

City of Joliet, Illinois

Eight Year Water Distribution System Rehabilitation and Lead Water Service Line Replacement Program



Prepared by:

BAXTER & WOODMAN
Consulting Engineers

www.baxterwoodman.com

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1. STUDY PURPOSE AND SCOPE

The City of Joliet, Illinois seeks to utilize funding from the Public Water Supply Loan Program (PWSLP) to replace deteriorated and undersized water mains and replace lead service lines within the City water distribution system. The purpose of this study is to provide the necessary background information and analysis to comply with Illinois Administrative Code 35 Section 662.320, which will allow for the funding agency to evaluate the merit of the proposed projects.

2. BACKGROUND INFORMATION

2.1 Introduction and Project Description

The subject projects are located in the City of Joliet, Illinois, in Will County and Kendall County. A location map is attached as Exhibit 1. The City proposes to replace and rehabilitate an average of 21 miles of existing water main annually each year over an eight-year span, targeting 3.2% of the system annually. Lead service lines will also be replaced as part of the water main replacement. The City is planning to switch water sources from the deep aquifer to Lake Michigan by May 2030. Replacing 3.2% of the system annually will achieve a non-revenue water (NRW) percentage of 9.7% by 2030, meeting the Lake Michigan Allocation permit requirement of a NRW percentage of below 10%.

2.2 Location

The City of Joliet is located in Will County and Kendall County in northeastern Illinois. The City is 40 miles southwest of Chicago. A location map is attached as Exhibit 1. The City's corporate limits occupy approximately 62.77 square miles.

2.3 Population Projections

In 2020 the City of Joliet had a population of 150,362 persons. CMAP's 2050 population projections for the City are 206,995 persons. The population increase in the 40 years from the 2010 census to the 2050 projections is 28.8%. This represents an annual increase of 0.72%.

3. EXISTING AND PROJECTED WATER USAGE

3.1 Existing Water Usage

The City operates a public water supply system serving a population of approximately 150,362 residents plus commercial, industrial, and institutional customers. The average daily water consumption for 2018 within the City was approximately 19 MGD with a peak maximum daily demand of approximately 22.436 MGD occurring in August 2018.

3.2 Projected Water Usage

The projected population increase of 206,995 persons by 2050 correlates to a calculated average daily water consumption of 27.14 MGD and a maximum daily demand of 33.75 MGD in 2050. These water consumption projections were determined using the Chicago Metropolitan Agency for Planning (CMAP) population projections and previous water use trends.

4. EXISTING WATER SYSTEM

4.1 Water Supply

The City's existing water supply comes from 21 deep wells and five shallow wells. A summary of the physical features of each well is provided in Table 1.

TABLE 1
Summary of Physical Features of Existing Wells

Well Name	Year Drilled	Depth (ft)	Capacity (gpm)	Well Type	Well House
Well 5D	1951	1,609	±1,000	Dolomite Rock	Yes
Well 10D	1970	1,487	985	Dolomite Rock	Yes
Well 11D	1975	1,623	790	Dolomite Rock	Yes
Well 12D	1975	1,557	870	Dolomite Rock	Yes
Well 15D	1997	1,566	1,100	Dolomite Rock	Yes
Well 16D	1998	1,566	965	Dolomite Rock	Yes
Well 17D	2000	1,525	1,216	Dolomite Rock	Yes
Well 18D	2000	1,460	1,000	Dolomite Rock	Yes
Well 20D	2003	1,556	1,200	Dolomite Rock	Yes
Well 21D	2003	1,555	1,200	Dolomite Rock	Yes
Well 22D	2005	1,618	1,000	Dolomite Rock	Yes
Well 23D	2005	1,655	1,000	Dolomite Rock	Yes
Well 24D	2006	1,663	1,000	Dolomite Rock	Yes
Well 25D	2005	1,533	±1,000	Dolomite Rock	Yes
Well 27D	2006	1,523	±1,000	Dolomite Rock	Yes
Well 28D	2006	1,554	±1,000	Dolomite Rock	Yes
Well 29D	2010	1,548	±1,000	Dolomite Rock	Yes
Well 30D	2011	1,635	±1,000	Dolomite Rock	Yes
Rock Well R1	1951	1,660	875	Dolomite Rock	Yes
Rock Well R2	1951	1,700	980	Dolomite Rock	Yes
Rock Well R3	1951	1,640	865	Dolomite Rock	Yes
Gravel 101	2006	127	±500	Gravel	No
Gravel 102	2005	100	±500	Gravel	No
Gravel 103	2006	85	±500	Gravel	No
Gravel 104	2005	100	±500	Gravel	No
Gravel 105	2005	95	±500	Gravel	No

4.2 Water Treatment

The City has 11 water treatment plants (WTPs), which were constructed between 2005 and 2010, to remove naturally occurring radium found in the City's groundwater. The 11 WTPs are capable of treating 34.6 MGD. An additional 1.4 MGD could be treated by adding an eighth Hydrous Manganese Oxide (HMO) filter vessel to the Black Road WTP. A summary of the physical characteristics of each WTP is presented in Table 2.

TABLE 2
Summary of Physical Features of Water Treatment Plants

Treatment Plant Name	Capacity MGD	Source	No. of Filter Vessels
Washington Street WTP	1.4	5D	1
Fairmont and Garvin WTP	8.6	R1, R2, R3, 24D, 101, 102, 103, 104, 105	6
WTP 30D	1.4	30D	1
WTP 10D	2.9	10D, 22D	2
WTP 11D	2.9	11D, 23D	2
WTP 12D	1.4	12D	1
WTP 15D	1.4	15D	1
WTP 16D	1.4	16D	1
WTP 18D	1.4	18D	1
WTP 29D	1.4	29D	1
Black Road WTP	8.6	17D, 20D, 21D, 25D, 27D, 28D	7

4.3 Water Storage

The City currently provides 16.5 MG of storage with four reservoirs, five elevated tanks, and one standpipe. Constructed between 1956 and 2006, the reservoirs provide a total of 9.0 MG of storage. The tanks and standpipe were constructed between 1997 and 2009 and provide 7.5 MG of storage. The locations, capacities, and overflow elevations are summarized in Table 3.

TABLE 3
Summary of Physical Features of Water Storage Facilities

Name	Zone	Capacity MGD	Type	Overflow Elevation
Essington Reservoir 10D	High	2.0	Below-grade concrete	607
Ingalls Reservoir 11D	High	2.0	Below-grade concrete	618
Prairie and Campbell Reservoir	High	1.0	Below-grade concrete	663
Fairmont and Garvin Reservoir	Ridgewood/ Low	4.0	Torospherical Roof Ground Level Steel	690

Name	Zone	Capacity MGD	Type	Overflow Elevation
Ridge Road Standpipe	High	3.0	Ellipsoidal Roof Standpipe	774
Rock Run Water Tower	High	0.5	Spheroid	772
Louis Joliet Mall Water Tower	High	1.0	Spheroid	772
Campbell Street Water Tower	High	1.0	Torospherical Vertical Shell Multi-leg	772
Parkwood Water Tower	Ridgewood	1.0	Spheroid	790
Laraway Road Water Tower	Southeast	1.0	Double Ellipsoidal Multi-leg	772

4.4 Water Distribution System

The City maintains a water distribution system with pipes ranging in size from 2 inches up to 24 inches in diameter. The distribution system contains approximately 665 lineal miles of water main. The system ranges in installation decade from 1890 to 2010. Approximately 60% of the water main system was installed in the 1990s and on. A breakdown of system age is shown in Table 4. A map of the City's water system showing installation decade is included in Exhibit 2.

TABLE 4
Water System Age

Decade of Installation	Length of WM (Miles)	Water Main Length (%)
1890	7.6	1.1%
1900	28.1	4.2%
1910	18.0	2.7%
1920	20.5	3.1%
1930	3.6	0.5%
1940	42.9	6.4%
1950	37.0	5.6%
1960	34.6	5.2%
1970	49.3	7.4%
1980	23.8	3.6%
1990	145.1	21.8%
2000	188.6	28.4%
2010	66.0	9.9%
Total	665.1	100%

The City experiences, on average, 276 water main breaks per year (using a break record from 2013-2020). The average rate is approximately 41.4 breaks per 100 miles of main. The American Water Works Association (Distribution System Performance Evaluation, 1995) (AWWA) recommends a utility should be willing to tolerate a maximum of 25 or fewer breaks per 100 miles of water main per year. The majority of the main breaks occur on the existing water mains that were installed in the 1940s-1960s. While these mains only make up 19% of the total water main system, 62% of breaks occurred on these mains. These breaks have a significant impact on the City's expenses because the City not only pays for the labor, equipment and materials to make the repairs, but also must pay for the water that is lost. Water main breaks result in lower water quality, decreased capacity in the distribution system, wasted water resources, a risk to the crews that must repair them, an inconvenience to the public that relies on a consistent water supply, and potentially long term damage to the surrounding areas.

In 2019, non-revenue water (NRW) loss in the system was 34.9%. Although there are currently no NRW regulatory requirements for the City, in September 2020, the City worked with Stantec Inc. and Crawford, Murphy, and Tilly Inc. to prepare a plan to reduce NRW to meet the Lake Michigan Allocation permit requirement of NRW below 10% by 2030. The memo detailing this plan is included as Appendix D.

The NRW percentage is determined by adding the apparent water losses (water theft, meter inaccuracies), real water losses (physical losses from breaks and storage tanks), and the unbilled authorized consumption of water (fire hydrant flushing, water treatment plant water usage, municipal building water use, etc.). To reduce NRW, the City committed to reducing the real water losses in the system by increasing the water main replacement rate to 3.2% of the system per year.

While determining a real water loss reduction strategy, a main break analysis was performed. It was noted that a majority of breaks occurred in cast iron/ductile iron pipes that were installed pre-1970. Pipes installed in the 1940s to the 1960s make up 19% of the City's water main system, yet 62% of the total breaks occur on these mains. Exhibit C: "2013 - 2018 Water Main Breaks & Breaks Per 100 Miles" in the NRW Reduction Strategy Memo provides a breakdown of the City's water main break rate per 100 miles of main. The break rate increases pre-1970 and then dramatically drops in the 1970s main and after. Replacement of mains will reduce the overall average water main break rate of 41.4 breaks per 100 miles closer to the AWWA standard of 25 breaks per 100 miles. Therefore, the City's replacement program focuses on replacing mains installed pre-1970.

The City is continually updating its water service line material inventory. As of 2020, the City had a total of 49,681 connections, of which 1,072 were identified as lead and 16,851 were unknown.

4.5 Existing and Future Regulations

The existing facilities are currently in compliance with all existing applicable laws and regulations. The proposed improvements will be designed in accordance with 35 IL Administrative Code 651 through 654 and are intended to ensure the water distribution system remains in compliance.

The Lead Service Line Replacement and Notification Act was signed into law this year (2021). The new law requires Illinois water utilities to replace all lead service lines and creates a low-income water assistance program (the Lead Service Line Replacement Fund) to help fund financial assistance and water projects that include lead pipe replacement. This fund will be used to distribute state grants to municipalities and other community water suppliers to offset costs associated with lead service line replacement.

The legislation requires that community water suppliers provide a material inventory of all lead service lines in the water distribution system, whether they are suspected, known or unknown by April 15, 2024. The Act also creates a replacement schedule for all community water suppliers as well as notice requirements and other provisions. The law becomes effective on January 1, 2022. The City is actively replacing lead service lines throughout the system and has an interactive lead service line inventory map available on the City website, along with educational materials for residents.

5. PROPOSED IMPROVEMENTS

5.1 Basis for Design and Project Compliance

Rehabilitation techniques such as traditional open cut replacement, horizontal directional drilling, and water main lining were evaluated for cost-effectiveness and suitability for the project locations. Based on a review of the conditions, sizes, and ages of existing pipes, it was determined that traditional open-cut replacement would be the most feasible and cost-effective means to improve fire flow and reduce water main breakage for the majority of the water main improvement projects. Lining was recommended for water main rehabilitation projects with limited service line connections and not requiring an increase in pipe size.

The improvements identified will improve fire flow rates, improve water quality, reduce water main breaks, reduce water loss, and reduce headloss through the pipes. A decrease in water main breaks will improve water quality by keeping out contaminants and reducing water loss. Detailed descriptions of each project are included as Appendix A. Locations of the improvements are shown in Exhibit 3 through Exhibit 11.

5.2 Lead Service Line Replacement Compliance

As part of the water main replacement, the City intends to replace any known lead service lines and any discovered during construction. The City will replace the full service line, on the public side and the private side, from the water main to the interior shut-off valve. The lead service lines will be designed in accordance with 35 IL Administrative Code 651 through 654 and AWWA/ANSI Standard C810-17 "Replacement and Flushing of Lead Service Lines." The areas where lead service lines are suspected are shown in Exhibit 12.

6. ENVIRONMENTAL IMPACTS

We contacted several agencies to request sign-offs for the projects.

- Illinois Department of Natural Resources (IDNR), State Historic Preservation Office (SHPO)
- IDNR Impact Assessment Section (IAS)

The project may include crossing rivers and creeks. If crossings are required, we will contact the U.S. Army Corps of Engineers (USACE) when detailed plans are available for the USACE to review. Crossings will be designed as trenchless or directional drilling to minimize environmental impacts.

This project does not involve the conversion of prime agricultural land to other uses, nor does it include reserve capacity for future growth.

The projects include water main replacement, and no new construction in undeveloped natural areas. We did not consult with federally recognized Indian tribes.

The proposed projects are located in dedicated roadway right-of-way and easements. Temporary environmental impacts of the construction include increased noise and reduced air quality due to dust and exhaust from internal combustion construction equipment. Once construction is completed, and the system is operational, the proposed projects will not have any adverse air quality impacts. Construction impacts on the environment will be minimized by erosion control measures, including silt fences, inlet filter protection, and excelsior blanketing. The majority of water main installation will be within the limits of existing pavement, so minimal vegetation and green space will be affected during construction.

Construction will occur in previously dedicated right-of-way and existing easements disturbed by open-cut construction in the past. A review performed by the Illinois State Historic Preservation Office determined there are no archeological or historical remains within the project area. IDNR conducted a wetland review during the EcoCAT consultation, and it was determined that, though the Illinois Wetlands Inventory showed wetlands within 250 feet of a project location, adverse effects are unlikely.

There are no known specific adverse impacts on floodplains and wetlands, threatened and endangered species of plants and animals, or archaeological-historic-cultural resources. A copy of the Environmental Signoff checklist and signoffs from IDNR-SHPO and IDNR-IAS are included with this report as Appendix B.

7. IMPLEMENTATION PLAN

7.1 Project Schedules

The proposed schedule for this project anticipates IEPA Project planning approval in March 2022. The proposed construction schedule for this project is shown in Table 5 below.

