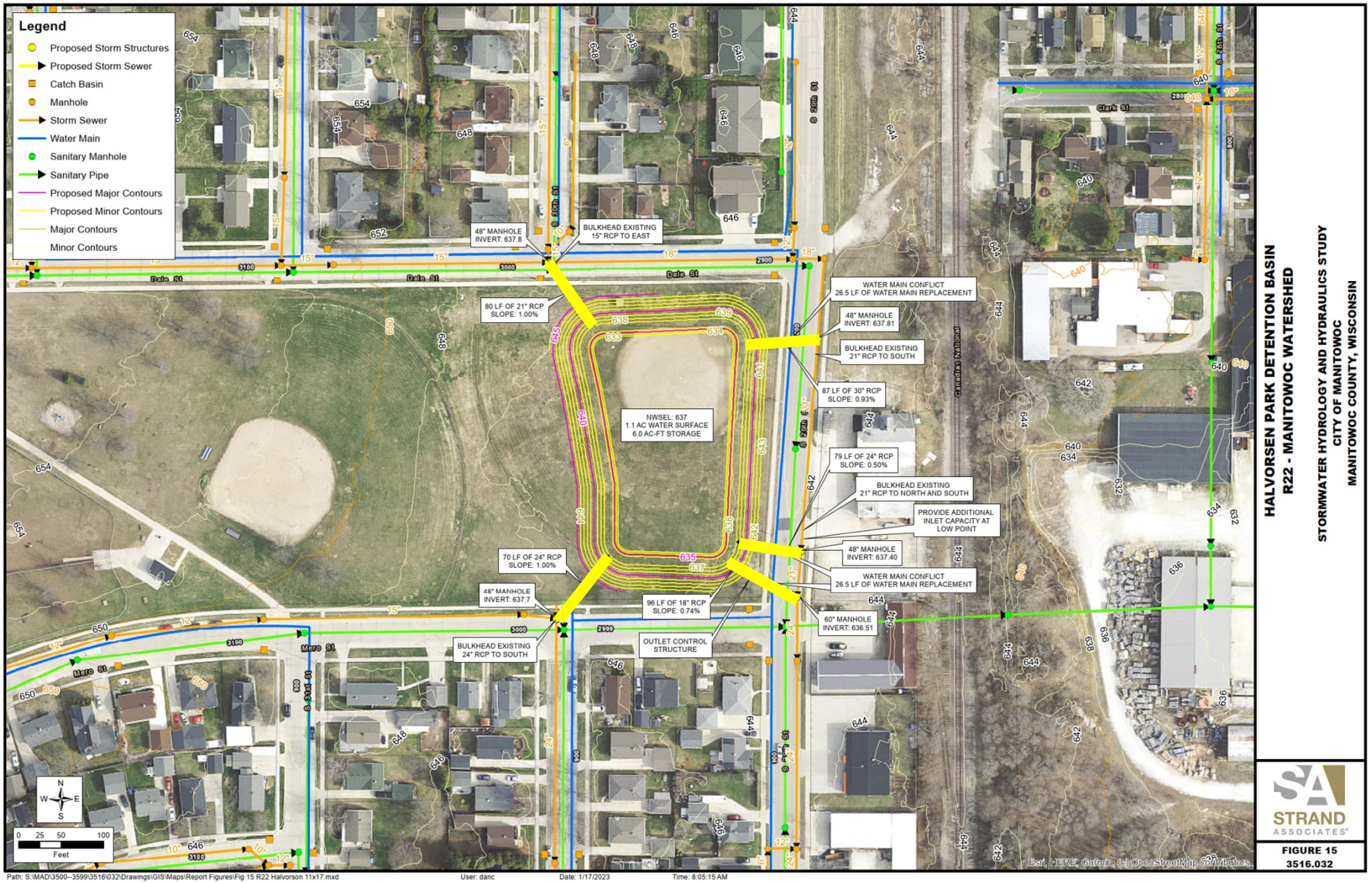
# R22 Alternative 1




**Halvorsen Park Wet Detention Basin**

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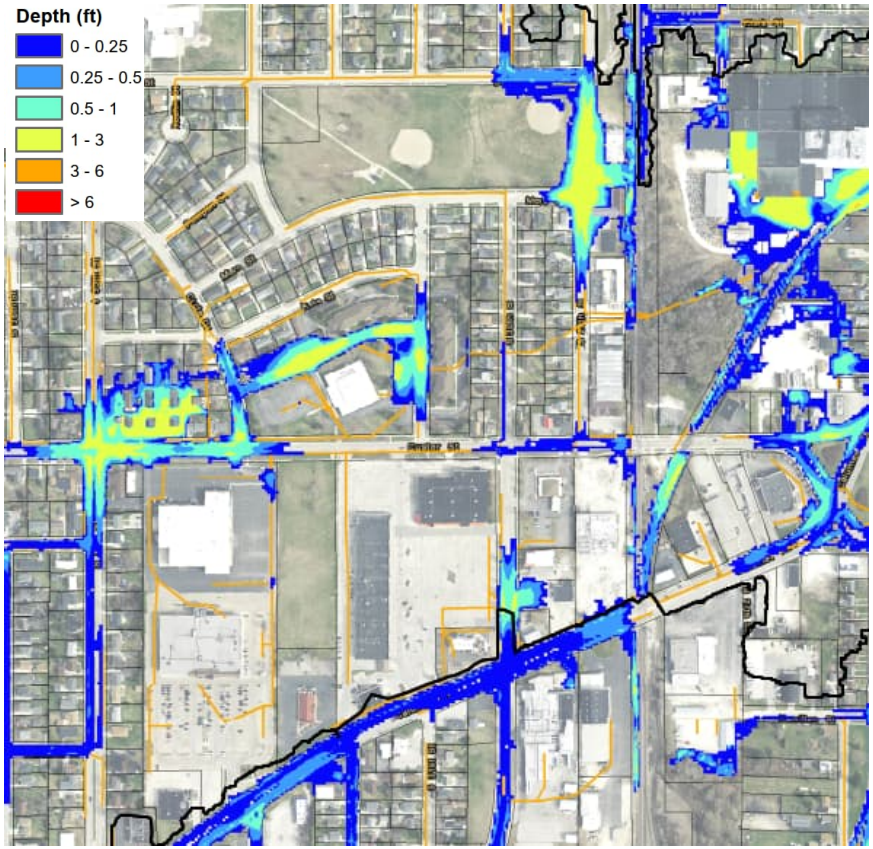
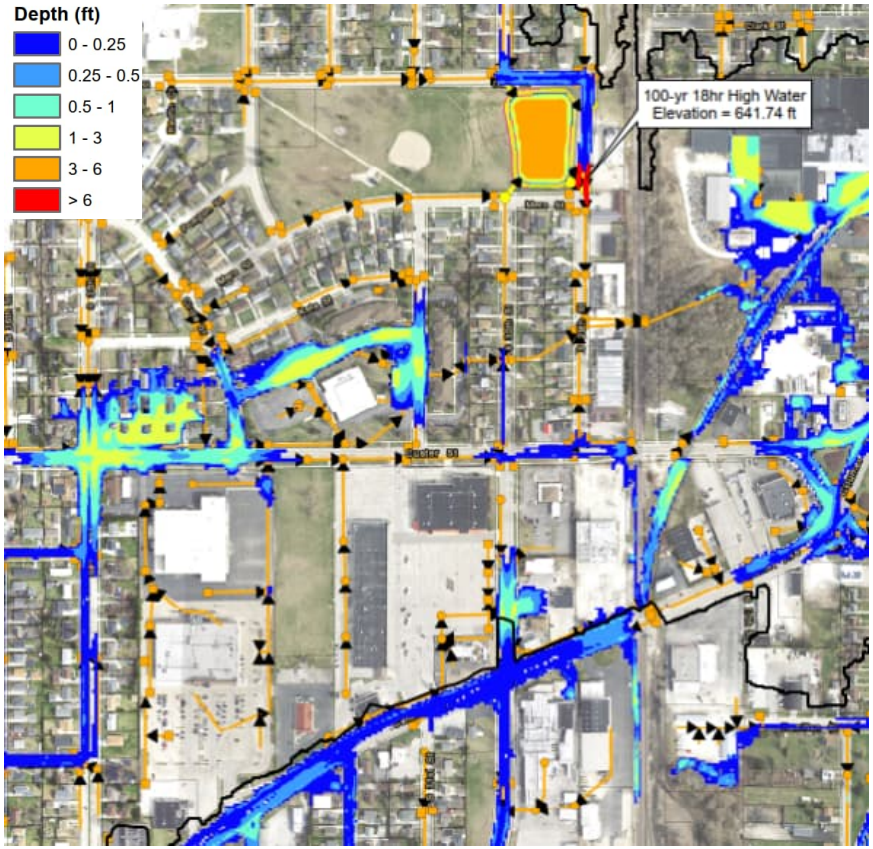
# R22 Alternative 1




**Existing Condition 100-Year Flood Depth**




**Alternative 1 100-Year Flood Depth**

- The 100-Year flood depth on 29th Street goes from 2.08 feet to 0.14 feet for a reduction of 1.94 feet.

