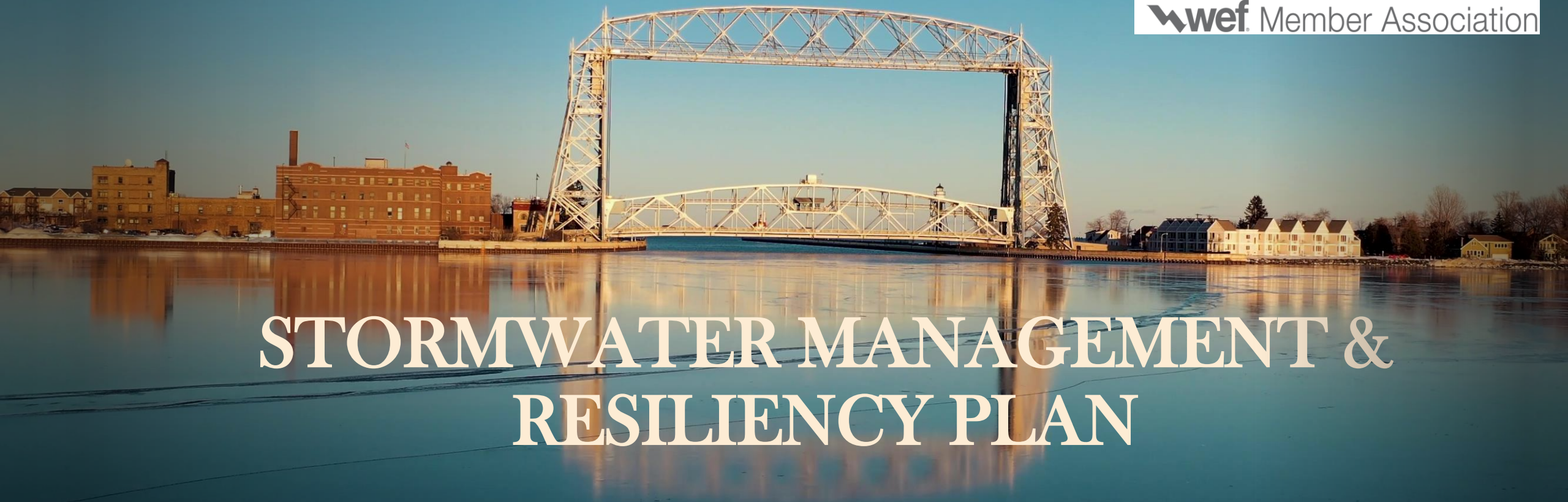
CITY OF DULUTH
MINNESOTA

Florida Water Environment Association
wef Member Association



STORMWATER MANAGEMENT & RESILIENCY PLAN

Angly Ulschmid, PE, M.ASCE
Senior Water Resources Engineer

SEH

SEHINC.COM/**DRONES**

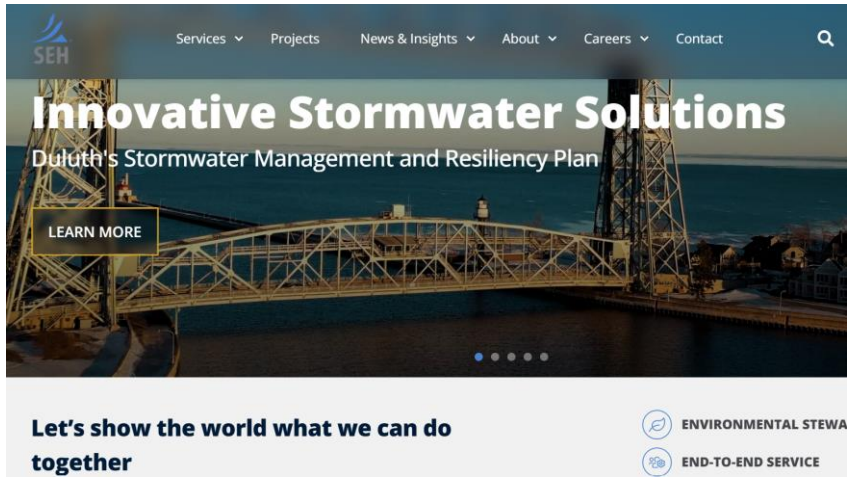
Background

Funding - MPCA Planning Grants for Stormwater Management and Community Resiliency

- Study & address stormwater issues and effects on vulnerable populations
- Climate risk assessment –First step of many!
- Road map to implementation of projects & recommendations

THE CITY OF DULUTH MINNESOTA

MINNESOTA POLLUTION CONTROL AGENCY



Climate Adaptation Partnership

UNIVERSITY OF MINNESOTA

Driven to Discover®

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Engineers | Architects | Planners | Scientists

Building a Better World for All of Us®

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THE CITY OF DULUTH MINNESOTA


KENWOOD
CONGDON PARK
CHESTER PARK
Hermantown
EAST HILLSIDE
DULUTH HEIGHTS
Duluth
CANAL PARK
PIEDMONT HEIGHTS
RICES POINT
LINCOLN PARK
DENFELD
BAYVIEW
CODY
Proctor
ONEOTA
Saint Louis Bay
WISCONSIN
SPIRIT VALLEY
WEST DULUTH
DOWNTOWN
NORTON PARK
Superior
BARKER'S ISLAND
RIVERSIDE
St Louis River
EAST END
MORGAN PARK
ALLOUEZ
ITASCA
Riverview
FOND DU LAC
GARY
SOUTH END
NEW DULUTH
Oliver
SUPERIOR VILLAGE
MINNESOTA
Image © 2024 TerraMetrics
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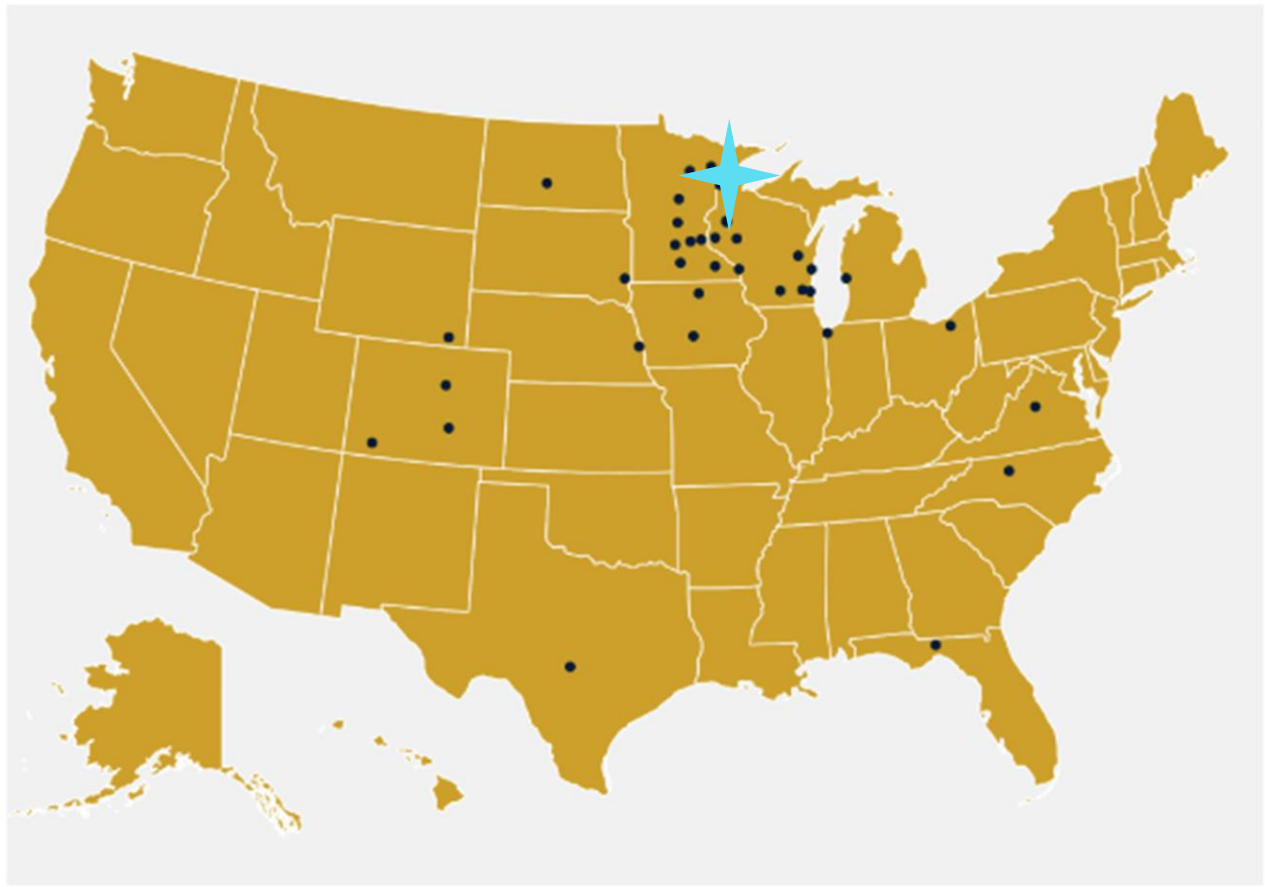
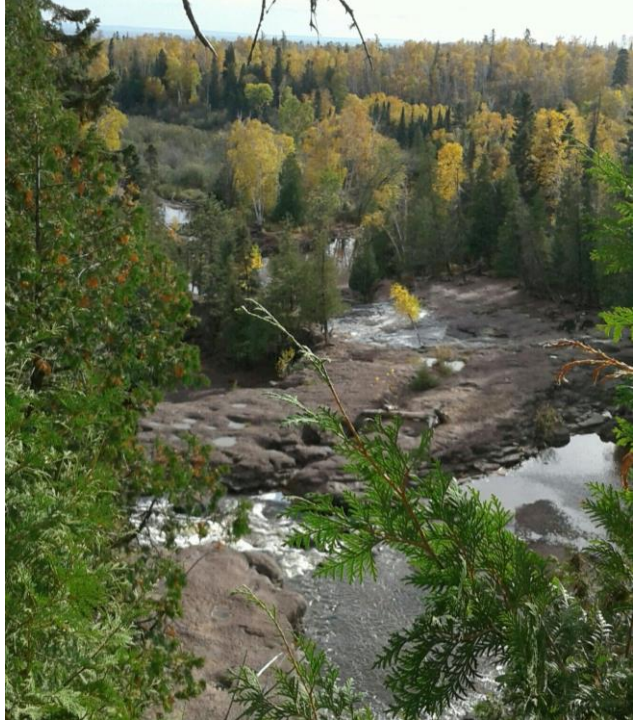
Peyton
Parkland
Pokegama



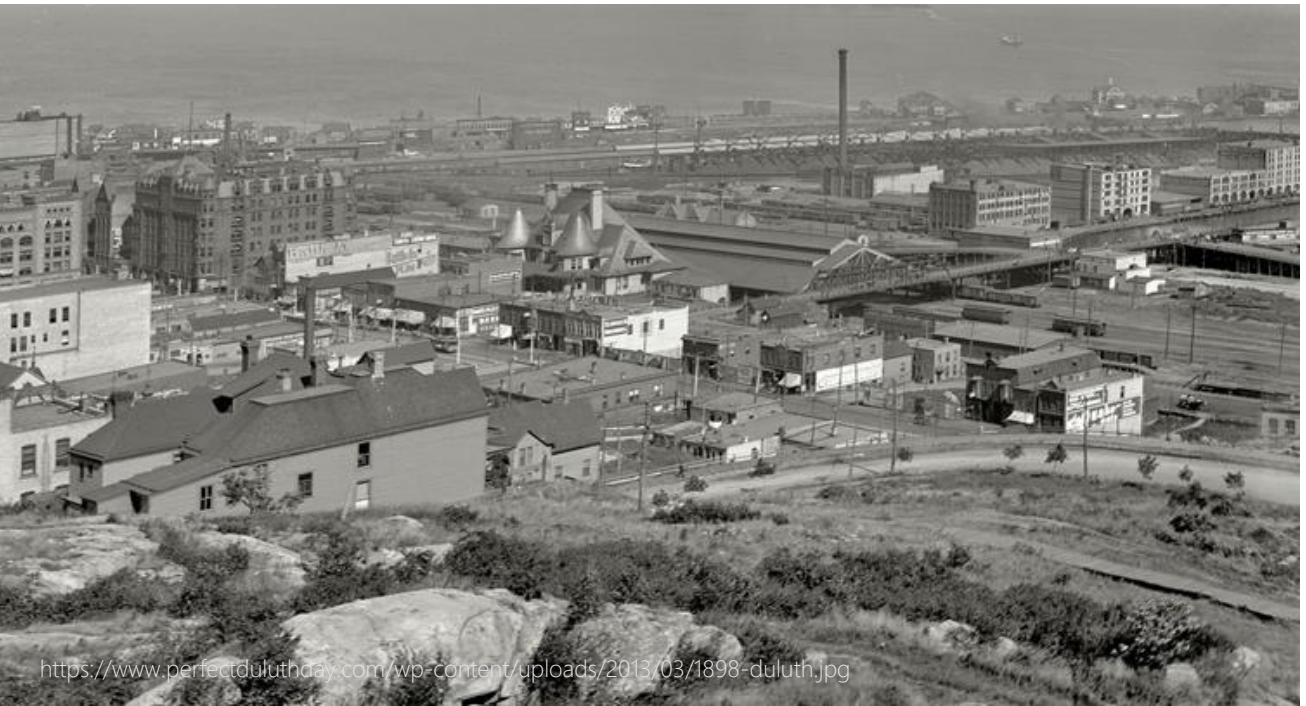
Water Resources

The St. Louis River Estuary, Our Home - Perfect Duluth Day

St. Louis River Estuary Water Trail - St. Louis River Alliance (stlouisriver.org)