TABLE 5
Proposed Construction Schedule

Construction Year	Construction Documents Complete	Bidding	Construction
2023	October 2022	December 2022	March 2023
2024	October 2023	December 2023	March 2024
2025	October 2024	December 2024	March 2025
2026	October 2025	December 2025	March 2026
2027	October 2026	December 2026	March 2027
2028	October 2027	December 2027	March 2028
2029	October 2028	December 2028	March 2029
2030	October 2029	December 2029	March 2030

7.2 Project Costs

The engineer's estimate of probable construction cost for the eight-year water main replacement program is \$357,221,000. A breakdown of the total project cost by implementation year is summarized in Table 6. Detailed cost estimates are provided in Appendix A.

TABLE 6
Summary of Project Cost for Water Main Replacement

Construction Year	Estimated Construction Cost	Construction Contingency (10%)	Design Engineering	Construction Engineering	Total Estimated Cost
2023	\$31,630,000	\$3,163,000	\$1,265,000	\$1,265,000	\$37,323,000
2024	\$34,900,000	\$3,490,000	\$1,396,000	\$1,396,000	\$41,182,000
2025	\$39,700,000	\$3,970,000	\$1,588,000	\$1,588,000	\$46,846,000
2026	\$39,000,000	\$3,900,000	\$1,560,000	\$1,560,000	\$46,020,000
2027	\$46,800,000	\$4,680,000	\$1,872,000	\$1,872,000	\$55,224,000
2028	\$35,500,000	\$3,550,000	\$1,420,000	\$1,420,000	\$41,890,000
2029	\$39,800,000	\$3,980,000	\$1,592,000	\$1,592,000	\$46,964,000
2030	\$35,400,000	\$3,540,000	\$1,416,000	\$1,416,000	\$41,772,000
Total					\$357,221,000

As this program will be replacing the water main pipes that break most frequently, a substantial decrease in water main breaks is anticipated and thus this program will decrease O, M, & R costs to the City.

The City intends to replace any known lead service lines as well as any discovered during water main replacement. The City would like to fund the cost of lead service line replacement and maximize the amount of principal forgiveness from the LSLR Principal Forgiveness Fund. A breakdown of the project costs for the lead service line replacement projects is summarized in Table 7.

TABLE 7
Summary of Project Cost for Lead Service Line Replacement

Construction Year	Lead Service Construction Estimate	Construction Contingency (10%)	Design Engineering	Construction Engineering	Total Estimated Cost
2023	\$3,390,000	\$339,000	\$50,000	\$221,000	\$4,000,000
2024	\$3,390,000	\$339,000	\$50,000	\$221,000	\$4,000,000
2025	\$3,390,000	\$339,000	\$50,000	\$221,000	\$4,000,000
2026	\$3,390,000	\$339,000	\$50,000	\$221,000	\$4,000,000
2027	\$3,390,000	\$339,000	\$50,000	\$221,000	\$4,000,000
2028	\$3,390,000	\$339,000	\$50,000	\$221,000	\$4,000,000
2029	\$3,390,000	\$339,000	\$50,000	\$221,000	\$4,000,000
2030	\$3,390,000	\$339,000	\$50,000	\$221,000	\$4,000,000

8. EXISTING REVENUE SOURCES

Currently, customers with water service from the City receive a water bill that is made up of two charge components that are assessed to each customer. The components include a flat rate Monthly Charge of \$6.18 per month and a Water Rate Volume Charge of \$1.64 per 100 cubic feet for the first 200 cubic feet and then \$4.91 per 100 cubic feet for any usage over 200 cubic feet.

The City has reviewed its customer database and has found that the “average residential customer” can be generally categorized as a household that uses 5,050 gallons of water per month. The volume of 5,050 gallons equates to 675 cubic feet of water. Using that standard, the average customer’s monthly water bill is computed as follows:

• Monthly Charge:	\$6.18/month	= \$ 6.18
• Water Volume Charge:	\$1.64/100 CF x 200 CF	= \$ 3.28
• Water Volume Charge:	\$4.91/100 CF x 475 CF	= \$ 23.32

Total Current Average Monthly Water Bill	\$32.78
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It is important to note that the calculation above applies only to the average residential customer using 675 cubic feet (5,050 gallons) per month, and it cannot be strictly applied to all City customers. At this early stage of the project, a Water Rate Study has not been completed. A comprehensive rate analysis will be completed prior to the IEPA making a loan offer to the City to assess financing impacts on all City water customers. A copy of the current rate structure is provided as Appendix C.

9. FUNDING FOR LOAN REPAYMENT

9.1 Rate Increases

The City of Joliet plans to pay back the loans by increasing water rates. At the anticipated interest rate of 2% and assuming eight loans for water main replacement at an average of \$44.7 million per year amortized over 20 years and eight loans for LSLR with principal forgiveness of \$4,000,000 each year, the total annual loan repayment is approximately \$2,720,000 for each loan. As of 2021, the City has approximately 44,302 residential customers. Uniformly distributing the approximate loan repayment among these customers would result in a cost increase of \$472 per year or \$39 per month to the average customer's water bill, for an average bill of \$72.10 per month in 2030. This represents a 120% increase in the average customer's water bill. The minimum required rate increases are calculated assuming the number of customers increases at the same rate as the population (0.72% per year as described in Section 2) and the average per capita water use remains constant. See Table 8.

9.2 Water Infrastructure Finance and Innovation Act

The City of Joliet is in the process of applying for Water Infrastructure Finance and Innovation Act (WIFIA) funding that could fund up to 49% of the water main replacement project costs. The WIFIA funding is expected to be executed in the first quarter of 2022. To provide the City with maximum flexibility at this planning stage of the project, it is assumed that the water main replacement program will be funded entirely with SRF funding. The calculated repayment in Section 9.1 does not assume any funding from WIFIA. The funding nomination forms will be submitted annually and will take into account WIFIA funding if it is secured.

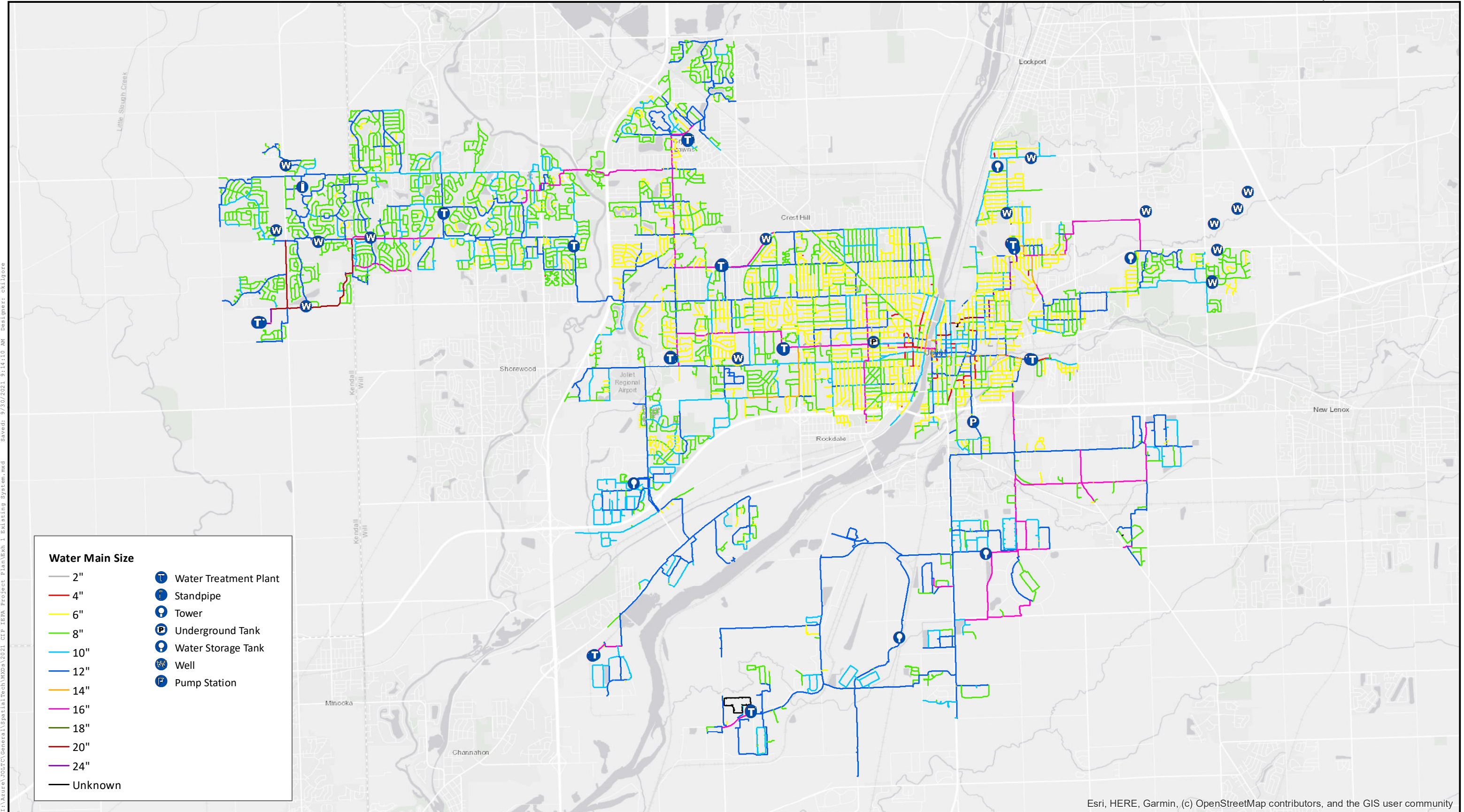
TABLE 8
Summary of Minimum Required Rate Increases

	2023	2024	2025	2026	2027	2028	2029	2030
Loan Amount	\$37,323,000	\$41,182,000	\$46,846,000	\$46,020,000	\$55,224,000	\$41,890,000	\$46,964,000	\$41,772,000
Loan Interest Rate	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%
Loan Term	20	20	20	20	20	20	20	20
Assume semi-annual payments	\$1,136,694	\$1,254,222	\$1,426,723	\$1,401,567	\$1,681,880	\$1,275,785	\$1,430,317	\$1,272,191
Annual loan payment	\$2,273,389	\$2,508,445	\$2,853,446	\$2,803,133	\$3,363,760	\$2,551,570	\$2,860,633	\$2,544,382
Monthly Debt Service Cost	\$189,449	\$209,037	\$237,787	\$233,594	\$280,313	\$212,631	\$238,386	\$212,032
Monthly Debt Service Cost	\$189,449	\$209,037	\$237,787	\$233,594	\$280,313	\$212,631	\$238,386	\$212,032
Number of households	44,942	45,266	45,592	45,920	46,251	46,584	46,919	47,257
Monthly Debt Service Cost per hh	\$4.22	\$4.62	\$5.22	\$5.09	\$6.06	\$4.56	\$5.08	\$4.49
Average usage per month, gal	5,050	5,050	5,050	5,050	5,050	5,050	5,050	5,050
Min req'd rate increase, \$/1,000 gal	\$0.83	\$0.91	\$1.03	\$1.01	\$1.20	\$0.90	\$1.01	\$0.89
Min req'd rate increase, \$/100 CF	\$0.62	\$0.68	\$0.77	\$0.75	\$0.90	\$0.68	\$0.75	\$0.66
Water Rate, per 100 CF (1st 200 CF)	\$1.64	\$2.26	\$2.95	\$3.72	\$4.47	\$5.37	\$6.05	\$6.80
Resulting water rate, per 100 CF	\$2.26	\$2.95	\$3.72	\$4.47	\$5.37	\$6.05	\$6.80	\$7.47
Water Rate, per 100 CF (over 200 CF)	\$4.91	\$5.53	\$6.22	\$6.99	\$7.74	\$8.64	\$9.32	\$10.07
Resulting water rate, per 100 CF	\$5.53	\$6.22	\$6.99	\$7.74	\$8.64	\$9.32	\$10.07	\$10.74
Fixed Fee	\$6.18	\$6.18	\$6.18	\$6.18	\$6.18	\$6.18	\$6.18	\$6.18
Average usage, CF	675	675	675	675	675	675	675	675
Fee for first 200 CF	\$4.53	\$5.90	\$7.44	\$8.95	\$10.74	\$12.10	\$13.60	\$14.93
Fee over 200 CF	\$26.29	\$29.54	\$33.21	\$36.79	\$41.05	\$44.26	\$47.84	\$50.99
Average Monthly Residential Bill	\$37.00	\$41.62	\$46.83	\$51.92	\$57.97	\$62.54	\$67.62	\$72.10

10. CONCLUSION

The City of Joliet seeks financial assistance from the Public Water Supply Loan Program to fund the Eight Year Water Distribution System Rehabilitation and Lead Water Service Line Replacement Program. The proposed projects comply with all applicable laws and regulations and will enhance the reliability and safety of the water distribution system by replacing lead water service lines and reducing the frequency of main breaks, resulting in non-revenue water less than 10% by 2030 as required by the City's Lake Michigan Allocation permit.