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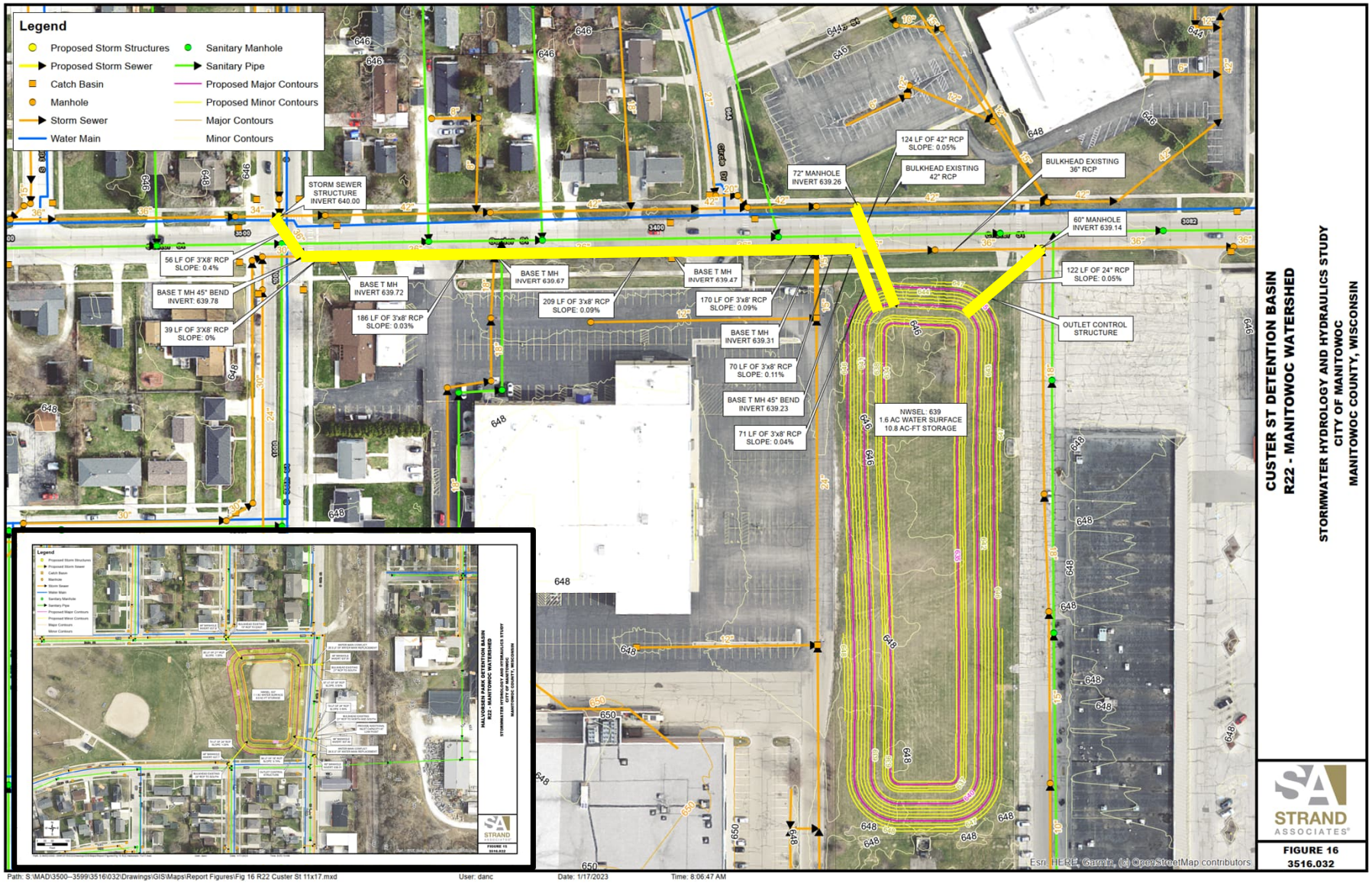
# R22 Alternative 2




**Custer Street Wet Detention Basin**

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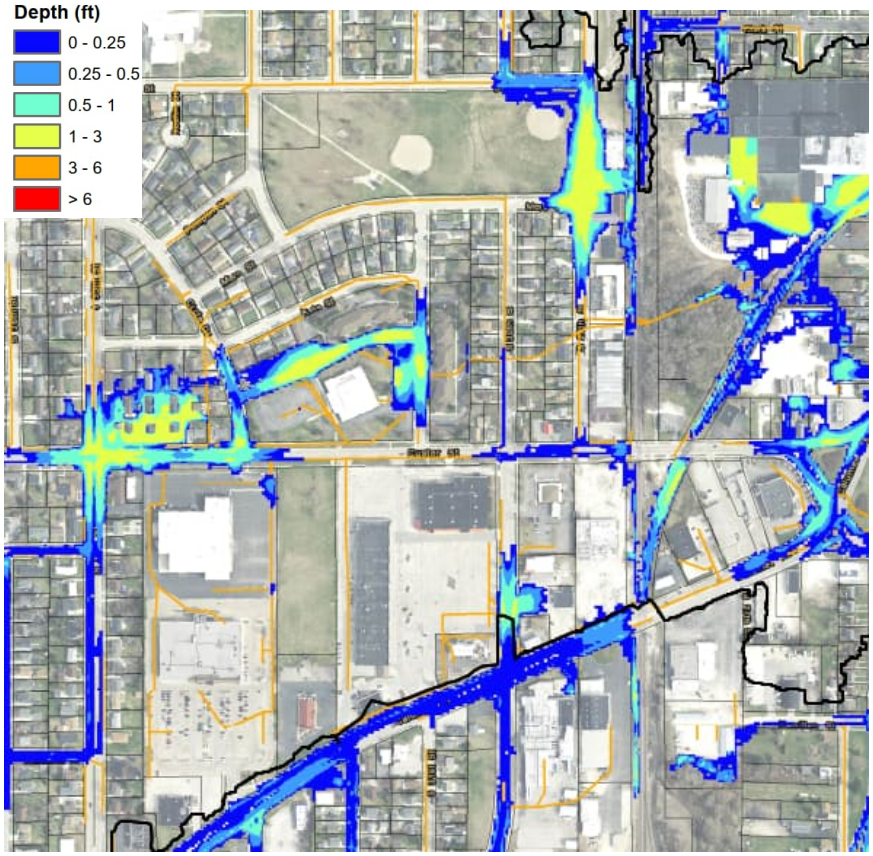
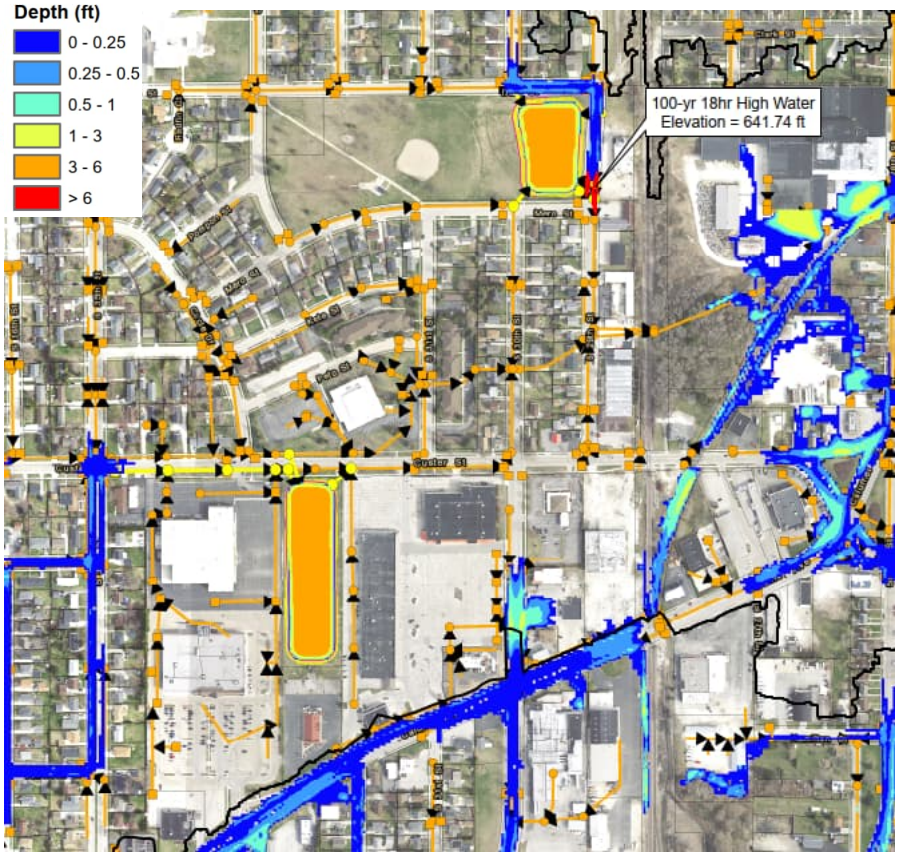
# R22 Alternative 2




Existing Condition 100-Year Flood Depth




Alternative 2 100-Year Flood Depth

- The 100-Year flood depth on 29th Street goes from 2.08 feet to 0.10 feet for a reduction of 1.98 feet.
- The 100-Year flood depth on Custer Street goes from 1.19 feet to 0.00 feet for a reduction of 1.19 feet.

