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STORMWATER HYDROLOGY AND HYDRAULICS STUDY

City of Manitowoc, WI

March 1, 2023



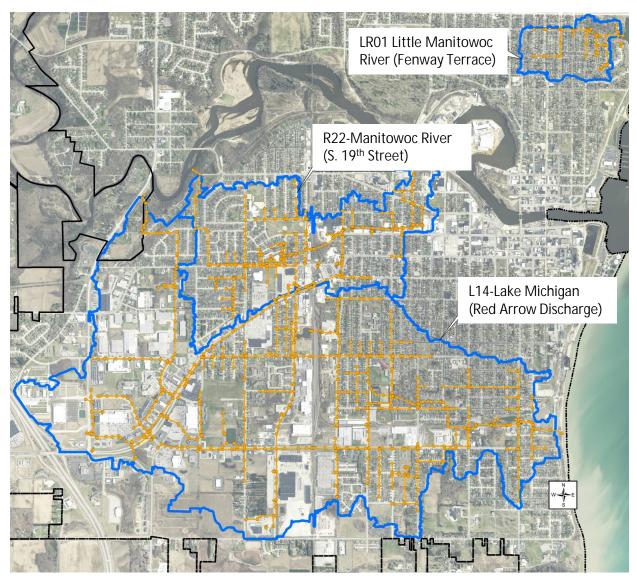


Presentation Outline

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



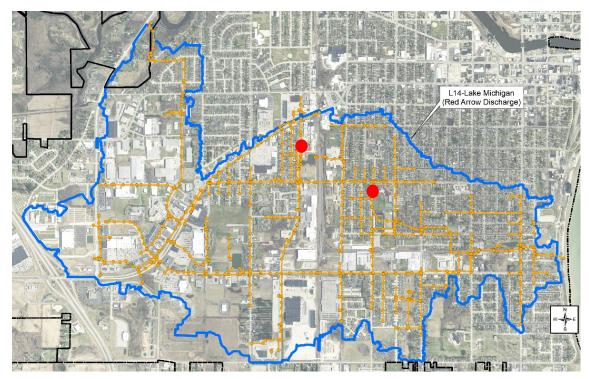
Studied Watersheds



Watershed Map



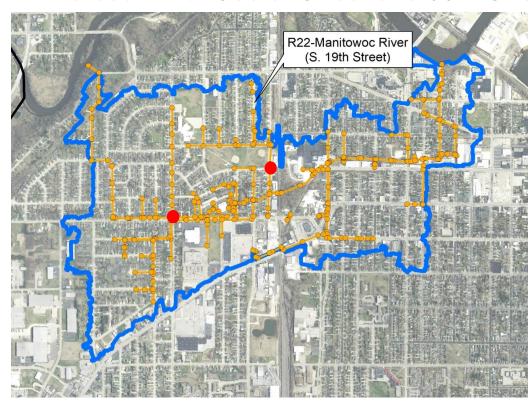
- L14 Lake Michigan (Red Arrow Discharge)
 - 23rd Street from Division Street to Grand Avenue
 - 30th Street from HWY 42 to Division Street.



L14 Flooding Problem Areas



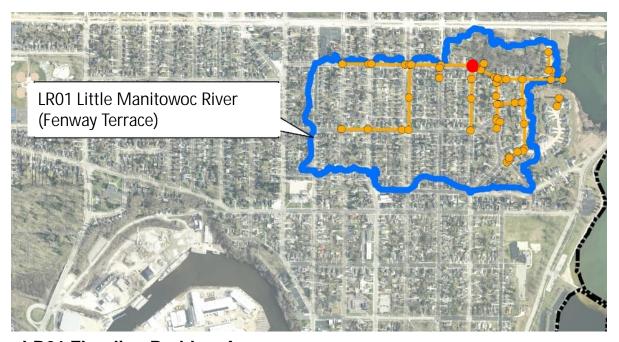
- R22 Manitowoc (S. 19th Street) Watershed
 - Intersection of 29th Street and Mero Street
 - Intersection of Custer Street and 35th Street



R22 Flooding Problem Areas



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



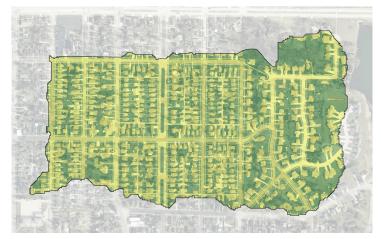
LR01 Flooding Problem Areas



XPSWMM 2D Modeling



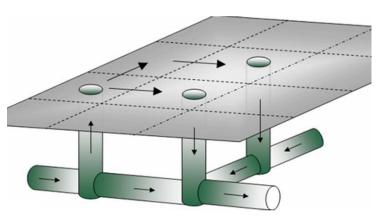
Watershed Delineation & Modeled Storm



Impervious Area & Building Footprints



Digital Elevation Model (Surface)