EXHIBITS

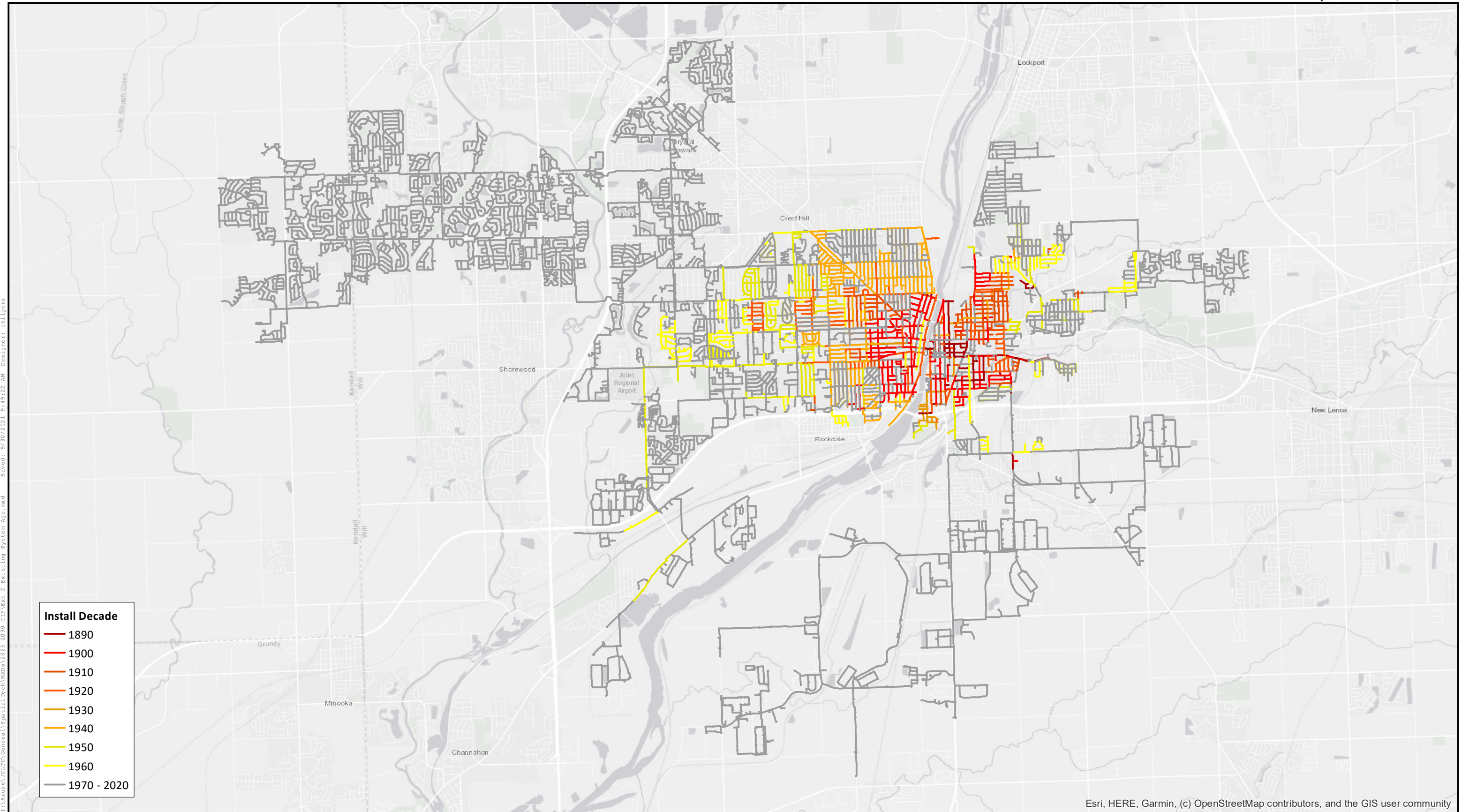


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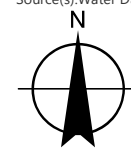
EXISTING SYSTEM AGE



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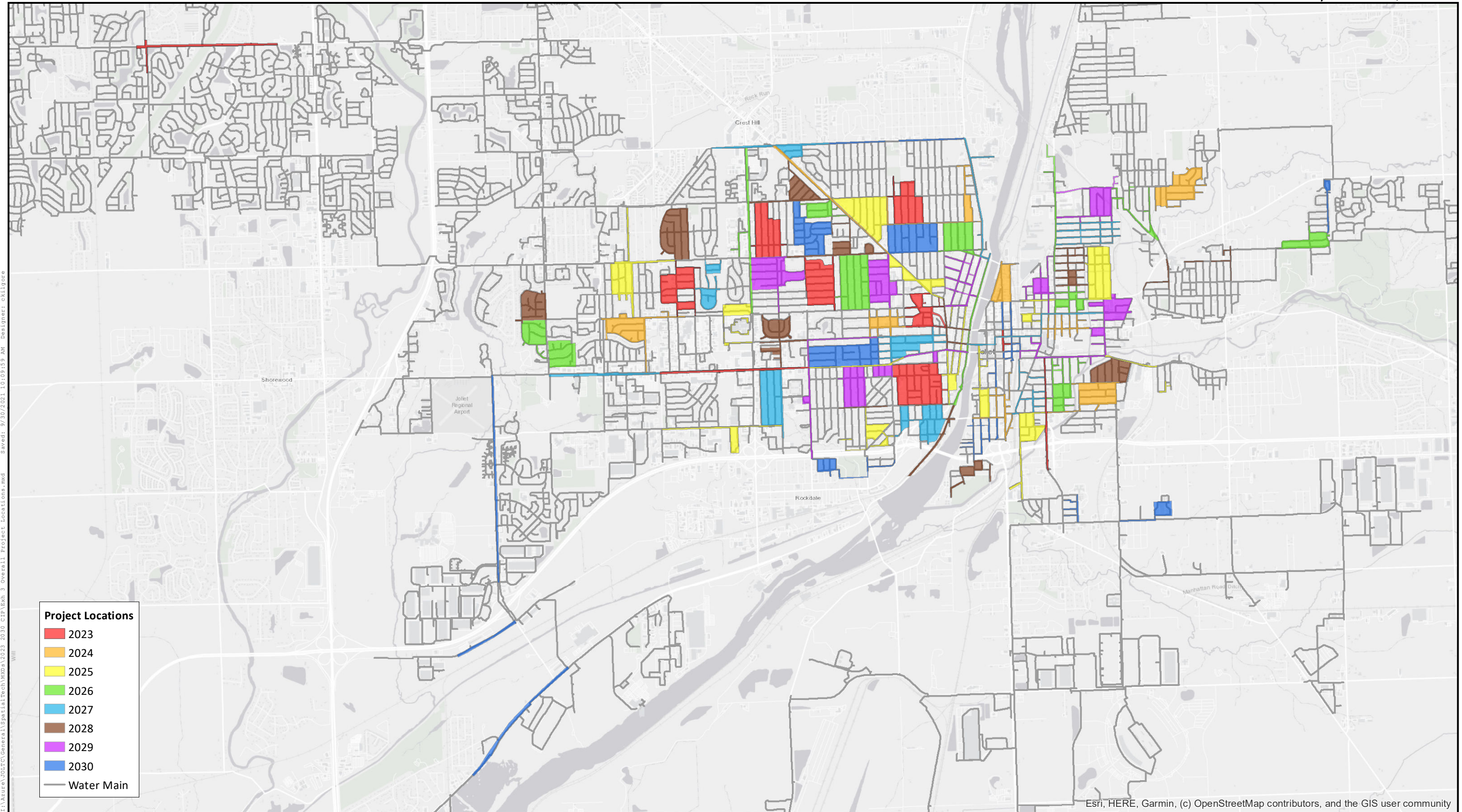
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Source(s): Water Data from Great Pyrenees Technology 9/4/2021.



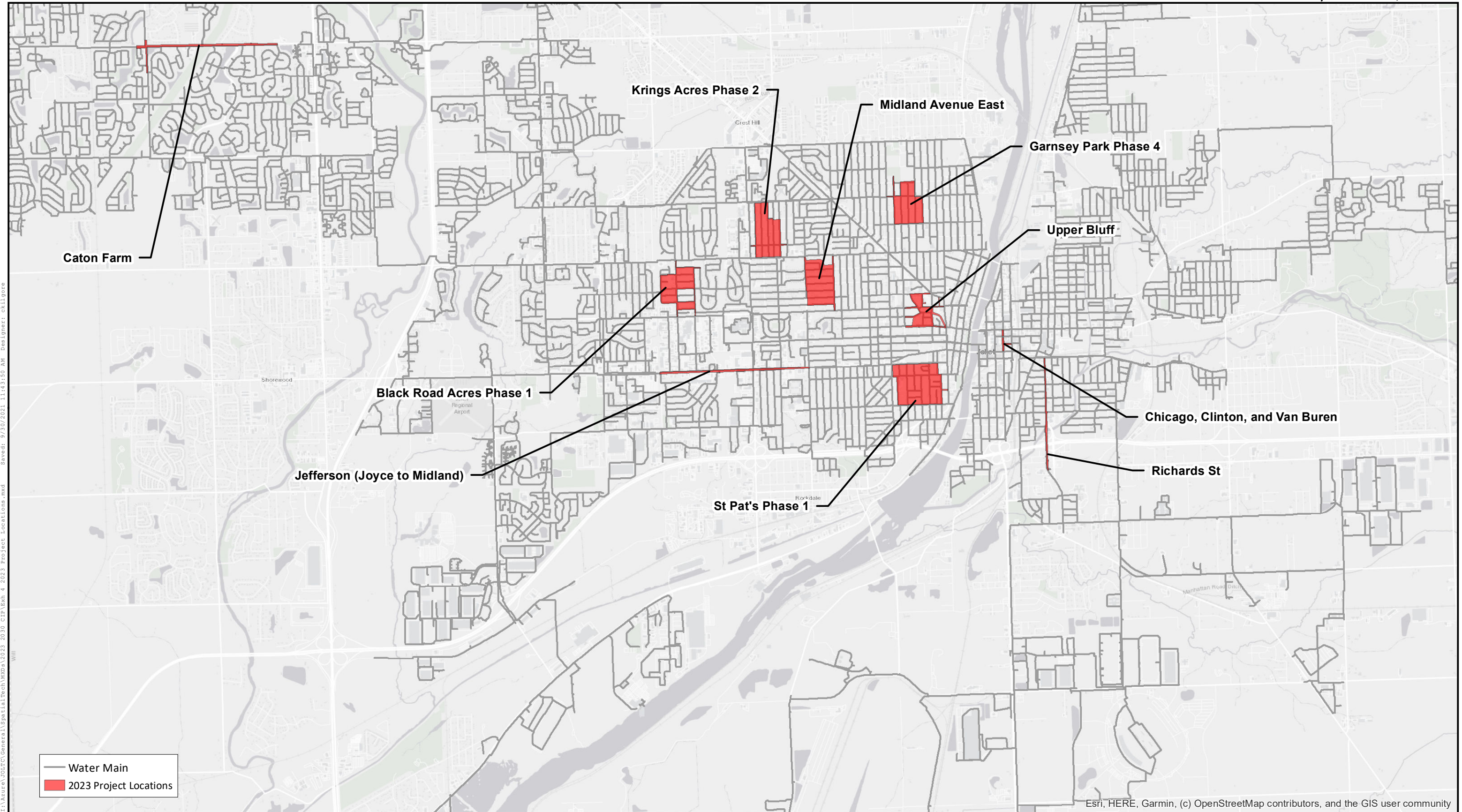
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OVERALL PROJECT LOCATIONS



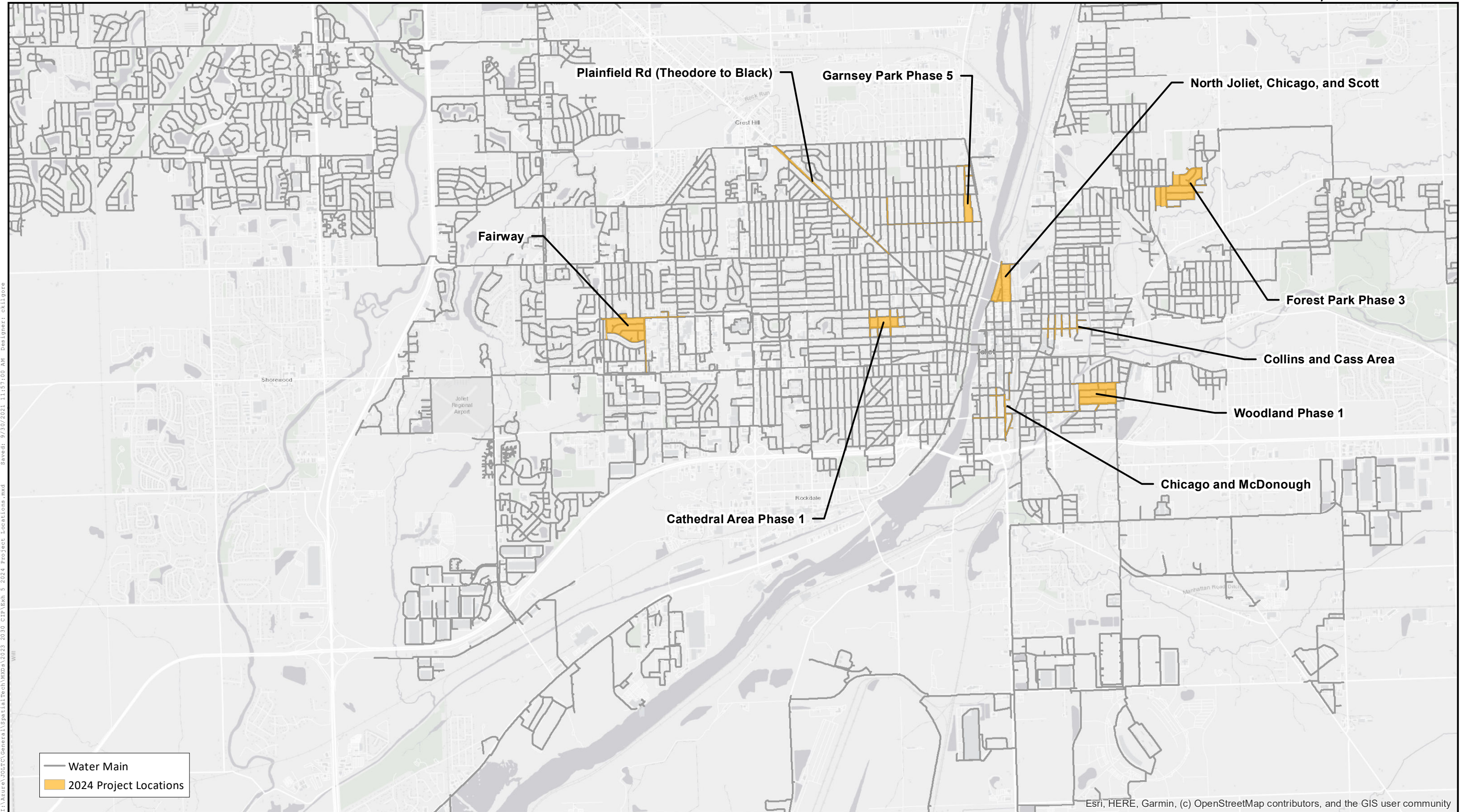
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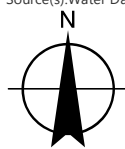