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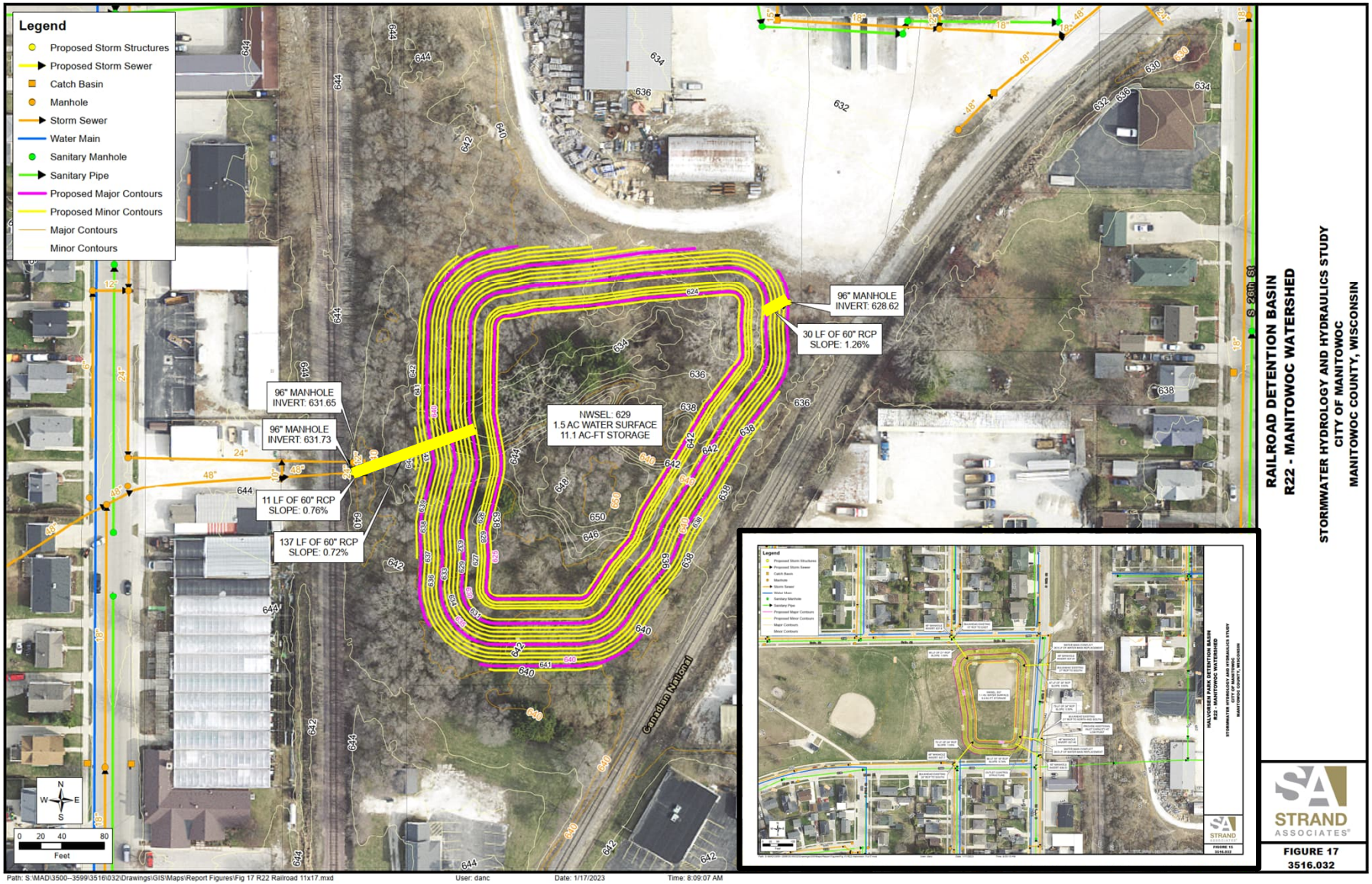
# R22 Alternative 3




**Railroad Wet Detention Basin**

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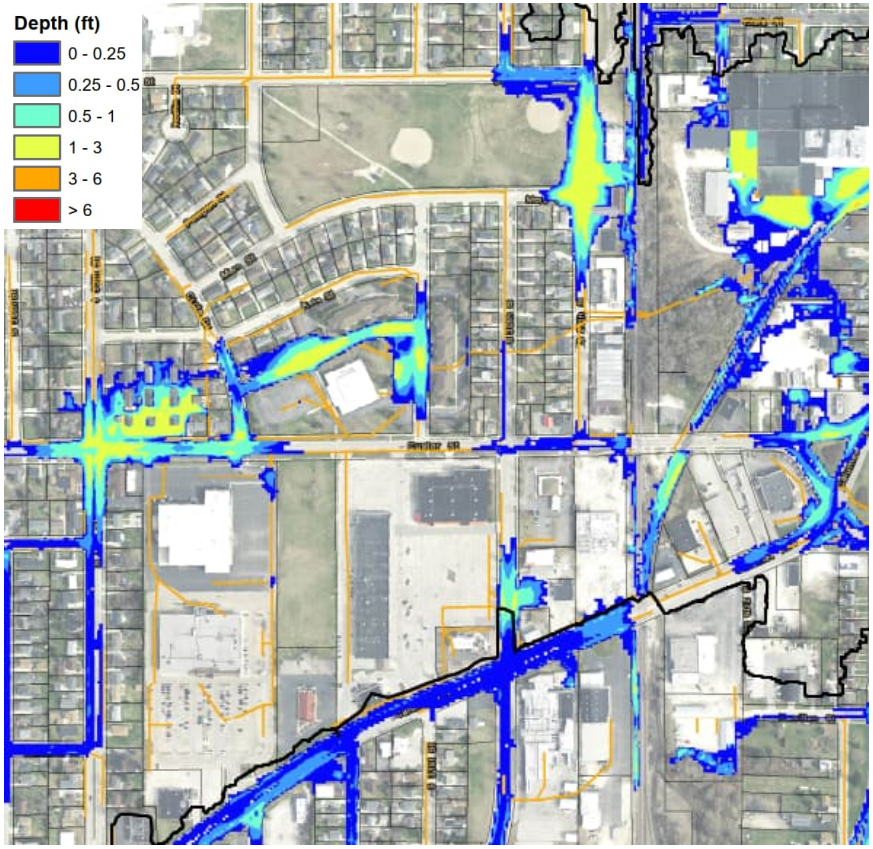
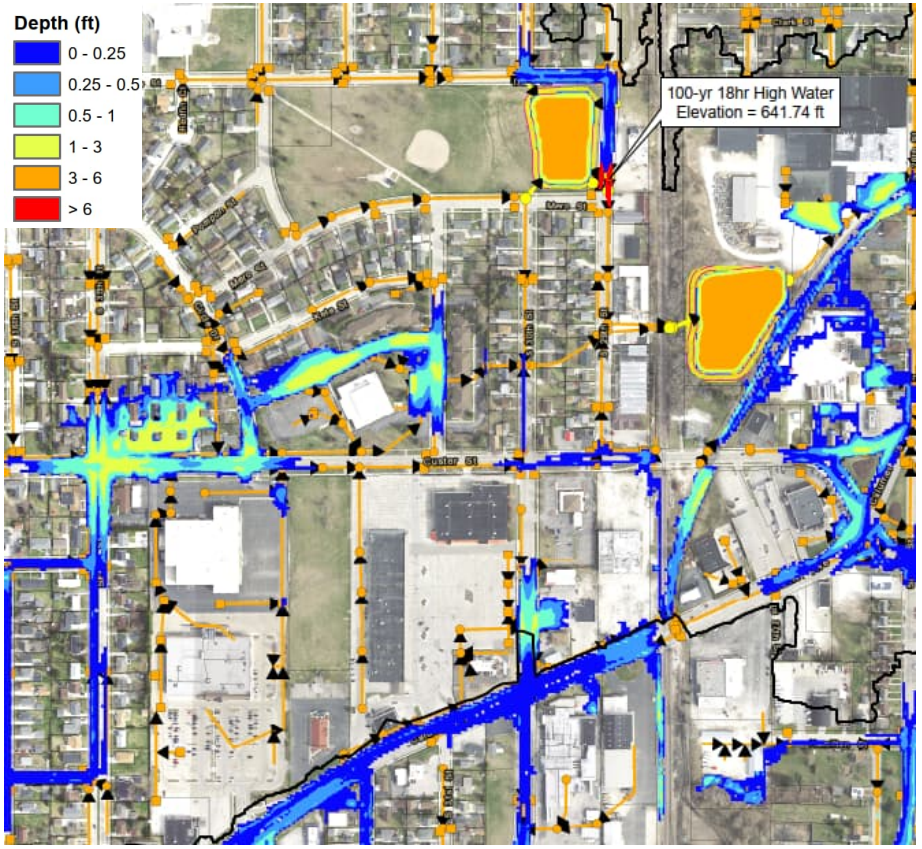
# R22 Alternative 3




**Existing Condition 100-Year Flood Depth**




**Alternative 3 100-Year Flood Depth**

- The 100-Year flood depth on 29th Street goes from 2.08 feet to 0.16 feet for a reduction of 1.92 feet.
- The 100-Year flood depth on Custer Street stays at 1.19 feet.

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# R22 Opinion of Probable Construction Cost

| Project Descriptions | OPCC |
|---|---|
| **R22 Alternative 1** | |
| Halvorsen Park Detention Basin | $1,415,700 |
| R22 Alternative 1 Total | $1,415,700 |
| | |
| **R22 Alternative 2** | |
| Halvorsen Park Detention Basin | $1,415,700 |
| Custer Street Detention Basin | $3,157,000 |
| R22 Alternative 2 Total | $4,572,700 |
| | |
| **R22 Alternative 3** | |
| Halvorsen Park Detention Basin | $1,415,700 |
| Railroad Detention Basin | $2,199,700 |
| R22 Alternative 3 Total | $3,615,400 |

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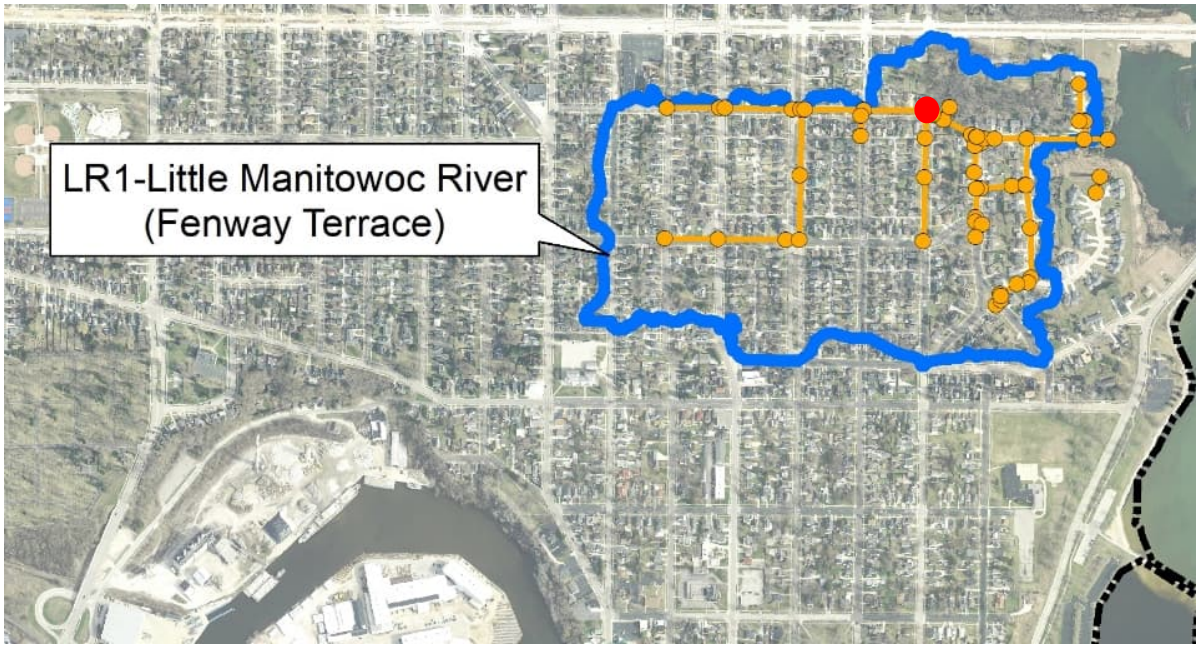
# Flooding Problem Areas

- LR01 - Little Manitowoc River (Fenway Terrace) Watershed
  - Intersection of Pine Street and 5th Street.