Hiking Trails in Duluth, MN | Visit Duluth



https://www.perfectduluthday.com/wp-content/uploads/2013/03/1898-duluth.jpg

Unique Topography & Geology

Early Development

https://www.perfectduluthday.com/wp-content/uploads/2013/03/1905-Duluth

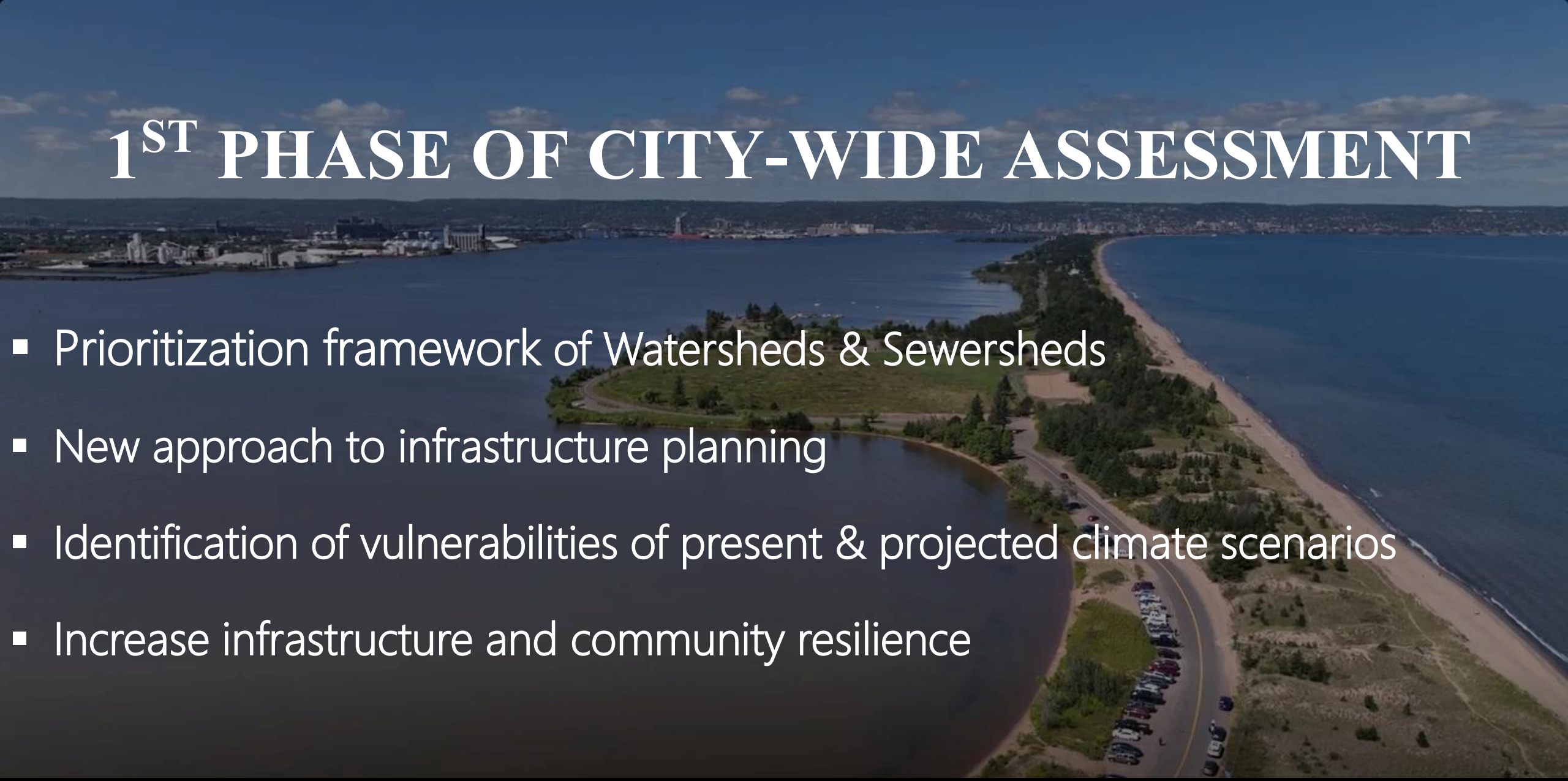
Extreme Events

Source: Bob King/Duluth News Tribune

Records Broken	Previous Duluth Record		New Duluth Record	
	Rainfall	Date	Rainfall	Date
Greatest 24-hr Precipitation	5.79”	August 22-23, 1978	6.90”	June 19-20, 2012
Greatest 2-Day Precipitation	6.68”	July 20-21, 1909	7.25”	June 19-20, 2012
Greatest June 24-hr Precipitation	4.00”	June 23, 1876	6.90”	June 19-20, 2012
Greatest Precipitation on a June Calendar Day	4.00”	June 23, 1876	4.14”	June 19, 2012
Greatest Precipitation for June 19	1.55”	June 19, 1998	4.14”	June 19, 2012
Greatest Precipitation for June 20	1.77”	June 20, 1926	3.11”	June 20, 2012