XPSWMM 1D & 2D

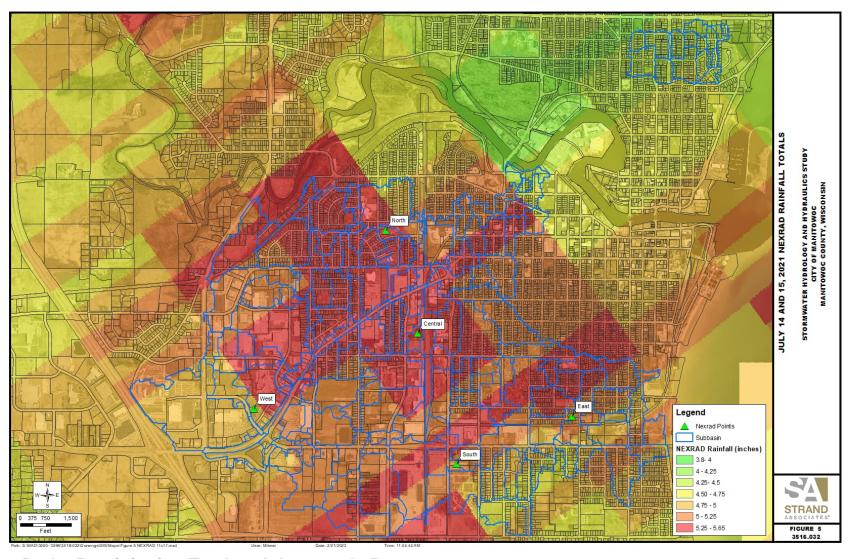


Existing Condition Model Calibration

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



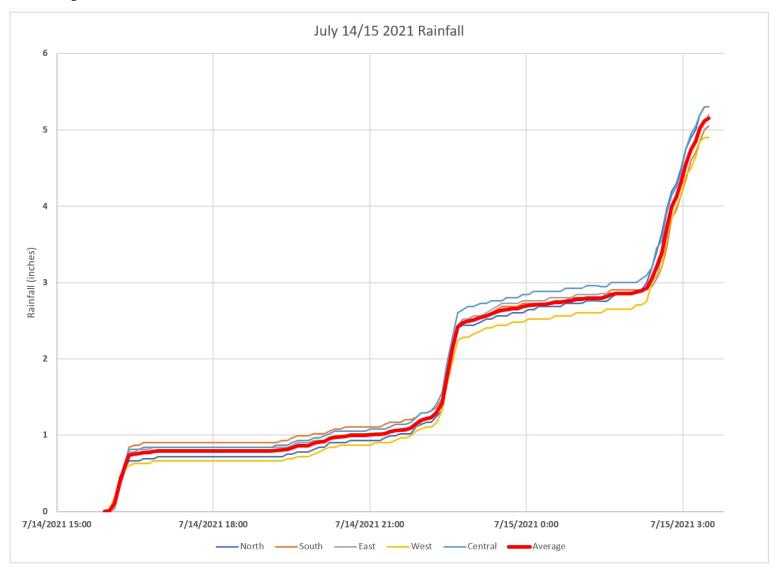
July 14 and 15, 2021 Storm Event



Radar Precipitation Totals – July 14 and 15, 2021



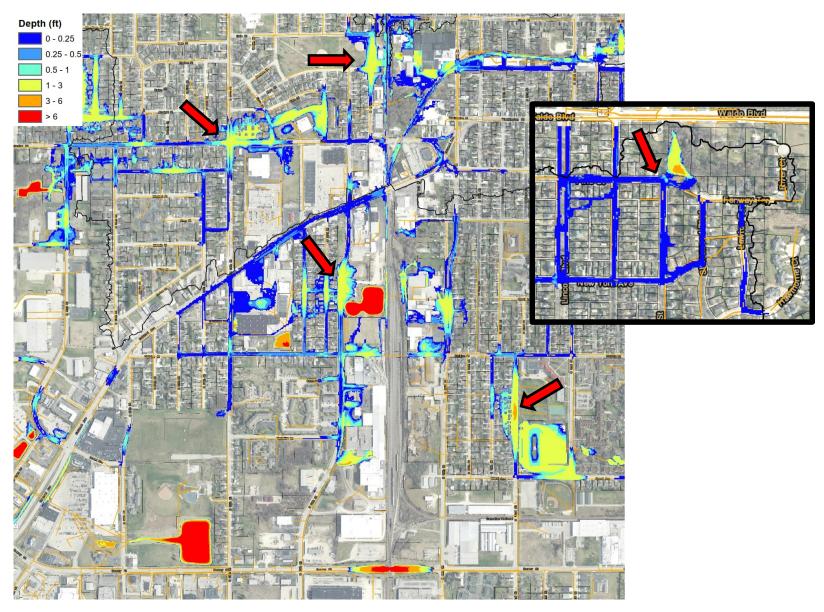
July 14 and 15, 2021 Storm Event



Radar Precipitation Totals – July 14 and 15, 2021



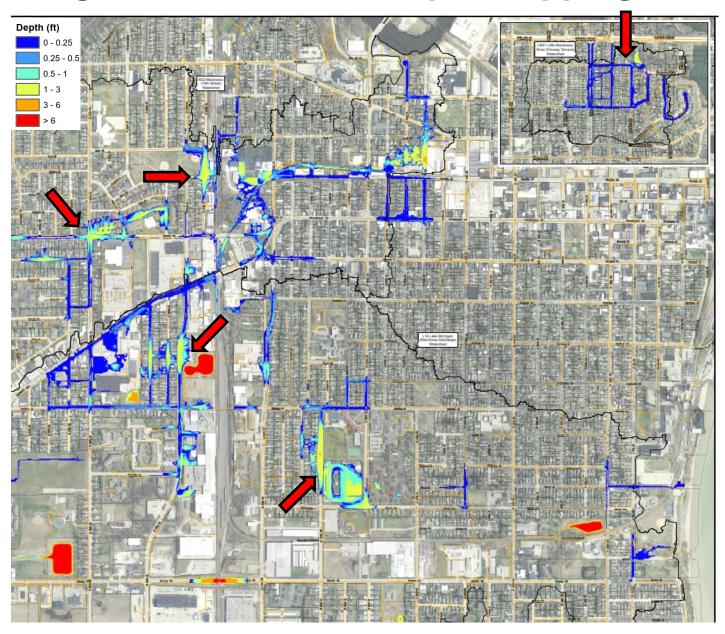
July 14 and 15, 2021 Flood Depth





July 14 and 15, 2021 Flood Depth Map

Existing Condition Flood Depth Mapping





100-Year Flood Depth Mapping (Existing Condition)

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.