**LR01 Flooding Problem Areas**

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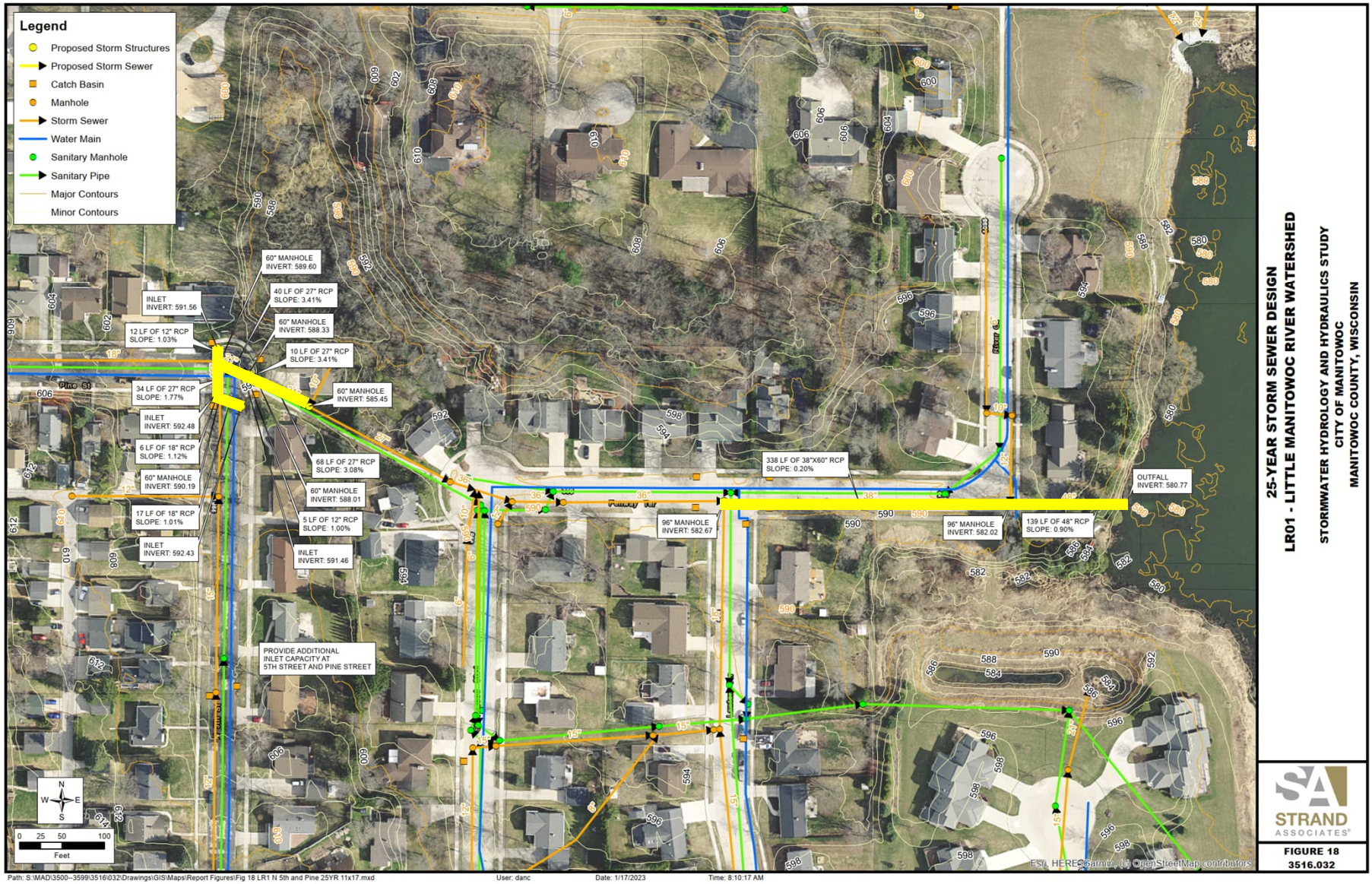
# LR01 Alternative 1




**25-Year Storm Sewer Design**

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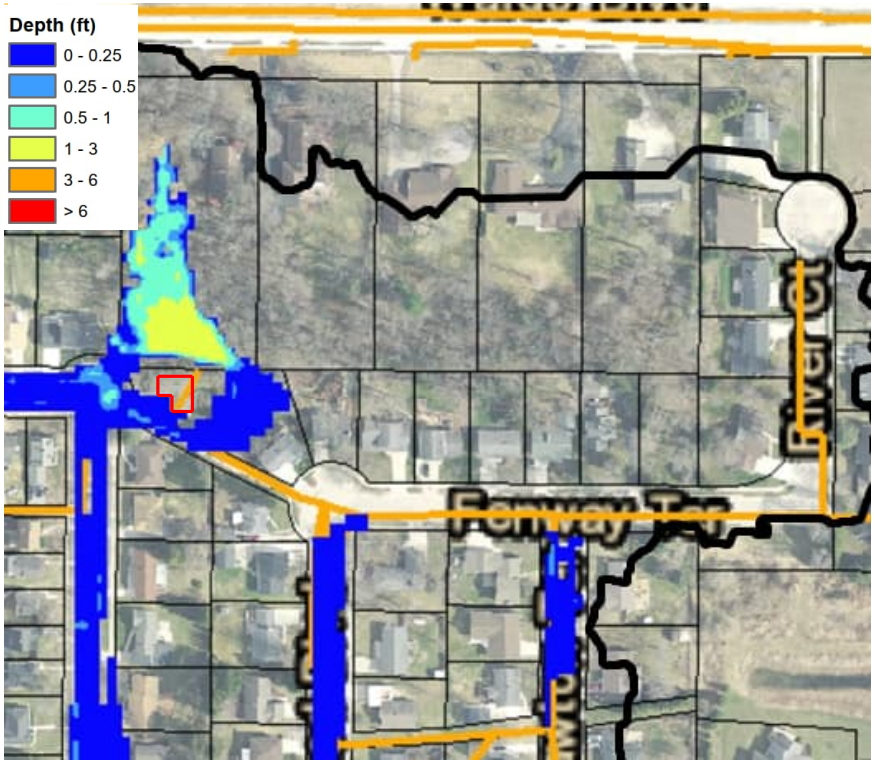
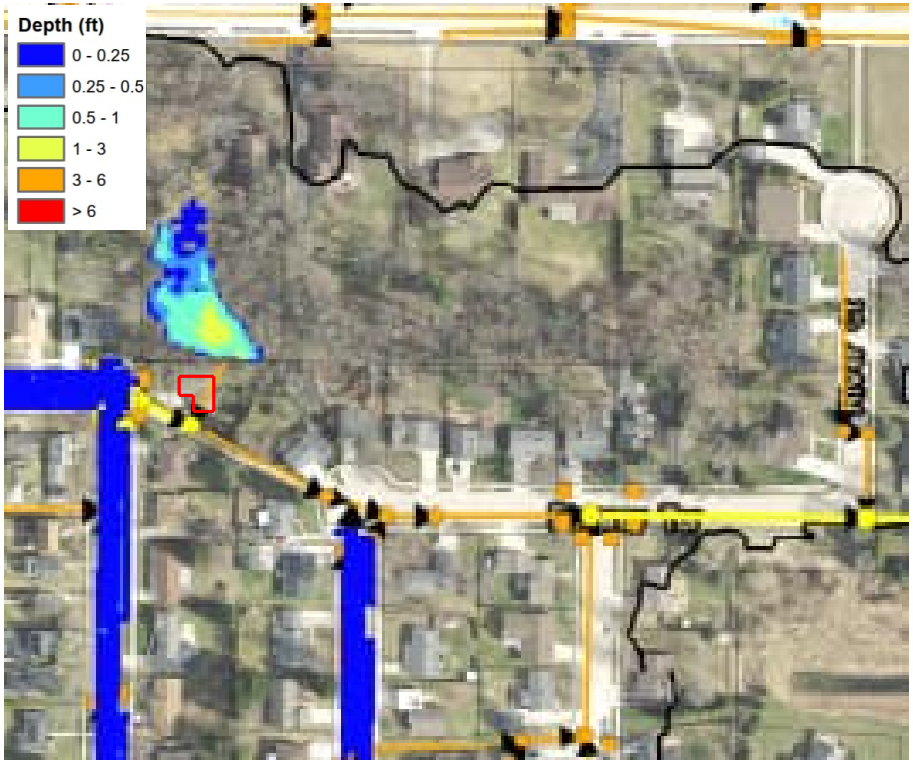
# LR01 Alternative 1