Souce – NOAA-NWS Duluth Significant Weather Events Database

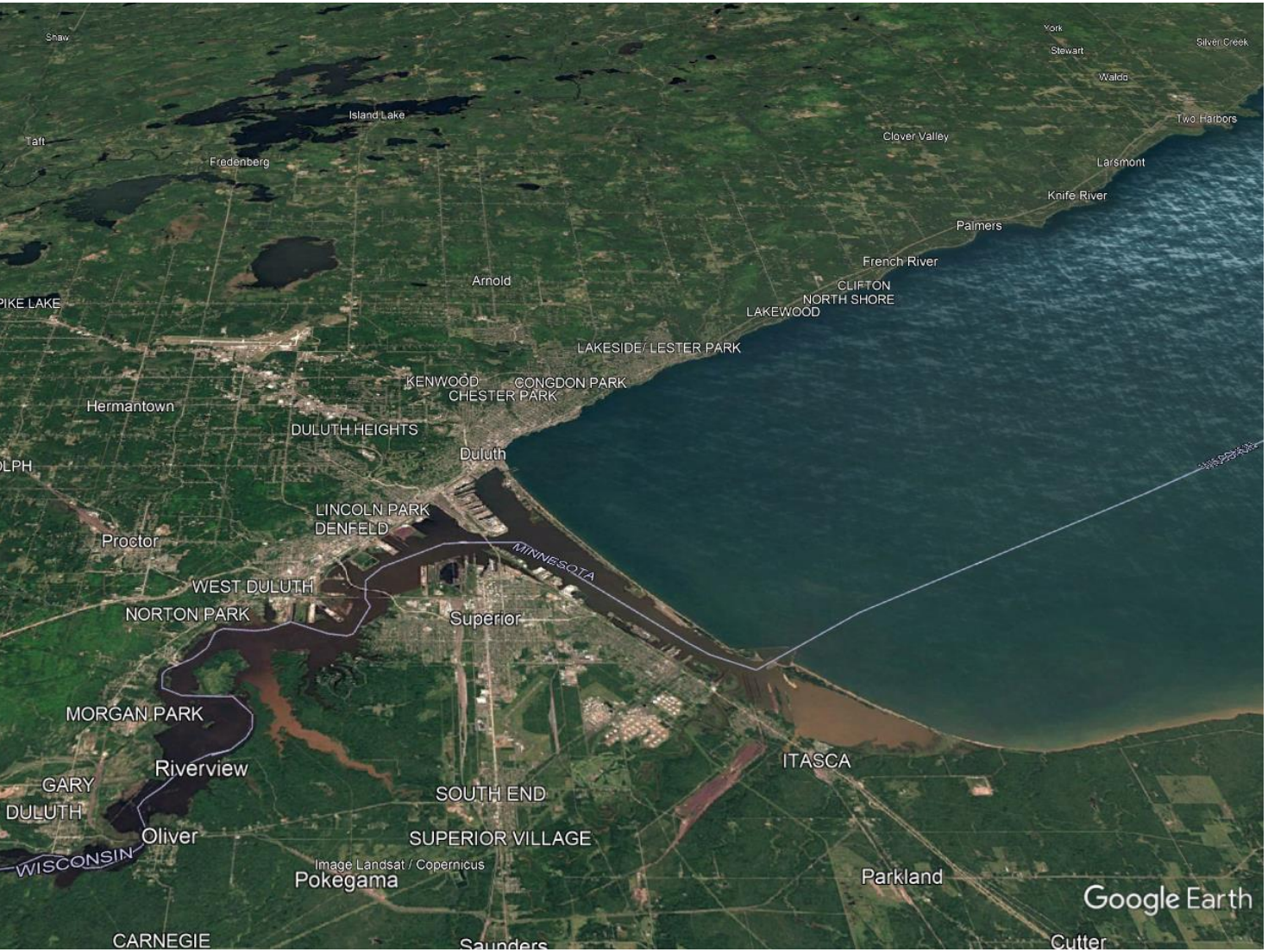
1ST PHASE OF CITY-WIDE ASSESSMENT



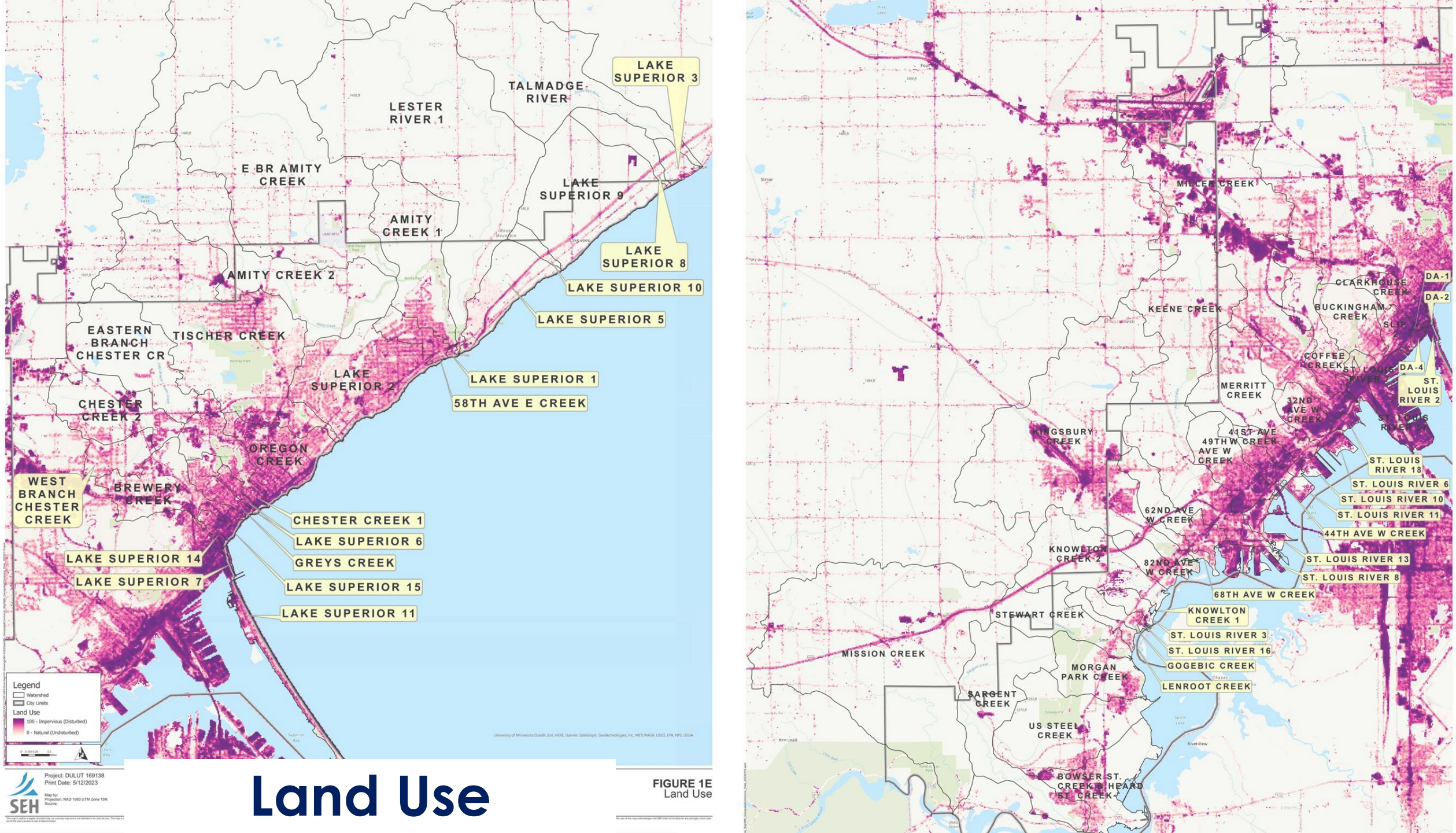
- Prioritization framework of Watersheds & Sewersheds
- New approach to infrastructure planning
- Identification of vulnerabilities of present & projected climate scenarios
- Increase infrastructure and community resilience

Plan Purpose

City-Wide Study



- Land Use
- Floodplains
- Social Vulnerability Index (EPA)
- Environmental Justice Areas of Concern (MPCA)
- Water Quality
- Existing Infrastructure
- Unique Risk & Hazards

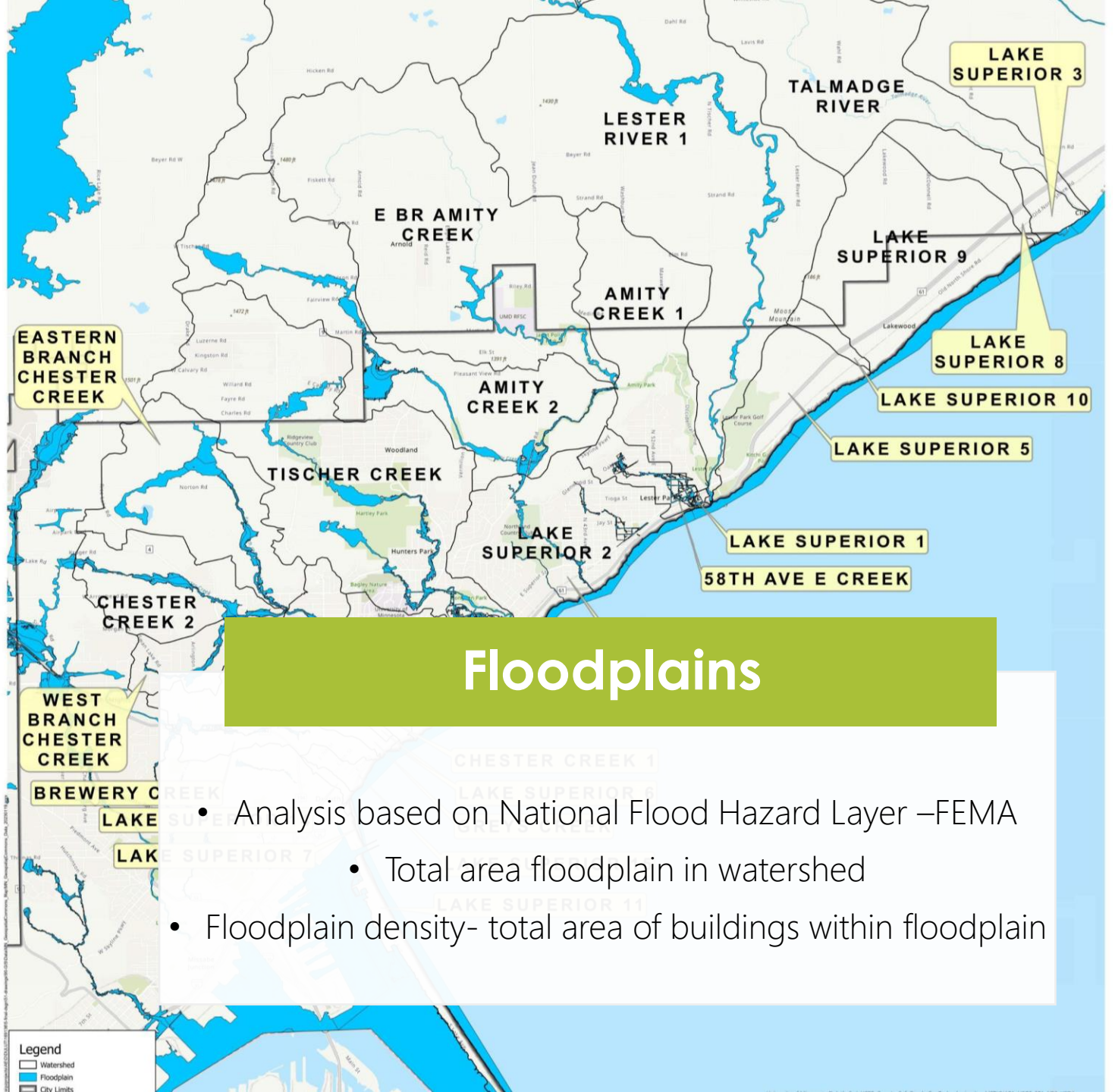


Project: DULUT 169138
Print Date: 5/12/2023
Map by:
Projection: NAD 1983 UTM Zone 15N
Source:

SEH

Land Use

FIGURE 1E
Land Use



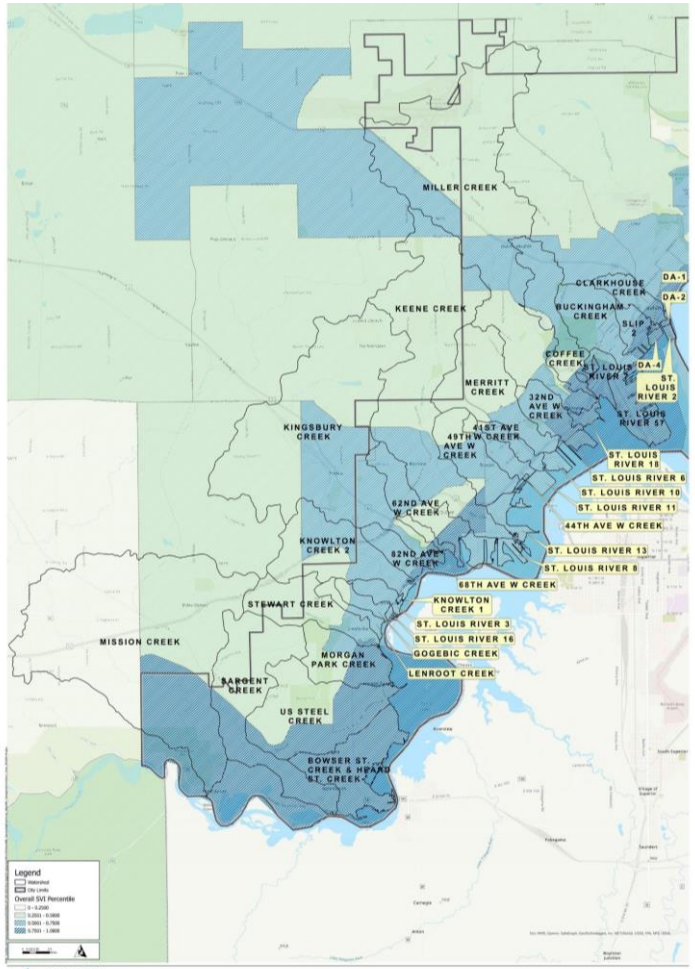
Floodplains

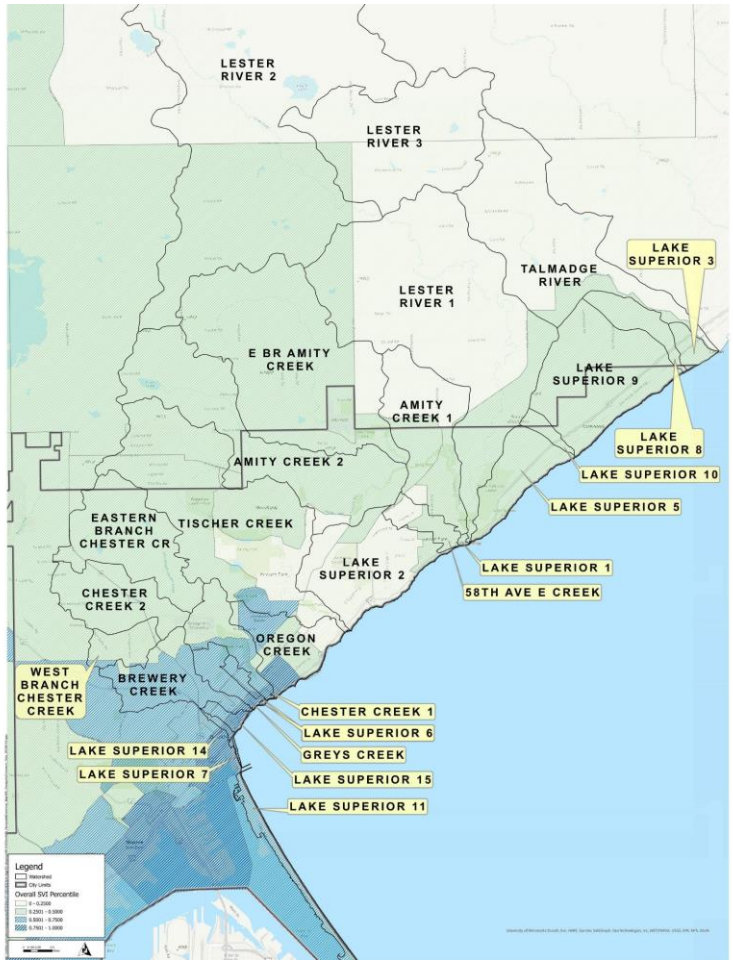
- Analysis based on National Flood Hazard Layer –FEMA
- Total area floodplain in watershed
- Floodplain density- total area of buildings within floodplain