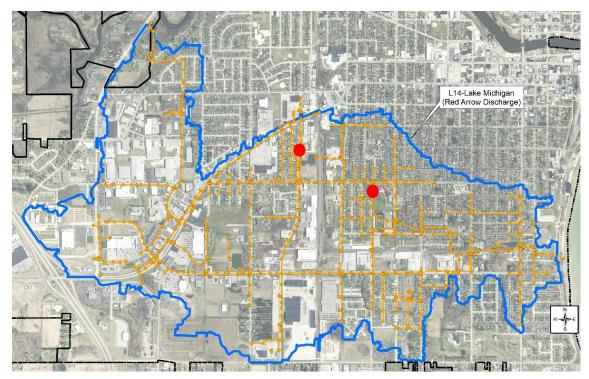


Alternative Analysis

- 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

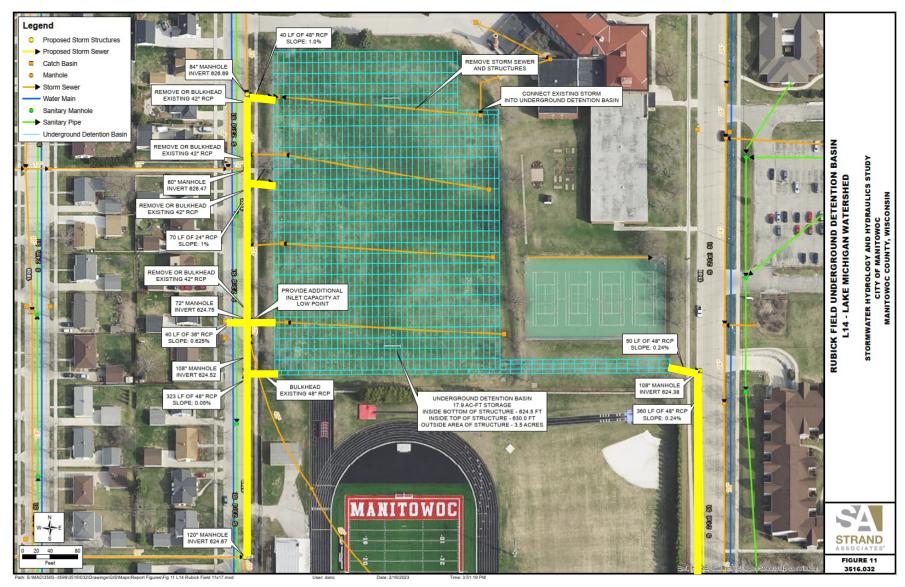


- L14 Lake Michigan (Red Arrow Discharge)
 - 23rd Street from Division Street to Grand Avenue
 - 30th Street from HWY 42 to Division Street.



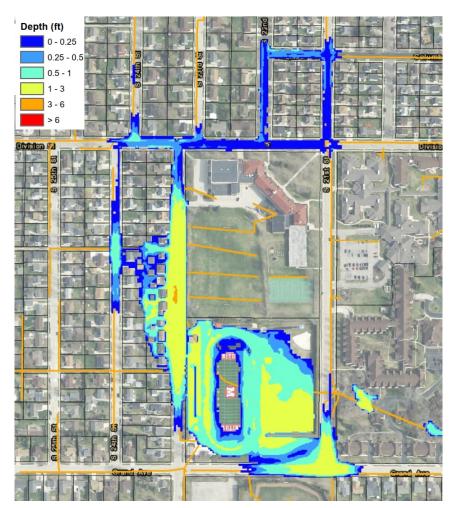
L14 Flooding Problem Areas



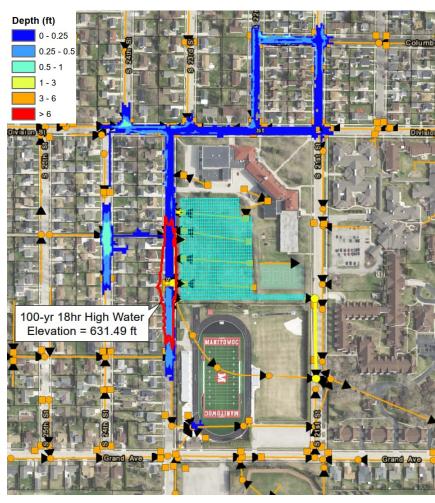


Rubick Field Underground Detention Basin





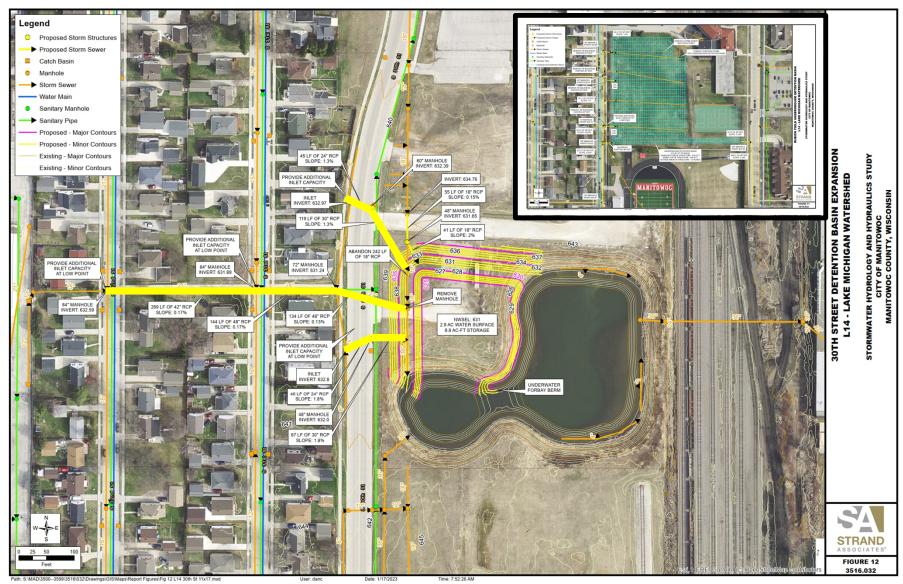
Existing Condition 100-Year Flood Depth



Alternative 1 100-Year Flood Depth

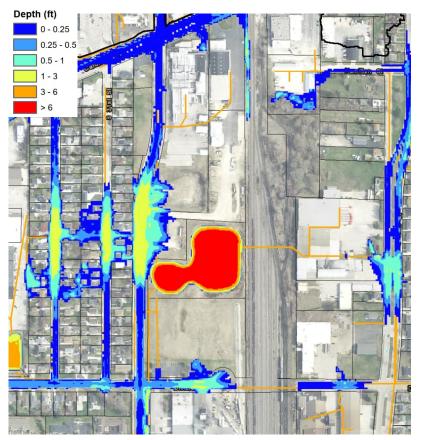
• The 100-Year flood depth on 23rd Street goes from 3.42 feet to 1.52 feet for a reduction of 1.9 feet.