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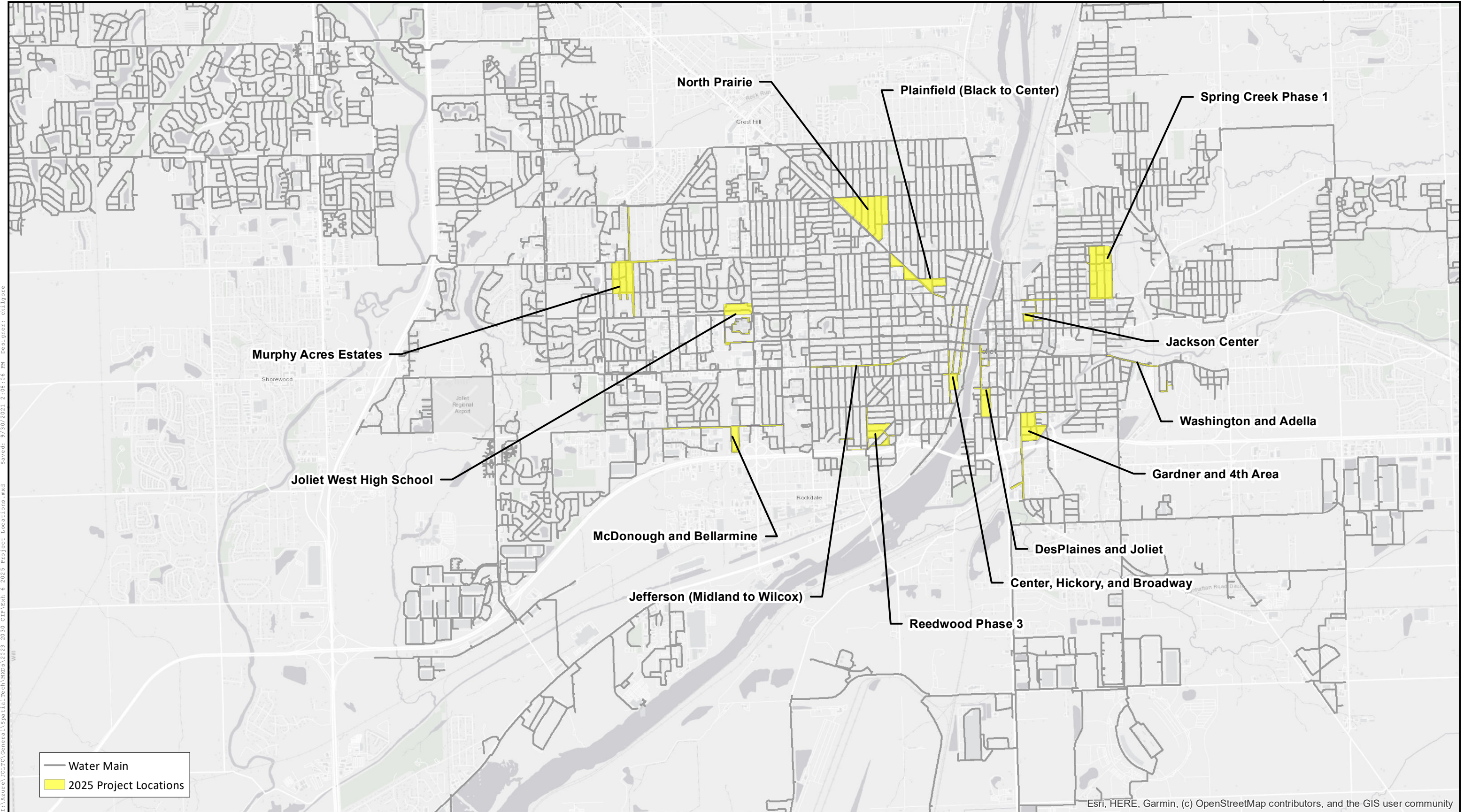




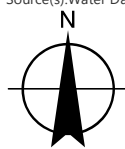
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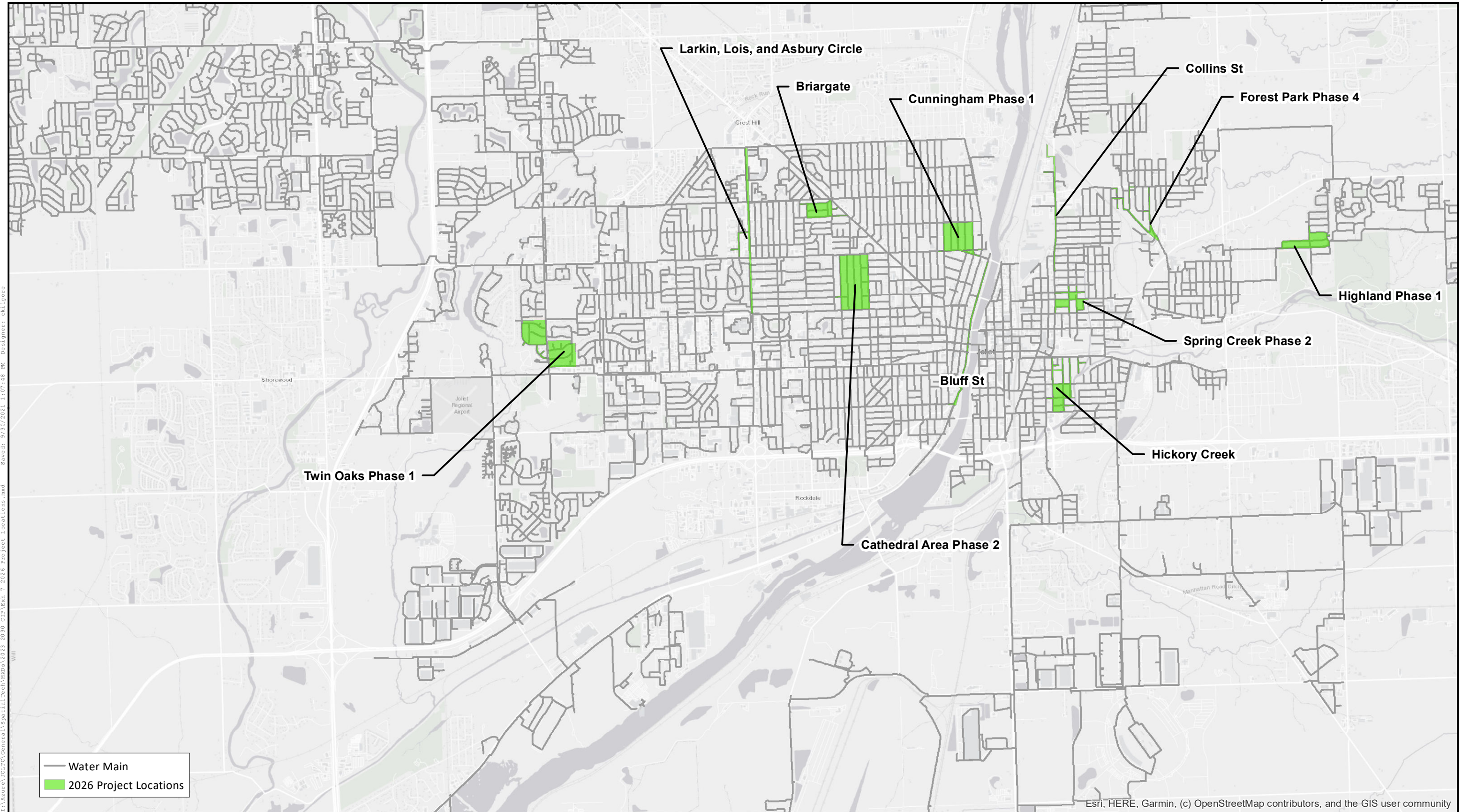


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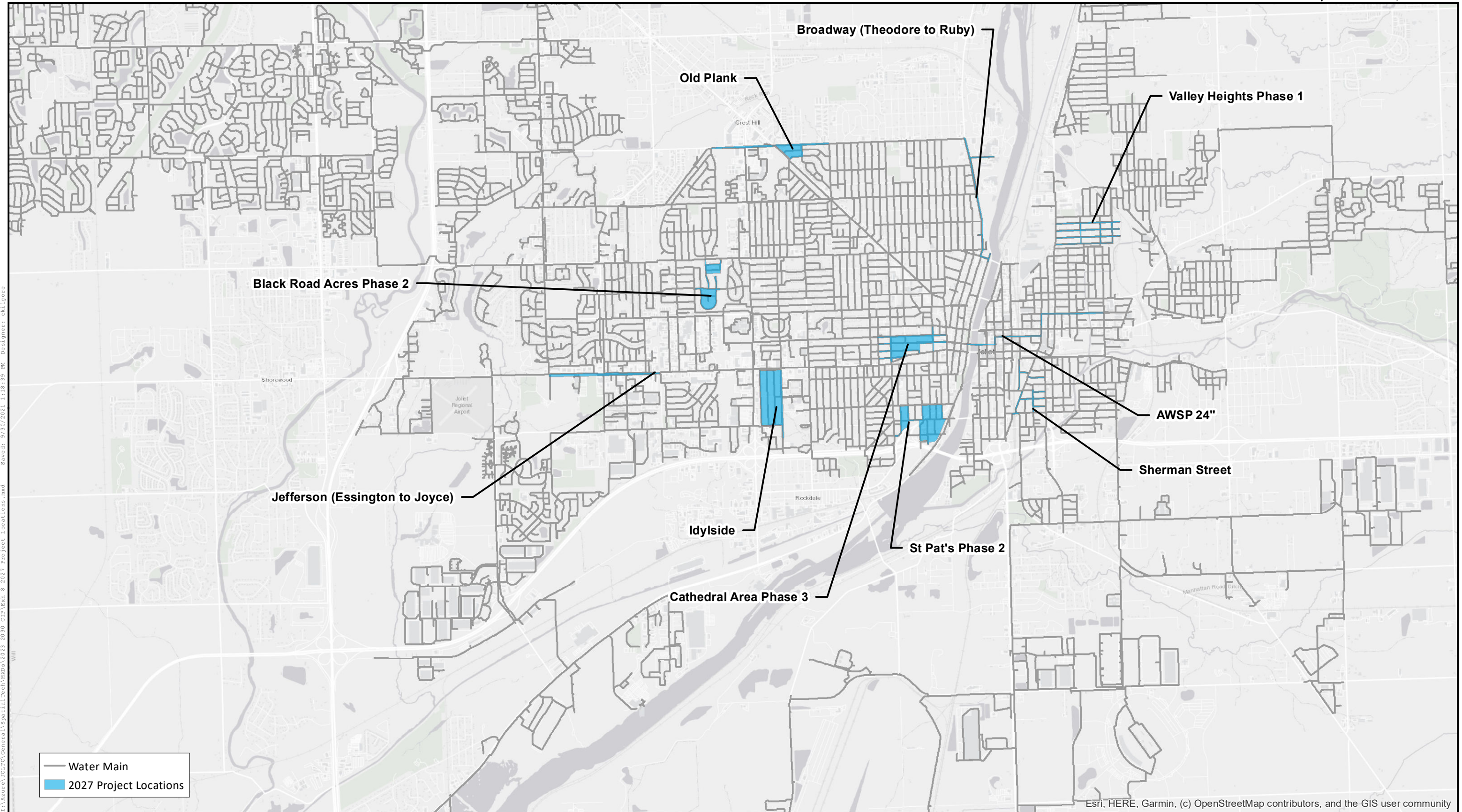
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2026 PROJECT LOCATIONS



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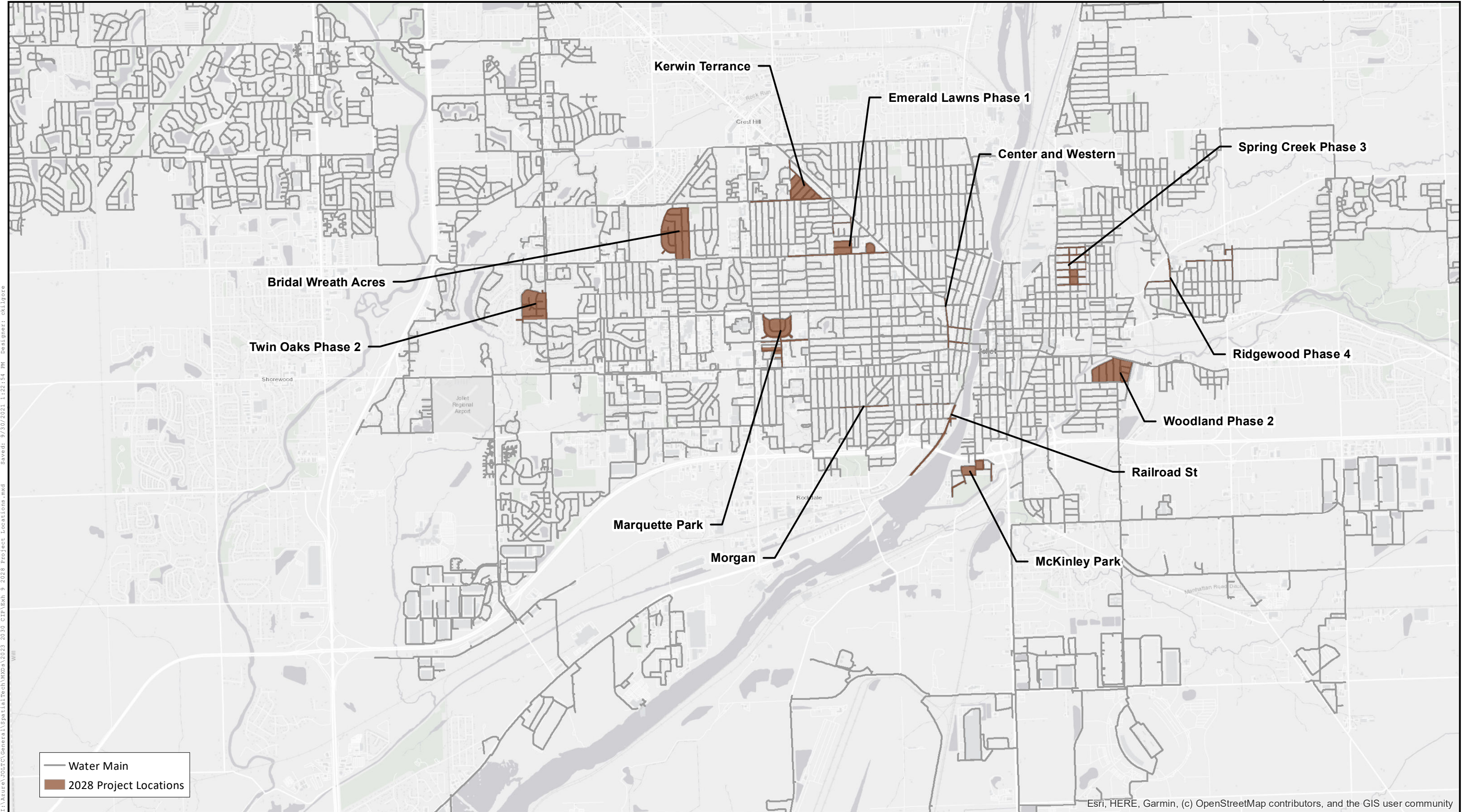