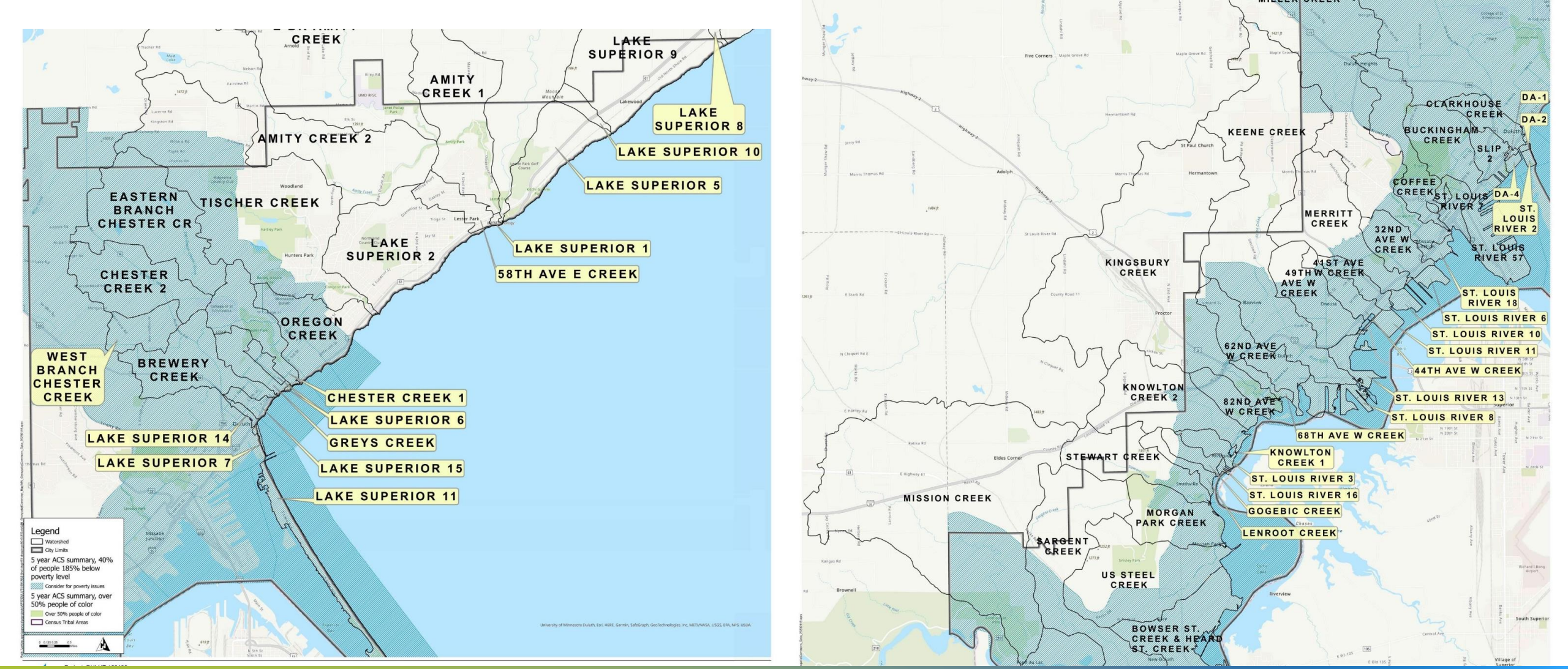
EPA Social Vulnerability Index (SVI)

Refers to the potential negative effects on communities caused by external stresses on human health.

Evaluates the degree to which vulnerable populations may be exposed to the impacts of climate change.



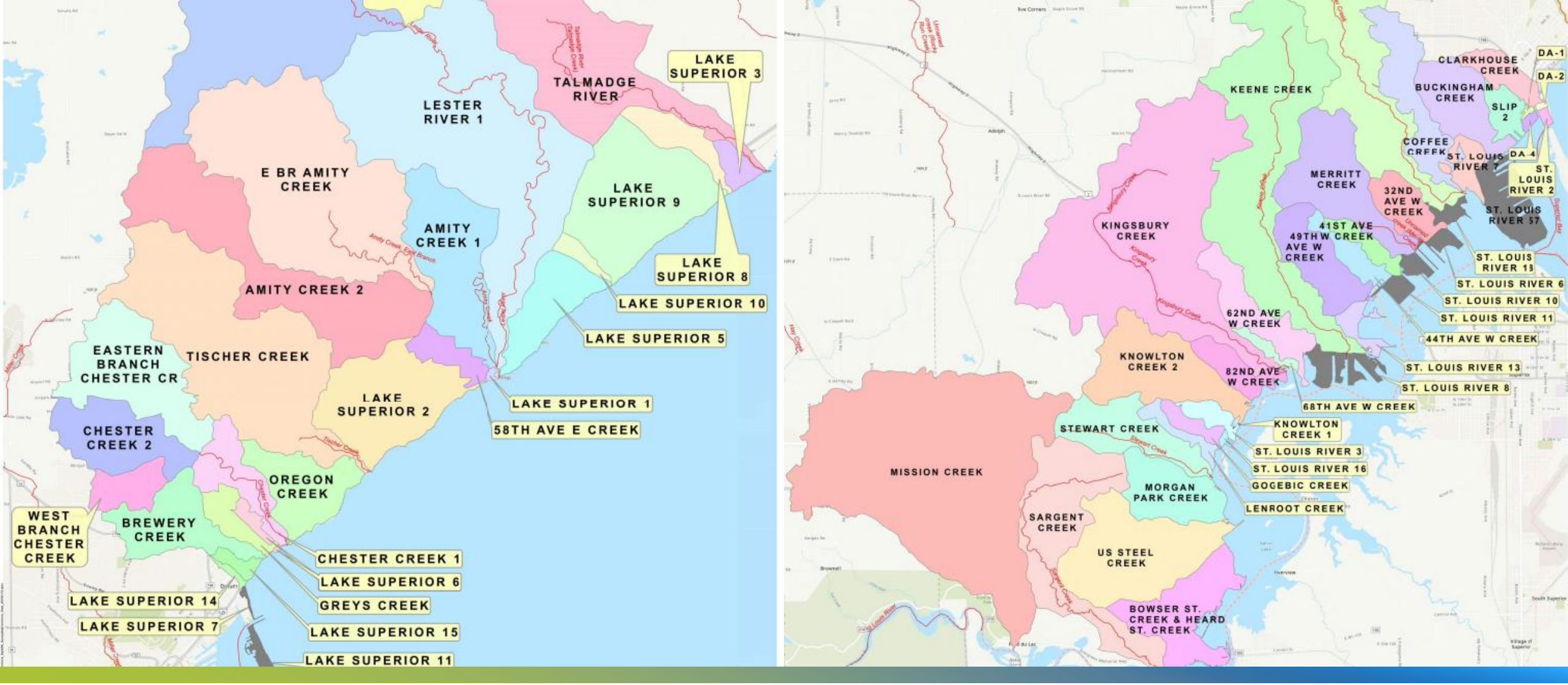




MPCA
Environmental Justice Areas of Concern

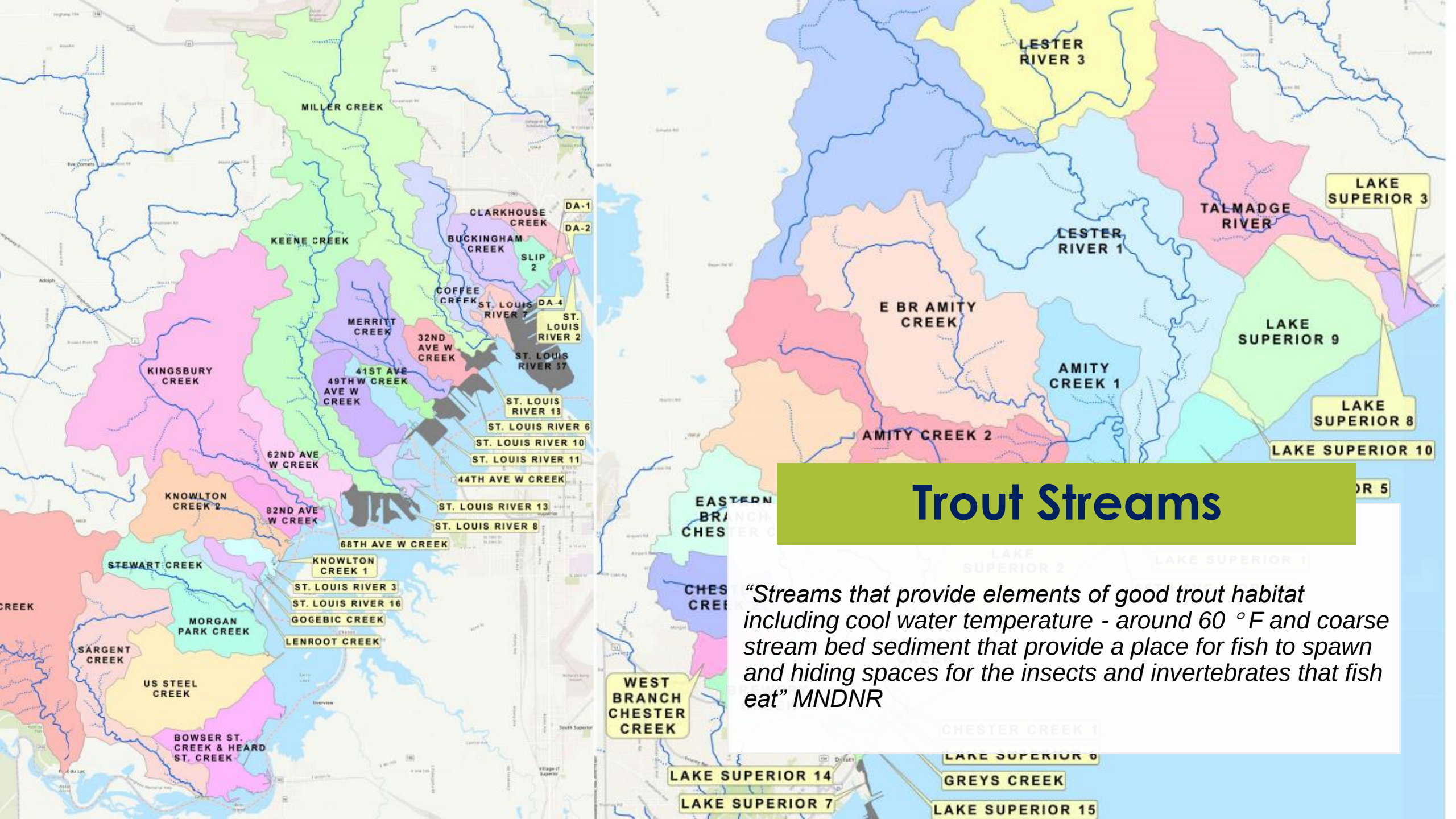
....to ensure that pollution does not have a disproportionate impact on any group of people. *"This means that all people -regardless of their race, color, national origin or income- benefit from equal levels of environmental protection and have opportunities to participate in decisions that may affect their environment or health."*

Critical Services



Water Quality- Impaired Streams

"A body of water is considered impaired if it fails to meet one or more water quality standards and does not meet use standards for swimming, fishing, drinking, and/or aquatic species health" MPCA



Trust Streams

"Streams that provide elements of good trout habitat including cool water temperature - around 60 °F and coarse stream bed sediment that provide a place for fish to spawn and hiding spaces for the insects and invertebrates that fish eat" MNDNR

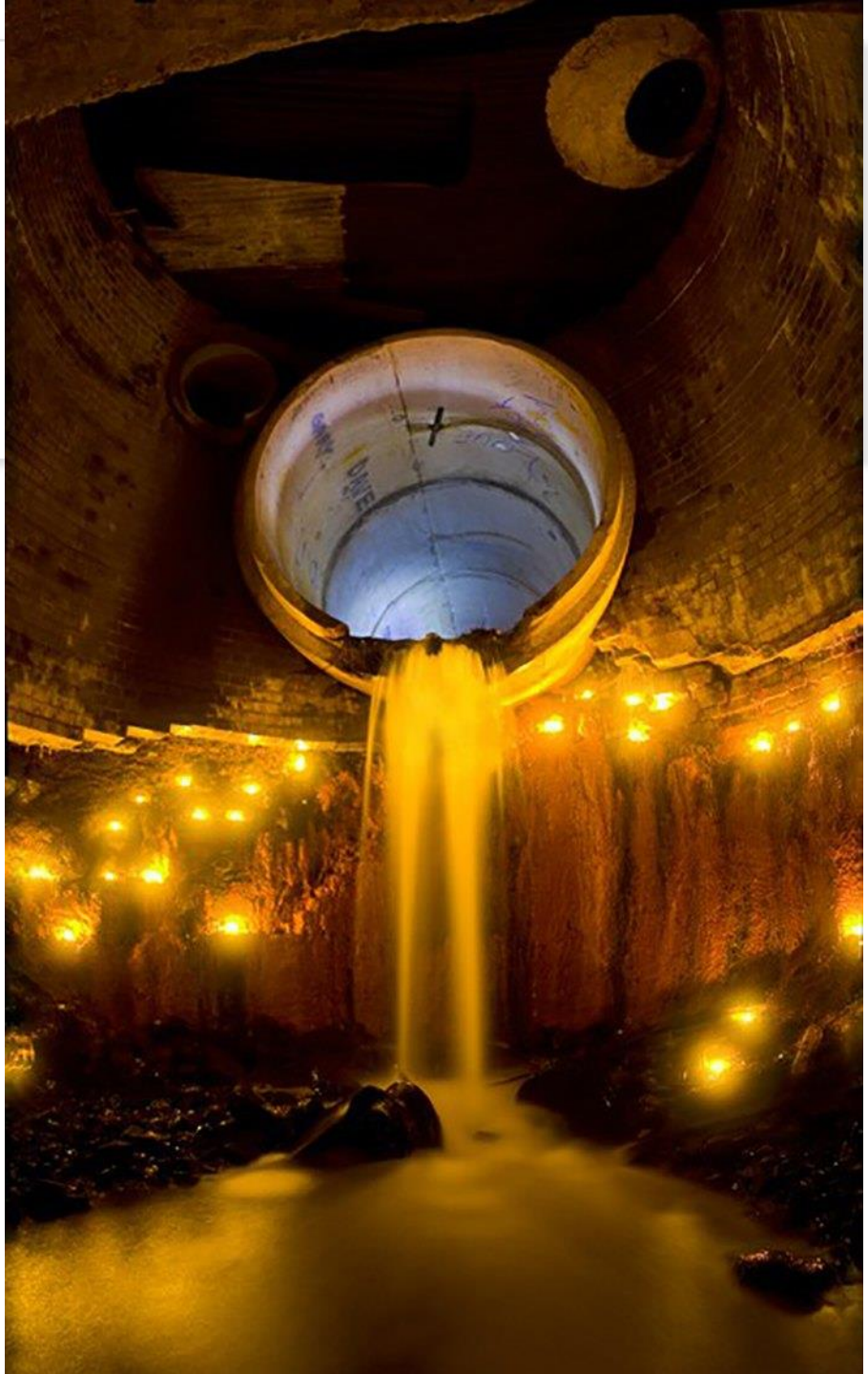
Existing Infrastructure

Chester Creek Culvert, Jeremy Walgrave

As climate changes, cities grapple with big rains | MPR News
63rd Ave. West & Bristol Street Culverts replacement