30th Street Detention Basin Expansion





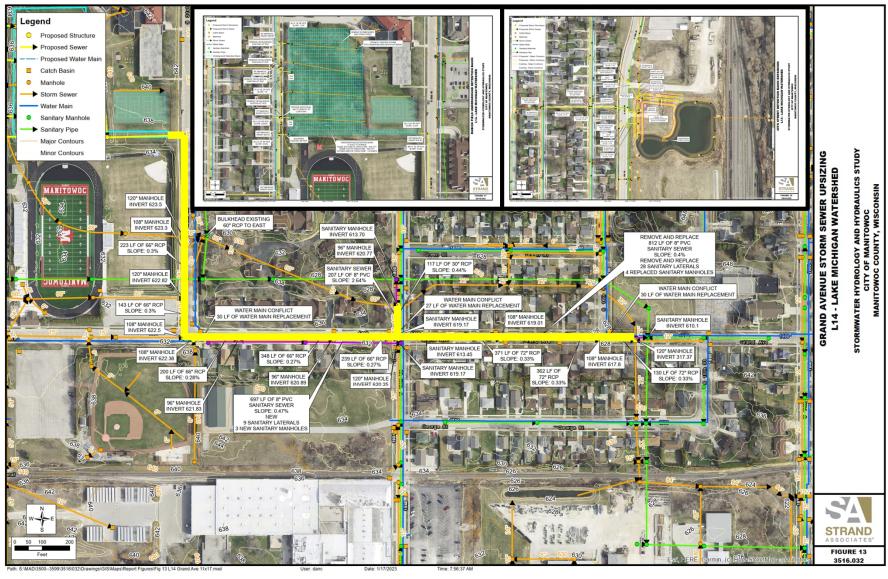
Depth (ft) 100-yr 18hr High Water Elevation = 638.41 ft

Existing Condition 100-Year Flood Depth

Alternative 2 100-Year Flood Depth

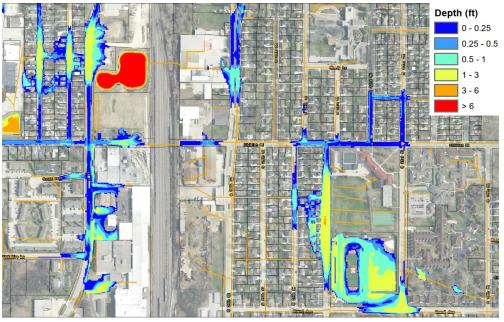
- The 100-Year flood depth on 30th Street goes from 2.21 feet to 0.32 feet for a reduction of 1.89 feet.
- The 100-Year flood depth on 23rd Street goes from 3.42 feet to 1.34 feet for a reduction of 2.08 feet.





Grand Avenue Storm Sewer Upsizing

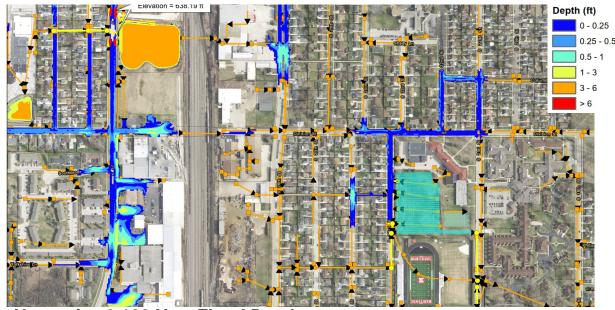




 The 100-Year flood depth on 30th Street goes from 2.21 feet to 0.18 feet for a reduction of 2.03 feet.

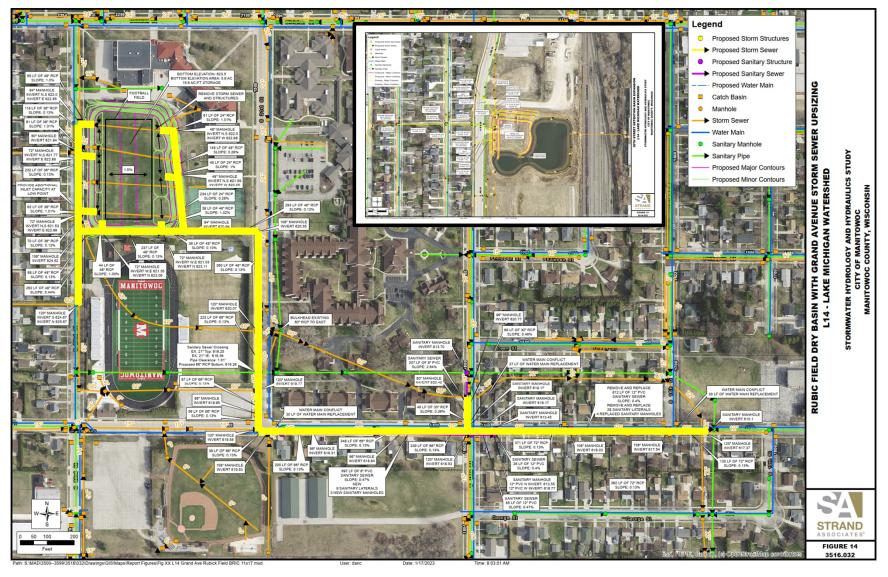
Alternative 2 100-Year Flood Depth

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



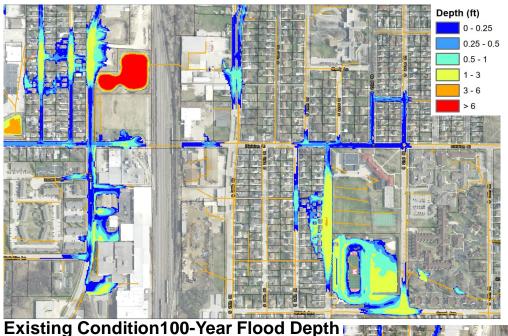
Alternative 3 100-Year Flood Depth





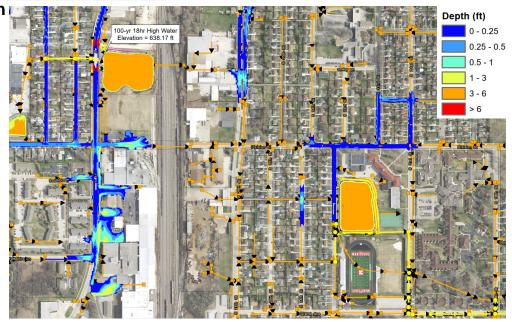
Rubick Field Dry Detention Bains and Grand Avenue Storm Sewer Upsizing