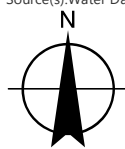
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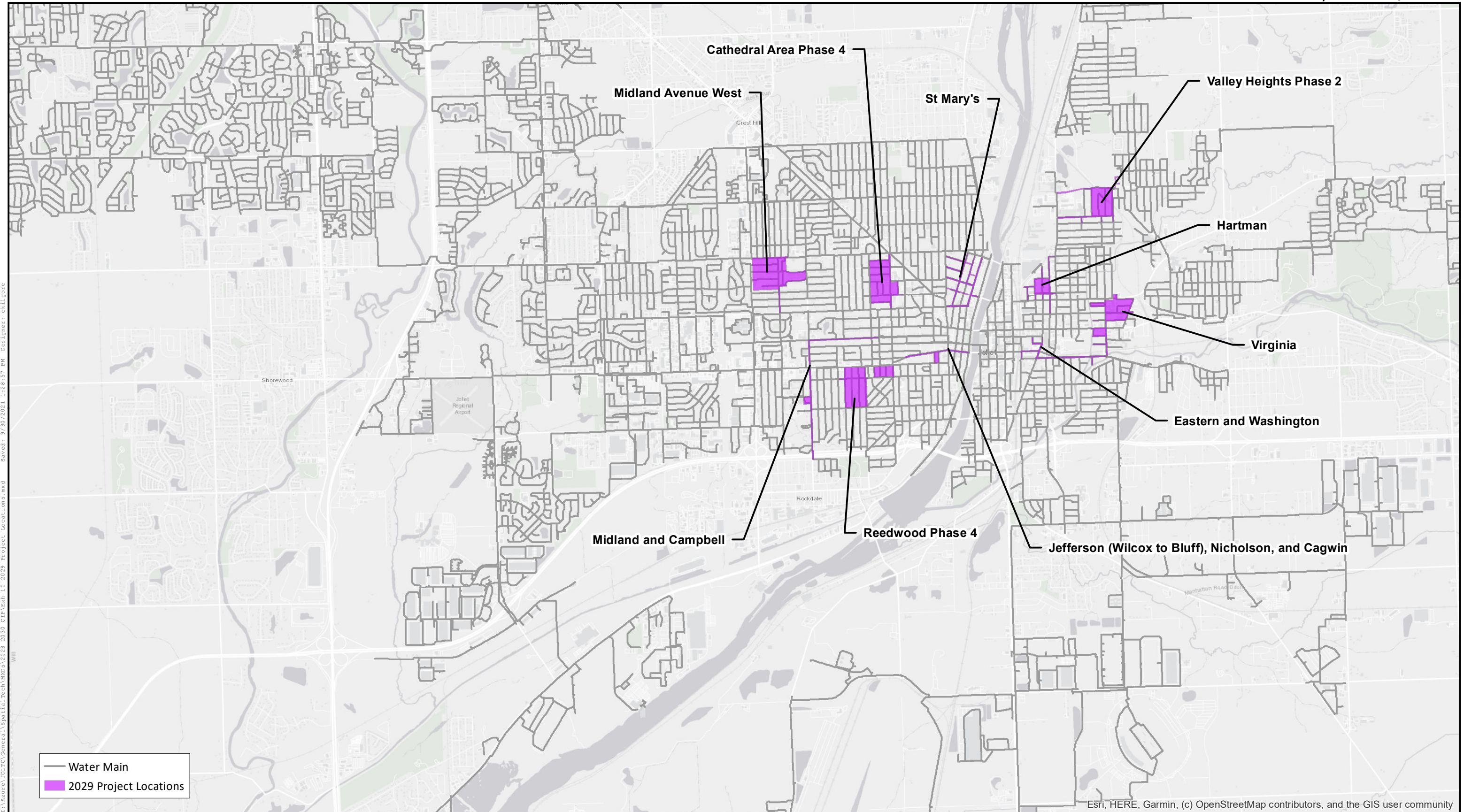
2028 PROJECT LOCATIONS



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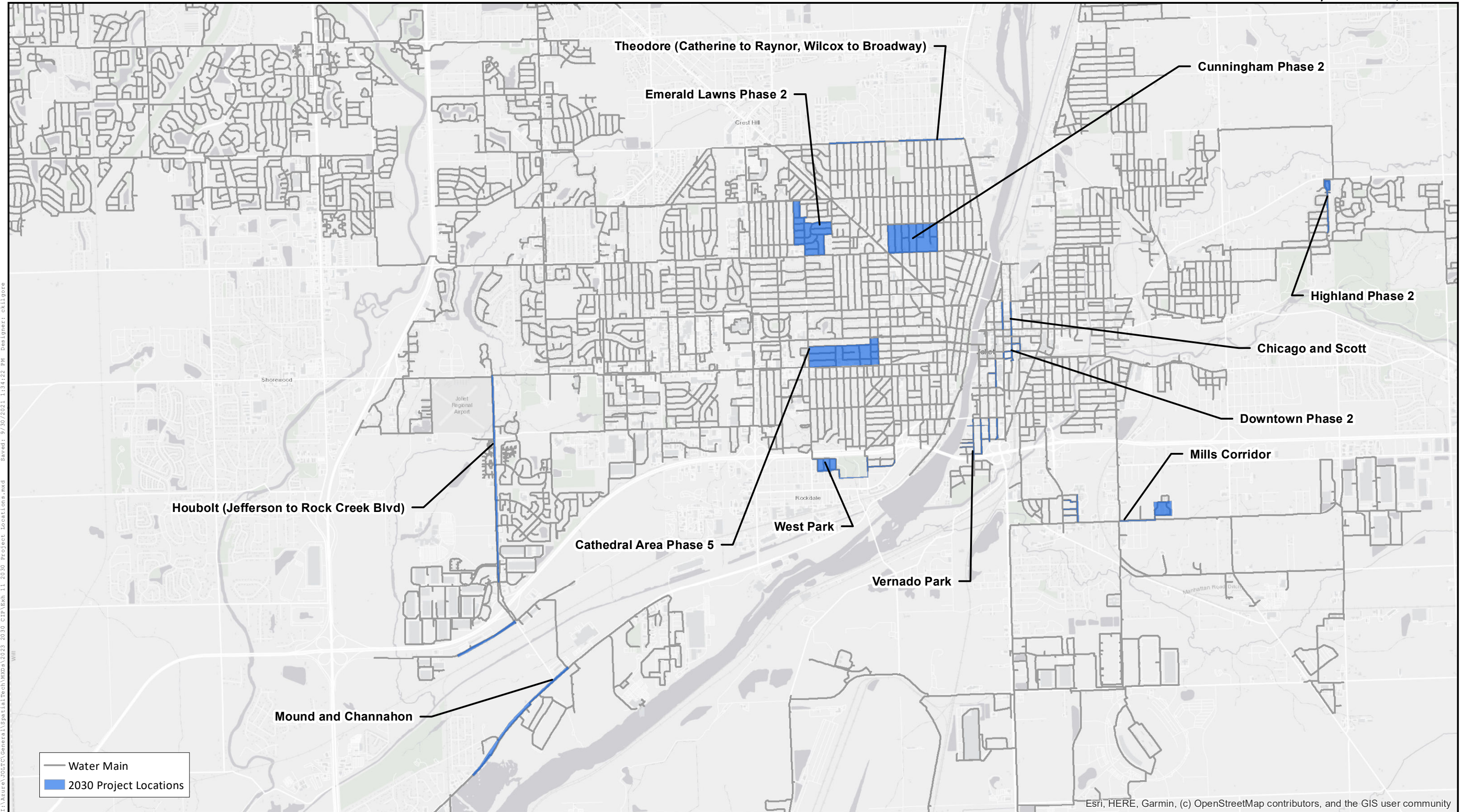


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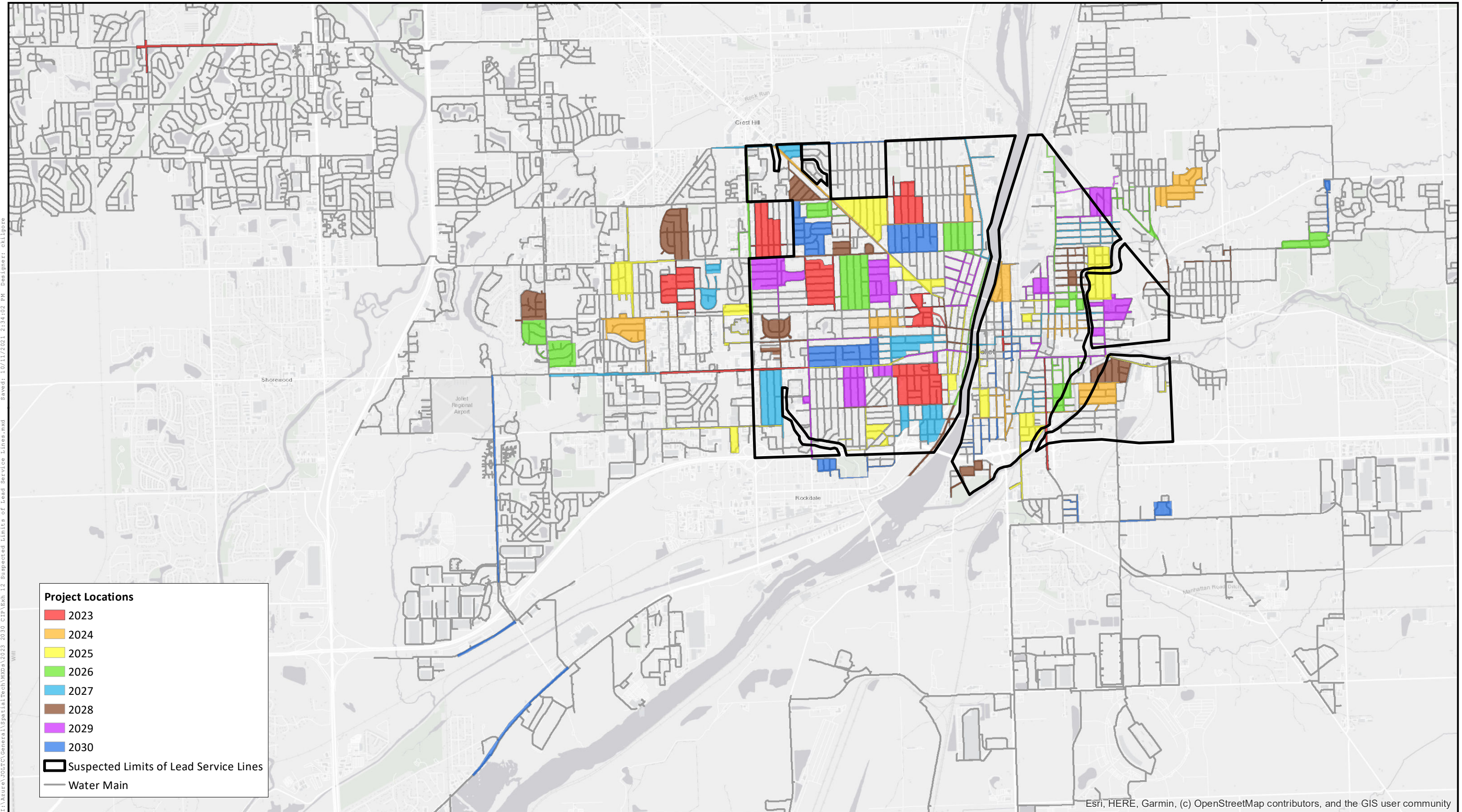


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SUSPECTED LIMITS OF LEAD SERVICE LINES



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Source(s): Water Data from Great Pyrenees Technology 9/4/2021.



APPENDICES

APPENDIX A

Project Title	Improvement Type	Installation Decade	Existing Diameter (in)	New Diameter (in)	Quantity	Unit Price	WM Replacement Construction Cost	Construction Cost Contingency	Design Engineering	Construction Engineering	Annual Total	LSL Replacement Construction Cost	Construction Cost Contingency	Design Engineering	Construction Engineering	Annual Total	
2023																	
Krings Acres Phase 2	Replacement	1920-1950	6	8	14,000	\$ 250	\$ 3,500,000										
St. Pat's Area Phase 1	Replacement/ Extension	1900-1960	4-10	8-12	14,500	\$ 300	\$ 4,400,000										
Caton Farm	Rehabilitation	1990	10	10	9,200	\$ 300	\$ 2,800,000										
Black Road Acres Phase 1	Replacement	1920	6-8	8-12	15,300	\$ 275	\$ 4,300,000										
Upper Bluff	Replacement/ Extension	1900-1920	2-8	8	11,200	\$ 300	\$ 3,400,000										
Richards St	Replacement	1890-1960	6-12	12	6,500	\$ 400	\$ 2,600,000										
Garnsey Park Phase 4	Replacement	1940	6-8	8-12	11,500	\$ 250	\$ 2,900,000										
Midland Avenue East	Replacement	1920-1960	6-10	8-12	13,700	\$ 275	\$ 3,800,000										
Chicago and Van Buren	Replacement	1890	12	12	1,700	\$ 500	\$ 850,000										
Jefferson St (Joyce to Midland)	Replacement	1920-1960	10-12	12	7,700	\$ 400	\$ 3,080,000										
							105,300 feet	\$ 31,630,000	\$ 3,163,000	\$ 1,265,000	\$ 1,265,000	\$ 37,323,000	\$ 3,390,000	\$ 339,000	\$ 50,000	\$ 221,000	\$ 4,000,000
2024																	
North Joliet, Chicago, and Scott	Replacement	1890-1920	6-10	8-12	7,700	\$ 400	\$ 3,100,000										
Plainfield Road (Theodore to Black)	Replacement	1940	8	12	8,600	\$ 350	\$ 3,100,000										
Woodland	Replacement/ Extension	1900-1950	6-8	8-12	15,700	\$ 275	\$ 4,400,000										
Forest Park Phase 3	Replacement/ Extension	1960	6-14	6-16	14,200	\$ 275	\$ 4,000,000										
Cathedral Area Phase 1	Replacement	1900-1940	6-16	8-16	8,000	\$ 300	\$ 2,400,000										
Fairway	Replacement	1950-1970	6-16	8-16	13,500	\$ 275	\$ 3,800,000										
Garnsey Park Phase 5	Replacement	1940	6-10	6-12	11,800	\$ 275	\$ 3,300,000										
Chicago and McDonough	Replacement	1890-1930	4-10	6-12	9,700	\$ 500	\$ 4,900,000										
Collins and Cass Area	Replacement	1900-1920	6-12	6-12	7,200	\$ 400	\$ 2,900,000										
North Prairie	Replacement	1940	6-12	8-12	12,000	\$ 250	\$ 3,000,000										
							108,400 feet	\$ 34,900,000	\$ 3,490,000	\$ 1,396,000	\$ 1,396,000	\$ 41,182,000	\$ 3,390,000	\$ 339,000	\$ 50,000	\$ 221,000	\$ 4,000,000
2025																	
Spring Creek Neighborhood Phase 1	Replacement	1910	6-8	8-16	14,000	\$ 350	\$ 4,900,000										
McDonough and Bellarmine	Replacement	1950-1970	6-14	8-16	8,000	\$ 300	\$ 2,400,000										
Reedwood Phase 3	Replacement/ Extension	1900-1950	6-16	8-16	9,400	\$ 250	\$ 2,400,000										
Jefferson (Midland to Wilcox)	Replacement	1900-1940	8-16	12-16	7,200	\$ 400	\$ 2,900,000										
Jackson Center	Replacement	1900-1910	6-10	6-12	5,800	\$ 375	\$ 2,200,000										
Joliet West High School	Replacement	1950-1960	6-16	8-16	8,700	\$ 250	\$ 2,200,000										
Center, Hickory, and Broadway	Replacement	1890-1960	4-6	8	9,900	\$ 450	\$ 4,500,000										
DesPlaines and Joliet	Replacement	1890-1920	4-14	8-12	7,000	\$ 500	\$ 3,500,000										
Murphy Acres Estates	Replacement	1950-1960	6-12	6-16	14,600	\$ 275	\$ 4,100,000										
Gardner and 4th Area	Replacement	1900-1950	6-8	8	11,000	\$ 350	\$ 3,900,000										
Washington and Adella	Replacement/ Extension	1890-1960	6-14	6-16	6,600	\$ 500	\$ 3,300,000										
Plainfield (Black to Center)	Replacement	1900-1910	6-8	8-12	8,500	\$ 400	\$ 3,400,000										
							110,700 feet	\$ 39,700,000	\$ 3,970,000	\$ 1,588,000	\$ 1,588,000	\$ 46,846,000	\$ 3,390,000	\$ 339,000	\$ 50,000	\$ 221,000	\$ 4,000,000
2026																	
Cathedral Area Phase 2	Replacement	1910-1960	6-10	8-12	15,300	\$ 275	\$ 4,300,000										
Briargate	Replacement	1940	6-8	8	7,500	\$ 250	\$ 1,900,000										
Collins St	Replacement/ Extension	1900-1950	6-10	6-16	7,400	\$ 400	\$ 3,000,000										
Forest Park Phase 4	Replacement	1900-1960	6-14	8-16	9,000	\$ 275	\$ 2,500,000										
Larkin, Lois, and Asbury Circle	Replacement	1950	6-12	6-12	11,100	\$ 400	\$ 4,500,000										
Cunningham Phase 1	Replacement	1940	6-10	8-12	9,700	\$ 350	\$ 3,400,000										
Bluff St	Replacement	1900-1920	8-14	24	8,500	\$ 900	\$ 7,700,000										
Highland Phase 1	Replacement	1960	8	6-8	5,000	\$ 250	\$ 1,300,000										
	Abandonment	1960	8	8	2,500	-	\$ 500,000										
Hickory Creek	Replacement	1890-1920	4-8	6-8	12,100	\$ 350	\$ 4,300,000										
Twin Oaks Phase 1	Replacement	1960	6-8	6-8	12,500	\$ 250	\$ 3,200,000										
Spring Creek Phase 2	Replacement	1900-1920	6-12	6-12	8,000	\$ 300	\$ 2,400,000										
							108,600 feet	\$ 39,000,000	\$ 3,900,000	\$ 1,560,000	\$ 1,560,000	\$ 46,020,000	\$ 3,390,000	\$ 339,000	\$ 50,000	\$ 221,000	\$ 4,000,000