Existing Condition 25-Year Flood Depth




Alternative 1 25-Year Flood Depth

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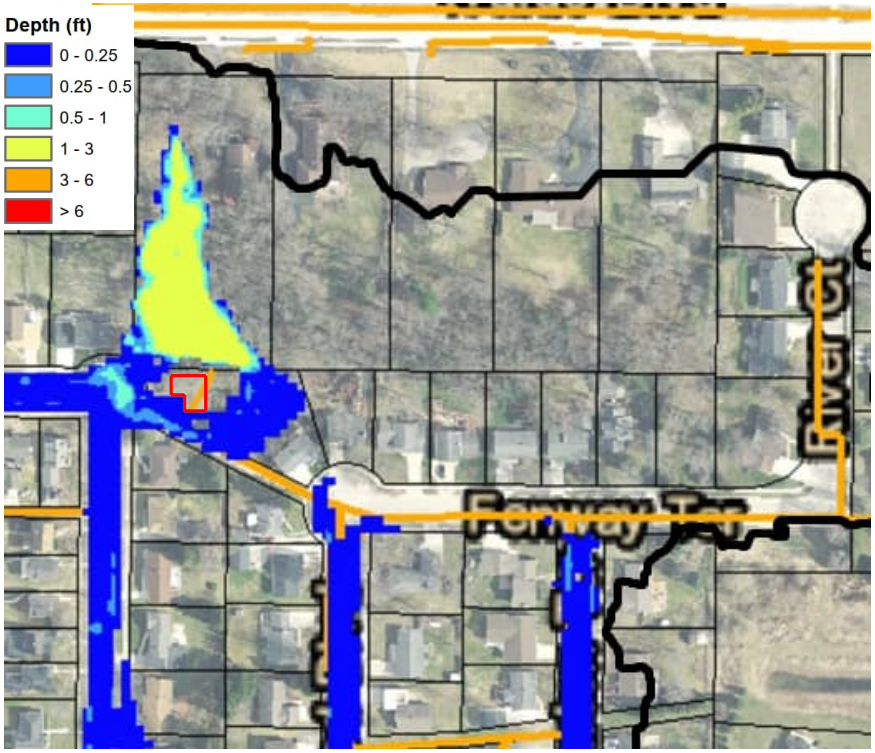
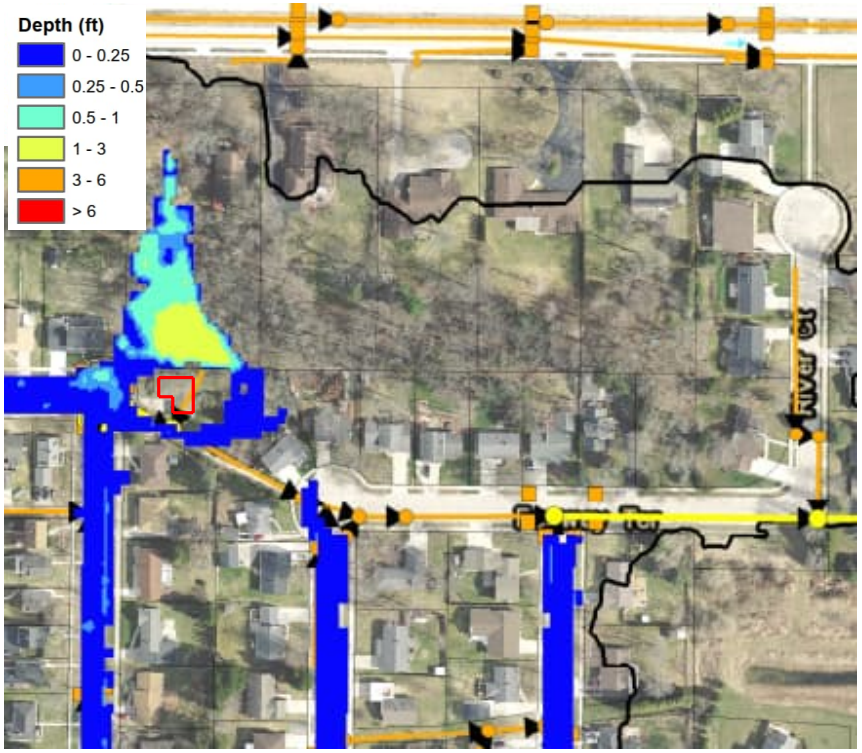
# LR01 Alternative 1




Existing Condition 100-Year Flood Depth




Alternative 1 100-Year Flood Depth

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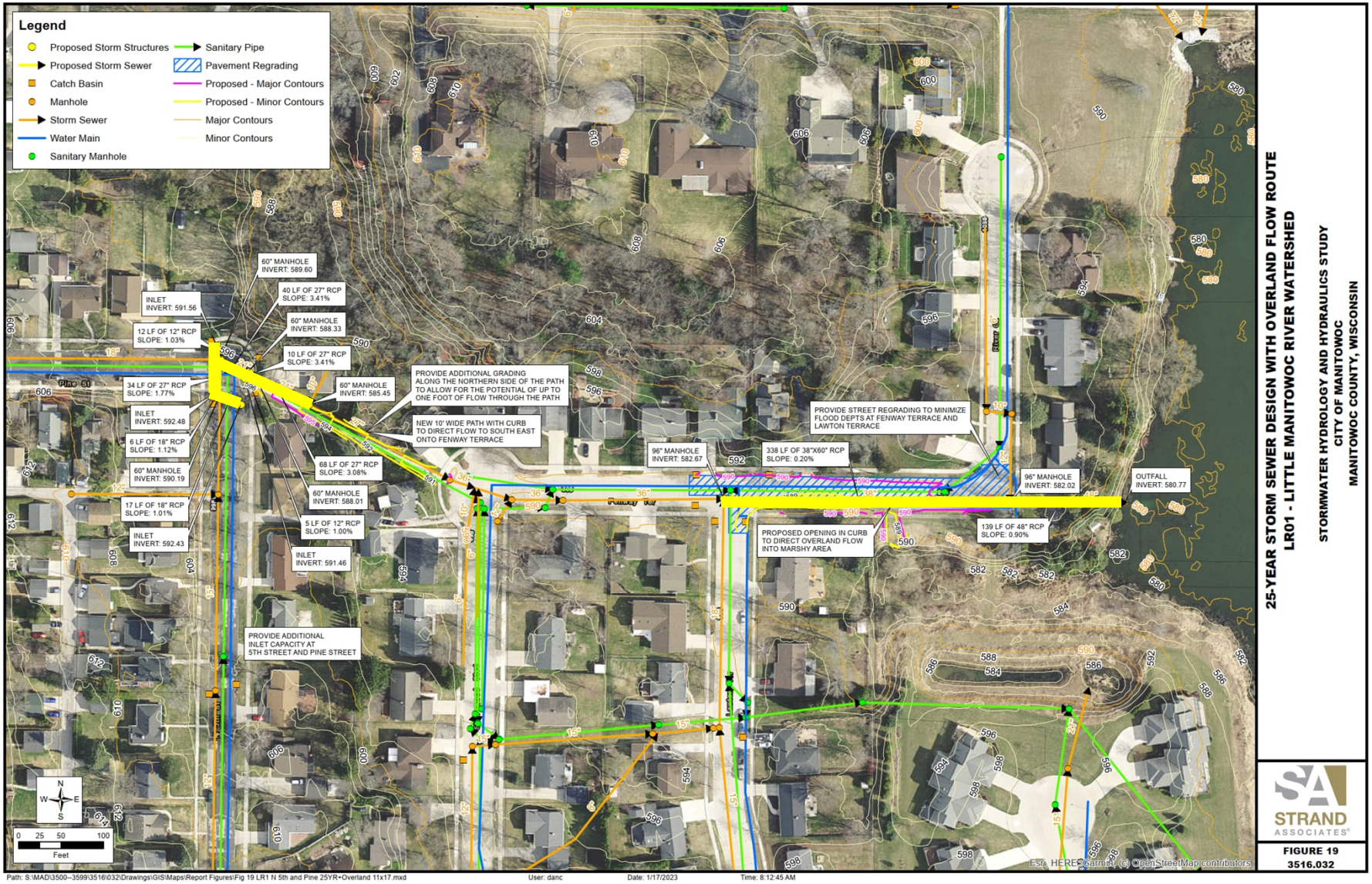
# LR01 Alternative 2