 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

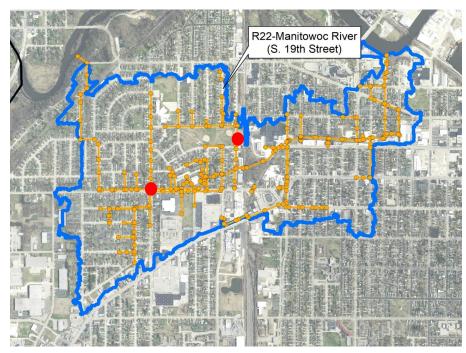


L14 Opinion of Probable Construction Cost

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
30 th 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
30 th 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
30 th Street Detention Basin Expansion	\$1,788,300
L14 Alternative 4 Total	\$9,975,400

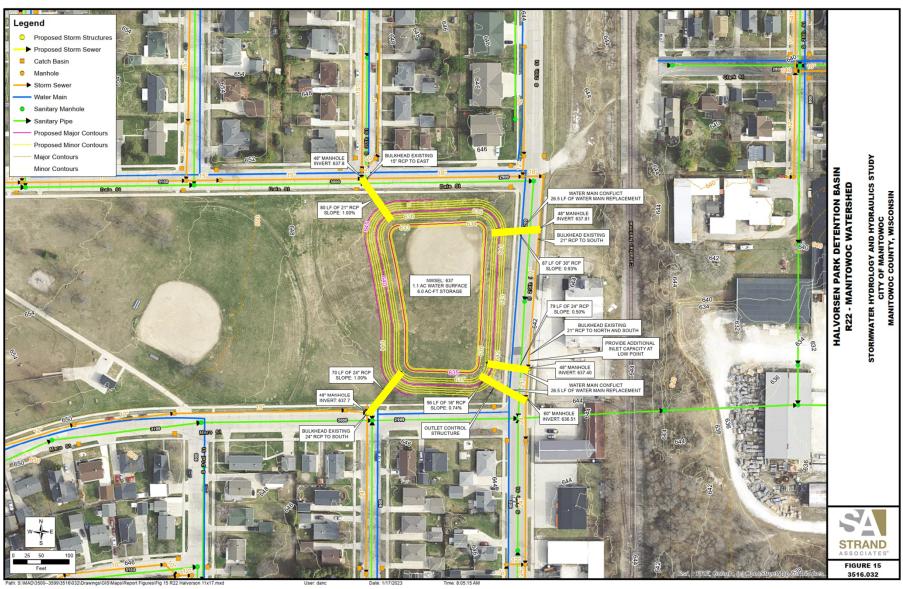


- R22 Manitowoc (S. 19th Street) Watershed
 - Intersection of 29th Street and Mero Street
 - Intersection of Custer Street and 35th Street