5. Existing Infrastructure							
Total length of Stormsewer & Culvert Pipe		Ratio of Stormsewer Pipe to Watershed Area		Total length of Stormsewer & Culvert Pipe 36"+		Ratio of Stormsewer Pipe 36"+ to Watershed Area	
LF	Miles	Ratio	Score	LF	Miles	Ratio	Score
7,597	1.4	1.46	0	476	0.1	0.09	0
25,300	4.8	7.16	0	1,183	0.2	0.33	0
66,950	12.7	34.22	0	2,724	0.5	1.39	0
137,122	26.0	127.04	1	12,555	2.4	11.63	0
31,744	6.0	37.41	0	4,076	0.8	4.80	0
76,007	14.4	102.77	1	1,166	0.2	1.58	0

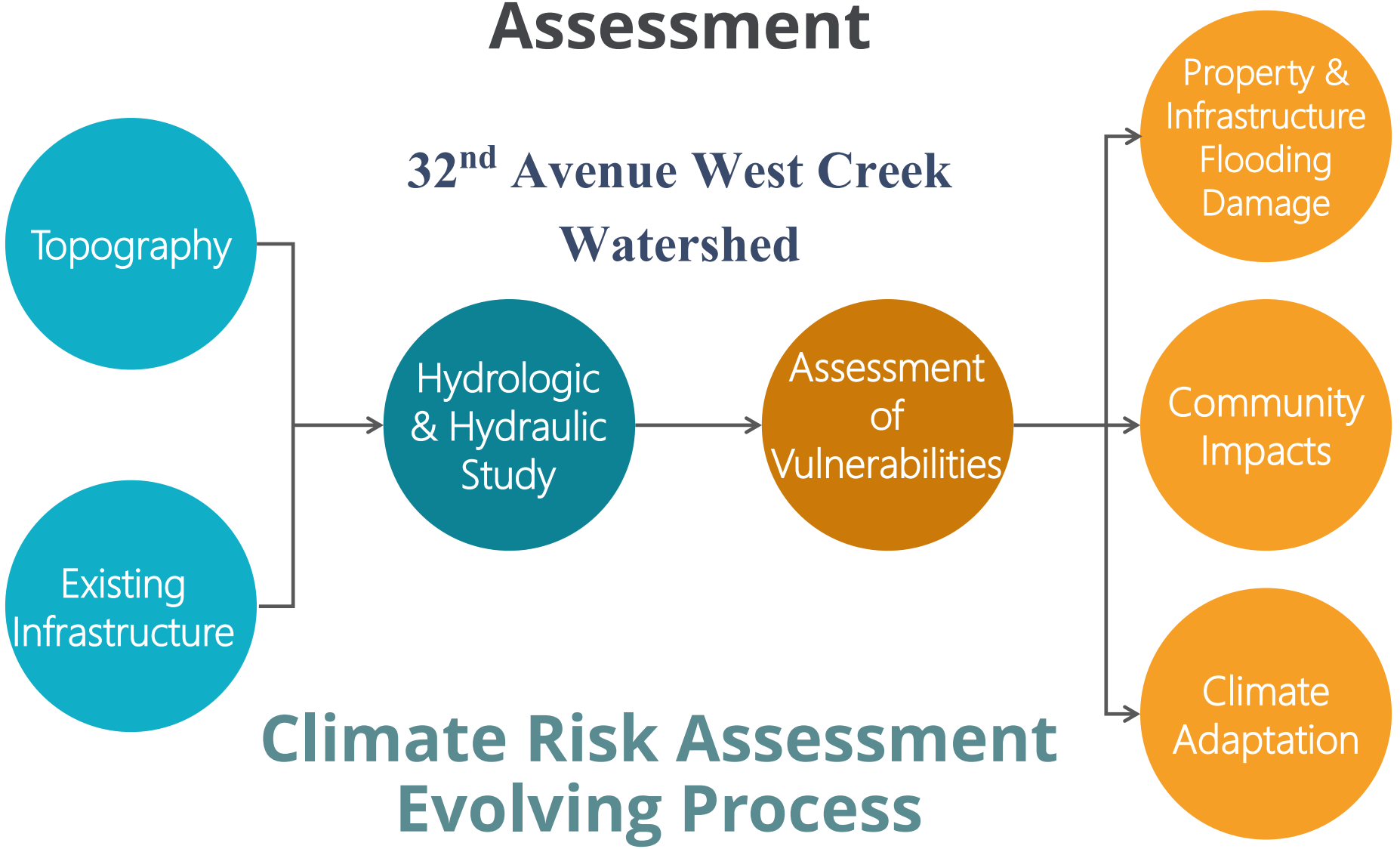
The Hidden Streams Beneath Duluth (onlyinyourstate.com)