**25-Year Storm Sewer Design With Overland Flow Route**

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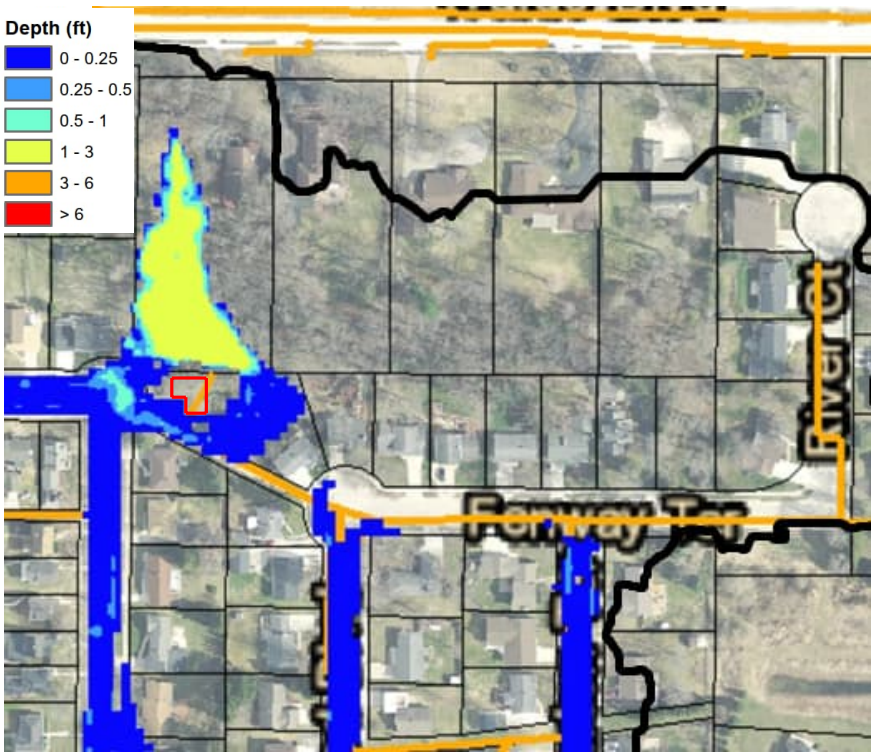
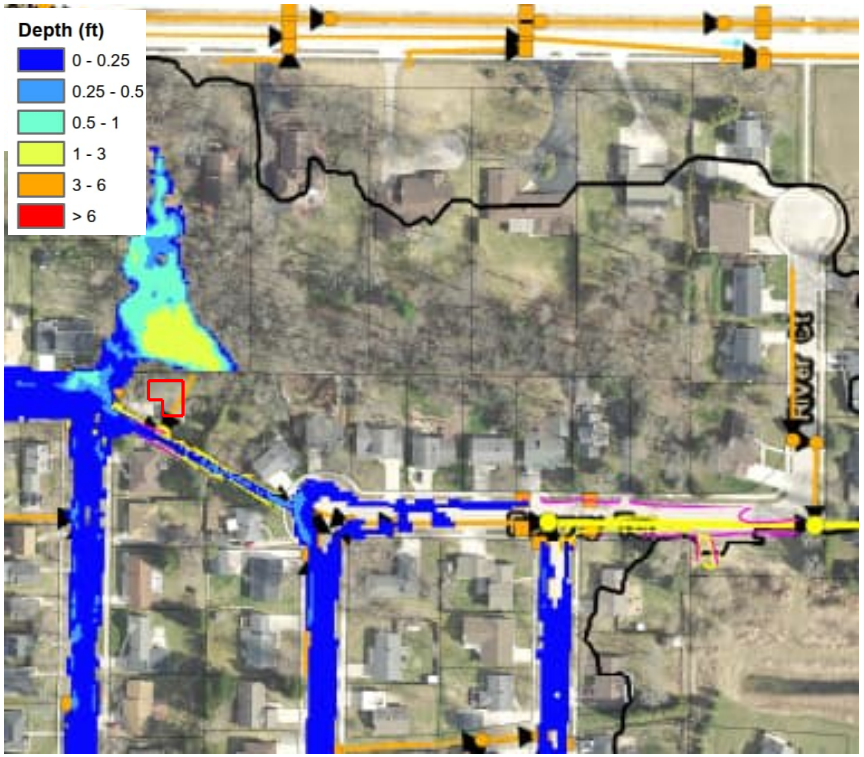
# LR01 Alternative 2




Existing Condition 100-Year Flood Depth




Alternative 2 100-Year Flood Depth

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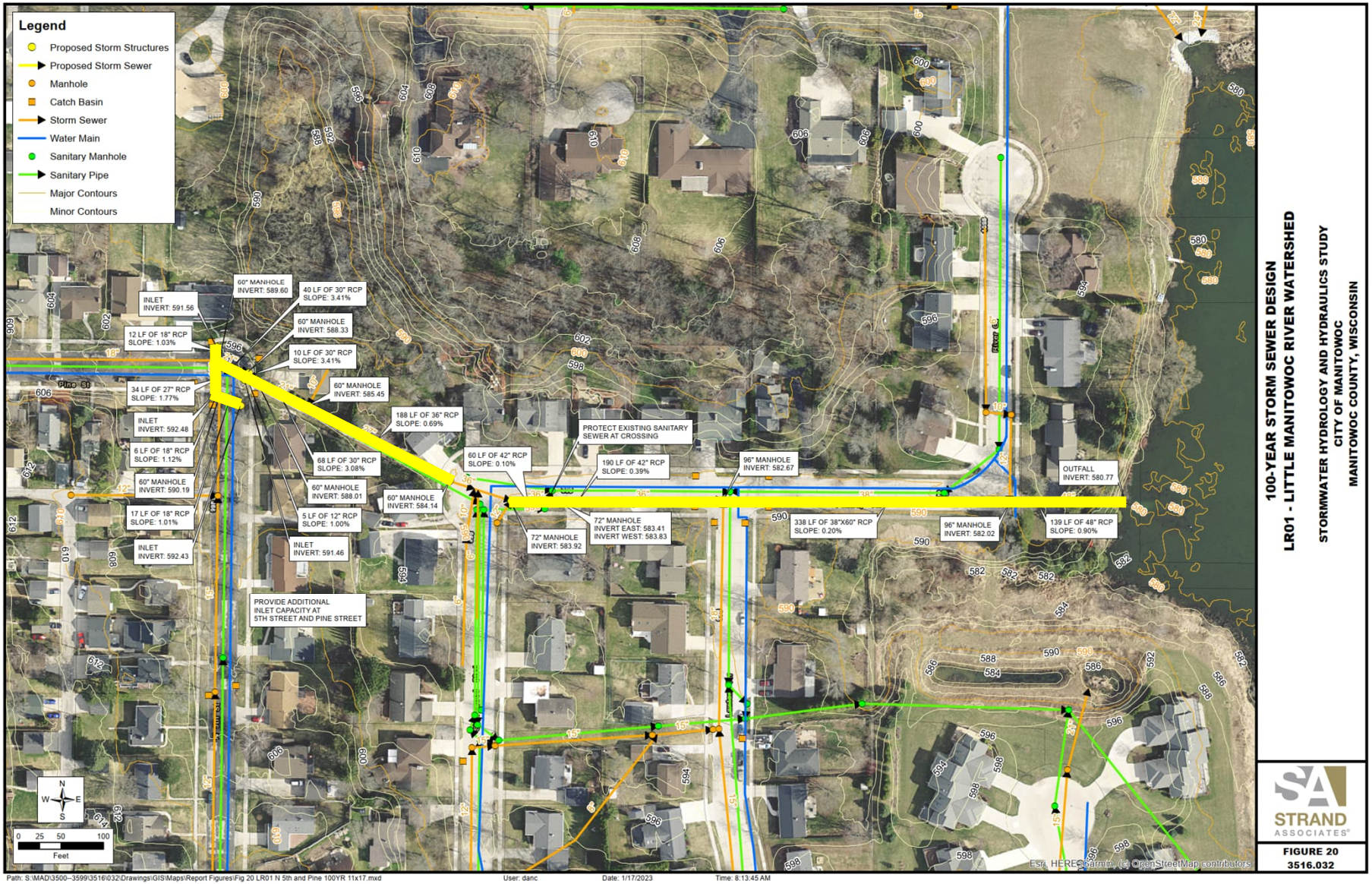
# LR01 Alternative 3




**100-Year Storm Sewer Design**

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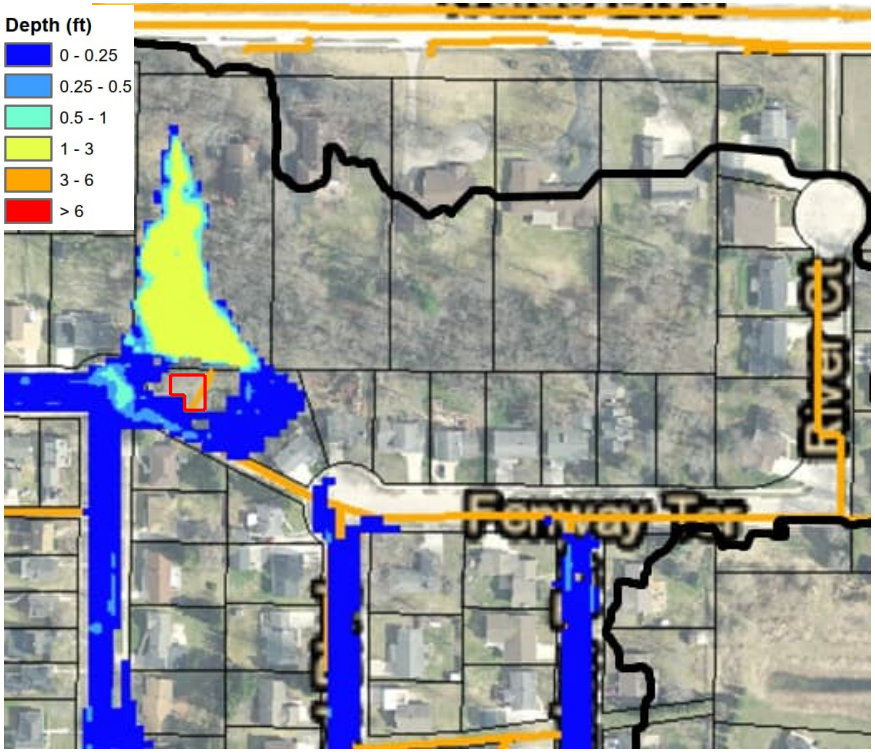
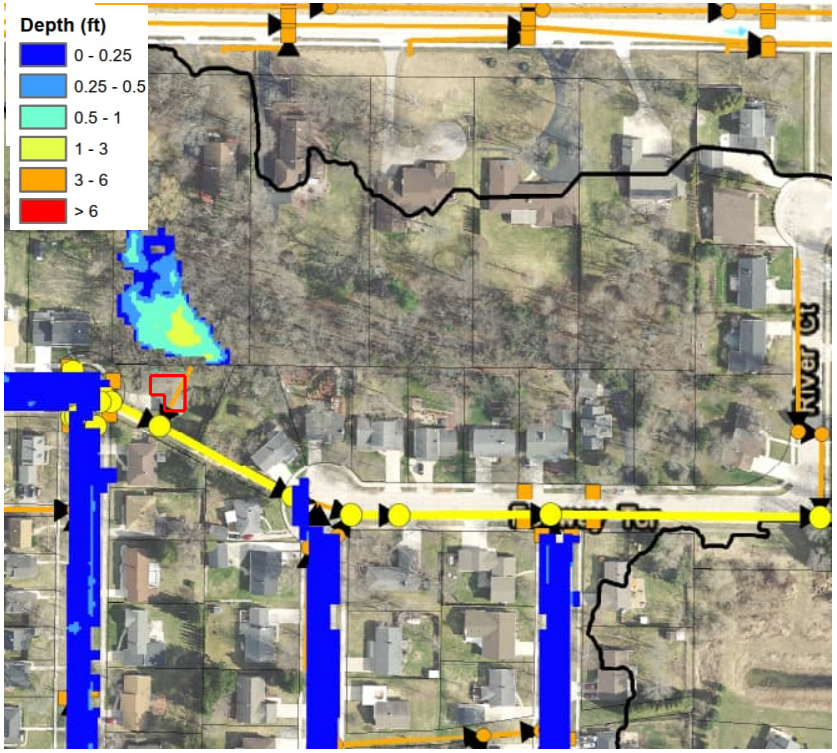
# LR01 Alternative 3