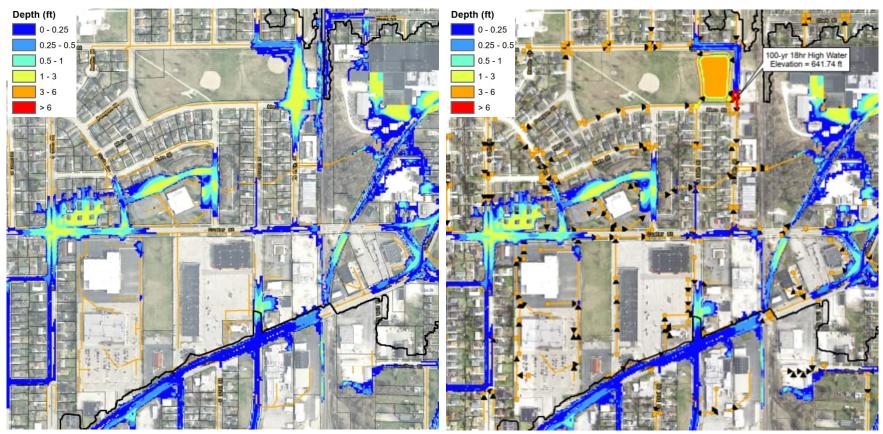
R22 Flooding Problem Areas





Halvorsen Park Wet Detention Basin



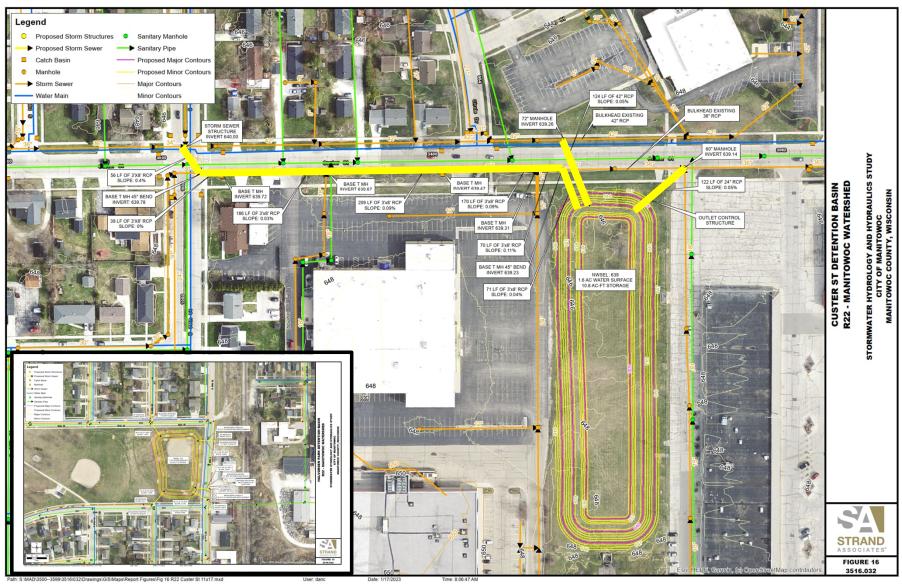


Existing Condition 100-Year Flood Depth

Alternative 1 100-Year Flood Depth

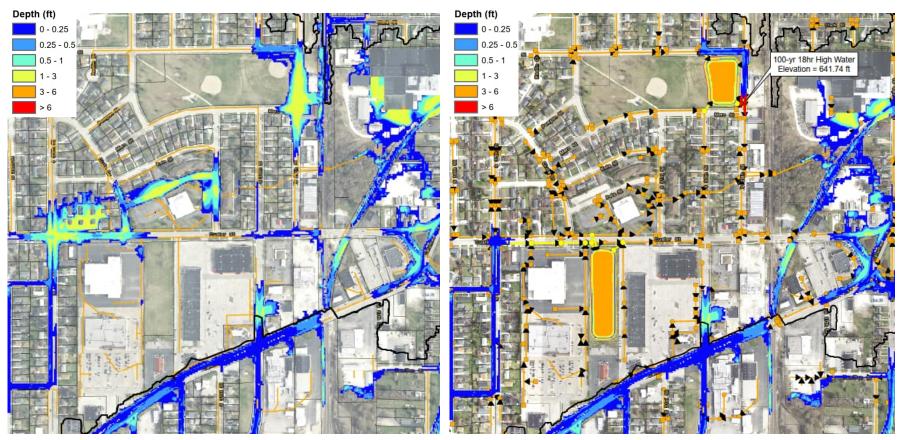
• The 100-Year flood depth on 29th Street goes from 2.08 feet to 0.14 feet for a reduction of 1.94 feet.





Custer Street Wet Detention Basin

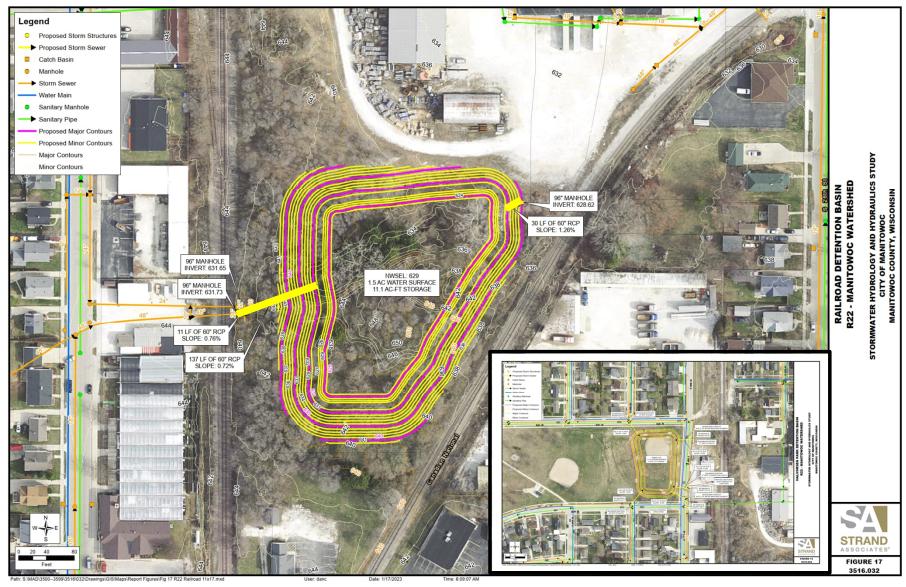




Existing Condition 100-Year Flood Depth

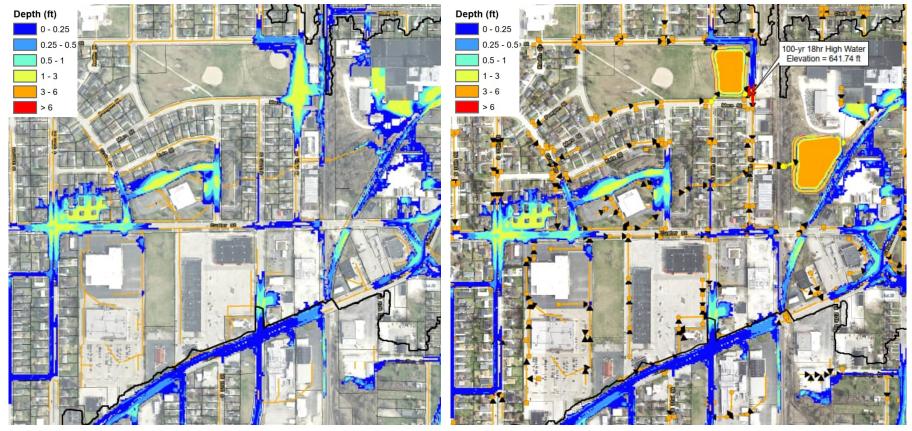
Alternative 2 100-Year Flood Depth

- 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.



Railroad Wet Detention Basin





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.