Project Title	Improvement Type	Installation Decade	Existing Diameter (in)	New Diameter (in)	Quantity	Unit Price	WM Replacement Construction Cost	Construction Cost Contingency	Design Engineering	Construction Engineering	Annual Total	LSL Replacement Construction Cost	Construction Cost Contingency	Design Engineering	Construction Engineering	Annual Total
2027																
Broadway (Theodore to Ruby)	Replacement	1890-1940	4-10	6-12	9,000	\$ 500	\$ 4,500,000									
Jefferson (Essington to Joyce)	Replacement	1950-1960	6-12	8-12	9,100	\$ 400	\$ 3,700,000									
AWSP 24"	Replacement/ Extension	1890-1940	6-16	12-24	12,500	\$ 1,000	\$ 12,500,000									
Valley Heights Phase 1	Replacement/ Extension	1900-1940	6-10	6-16	14,700	\$ 300	\$ 4,500,000									
Black Road Acres Phase 2	Replacement	1950-1960	6	6-8	9,800	\$ 250	\$ 2,500,000									
Idylside	Replacement	1950	6-8	8-16	12,700	\$ 300	\$ 3,900,000									
Sherman Street	Replacement	1890-1930	4-8	8-12	8,000	\$ 350	\$ 2,800,000									
Old Plank	Replacement	1940-1950	12	12	8,200	\$ 250	\$ 2,100,000									
St Pat's Phase 2	Replacement	1900-1960	6-8	8	12,000	\$ 500	\$ 6,000,000									
Cathedral Area Phase 3	Replacement/ Extension	1900-1940	6-16	8-16	14,300	\$ 300	\$ 4,300,000									
110,300 feet							\$ 46,800,000	\$ 4,680,000	\$ 1,872,000	\$ 1,872,000	\$ 55,224,000	\$ 3,390,000	\$ 339,000	\$ 50,000	\$ 221,000	\$ 4,000,000
2028																
Center and Western	Replacement	1900-1960	8-12	12	5,700	\$ 500	\$ 2,900,000									
Kerwin Terrace	Replacement	1940-1950	6-12	8-12	11,500	\$ 275	\$ 3,200,000									
Marquette Park	Replacement	1920-1960	2-16	6-16	15,000	\$ 300	\$ 4,500,000									
Emerald Lawns Phase 1	Replacement	1910-1960	6-12	8-12	11,500	\$ 275	\$ 3,200,000									
Woodland Phase 2	Replacement	1910-1920	6-8	6-12	7,700	\$ 350	\$ 2,700,000									
Bridal Wreath Acres	Replacement	1950	6-8	6-8	14,000	\$ 250	\$ 3,500,000									
Ridgewood Phase 4	Replacement	1910-1950	6-12	8-16	7,500	\$ 275	\$ 2,100,000									
Morgan	Replacement	1900-1940	6-12	12	3,500	\$ 275	\$ 1,000,000									
Twin Oaks Phase 2	Replacement	1960-1970	6-12	6-12	8,500	\$ 275	\$ 2,400,000									
McKinley Park	Replacement	1930-1950	6-10	6-8	6,500	\$ 400	\$ 2,600,000									
Spring Creek Phase 3	Replacement	1900-1940	6-10	6-12	13,200	\$ 350	\$ 4,700,000									
Railroad St	Replacement	1900-1940	6-10	12	5,300	\$ 500	\$ 2,700,000									
109,900 feet							\$ 35,500,000	\$ 3,550,000	\$ 1,420,000	\$ 1,420,000	\$ 41,890,000	\$ 3,390,000	\$ 339,000	\$ 50,000	\$ 221,000	\$ 4,000,000
2029																
Cathedral Area Phase 4	Replacement	1900-1940	6-8	8	11,600	\$ 250	\$ 2,900,000									
Midland and Campbell	Replacement/Lining	1940-1960	8-16	8-16	10,500	\$ 350	\$ 3,700,000									
Reedwood Phase 4	Replacement	1900-1950	6-16	8-16	11,500	\$ 275	\$ 3,200,000									
Jefferson (Wilcox to Bluff), Nicholson, and Cagwin	Replacement	1900-1960	4-10	8-12	5,200	\$ 500	\$ 2,600,000									
Midland Avenue West	Replacement	1920-1960	6-8	8	14,000	\$ 250	\$ 3,500,000									
Virginia	Replacement	1910-1950	6-12	6-16	13,800	\$ 400	\$ 5,600,000									
St Mary's	Replacement	1900-1960	6-10	8	13,300	\$ 400	\$ 5,400,000									
Eastern and Washington	Replacement	1890-1910	6-14	6-16	7,000	\$ 500	\$ 3,500,000									
Valley Heights Phase 2	Replacement	1900	6-8	6-16	14,400	\$ 450	\$ 6,500,000									
Hartman	Replacement	1900-1940	6-12	8-16	9,500	\$ 300	\$ 2,900,000									
110,800 feet							\$ 39,800,000	\$ 3,980,000	\$ 1,592,000	\$ 1,592,000	\$ 46,964,000	\$ 3,390,000	\$ 339,000	\$ 50,000	\$ 221,000	\$ 4,000,000

Project Title	Improvement Type	Installation Decade	Existing Diameter (in)	New Diameter (in)	Quantity	Unit Price	WM Replacement Construction Cost	Construction Cost Contingency	Design Engineering	Construction Engineering	Annual Total	LSL Replacement Construction Cost	Construction Cost Contingency	Design Engineering	Construction Engineering	Annual Total
2030																
Cunningham Phase 2	Replacement	1940	6-10	8-12	13,300	\$ 275	\$ 3,700,000									
Theodore (Catherine to Raynor, Wilcox to Broadway)	Replacement	1940-1950	8-10	12	6,500	\$ 375	\$ 2,500,000									
Houbolt (Jefferson to Rock Creek Blvd)	Replacement	1960	12	12	10,500	\$ 350	\$ 3,700,000									
Cathedral Area Phase 5	Replacement	1900-1940	6-16	6-16	14,500	\$ 275	\$ 4,000,000									
Mound Rd and Channahon Rd	Replacement	1950-1960	10-12	12	10,300	\$ 350	\$ 3,700,000									
Mills Corridor	Replacement	1960	6-12	8-12	7,500	\$ 275	\$ 2,100,000									
Vernado Park	Replacement	1890-1930	6-12	8-12	9,500	\$ 400	\$ 3,800,000									
Chicago and Scott	Replacement	1980-1940	10-12	12	3,500	\$ 500	\$ 1,800,000									
Highland Phase 2	Replacement	1960	6-8	6-12	4,000	\$ 275	\$ 1,100,000									
West Park	Replacement/ Extension	1940-1960	6-16	6-16	8,600	\$ 275	\$ 2,400,000									
Emerald Lawns Phase 2	Replacement	1940-1950	6-8	8	15,000	\$ 250	\$ 3,800,000									
Downtown Phase 2	Replacement	1890-1920	8-14	8-12	5,500	\$ 500	\$ 2,800,000									
108,700 feet							\$ 35,400,000	\$ 3,540,000	\$ 1,416,000	\$ 1,416,000	\$ 41,772,000	\$ 3,390,000	\$ 339,000	\$ 50,000	\$ 221,000	\$ 4,000,000
1. Prices include water service replacement/adjustment, new valves, new hydrants, trench backfill, pavement patching or lawn restoration, traffic control, erosion control, construction layout, and mobilization.																
2. Prices do not include right-of-way acquisition, temporary or permanent easements, or relocating other utilities.																
3. Prices are current for 2021.																

APPENDIX B

IEPA Loan Applicant Environmental Checklist and Certification Form

Loan Applicant: City of Joliet

L17#: _____

This form must be signed by the loan applicant's Authorized Representative. All loan applicants must provide items 1 and 2 below. The information that must be provided for items 3-8 are specific to conditions of the project. See the attached instructions that explain the requirements and provide contact information. If you believe an item is not required for your project, enter N/A instead of the date of response and provide an explanation in the planning report. For checklist items marked as N/A, also indicate the page number of the planning report where the explanation is located.

Provide records of consultation with Illinois Department of Natural Resources (IDNR), State Historic Preservation Office (SHPO) for the National Historic Preservation Act, Section 106 sign-off.

1) **Date of IDNR, SHPO response:** Sent: July 23, 2021; Response Received: August 24, 2021

Provide records of consultation with IDNR's Impact Assessment Section for evaluation pursuant to the Illinois Endangered Species Protection Act [520 ILCS 10/11], the Illinois Natural Areas Preservation Act [525 ILCS 30/17], Title 17 Illinois Administrative Code, Part 1075, and Interagency Wetlands Policy Act of 1989 (Illinois Administrative Code, Part 1090).

2) **Date of EcoCAT printout:** July 16, 2021

Date of IDNR follow-up letter (when protected resources are identified): July 26, 2021

For projects located within any wetland, river, stream, flood plain, floodway, waterway, any body of water, or construction located within 250 feet of a wetland; provide records of consultation from:

3) **U.S. Army Corps of Engineers (USACE) Date of USACE response:** N/A

For projects located within a flood plain or floodway, or along a jurisdictional river, lake, or stream without a mapped floodway or flood plain, provide records of consultation from:

4) **IDNR Office of Water Resources (OWR) Date of IDNR OWR response:** N/A

If the project involves conversion of prime agricultural land to other uses, provide records of consultation from:

5) **Illinois Department of Agriculture (IDOA). Date of IDOA response:** N/A

If the project includes 30% or more reserve capacity for future growth in the existing or proposed service areas, provide records of consultation from all applicable environmental regulatory entities listed on this form for the known growth/development areas associated with the identified secondary/indirect environmental impacts.

6) **Secondary impacts list of applicable regulatory entities and date of their responses:** N/A

If any project with secondary impacts is located in a county under the jurisdiction of a Designated Water Quality Management Agency (DWQMA), which are the Greater Egypt Regional Planning & Development Commission (GERPDC), the Southwestern Illinois Metropolitan and Regional Planning Commission (SIMAPC), and the Chicago Metropolitan Agency for Planning (CMAP), provide records of consultation from:

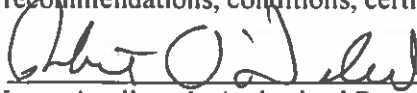
7) Date of DWQMA response: N/A

For certain projects, Section 106 of the National Historic Preservation Act of 1966 (NHPA) requires consultation with all interested, federally recognized Indian tribes. Consultation is required if construction has the potential to affect properties that have religious or cultural significance to Indian tribes previously residing in Illinois. Check all boxes below that apply to this project. If applicable, consultation is required with the Tribal Historic Preservation Office of each interested tribe. If a response is not received in 30 days, consider consultation closed.

- Significant ground disturbance (digging)**
Examples: new sewers, utility lines (above and below ground), foundations, footings, grading, access roads. This does not include sewer lining; in-place sewer or water main replacements without an increase to the trench size; or re-building a lift station, well, or above-ground building without increasing the footprint.
- New construction in undeveloped natural areas**
Examples: treatment plants, pipelines, or other new facilities in undeveloped natural areas such as forests, etc.
- Visual changes and/or audible changes**
Examples: construction of a focal point that is out of character with the surrounding natural area, impairment of the view from an observation point in the natural landscape, impairment of the historic scenic qualities of an area, or an increase in noise levels above an acceptable standard in areas known and appreciated for their quietness.
- Atmospheric changes**
Example: introduction of lights that create skyglow in an area with a dark night sky.
- Work on a building with significant tribal association**
Examples: rehabilitation, demolition, or removal of a surviving ancient tribal structure(s), or a structure that is believed to be the location of a significant tribal event or that served as a tribal school or community hall.
- Transfer, lease, or sale of a historic property of religious and cultural significance**
Examples: Involves properties that contain archaeological sites, burial grounds, sacred landscapes or features, ceremonial areas, or structures with significant tribal association.
- None of the above apply – Tribal Consultation is Not Applicable**

8) Date Submitted to Interested Tribes N/A List tribes contacted below or attach a list. Indicate contact date and if a response was received. Copies of all responses must be submitted to IEPA.

Certification: By signing this form, the Loan Applicant certifies that the applicable environmental evaluations were conducted for the proposed project locations, and if the review results for any of these environmental evaluations include recommendations, conditions, certifications, and/or permits, the Loan Applicant agrees to comply.