Existing Condition 100-Year Flood Depth




Alternative 3 100-Year Flood Depth

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# LR01 Opinion of Probable Construction Cost

| Project Descriptions | OPCC |
|---|---|
| **LR01 Alternative 1** | |
| 25-Year Storm Sewer Design | $547,900 |
| LR01 Alternative 1 Total | $547,900 |
| | |
| **LR01 Alternative 2** | |
| 25-Year Storm Sewer Design with Overland Flow Route | $722,700 |
| LR01 Alternative 2 Total | $722,700 |
| | |
| **LR01 Alternative 3** | |
| 100-Year Storm Sewer Design | $860,200 |
| LR01 Alternative 3 Total | $860,200 |

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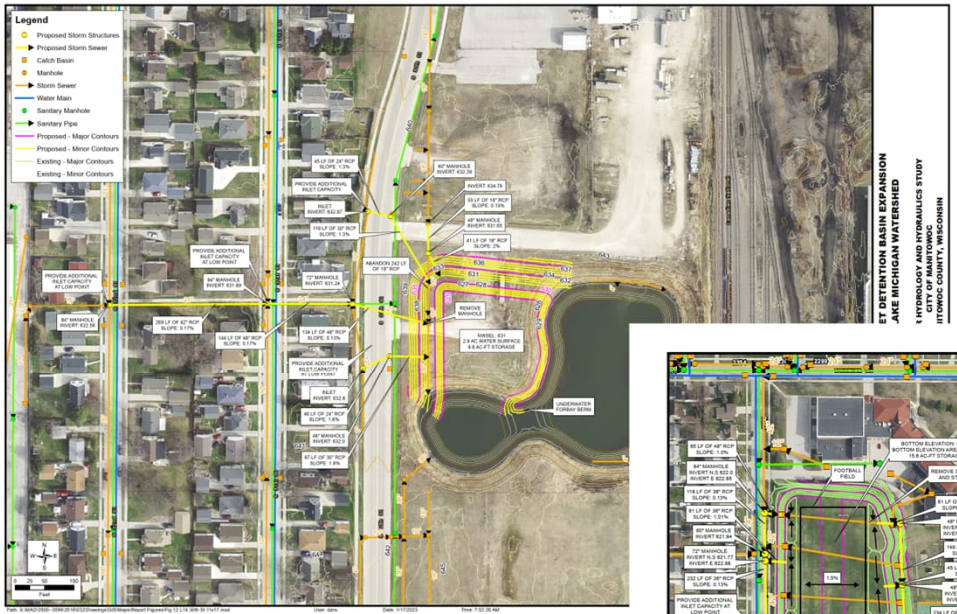
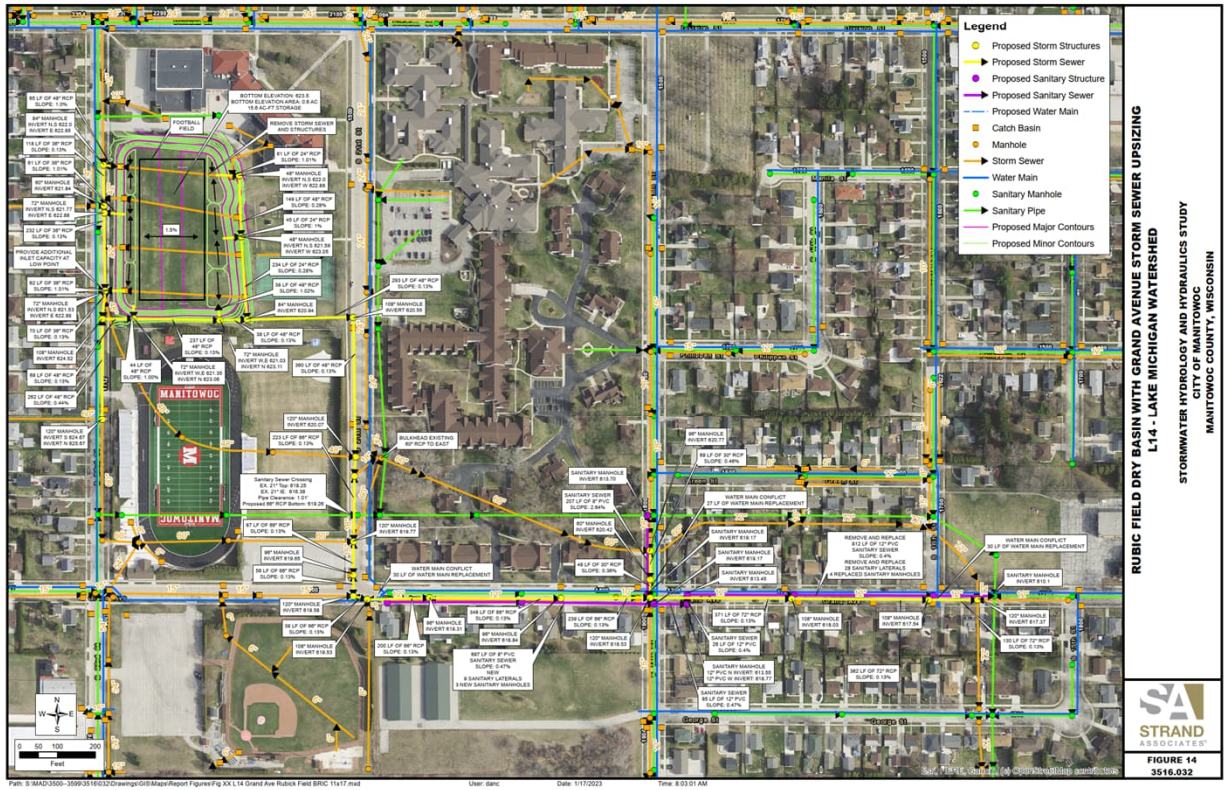
# L14 Recommended Alternative

- Alternative 4

| Project Descriptions | OPCC |
|---|---|
| L14 Alternative 4 | |
| Rubick Field Dry Detention Basin | $3,749,700 |
| Grand Avenue Storm Sewer Upsizing (With Rubick Field Dry Det.) | $4,437,500 |
| 30th Street Detention Basin Expansion | $1,788,300 |
| L14 Alternative 4 Total | $9,975,400 |