City of Duluth
Stormwater Management Plan
Watershed Priority Matrix

HUC10 Watershed	Watershed HUC-AUID	Watershed/Sewershed	Total Priority Score	1. Land Use				2. Floodplains						3. Social Vulnerability & Environmental Justice			4. Water Quality			5. Existing Infrastructure								Unique Risk Conditions Hazards	Total Priority Score	Additional Information
				Area		Natural Undisturbed Area	Impervious Area	Impervious Area score	Area of floodplain in watershed	Percentage of floodplain area in watershed area	Number of Buildings within floodplain	Total Area of Buildings within floodplain	Floodplain Density	Floodplains Score	3A. EPA Social Vulnerability Index (SVI)	3B. MPCA Environmental Justice Areas of Concern- Score	3C. Critical Services	4A. Impaired Streams		4B. Trout Streams	Total length of Stormsewer & Culvert Pipe		Ratio of Stormsewer Pipe to Watershed Area		Total length of Stormsewer & Culvert Pipe 36"+		Ratio of Stormsewer Pipe 36"+ to Watershed Area				
				Square Feet	Acres	NLCD %	NLCD %	Score	Acres	%	Unit	Square Feet	Ratio of Area of Buildings within Floodplain to Areaof Watershed	Score	Score	Score	Score	MPCA Listed Impaired Waters	Score	Score	LF	Miles	Ratio	Score	LF	Miles	Ratio	Score			
Lake Superior South	04010102-511	Amity Creek East Branch	**3.00**	226,262,336	5,194	97%	3%	0	81	1.6%	0	0	0.0	0	1	0		Turbidity	1	1	7,597	1.4	1.46	0	476	0.1	0.09	0		**3.00**	Sensitive trout habitat . MPCA long term focus since 2002. Lester/Amity focus Weber Stream Restoration Initiative. 2017 MPCA Urban Stream assessment.
Lake Superior South	04010102-511	Amity 2	**3.00**	153,849,449	3,531.90	96%	4%	0	318	9.0%	7	5,508	1.6	0	1	0		Turbidity	1	1	25,300	4.8	7.16	0	1,183	0.2	0.33	0		**3.00**	Sensitive trout habitat . MPCA long term focus since 2002. Lester/Amity focus Weber Stream Restoration Initiative. 2017 MPCA Urban Stream assessment.
Lake Superior South	04010102-511	Amity 1	**3.00**	85,214,056	1,956.25	93%	7%	0	3	0.1%	3	1,134	0.6	0	1	0		Turbidity	1	1	66,950	12.7	34.22	0	2,724	0.5	1.39	0		**3.00**	Sensitive trout habitat . MPCA long term focus since 2002. Lester/Amity focus Weber Stream Restoration Initiative. 2017 MPCA Urban Stream assessment.
Lake Superior South	04010102-C14	Brewery Creek	**6.00**	47,015,965	1,079.34	66%	34%	0	43	4.0%	45	109,249	101.2	1	2	1	1				137,122	26.0	127.04	1	12,555	2.4	11.63	0		**6.00**	Most of the creek underground. Starts around 6th Avenue East and enters the lake at 8th Avenue East. Estimated length 0.9 miles
St. Louis River	04010201-A62	Buckingham Creek	**5.00**	36,960,389	848.49	46%	54%	1	48	5.6%	10	54,104	63.8	0	2	1				1	31,744	6.0	37.41	0	4,076	0.8	4.80	0		**5.00**	Brook trout habitat. 2016 Stream restoration study- Barr. Enger Park Golf Course overuse 15-20MG/Year. Segments underground suburban neighborhood, south of twin ponds-high risk.
Lake Superior South	04010102-545	Chester 1	**7.00**	32,217,642	739.62	63%	37%	1	36	4.9%	4	3,374	4.6	0	2	1		E. coli	1	1	76,007	14.4	102.77	1	1,166	0.2	1.58	0		**7.00**	Some segments south of Chester Park underrgound. Old tunnels, high risk. Flows through the College of St. Scholastica campus and Chester. Entering Lake Superior at Leif Erikson Park. 2017 MPCA Urban Stream assessment
Lake Superior South	04010102-545	Chester 2	**5.00**	54,549,400	1,252.28	82%	18%	0	103	8.2%	0	0	0.0	0	1	1	1	E. coli	1	1	78,943	15.0	63.04	0	1,403	0.3	1.12	0		**5.00**	Spring fed, ravine creek.
Lake Superior South	04010102-545	Chester Creek West Banch	**3.00**	20,530,952	471.33	77%	23%	0	50	10.6%	3	2,803	5.9	0	1	0	1			1	16,610	3.1	35.24	0	400	0.1	0.85	0		**3.00**	Spring fed, ravine creek.
Lake Superior South	04010102-545	Chester Creek East Branch	**3.00**	84,172,303	1,932.33	95%	5%	0	197	10.2%	6	5,311	2.7	0	1	1				1	37,657	7.1	19.49	0	1,200	0.2	0.62	0		**3.00**	Spring fed, ravine creek.
St. Louis River	04010201-999	Clarkhouse Creek	**7.00**	15,476,423	355.29	49%	51%	2	8	2.1%	2	1,192	3.4	0	2	1					70,915	13.4	199.60	2	4,780	0.9	13.45	0		**7.00**	Creek routed underground at about 1st. Avenue West. Estimated leght of stream 0.5 miles
St. Louis River	04010201-A83	Coffee Creek	**5.00**	42,899,032	984.83	71%	29%	0	49	4.9%	28	35,493	36.0	0	2	1				1	109,177	20.7	110.86	1	7,374	1.4	7.49	0		**5.00**	Begins in Duluth Heights area, meanders through part of Enger Park golf course, follows US Hwy 53 to its mouth at the St. Louis River. 2012 flood blew out the golf course holding pond. Tributary area needs further evaluation, confusing with St. Louis River 7 area. Needs evaluate topography and tributary area. Dense urban area, high risk.
St. Louis River	04010201-999	Gogebic Creek	**6.00**	7,970,695	182.98	90%	10%	0	2	1.0%	0	0	0.0	0	2	1					13,997	2.7	76.49	1	13,997	2.7	76.49	2		**6.00**	Creek underground-further evaluation needed -No stream leght data available.
Lake Superior South	04010102-999	Greys Creek	**7.00**	14,904,477	342.16	52%	48%	1	0	0.1%	0	0	0.0	0	2	1	1				65,141	12.3	190.38	2	7,016	1.3	20.51	0		**7.00**	This creek is routed underground for most of its journey to Lake Superior. Roughly follows 8th & 9th Avenue West.
St. Louis River	04010201-627	Keene Creek	**7.00**	180,890,762	4,152.68	13%	87%	2	206	5.0%	48	106,333	25.6	0	2	1		E. coli & Chloride	1	1	107,819	20.4	25.96	0	5,834	1.1	1.40	0		**7.00**	Trout stream. Restoration efforts following 2012 floods . Wetland complex habitat restoration project at Grassy Point-Creek entrance St. Louis River. 2017 MPCA Urban Stream assessment.
St. Louis River	04010201-626	Kingsbury Creek	**5.00**	245,940,529	5,646.02	88%	12%	0	330	5.8%	0	0	0.0	0	2	1		Chloride , Fish& Macroinvertebrates Bioassessments	1	1	24,595	4.7	4.36	0	2,272	0.4	0.40	0		**5.00**	Trout stream. Lower reaches serve as a fish spawning ground & nursery. Historical flooding.
St. Louis River	04010201-985	Knowlton Creek	**4.00**	63,866,110	1,466.16	90%	10%	0	74	5.0%	0	0	0.0	0	2	1				1	13,146	2.5	8.97	0	2,361	0.4	1.61	0		**4.00**	Development of Spirit Mountain Recreation area disturbed land. Efforts underway to restore wetlands and reduce stream flows & sedimentation.
St. Louis River	04010201-999	Lenroot Creek	**3.00**	8,100,150	185.95	91%	9%	0	1	0.6%	0	0	0.0	0	2	1					3,995	0.8	21.48	0	667	0.1	3.59	0		**3.00**	Creek underground-further evaluation needed -No stream leght data available.
Lake Superior South	04010102-549	Lester 1	**3.00**	305,051,308	7,003.01	99%	1%	0	276	3.9%	0	0	0.0	0	0	0	1	Turbidity & Mercury	1	1	1,352	0.3	0.19	0	0	0.0	0.00	0		**3.00**	Sensitive trout habitat. MPCA long term focus since 2002. Lester/Amity focus Weber Stream Restoration Initiative. Historic Lakeside neighboorhod. Enters Lake Superior at about 61st Avenue East.
Lake Superior South	04010102-549	Lester 2	**2.00**	530,844,507	12,186.51	99%	1%	0	976	8.0%	0	0	0.0	0	0	0		Turbidity & Mercury	1	1	0	0.0	0.00	0	0	0.0	0.00	0		**2.00**	Sensitive trout habitat. MPCA long term focus since 2002. Lester/Amity focus Weber Stream Restoration Initiative. Historic Lakeside neighboorhod.
Lake Superior South	04010102-549	Lester 3	**2.00**	157,802,913	3,622.66	99%	1%	0	1	0.0%	0	0	0.0	0	0	0		Turbidity & Mercury	1	1	0	0.0	0.00	0	0	0.0	0.00	0		**2.00**	Sensitive trout habitat. MPCA long term focus since 2002. Lester/Amity focus Weber Stream Restoration Initiative. Historic Lakeside neighboorhod.
St. Louis River	04010201-987	Merrit Creek	**5.00**	63,224,102	1,451.43	84%	16%	0	107	7.4%	36	99,525	68.6	0	2	1		E. coli	1	1	49,620	9.4	34.19	0	4,385	0.8	3.02	0		**5.00**	2017 MPCA Urban Stream assessment. Meanders in West Duluth-Wade Stadium. Enters St. Louis River at about 35th Avenue West.
St. Louis River	04010201-512	Miller Creek	**7.00**	260,075,854	5,970.52	71%	29%	0	634	10.6%	67	688,243	115.3	1	2	1	1	Temperature, E. coli, Chloride, Macroinvertebrates Bioassessments	1	1	263,383	49.9	44.11	0	13,837	2.6	2.32	0		**7.00**	Cold water trout stream. Regular sediment clearing at mouth- 500 CY/ year. MPCA TMDL Study. 2017 MPCA Urban Stream assessment. Flows past Miller Hill Mall, trhough Lincoln Park, entering St. Louis Bay at about 26th Avenue West.Some Segments underground, further evaluation needed.
St. Louis River	04010201-640	Mission Creek	**5.00**	306,803,710	7,043.24	96%	4%	0	28	0.4%	10	3,977	0.6	0	3	1				1	1,625	0.3	0.23	0	242	0.0	0.03	0		**5.00**	Trout Stream. Western edge of Duluth City limits
Lake Superior South	04010102-No AUID	Oregon Creek	**7.00**	45,273,487	1,039.34	44%	56%	1	22	2.1%	55	87,299	84.0	0	2	1	1				223,079	42.2	214.64	2	10,202	1.9	9.82	0		**7.00**	Segments of the creek underground-further evaluation needed -Stream data available seems incomplete
St. Louis River	04010201-848	Sargent Creek	**6.00**	92,601,935	2,125.85	96%	4%	0	65	3.1%	2	598	0.3	0	3	1		E. coli	1	1	13,160	2.5	6.19	0	551	0.1	0.26	0		**6.00**	Near western city limits, 86% of the watershed is forest. Enters St. Louis River at about 100th Avenue West.
St. Louis River	04010201-884	Stewart Creek	**5.00**	43,284,493	993.68	95%	5%	0	40	4.0%	15	30,293	30.5	0	2	1		E. coli	1	1	17,159	3.2	17.27	0	1,231	0.2	1.24	0		**5.00**	85% of the watershed is forest.
Lake Superior South	04010102-544	Tischer Creek	**5.00**	206,227,012	4,734.32	85%	15%	0	293	6.2%	126	221,757	46.8	0	1	1	1	E. coli	1	1	287,545	54.5	60.74	0	13,361	2.5	2.82	0		**5.00**	Also called Congdon Creek. Flows past Mount Royal Shopping Center, cascades down the Duluth Hillside to Lake Superior. 2017 MPCA Urban Stream assessment
Lake Superior South	04010102-508	Talmadge River	**1.00**	165,142,119	3,791.14	99%	1%	0	0	0.0%	0	0	0.0	0	0	0		Dissolved oxygen, Fish bioassessments, turbidity	1		0	0.0	0.00	0	0	0.0	0.00	0		**1.00**	Forested & rural residential watershed.
St. Louis River	04010201-999	US Steel Creek	**4.00**	84,366,547	1,936.79	92%	8%	0	94	4.8%	2	1,259	0.7	0	3	1					39,798	7.5	20.55	0	5,592	1.1	2.89	0		**4.00**	Creek underground-further evaluation needed. No stream lenght data available. Historical data =6.8 Miles
St. Louis River	04010201-No AUID	32nd Avenue West Creek	**7.00**	20,551,052	471.79	51%	49%	1	1	0.1%	0	0	0.0	0	3	1	1				50,930	9.6	107.95	1	6,346	1.2	13.45	0		**7.00**	Segments of the creek are underground. Estimated 6107 above ground, 2457' underground.
St. Louis River	04010201-No AUID	41st Avenue West Creek	**5.00**	10,266,514	235.69	52%	48%	1	6	2.5%	0	0	0.0	0	2	1					26,639	5.0	113.03	1	3,871	0.7	16.43	0		**5.00**	Creek underground-further evaluation needed -No stream leght data available. Open Land opportunities - Merrit Park
St. Louis River	04010201-99	44th Avenue West Creek	**7.00**	12,485,299	286.62	52%	48%	1	5	1.8%	0	0	0.0	0	2	1	1				37,621	7.1	131.26	1	8,112	1.5	28.30	1		**7.00**	Creek underground-further evaluation needed -No stream leght data available.
St. Louis River	04010201-99	49th Avenue West Creek	**8.00**	35,661,265	818.67	65%	35%	0	35	4.3%	24	340,492	415.9	3	2	1	1				94,584	17.9	115.53	1	13,036	2.5	15.92	0		**8.00**	Creek underground-further evaluation needed -No stream leght data available. Open Land opportunities - Memorial Community Center
Lake Superior South	04010102-999	58th Avenue East Creek	**6.00**	15,964,928	366.50	61%	39%	1	35	9.5%	128	106,409	290.3	2	1	0					79,133	15.0	215.91	2	2,160	0.4	5.89	0		**6.00**	Creek underground-further evaluation needed -No stream leght data available.
St. Louis River	04010102-999	62nd Avenue West Creek	**4.00**	32,288,651	741.25	81%	19%	0	28	3.8%	4	3,869	5.2	0	2	1					55,809	10.6	75.29	1	4,065	0.8	5.48	0		**4.00**	Creek underground-further evaluation needed -No stream leght data available.
St. Louis River	04010201-No AUID	68th Avenue West Creek	**4.00**	5,026,290	115.39	78%	22%	0	4	3.5%	0	0	0.0	0	2	1					11,674	2.2	101.17	1	1,156	0.2	10.02	0		**4.00**	Segments of the creek underground- further evaluation needed.
St. Louis River	04010201-No AUID	82nd Avenue West Creek	**3.00**	17,214,083	395.18	83%	17%	0	25	6.2%	2	1,380	3.5	0	2	1					24,031	4.6	60.81	0	1,406	0.3	3.56	0		**3.00**	Creek underground-further evaluation needed- Open Land opportunities- Norton Park, Indian Point park
Lake Superior South		Lake Superior 1	**7.00**	878,499	20.17	47%	53%	1	4	21.3%	22	19,151	949.6	3		1					4,242	0.8	210.36	2	0	0.0	0.00	0		**7.00**	Small watershed, west of Leaster River 1. Large floodplain area, needs further evaluation to determine tributary area, floodplain association, topography-seems to be part of 58th Ave. East Creek. UMD Limmology.
Lake Superior South		Lake Superior 2	**3.00**	85,251,291	1,957.10	66%	34%	0	61	3.1%	51	43,942	22.5	0		0	1				324,657	61.5	165.89	2	15,988	3.0	8.17	0		**3.00**	34th, 37th, 38th, 40th, 43rd, 47th, 50th Avenue East Creek watersheds. Underground Creeks, further evaluation needed.
Lake Superior South		Lake Superior 3	**1.00**	9,829,749	225.66	88%	12%	0	2	0.9%	0	0	0.0	0		1					200	0.0	0.88	0	0	0.0	0.00	0		**1.00**	Area drains directly to the Lake. No stream data available.