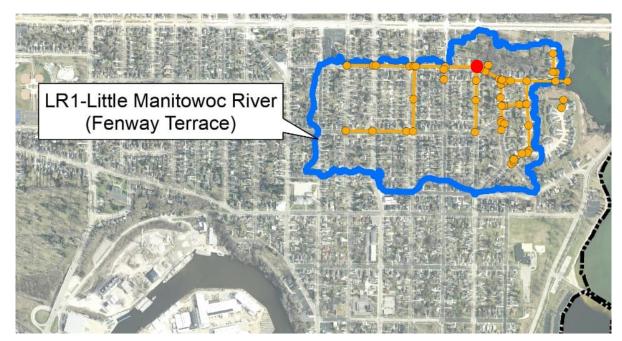


R22 Opinion of Probable Construction Cost

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

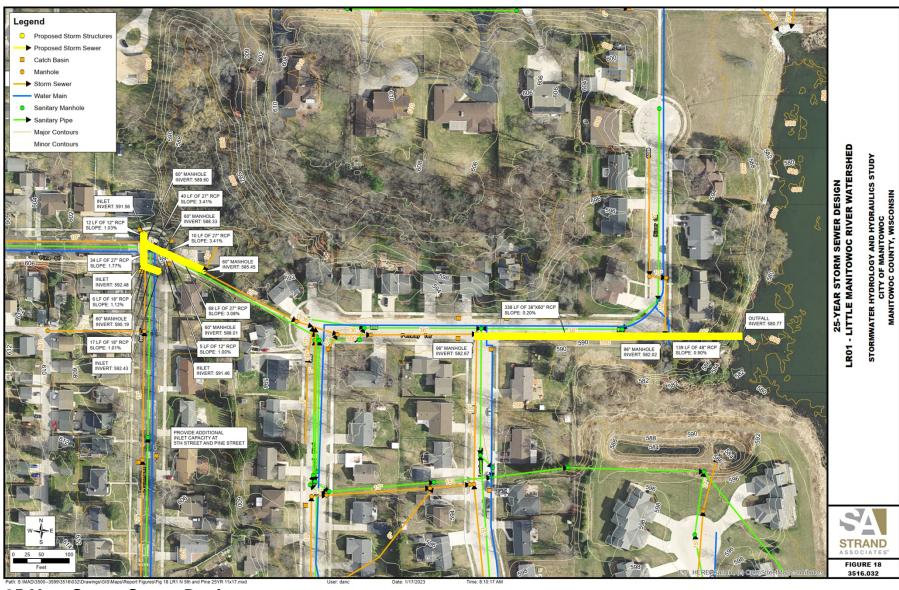


- LR01 Little Manitowoc River (Fenway Terrace) Watershed
 - Intersection of Pine Street and 5th Street.