**30th Street Detention Basin Expansion**




**Rubick Field Dry Detention Bains and Grand Avenue Storm Sewer Upsizing**

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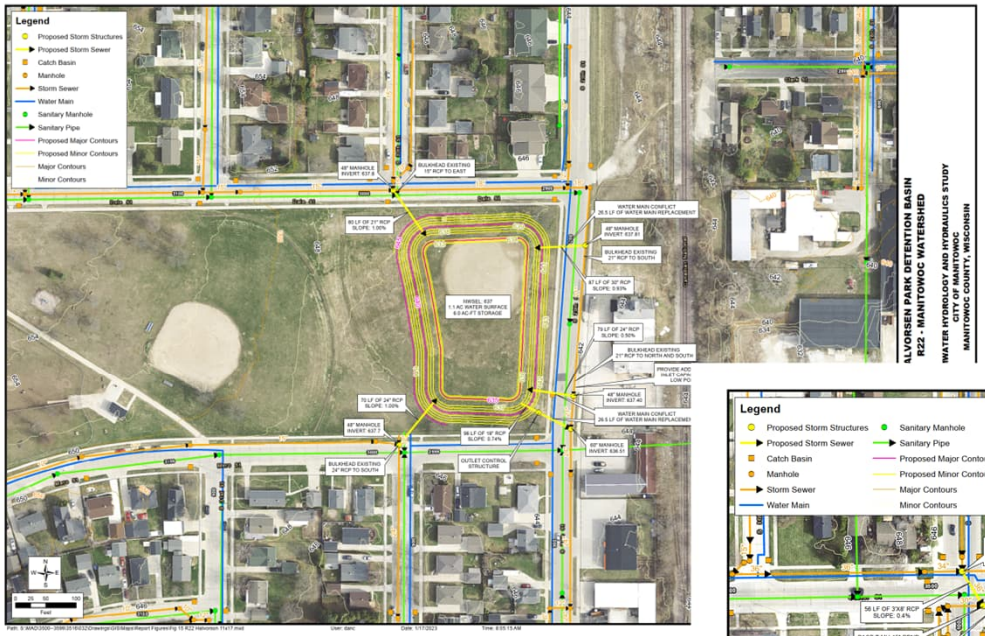
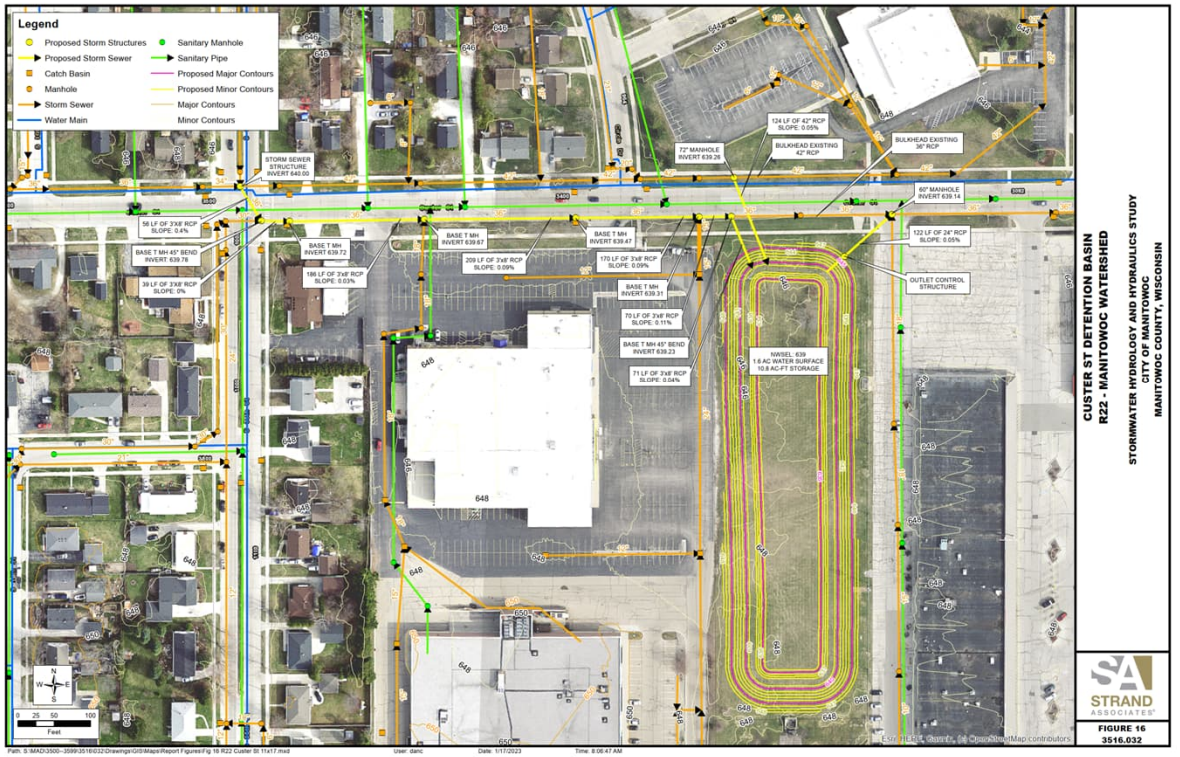
# R22 Recommended Alternative

- Alternative 2

| Project Descriptions | OPCC |
|---|---|
| **R22 Alternative 2** | |
| Halvorsen Park Detention Basin | $1,415,700 |
| Custer Street Detention Basin | $3,157,000 |
| **R22 Alternative 2 Total** | **$4,572,700** |




**Halvorsen Park Wet Detention Basin**




**Custer Street Wet Detention Basin**

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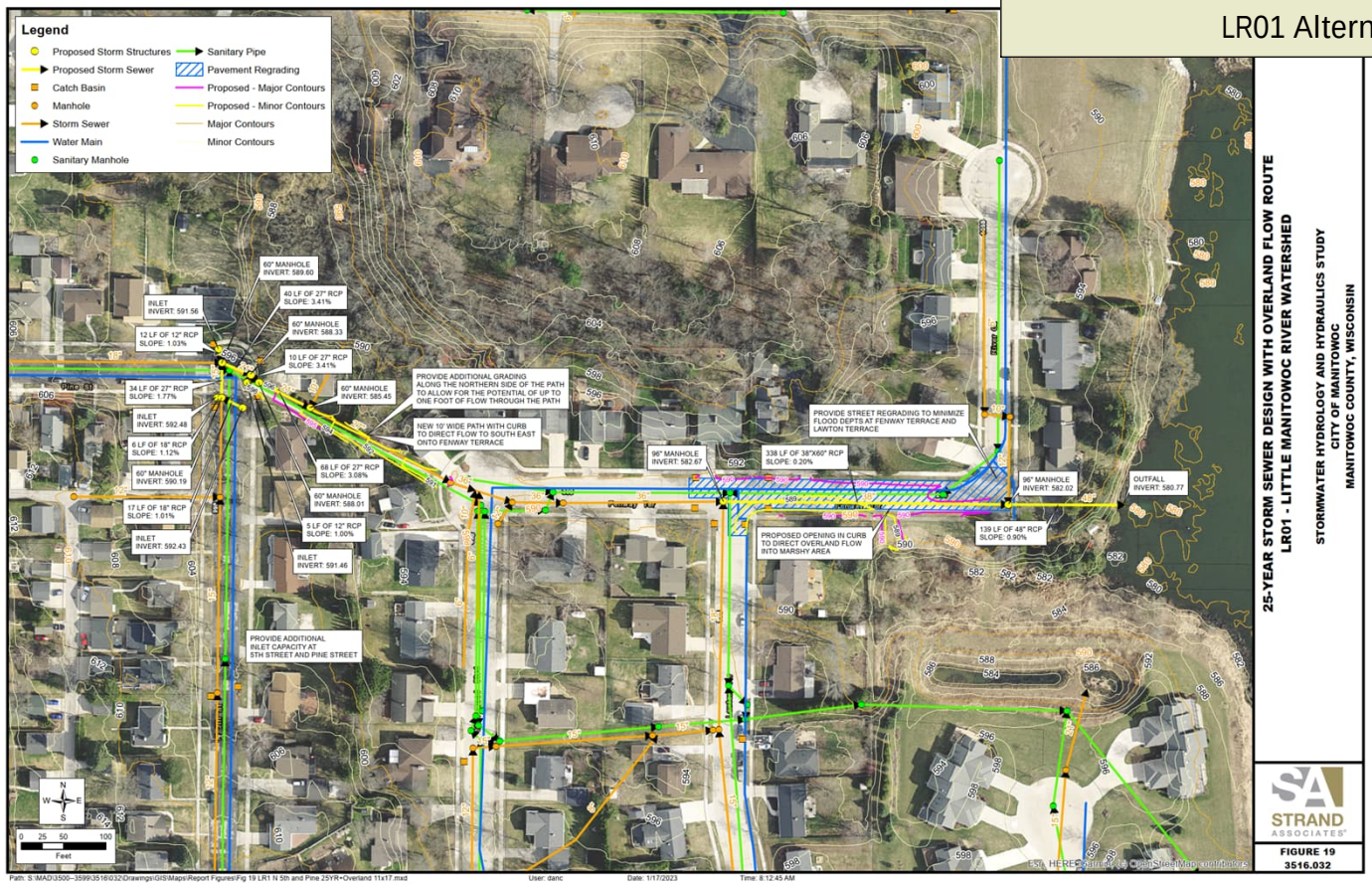
# LR01 Recommended Alternative

- Alternative 2

| Project Descriptions | OPCC |
|---|---|
| LR01 Alternative 2 | |
| 25-Year Storm Sewer Design with Overland Flow Route | $722,700 |
| LR01 Alternative 2 Total | $722,700 |




**25-Year Storm Sewer Design With Overland Flow Route**

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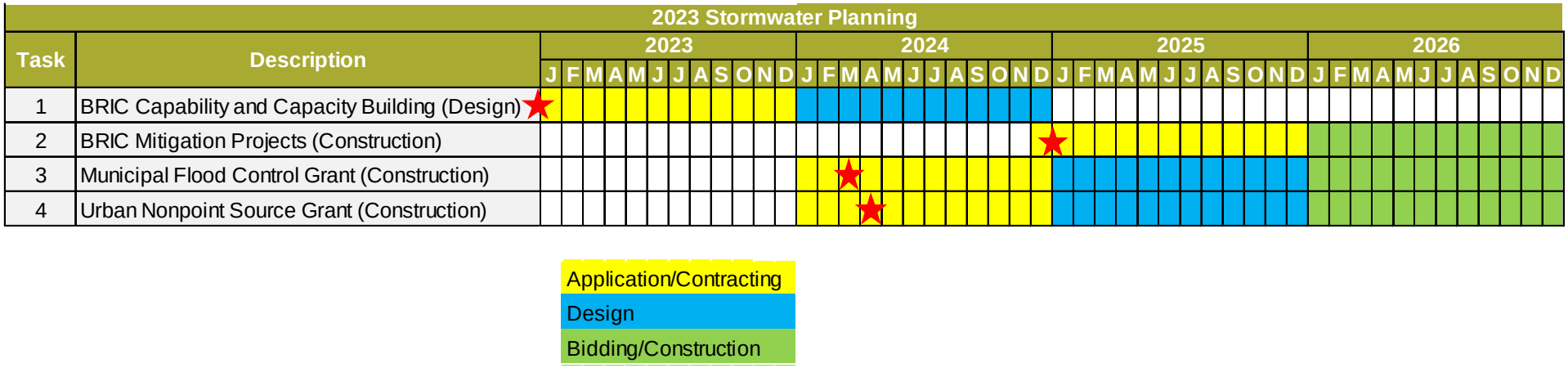
# Project Funding Opportunities

| Funding Opportunities | Cost Share | Potential Funding Received |
|---|---|---|
| FEMA Building Resilient Infrastructure and Communities (BRIC) | | |
| Capability and Capacity Building (C&CB) | 75% Federal/25% Local | State gets $2,000,000 / Year |
| Mitigation Projects | 75% Federal/25% Local | $50,000,000 |
| | | |
| Wisconsin Department of Natural Resources | | |
| Municipal Flood Control Grant | 50% State/50% Local | $484,000 |
| Urban Nonpoint Source Grant | 50% State/50% Local | $150,000 |




- A BRIC C&CB Grant application was submitted in January of 2023 for a funded total of $260,000 (total project cost $346,000) for design of the Rubick Field Dry Detention Basin and downstream storm sewer.

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