Focused Watershed Stormwater Vulnerability Assessment

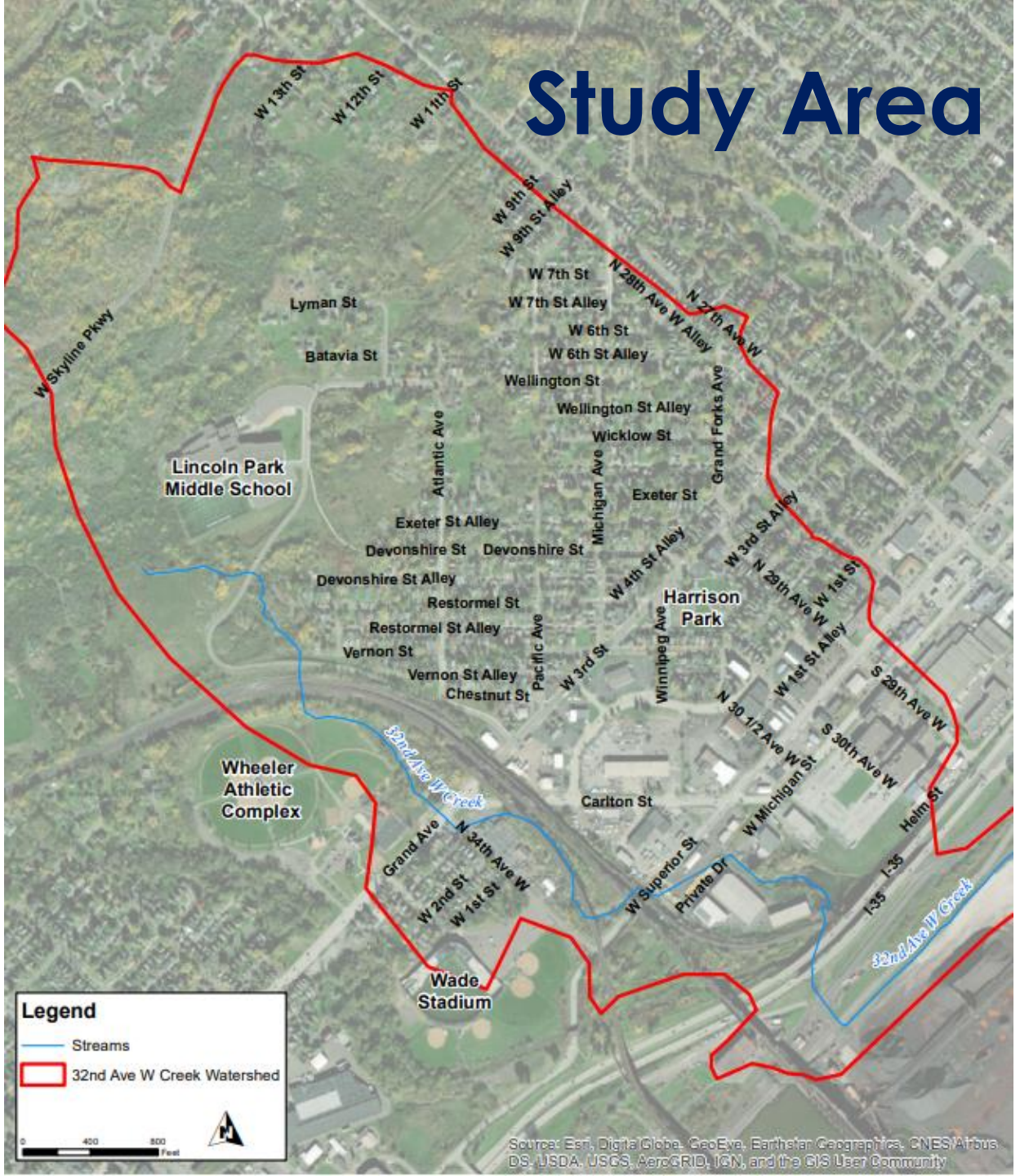


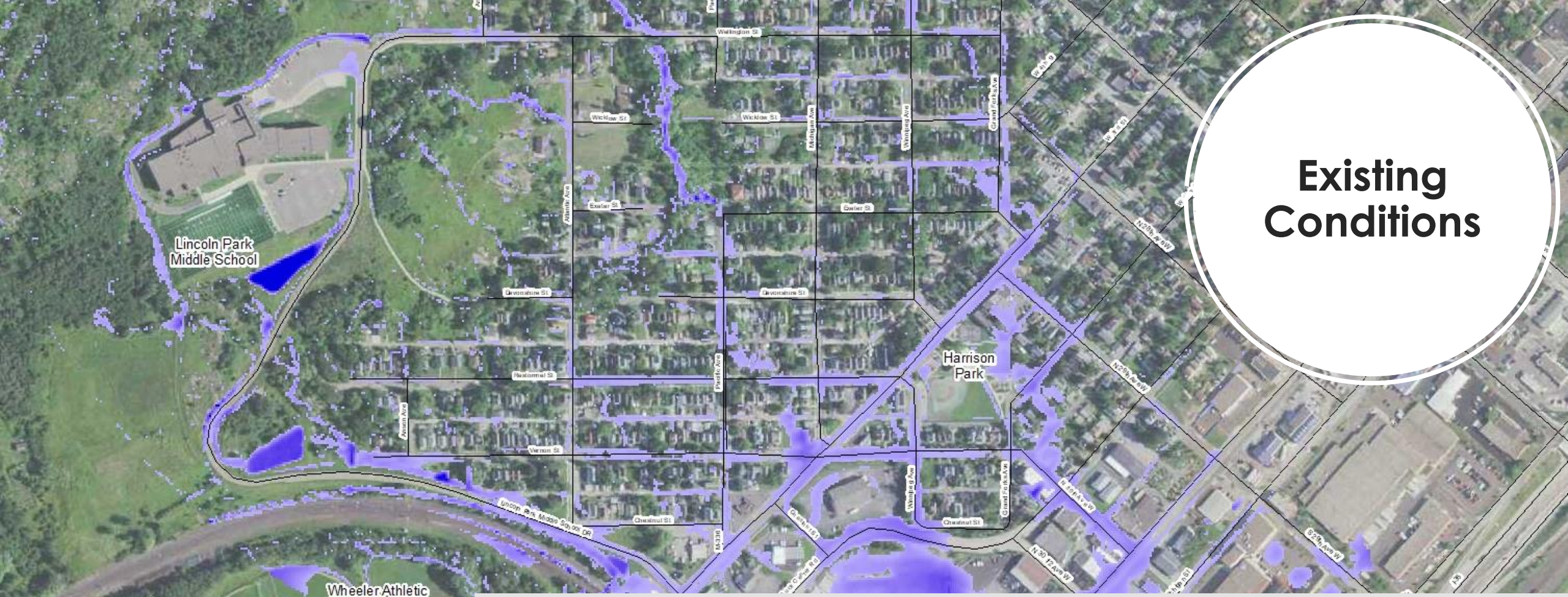
Climate Risk Assessment Evolving Process

Development of climate resilient solutions.

Analysis of existing NOAA Atlas-14 data & St. Louis County precipitation intensity projections developed by

University of Minnesota Climate Adaptation Partnership





Existing Conditions

- Comprehensive aerial survey
- On-site assessment of infrastructure existing conditions
- Hydraulic & Hydrology Model _ XP-SWMM
- Photogrammetry & GIS data analysis

Existing Conditions

Event	Precipitation Depth (Inches)
10 Year	3.92
100 Year	6.36

June 2012 Event

Event	Precipitation Depth (Inches)
24Hrs	6.90

End of Century Projections

Event	Precipitation Depth (Inches)
10 Year	4.37
100 Year	8.90

Climate Resiliency

Event	Precipitation Depth (Inches)
10 Year	4.70
100 Year	7.63

Minnesota CliMAT | University of Minnesota Climate Adaptation Partnership (umn.edu)

Climate Resiliency Scenario
20% Increase

100 Year Event

Precipitation Depth = 7.63 inches

Evaluation of Candidate Projects & Recommendations

Storm Sewer Improvements

Location	Proposed Action	Estimated Cost	Benefit
Duluth Heritage Sports Center (DHSP) parking lot	Upsize from 4.5' (54") to 6' (72") Proposed length 328 LF	$554,000	Reduced Private Property Flooding
Superior Street to DHSC parking lot	Upsize to 5' (60") - Proposed length 743 LF	$1,138,000	Reduced Private Property Flooding
Grand Forks Ave to Superior Street	Upsize to 4' (48") - Proposed length 750 LF	$840,000	Reduced Residential, Private Property, and Street Flooding
West 2nd Street, North 29th Ave West and West 3rd Street	Upsize to 3.5' (42") - Proposed length 1082 LF	$1,050,000	Reduced Residential, Private Property, and Street Flooding
Intersection of Exeter St and Grand Forks Ave	Upsize to 3' (36") - Proposed length 83 LF	$119,000	Reduced Residential Flooding

Twin Cities Interchange, SEH- Carson Webb

2.2.1 Storm Sewer Improvements

2.2.1.1 Recommendations

The model results indicate several areas where shallow street flooding may occur. When these streets are reconstructed in the future, additional catch basins inlets should be added to minimize street flooding. In addition, consideration should be given to overlay projects. Overlay projects can reduce the amount of stormwater storage in the street by up to 30%. This major reduction in street storage increases the frequency of break out flows into private property.

Additional catch basins (inlet capacity) should be added at the time of the street reconstruction projects to offset the loss of street storage when future overlay projects occur.

The modeling results for the proposed improvement projects with a 20% increase in precipitation are shown in the following figures:

- 5-A Proposed Conditions 20% Increase 10-year
- 5-B Proposed Conditions 20% Increase 100-year

To achieve full capacity of the storm system, the roadway needs to have good pavement that is sloped to gutters and does not divert flow due to rutting and deterioration of the pavement. Curb and gutters need to be sound and able to effectively capture and convey runoff to catch basin inlets. Curbs need to be continuous to keep runoff from leaving the roadway and entering private property. Inlet grates need to be set properly to allow gutter flow to enter the inlet and into the storm sewer system. The storm sewer piping needs to be sound to be able to handle high flow events.

2.2.2 Street and Storm Sewer System Maintenance

2.2.2.1 Recommendations

Street maintenance and storm system maintenance are a critical activity in Duluth. Sediment and debris can easily clog catch basin inlets. This causes bypass flows that go downstream, which has a cumulative flood risk and damage effect.

The City should continue to fund street sweeping, catch basin inlet cleaning, culvert inlet cleaning, culvert flushing/cleaning, storm sewer cleaning, and maintenance activities that ensure the function of the overall drainage system.

In addition, the City should promote an Adopt-a-Drain program for residents and businesses. This program provides an additional means to clean out catch basin inlets to promote proper function of the overall drainage system.

Evaluation of Candidate Projects & Recommendations

Green Infrastructure

Type of Project	Location	Existing Conditions	Proposed Action	Estimated Cost	Benefits
Green Streets	Superior Street Reconstruction	Existing impervious length 2,100 LF from Railroad track to 29th Avenue West.	Urban rain garden- Long/narrow cells capture, reduce and treat stormwater runoff in space limited urban settings.	$425,000	Volume Reduction Water Quality
		Existing 110,000 SF impervious road surface, from railroad tracks to 29th Avenue West.	Subsurface storage	$5,000,000	Flow Rate Reduction Water Quality
		4 Bus Stops	Urban rain garden, tree planting	$115,000	Volume Reduction Water Quality
	West 3rd Street	Narrow grass areas along edge road, approximately 842 LF from intersection with Lincoln Park Middle School Drive to Vernon Street.	Urban rain garden- capture, reduce and treat stormwater runoff in in space limited urban settings.	$80,000	Volume Reduction Water Quality

2.2.2.1.3 Bioretention Cells and Rain Gardens

Urban nature solutions use green (land based) and blue (water based) infrastructure. The goal is to mimic natural functions or enhance existing natural resources in a way that integrates urban living with nature. Examples of green infrastructure include rain gardens, bioretention cells, and biofiltration swales. Examples of blue infrastructure include ponds and pools.

Urban bioretention cells can be integrated into small and narrow spaces. The cells temporarily store stormwater and gradually filter it through the cell's soil and either infiltrate into the native soil below or is collected in an underdrain pipe and discharges into the stormwater sewer system.

The primary purpose of the bioretention cell is to capture as much volume as possible to reduce peak flow into the existing sewer system and to intercept stormwater runoff to reduce total suspended sediments and pollutants in order to improve water quality.

Recommendations

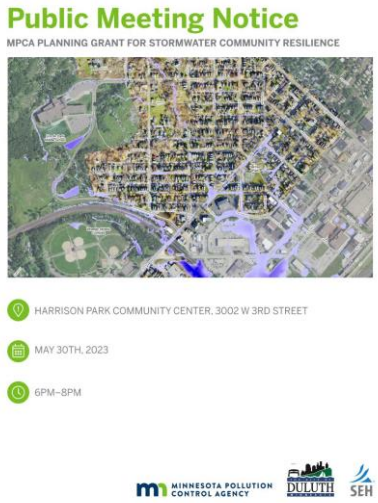
1. Integrate bioretention cells along West Superior Street as part of the street reconstruction project.
2. Integrate bioretention cells along residential streets including Restormel Street, West 3rd Street and Vernon Street.
3. Identify existing wetlands and potential wetland restoration opportunities to enhance the natural bioretention qualities of the watershed.

Impervious Surface Retrofit

Due to the unique topographic and geologic qualities of the City of Duluth, green infrastructure is not feasible at all locations, especially in natural land areas that have shallow bedrock and clay soils.

Large impervious areas such as parking lots, represent a great opportunity to capture and treat large amounts of stormwater, in comparison to individual residential or commercial properties.