Signed: 
Loan Applicant's Authorized Representative

Date: 10/04/21

July 23, 2021

Illinois Department of Natural Resources
Illinois State Historic Preservation Office
Attn: Review & Compliance
1 Old State Capitol Plaza
Springfield, Illinois 62701

Subject: City of Joliet - Eight Year Water Main Distribution System Improvements

Dear IHPA Representative:

The City of Joliet has developed an eight year water main distribution system improvement plan that consists of the replacement and rehabilitation of approximately 21.3 miles of water main. All work will be within existing City-owned property and rights-of-way. All pipe will be installed in areas previously disturbed from construction. No existing structures will be demolished.

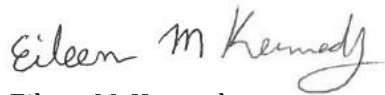
The proposed project locations are in Sections 01-18, 22-27, and 34-36, Township 35N, Range 10E; Sections 01-02 and 11-14, Township 35N, Range 09E; and Sections 05-08, 18-19, and 30, Township 35N, Range 11E.

The City is applying for federal funding through the Public Water Supply Loan Program (PWSLP) administered by IEPA to construct this project. On behalf of the City of Joliet, we are requesting IHPA review for the National Historic Preservation Act, Section 106 signoff on this project. Enclosed for your review is the project locations map included in the City's Eight Year Water Distribution System Rehabilitation Program.

Please call me at 815.444.3358 if you have any questions or require additional information in order to complete your review.

Sincerely,

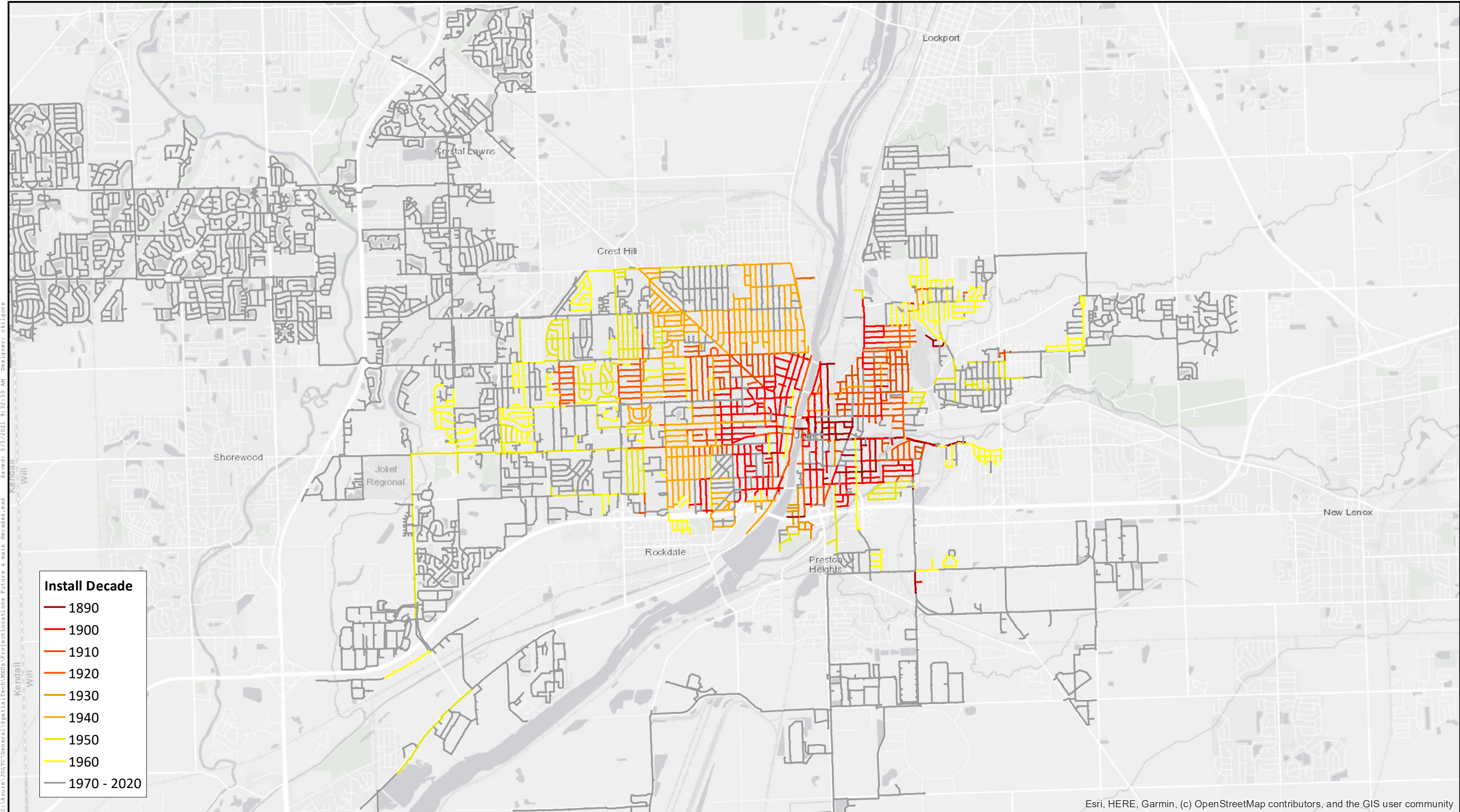
BAXTER & WOODMAN, INC.
CONSULTING ENGINEERS



Eileen M. Kennedy
Project Engineer
ekennedy@baxterwoodman.com

APPROXIMATE WATER MAIN INSTALLATION DECADE

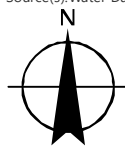
City of Joliet, Illinois



E:\Users\TJL\Documents\General\GIS\Projects\Joliet\Map\Project\Locations_Future & Main\decades.mxd Saved: 5/3/2021 9:32:50 AM Designer: cbligore

Source(s): Water Data from Great Pyrenees Technology 4/9/2021.

Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community



Not to Scale



Illinois Department of Natural Resources

JB Pritzker, Governor
Colleen Callahan, Director

www.dnr.illinois.gov

Mailing address: State Historic Preservation Office, 1 Old State Capitol Plaza, Springfield, IL 62701

Will County PLEASE REFER TO: SHPO LOG #008072321

Joliet

Various location throughout city - Sections 1-18, 22-27, 34, 35, 36-Township:35N-Range:10E

Sections 1, 2, 11, 12, 13, Section:14-Township:35N-Range:9E

Sections 5-8, 18, 19, Section:30-Township:35N-Range:11E

IEPA LOAN

*Water main replacement/rehabilitation

August 19, 2021

Eileen M. Kennedy
Baxter & Woodman Consulting Engineers
8430 West Bryn Mawr Avenue, Suite 400
Chicago, IL 60631

Dear Ms. Kennedy:

We have reviewed the documentation submitted for the referenced project(s) in accordance with 36 CFR Part 800.4. Based upon the information provided, no historic properties are affected. We, therefore, have no objection to the undertaking proceeding as planned.

Please retain this letter in your files as evidence of compliance with section 106 of the National Historic Preservation Act of 1966, as amended. This clearance remains in effect for two (2) years from date of issuance. It does not pertain to any discovery during construction, nor is it a clearance for purposes of the Illinois Human Skeletal Remains Protection Act (20 ILCS 3440).

If you are an applicant, please submit a copy of this letter to the state or federal agency from which you obtain any permit, license, grant, or other assistance. If further assistance is needed contact Jeff Kruchten, Chief Archaeologist at 217/785-1279 or Jeffery.kruchten@illinois.gov.

Sincerely,

Carey L. Mayer, AIA
Deputy State Historic
Preservation Officer

Applicant: Baxter & Woodman
Contact: Eileen M Kennedy
Address: 8430 W Bryn Mawr Ave
Suite 400
Chicago, IL 60631

IDNR Project Number: 2200647
Date: 07/16/2021
Alternate Number: 202304.30

Project: City of Joliet-2022-2030 Water Main Replacement Project
Address: Lincoln Hwy (Rte 30), Joliet

Description: Replacement of 20.6 miles of water main.

Natural Resource Review Results

Consultation for Endangered Species Protection and Natural Areas Preservation (Part 1075)

The Illinois Natural Heritage Database shows the following protected resources may be in the vicinity of the project location:

- Markgraf Quarry INAI Site
- Rock Run INAI Site
- Theodore Street Marsh INAI Site
- Rock Run Land And Water Reserve
- Theodore Marsh Land And Water Reserve
- American Burnet (*Sanguisorba canadensis*)
- Blackchin Shiner (*Notropis heterodon*)
- Blanding's Turtle (*Emydoidea blandingii*)
- Hine's Emerald Dragonfly (*Somatochlora hineana*)
- Leafy Prairie Clover (*Dalea foliosa*)
- Northern Long-Eared Myotis (*Myotis septentrionalis*)
- Osprey (*Pandion haliaetus*)
- Queen-Of-The-Prairie (*Filipendula rubra*)
- Royal Catchfly (*Silene regia*)
- Showy Lady's Slipper (*Cypripedium reginae*)

Wetland Review (Part 1090)

The Illinois Wetlands Inventory shows wetlands within 250 feet of the project location.

An IDNR staff member will evaluate this information and contact you to request additional information or to terminate consultation if adverse effects are unlikely.

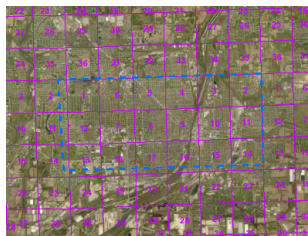
Location

The applicant is responsible for the accuracy of the location submitted for the project.

County: Will

Township, Range, Section:

35N, 10E, 1
35N, 10E, 2



35N, 10E, 3
35N, 10E, 4
35N, 10E, 5
35N, 10E, 6
35N, 10E, 7
35N, 10E, 8
35N, 10E, 9
35N, 10E, 10
35N, 10E, 11
35N, 10E, 12
35N, 10E, 13
35N, 10E, 14
35N, 10E, 15
35N, 10E, 16
35N, 10E, 17
35N, 10E, 18
35N, 9E, 1
35N, 9E, 2
35N, 9E, 11
35N, 9E, 12
35N, 9E, 13
35N, 9E, 14
36N, 10E, 31
36N, 10E, 32
36N, 10E, 33
36N, 10E, 34
36N, 10E, 35
36N, 10E, 36
36N, 9E, 35
36N, 9E, 36

IL Department of Natural Resources

Contact

Brian Willard
217-785-5500
Division of Ecosystems & Environment

Government Jurisdiction

IL Environmental Protection Agency
Heidi Allen
1021 North Grand Ave East
PO Box 19276
Springfield , Illinois 62794 -9276

Disclaimer

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Terms of Use

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Applicant: Baxter & Woodman
Contact: Eileen M Kennedy
Address: 8430 W Bryn Mawr Ave
Suite 400
Chicago, IL 60631

IDNR Project Number: 2200650
Date: 07/16/2021
Alternate Number: 202304.30

Project: City of Joliet-2022-2030 Water Main Replacement Project
Address: W Maple Rd (Rte 6), Joliet

Description: Replacement of 20.6 miles of water main

Natural Resource Review Results

Consultation for Endangered Species Protection and Natural Areas Preservation (Part 1075)

The Illinois Natural Heritage Database shows the following protected resources may be in the vicinity of the project location:

- Hickory Creek Sedge Meadow INAI Site
- Pilcher Park INAI Site
- Pilcher Park Land And Water Reserve
- Pilcher Park Nature Preserve
- Hine's Emerald Dragonfly (*Somatochlora hineana*)
- Northern Long-Eared Myotis (*Myotis septentrionalis*)
- Northern Long-Eared Myotis (*Myotis septentrionalis*)

Wetland Review (Part 1090)

The Illinois Wetlands Inventory shows wetlands within 250 feet of the project location.

An IDNR staff member will evaluate this information and contact you to request additional information or to terminate consultation if adverse effects are unlikely.

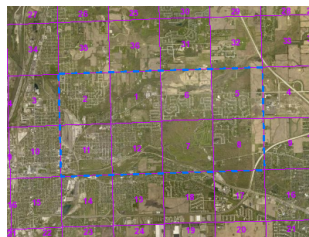
Location

The applicant is responsible for the accuracy of the location submitted for the project.

County: Will

Township, Range, Section:

- 35N, 10E, 1
- 35N, 10E, 2
- 35N, 10E, 3
- 35N, 10E, 10
- 35N, 10E, 11
- 35N, 10E, 12
- 35N, 10E, 13
- 35N, 10E, 14
- 35N, 10E, 15
- 35N, 11E, 4
- 35N, 11E, 5



35N, 11E, 6
35N, 11E, 7
35N, 11E, 8
35N, 11E, 9
35N, 11E, 17
35N, 11E, 18
36N, 10E, 34
36N, 10E, 35
36N, 10E, 36
36N, 11E, 31
36N, 11E, 32

IL Department of Natural Resources

Contact

Brian Willard
217-785-5500
Division of Ecosystems & Environment

Government Jurisdiction

IL Environmental Protection Agency
Heidi Allen
1021 North Grand Ave East
Springfield , Illinois 62794 -9276

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Applicant: Baxter & Woodman
Contact: Eileen M Kennedy
Address: 8430 W Bryn Mawr Ave
Suite 400
Chicago, IL 60631

IDNR Project Number: 2200653
Date: 07/16/2021
Alternate Number: 202304.30

Project: City of Joliet-2022-2030 Water Main Replacement Project
Address: Laraway Rd, Joliet

Description: Replacement of 20.6 miles of water main

Natural Resource Review Results

Consultation for Endangered Species Protection and Natural Areas Preservation (Part 1075)

The Illinois Natural Heritage Database shows the following protected resources may be in the vicinity of the project location:

- Hickory Creek Sedge Meadow INAI Site
- Markgraf Quarry INAI Site
- Pilcher Park INAI Site
- Pilcher Park Land And Water Reserve
- Northern Long-Eared Myotis (*Myotis septentrionalis*)

Wetland Review (Part 1090)

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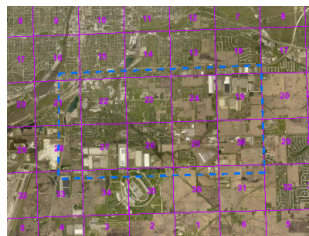
Location

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County: Will

Township, Range, Section:

- 35N, 10E, 13
- 35N, 10E, 14
- 35N, 10E, 15
- 35N, 10E, 16
- 35N, 10E, 21
- 35N, 10E, 22
- 35N, 10E, 23
- 35N, 10E, 24
- 35N, 10E, 25
- 35N, 10E, 26
- 35N, 10E, 27
- 35N, 10E, 28
- 35N, 10E, 33



35N, 10E, 34
35N, 10E, 35
35N, 10E, 36
35N, 11E, 18
35N, 11E, 19
35N, 11E, 20
35N, 11E, 29
35N, 11E, 30
35N, 11E, 31
35N, 11E, 32

IL Department of Natural Resources

Contact

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Illinois Department of Natural Resources

One Natural Resources Way Springfield, Illinois 62702-1271
<http://dnr.state.il.us>

JB Pritzker, Governor

Colleen Callahan, Director

July 26, 2021

Eileen M Kennedy
Baxter & Woodman
8430 W Bryn Mawr Ave
Suite 400
Chicago, IL 60631 3473

RE: City of Joliet-2022-2030 Water Main Replacement Project
Project Number(s): 2200647 [202304.30]
County: Will

Dear Applicant:

This letter is in reference to the project you recently submitted for consultation. The natural resource review provided by EcoCAT identified protected resources that may be in the vicinity of the proposed action. The Department has evaluated this information and concluded that adverse effects are unlikely. Therefore, consultation under 17 Ill. Adm. Code Part 1075 and 1090 is terminated.