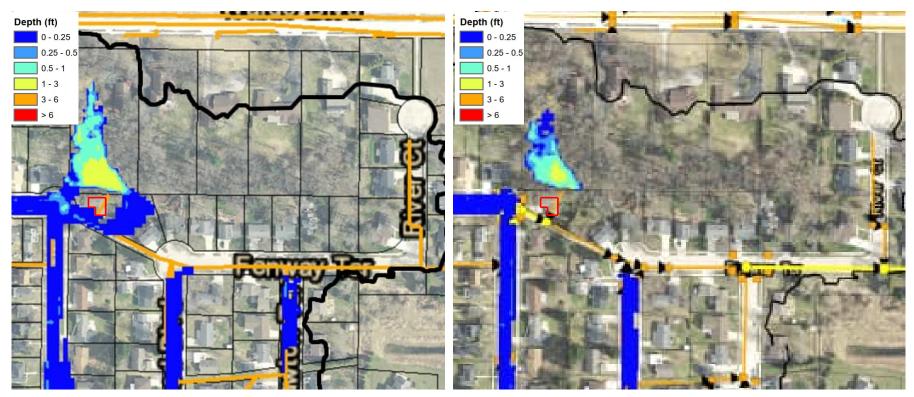
LR01 Flooding Problem Areas





25-Year Storm Sewer Design

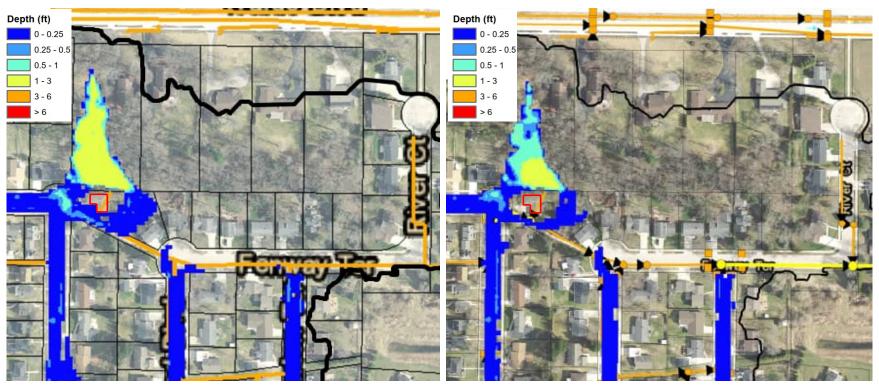




Existing Condition 25-Year Flood Depth

Alternative 1 25-Year Flood Depth

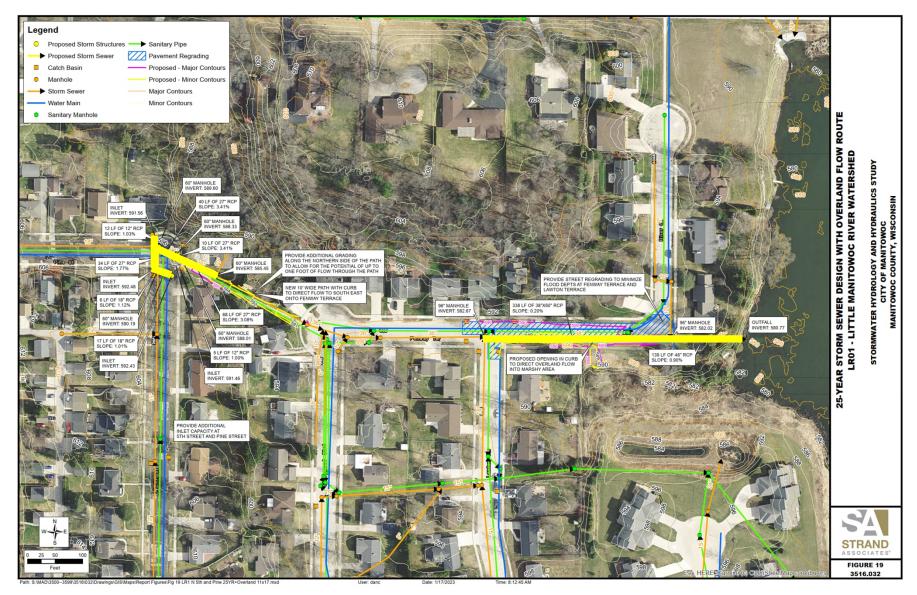




Existing Condition 100-Year Flood Depth

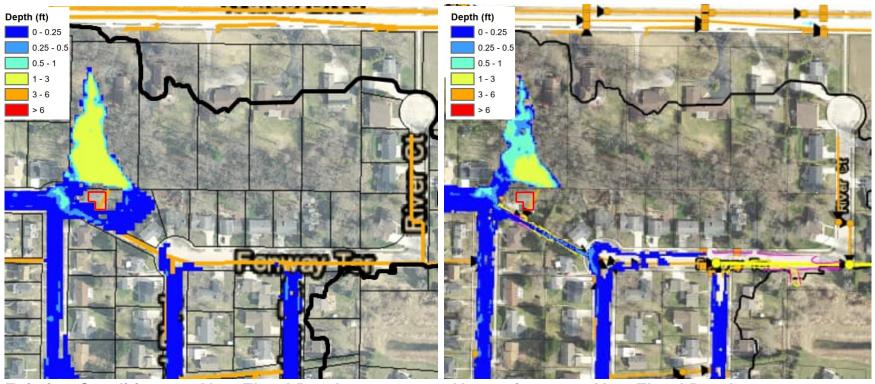
Alternative 1 100-Year Flood Depth





25-Year Storm Sewer Design With Overland Flow Route

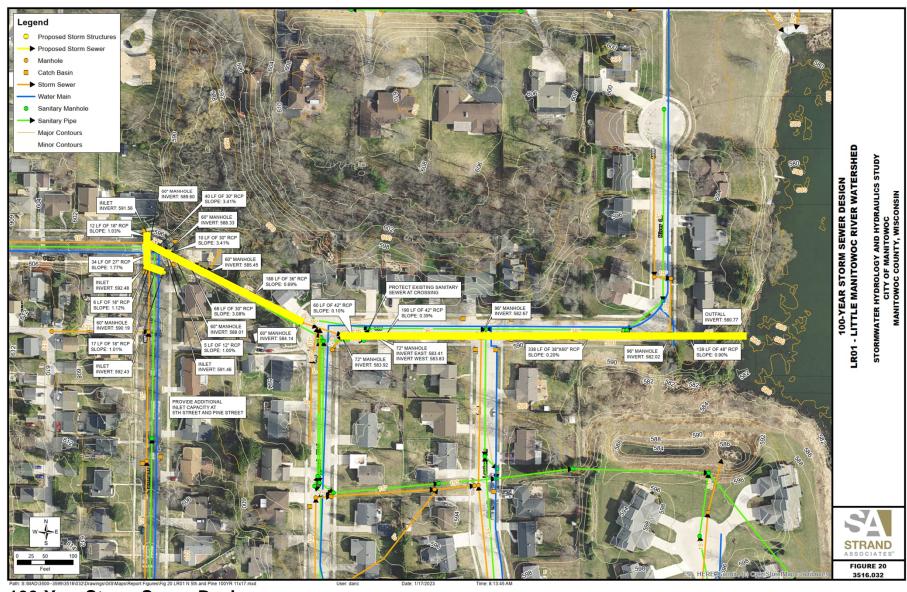




Existing Condition 100-Year Flood Depth

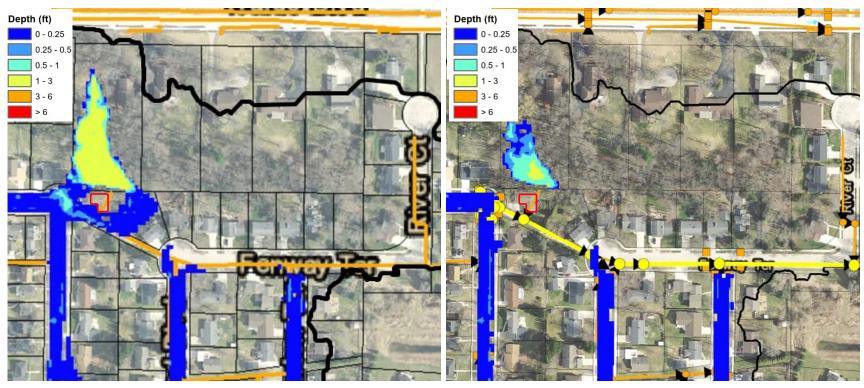
Alternative 2 100-Year Flood Depth





100-Year Storm Sewer Design





Existing Condition 100-Year Flood Depth

Alternative 3 100-Year Flood Depth



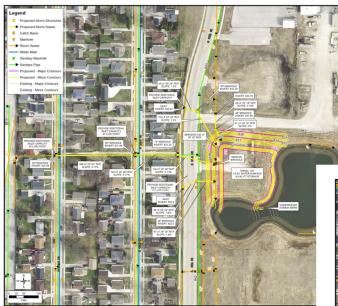
LR01 Opinion of Probable Construction Cost

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



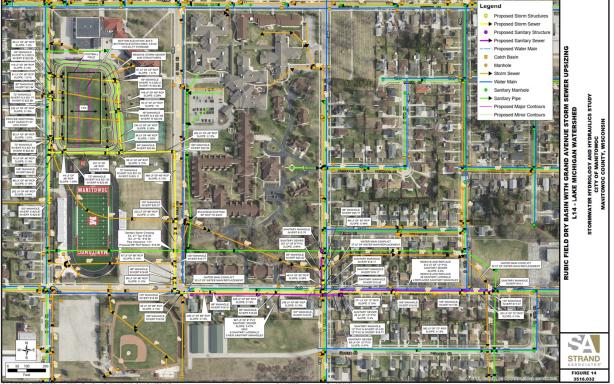
L14 Recommended Alternative

Alternative 4



30th Street Detention Basin Expansion

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
30 th Street Detention Basin Expansion	\$1,788,300
L14 Alternative 4 Total	\$9,975,400



Rubick Field Dry Detention Bains and Grand Avenue Storm Sewer Upsizing



R22 Recommended Alternative

Alternative 2



Halvorsen Park Wet Detention Basin

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



Custer Street Wet Detention Basin



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



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

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Task	Description		2023				2023 2024											2025								2026										
Task	Description	J	FN	I A	М	J,	JA	S	10	N D	J	FN	ΙΑ	M	JJ	Α	S	O N	D	JF	М	A	M J	J	A	S	N	D	F	M	A N	ار ا	J	A S	0	N D
1	BRIC Capability and Capacity Building (Design)	7																																	Ш	
2	BRIC Mitigation Projects (Construction)																		*	7																
3	Municipal Flood Control Grant (Construction)											*																								
4	Urban Nonpoint Source Grant (Construction)																																			

Application/Contracting
Design
Bidding/Construction

 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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