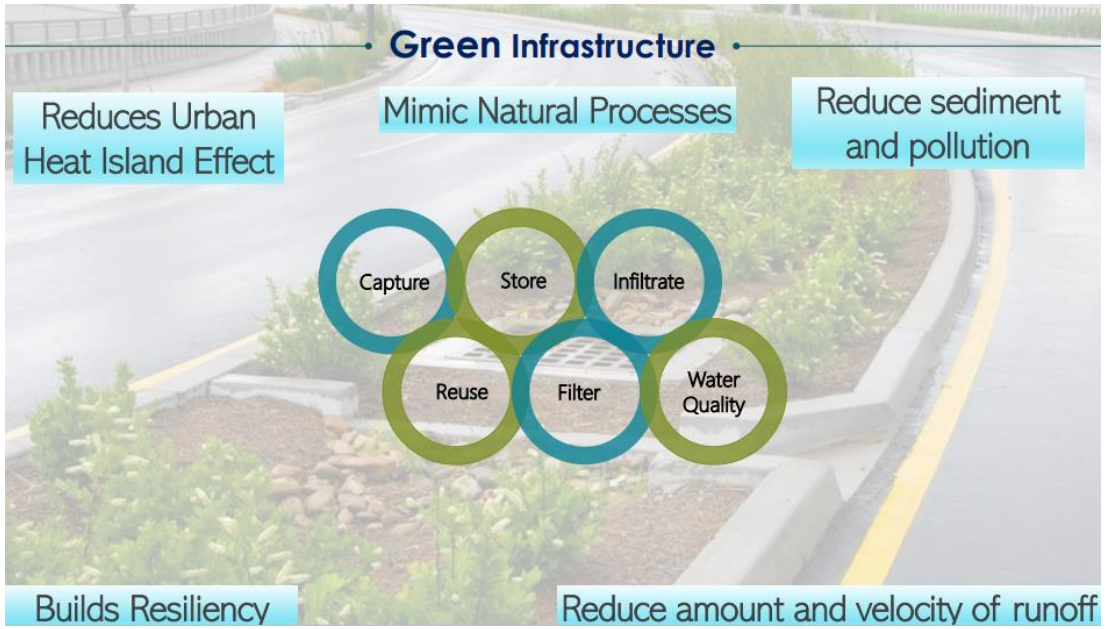
Underground stormwater storage is an alternative to stormwater basins, due to their limited footprint, underground storage can intercept stormwater runoff, extend detention time and provide relief to the storm sewer system. New technology offers traffic load rating capacities and permeable surfaces that can be accommodated in parking lots, sidewalks, and roads.



Community Engagement

- Flooding major concern for communities.
- Changing climate can compound the issue with heavy rainfall, rapid melting snow or ice jams that can push rivers and streams rapidly to major flooding.
- Flooding can happen anywhere!
- What can we do to minimize flood risk?

Green Infrastructure



Green Infrastructure

Bioswales

- Linear features that convey and treat stormwater runoff along roadsides, parking lots or other impervious areas.
- Slight slope and a drainage outlet to facilitate flow of water.
- Planted with grasses, shrubs or trees.
- Enhance the aesthetic and ecological value of the landscape.

Rain Gardens

- Shallow, landscaped depressions that collect and absorb stormwater from roofs, driveways and other impervious areas.
- Reduce runoff by allowing water to infiltrate into the soil, where it is filtered by plants and microorganisms and replenish groundwater.
- Planted with native vegetation that can tolerate dry or wet conditions

What Can Residents Do?

- Remove snow, ice, and debris from storm sewer inlets
- Rake leaves so they don't wash down the roads
- Property Drainage Improvements
- Adopt a Drain
- Green Infrastructure

Breakout Session

- ❑ Have you experienced flooding issues?
- ❑ What steps have you taken?
- ❑ What are the barriers?
- ❑ What would you like to know from the City?
- ❑ Comment Cards Available

Benefits

ENVIRONMENTAL

Pollution Control
Water Quality
Recreational Opportunities

SOCIAL

Public Waters
Community Engagement
Education & Training

ECONOMIC

Property Value
Utilities Pricing
Business Investment

Funding

SEH developed an in-depth funding matrix to further the City's ability to secure funding for the implementation of critical projects.

By aligning projects with the most suitable funding opportunities, the City is positioned to maximize funding, ensuring the implementation of critical infrastructure improvements.

Program	Agency	Program Description	URL	Amount/Matching
Capital Bonding	MMB	Publicly owned infrastucture, facilities, sites	https://mn.gov/mmb/budget/capital-budget/	50% match required. No minimum or maximum
Building Resilient Infrastructure and Communities (BRIC)	FEMA	Hazard mitigation projects to make communities more resilient to flooding, wild fires, tornadoes, hurricanes, drought, sea level rise, and earthquakes	https://www.fema.gov/grants/mitigation/building-resilient-infrastructure-communities	25% non-federal match required
Hazard Mitigation Grant Program	FEMA	Hazard mitigation projects to make communities more resilient to flooding, wild fires, tornadoes, hurricanes, drought, sea level rise, and earthquakes	https://www.fema.gov/grants/mitigation/hazard-mitigation	25% non-federal match required
Community planning grants for stormwater, wastewater, and community resilience	MPCA	Climate-planning projects to help communities be more resilient to climate change.	https://www.pca.state.mn.us/grants-and-loans/community-planning-grants-for-stormwater-wastewater-and-community-resilience	10% match required, may include in-kind match
Point Source Implementation Grant (PSIG)	PFA	Project must meet eligibility criteria found at link.	https://mn.gov/deed/pfa/funds-programs/point-source-grants.jsp	Grant for up to 80% of project cost, maximum $7 million
Army Corps of Engineers - 569 Program	USACE	Design and construction assistance for water-related environmental infrastructure and resource protection and development projects.	https://www.mvp.usace.army.mil/Home/Projects/Article/571011/environmental-infrastructure-assistance-section-569-northeastern-minnesota/	Typically $1M-$2M
Board of Water and Soil Resources Clean Water Fund	BWSR	Water quality issues	https://bwsr.state.mn.us/grants	25% match
Legislative-Citizens Committee on Minnesota Resources (LCCMR)	LCCMR	Funding for projects that protect, conserve, preserve, and enhance Minnesota's air, water, land, fish, wildlife, and other natural resources.	https://www.lccmr.mn.gov/	Local unit of government is eligible. No match required but those with a match score higher. No maximum award but usually in the $1,000,000 range
Clean Water Revolving Fund	PFA	Below-market rate financing	https://mn.gov/deed/pfa/funds-programs/cleanwaterrevolvingfund.jsp	
Sustain Our Great Lakes	NFWF	Funding to improve and enhance: 1) stream, riparian and coastal habitats; 2) water quality in the Great Lakes and its tributaries (Program priorities include: Expanding Green Stormwater Infrastructure in Great Lakes Communities)	https://www.nfwf.org/sustain-our-great-lakes-2022-request-proposals	$11.2 million available $1.36 m for project in Wisconsin's Lake Michigan watershed which Restore and Preserve Natural Areas and Biodiversity
Water Infrastructure Improvements for the Nation (WIIN) Act	EPA	This grant program was designed to assist small public water systems in complying with Safe Drinking Water Act (SDWA) requirements. The Wisconsin DNR has been appropriated $722,000 in grant monies to provide financial assistance to any qualifying other-than-municipal community and not-for-profit nontransient	https://www.epa.gov/dwcapacity/water-infrastructure-improvements-nation-act-wiin-act-grant-programs	45% funding match

Next Steps

1. Implementation of projects & recommendations

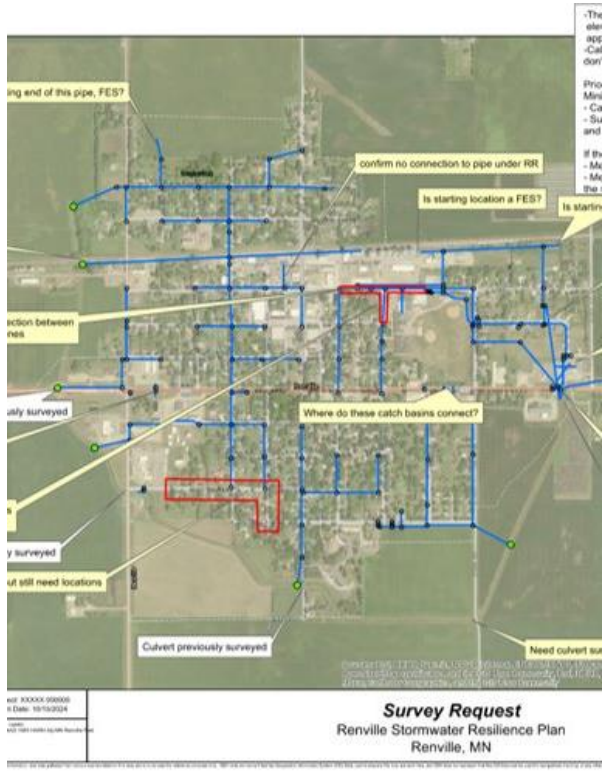
West Superior Street reconstruction - Currently under design

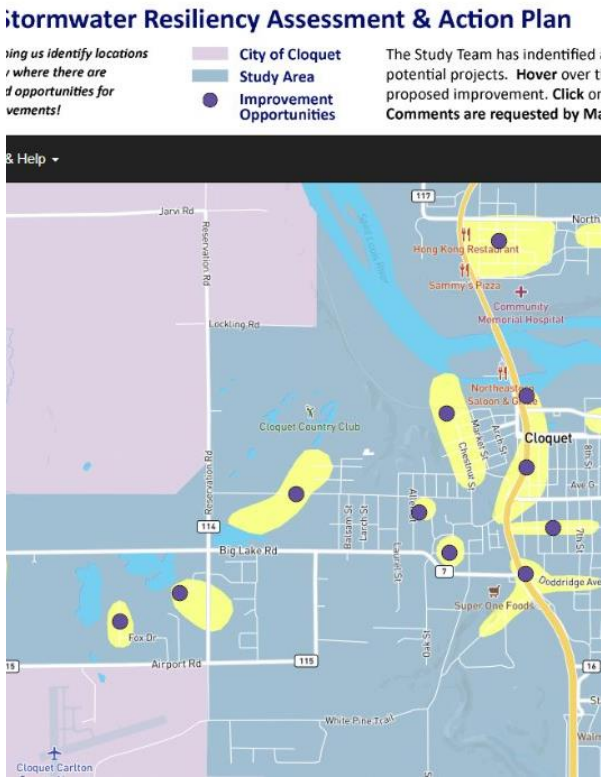
32nd Ave. West Watershed – Gray infrastructure improvements to increase SW capture 2M

Storm basin retrofit & water quality improvements – 5M

2. Additional watershed studies based on the prioritization matrix

MPCA Planning Grants for Stormwater, Wastewater and Community (SWC) Resilience





How can SEH help you secure funding?

- EXPERIENCE WITH STORMWATER MODELING TOOLS THAT IDENTIFY LOCALIZED FLOOD RISK
- \+
- EXPERIENCE PLANNING PROJECTS THAT INCREASE RESILIENCE TO FLOODING
- \+
- ABILITY TO SIMULATE CLIMATE CHANGE IMPACTS, SPECIFICALLY INCREASED RAINFALL
- \+
- DETAILED AND UP-TO-DATE CONSTRUCTION COST ESTIMATES
- =

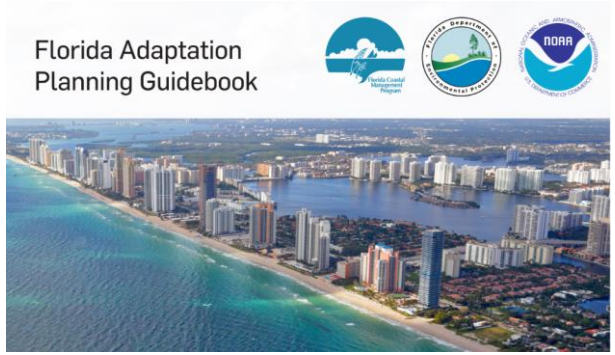
STATE OF FLORIDA

DEPARTMENT OF ENVIRONMENTAL PROTECTION

GRANT WORK PLAN

Comprehensive Vulnerability Assessment

Town of Lee
Madison County



Florida Water Environment Association

wef Member Association

Questions

aulschmid@sehinc.com

Duluth Stormwater Management and Resiliency Plan (sehinc.com)

SEH

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