Consultation for Part 1075 is valid for two years unless new information becomes available that was not previously considered; the proposed action is modified; or additional species, essential habitat, or Natural Areas are identified in the vicinity. If the project has not been implemented within two years of the date of this letter, or any of the above listed conditions develop, a new consultation is necessary. Consultation for Part 1090 (Interagency Wetland Policy Act) is valid for three years.

The natural resource review reflects the information existing in the Illinois Natural Heritage Database and the Illinois Wetlands Inventory at the time of the project submittal, and should not be regarded as a final statement on the site being considered, nor should it be a substitute for detailed site surveys or field surveys required for environmental assessments. If additional protected resources are encountered during the project's implementation, you must comply with the applicable statutes and regulations. Also, note that termination does not imply IDNR's authorization or endorsement of the proposed action.

Please contact me if you have questions regarding this review.

Adam Rawe

Adam Rawe
Division of Ecosystems and Environment
217-785-5500



Illinois Department of Natural Resources

One Natural Resources Way Springfield, Illinois 62702-1271
<http://dnr.state.il.us>

JB Pritzker, Governor

Colleen Callahan, Director

July 26, 2021

Eileen M Kennedy
Baxter & Woodman
8430 W Bryn Mawr Ave
Suite 400
Chicago, IL 60631 3473

RE: City of Joliet-2022-2030 Water Main Replacement Project
Project Number(s): 2200650 [202304.30]
County: Will

Dear Applicant:

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Please contact me if you have questions regarding this review.

Adam Rawe

Adam Rawe
Division of Ecosystems and Environment
217-785-5500



Illinois Department of Natural Resources

One Natural Resources Way Springfield, Illinois 62702-1271
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JB Pritzker, Governor

Colleen Callahan, Director

July 26, 2021

Eileen M Kennedy
Baxter & Woodman
8430 W Bryn Mawr Ave
Suite 400
Chicago, IL 60631 3473

RE: City of Joliet-2022-2030 Water Main Replacement Project
Project Number(s): 2200653 [202304.30]
County: Will

Dear Applicant:

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Adam Rawe

Adam Rawe
Division of Ecosystems and Environment
217-785-5500

APPENDIX C

City of Joliet
Proposed Rates
Rates Effective November 1, 2020

	Joliet Resident		Joliet Non-Resident		
	<u>First 2 HCF</u>	<u>Over 2 HCF</u>	<u>First 2 HCF</u>	<u>Over 2 HCF</u>	
Water Volume Charge					
<u>Customer Class</u>	<u>Code</u>				
Commercial	C	\$1.81	\$5.47	\$2.64	\$6.31
Industrial	I	\$1.81	\$5.47	\$2.64	\$6.31
Governmental	G	\$1.81	\$5.47	\$2.64	\$6.31
Residential Owner	RO	\$1.64	\$4.91	\$2.64	\$6.31
Residential Senior	RS	\$1.13	\$3.37	N/A	N/A
Residential Tenant	RT	\$1.81	\$5.47	\$2.64	\$6.31
Multi Family Owner	MO	\$1.81	\$5.47	\$2.64	\$6.31
Multi Family Senior	MS	\$1.31	\$3.96	N/A	N/A
Multi Family Tenant	MT	\$1.81	\$5.47	\$2.64	\$6.31
Water Daily Charge		<u>per Month</u>		<u>per Month</u>	
All classes, excluding seniors		\$6.18		\$6.18	
All Senior Classes (RS, MS)		\$5.54		\$6.18	
Sewer Volume Charge		<u>per HCF</u>		<u>per HCF</u>	
Measured Volume, all classes except seniors		\$4.02		\$4.13	
Measured Volume, seniors (RS, MS)		\$3.79		\$4.13	
Unmeasured Flow (per day charge)		<u>per Month</u>		<u>per Month</u>	
based on average flow of 14 HCF		\$56.28		\$57.82	
Senior customer (RS, MS)		\$53.06		\$57.82	
Sewer Daily Charge		<u>per Month</u>		<u>per Month</u>	
All classes, excluding seniors		\$5.37		\$5.37	
All Senior Classes (RS, MS)		\$4.81		\$5.37	
Senior Discount Credit		<u>per Month</u>		<u>per Month</u>	
\$5.69/30 days fixed credit		\$5.69		\$0.00	
Sewer Separation Fee		<u>per Month</u>		<u>per Month</u>	
\$7.77/30 days residential		\$7.77		\$7.77	
Multi Family based on # of units/30 days		<u>Each</u>	<u>Monthly Charge</u>	<u>Each</u>	<u>Monthly Charge</u>
2 units		\$7.52	\$15.04	\$7.52	\$15.04
3 units		\$7.16	\$21.48	\$7.16	\$21.48
4 units		\$6.80	\$27.20	\$6.80	\$27.20
5 units		\$6.45	\$32.25	\$6.45	\$32.25
All Non-Residential Customer Classes					
Fee based on usage (cubic feet):			<u>Monthly Charge</u>		<u>Monthly Charge</u>
0-700 (base charge)			\$7.88		\$7.88
701-1,200			\$15.04		\$15.04
1,201-2,100			\$21.48		\$21.48
2,101-2,800			\$27.20		\$27.20
2,801-3,500			\$32.25		\$32.25
>3,500					
Base Charge = 3,500 HCF			\$32.25		\$32.25
+ \$1.43 for each 700 CF			variable		variable
Maximum Charge			\$383.29		\$383.29
Sewer Surcharge Fees					
Biological Oxygen Demand (>400 mg/l)		\$0.49	per lb. of BOD	\$0.49	per lb. of BOD
Suspended Solids (>520 mg/l)		\$0.28	per lb. of SS	\$0.28	per lb. of SS

APPENDIX D

To: Allison M.W. Swisher, P.E.
City of Joliet

From: Jeffrey W. Freeman, P.E., CFM, LEED AP
Engineering Enterprises, Inc.

File: Non-Revenue Water Reduction Strategies

Date: September 21, 2020

Revised: January 19, 2021

Executive Summary

From 2016 through 2019, the City of Joliet has experienced Non-Revenue Water (NRW) percentages from 32.4% to 34.9% based on the American Water Works Association (AWWA) methodology found in AWWA Manual M36 – Water Audits and Loss Control and associated software. The City of Joliet has developed many strategies to reduce its NRW percentage, and currently is in the process of working through those strategies. This NRW Reduction Plan summarizes a number of the past strategies that had been put in place along with additional strategies the City has developed over time.

The main goal is to reduce NRW to below 10% by 2030 to meet the Lake Michigan Allocation permit requirements. Strategies have been developed to reduce both apparent and real losses to achieve that goal. While the City already has a robust water main replacement program that focuses on replacing 1% of the water main in the water works system per year, this plan commits the City to increase its water main replacement program to 3.2% per year. The 3.2% per year water main replacement program requires an investment of approximately \$33.7M per year in water main replacement from 2022 to 2030. With this funding commitment to reduce the real losses through aging water mains, along with the City's commitment to reduce apparent losses through tactical analysis of its metering and accounting systems, the City has set a path to achieve a 9.7% NRW percentage by 2030, the year the City integrates Lake Michigan water into its system.

1.0 Introduction

In 2018, following the completion of the calendar year 2016 and water year 2017 water loss audits based on the AWWA M36 methodology in which the NRW percentages were 33.9% and 32.4%, respectively, the City of Joliet began to develop strategies to reduce its NRW levels. Over the last two years, City staff has been making strides in implementing the subsequent recommendations to reduce NRW including, but not limited to, the following:

- ◆ Appointed a Water Loss Champion
- ◆ Committed to complete a water audit based on the AWWA M36 methodology on an annual basis
- ◆ Established a Water Loss Task Force of a diverse group of City Department representatives that meet on a monthly basis

-
- ◆ Implemented an annual master meter testing program at distribution entry locations
 - ◆ Refined the City staff's understanding of the status of the Exported Water Users and billing practices
 - ◆ Implemented an annual meter testing program for the majority of the Exported Water Meters
 - ◆ Performed larger customer inspections and meter testing
 - ◆ Increased leak detection and repairs from every other year to annuallyImproved tracking on unbilled, unmetered water use
 - ◆ Implemented new procedures internally to minimize unmetered construction water use on City of Joliet projects
 - ◆ Passed and implemented a new ordinance and process to eliminate unmetered construction water use
 - ◆ Continued to implement water main replacement up to the budgeted amount
 - ◆ Developed a water main break analysis to prioritize water main replacement program projects
 - ◆ Completed Sensus Analytics training and met with Sensus Analytics to begin the development of more accurate reports for billed water use during specific time periods
 - ◆ Hired a consultant to conduct testing on residential water meters and then develop a residential water meter replacement program and record-keeping process for meter replacements

Until a solid foundation for data collection and verification is identified for the information in the water loss audit, a true understanding of the magnitude or quantity of Non-Revenue Water (NRW) cannot exist or be managed. As a result of City staff's efforts, the Data Validity Score improved from 53 in 2017 to 65 in 2019 which indicates confidence in the data has increased despite no decrease in reported NRW. The Data Validity Score ranges from 0 to 100. The closer the Data Validity Score is to 100, the higher level of accuracy/confidence exists in the data.

While City staff has made significant improvements, they have also recognized a NRW level of 34.9% in 2019 is undesirable. Therefore, a NRW Reduction Plan needs to be developed and implemented to reduce NRW to below 10% by 2030 to meet the Lake Michigan Allocation permit requirements. This memorandum summarizes the City's water loss audit results for 2016 through 2019 and the recommended next steps to reduce the NRW levels.

2.0 The AWWA M36 Terminology

Before discussing the NRW Reduction Plan, it is critical to understand some of the common terminology utilized in the AWWA M36 methodology. First, the M36 completely eliminates the term “unaccounted for water.” This term is vague and holds a different definition depending on the various utilities. Two new terms are introduced in lieu of this traditional term: Water Loss and Non-Revenue Water.

Non-Revenue Water is the difference between system input volume (water produced) and billed authorized consumption. It consists of the following:

- Unbilled Authorized Consumption (fire hydrant flushing, water treatment plant process water, municipal buildings whose water is not metered, etc.);
- Apparent Losses (non-physical losses such as unauthorized consumption (water theft), meter inaccuracies, systematic data handling errors, etc.) and;
- Real Losses (physical losses from the distribution system and storage tanks up to the point of connection to the customer meter).

Unbilled Authorized Consumption is the difference between Non-Revenue Water and Water Loss. The two equations below summarize how each is calculated:

- $\text{Non-Revenue Water} = \text{Apparent Losses} + \text{Real Losses} + \text{Unbilled Authorized Consumption}$
- $\text{Water Loss} = \text{Apparent Losses} + \text{Real Losses}$

Water loss in the system equates to lost revenue for the utility. It is critical to the success of any water utility to manage and minimize water loss. In response to the need for consistent water loss auditing and benchmarking, the AWWA released Version 5 of their audit software in August 2014. This tool is focused on identifying water distribution system losses, not water treatment losses. This smart Microsoft Excel based audit program offers water utilities a tool to accurately and consistently identify, record, trend and benchmark the apparent and real losses in their water system. The audit provides a roadmap to help utilities reduce water waste and better prioritize infrastructure investments by identifying water losses that are viable to eliminate and are economically recoverable. Another benefit of the audit is that it provides a measuring stick by which to compare against past performance of other similar sized utilities. By completing the audit, several operational efficiency and financial performance indicators are calculated which will be discussed in a later section of this report.

3.0 Water Loss Audit Results (2016-2019)

The M36-based water audit software provides an array of performance indicators that allow for comparison of the utility to themselves from year to year to determine if they are improving or falling behind. These performance indicators are outlined within this section.

3.1 Historical Water Usage

Per the AWWA Manual M36, a focus on the Data Validity Score is the first critical step to reducing water loss. In terms of data validity, the key entries are the treated water use and billed water use confidence. Gaining confidence in the data entered into the audit form is the first step in managing the City's Non-Revenue Water. The closer the Data Validity Score is to 100, then the higher level of accuracy/confidence exists in the data.

3.2 Unavoidable Real Losses (UARL)

In every utility, a certain amount of real losses is inevitable. The software, based on the M36 Manual, provides a calculation of this "unavoidable" real loss based on the length of water main within the system, the number of services, and the average pressure in the system. The City of Joliet's UARL is estimated to be 364 million gallons (MG)/year.

3.3 Annual Cost of Apparent Losses

Apparent Losses are the non-physical losses such as unauthorized consumption (water theft), meter inaccuracies, systematic data handling errors, etc. Ultimately, these losses directly impact the amount of water that can be billed. Therefore, the cost of the apparent losses is calculated based on the retail unit cost for water (i.e. the cost per gallon to operate, maintain, and manage the system, including capital improvement projects).

3.4 Annual Cost of Real Losses

Real losses are the physical losses from the distribution system and storage tanks up to the point of connection to the customer meter. These types of losses do not correlate to less water use. To illustrate, if a water main break occurs, the water lost during the break and fixing the break is not water that otherwise would have been billed to a customer. Therefore, the only financial loss to the City for real losses are the operational costs. For utilities that supply and treat their own water, the operational costs are relatively low because they typically only include water supply and treatment labor, chemical, electrical, and possibly natural gas costs. However, if the City of Joliet moves to purchasing Lake Michigan water from the City of Chicago, the cost of the real losses will likely include higher operational costs such as the retail cost from the City of Chicago, in addition to any labor, chemical and electrical costs needed to distribute the water throughout the City of Joliet's system safely and sufficiently.

3.5 Non-Revenue Water and Water Loss as a Percent of Volume of Water Supplied

Joliet's Lake Michigan allocation will be subject to the State of Illinois' Level of Lake Michigan Act [615 ILCS 50] which then must meet the requirements of the 17 Illinois Administrative Code Ch. I Section 3730 Rules Allocation of Water From Lake Michigan which was updated in 2014. Under these requirements, Non-Revenue Water must be less than 10% of the Lake Michigan water used and the permittee must outline an action plan with timelines to reduce the Non-Revenue Water accordingly.

3.6 Infrastructure Leakage Index (ILI)

A common operational efficiency performance indicator that many utilities refer to is the Infrastructure Leakage Index (ILI). The ILI is a comparison benchmark that focuses on real losses. The ILI is calculated by dividing the current annual real losses (CARL) by the Unavoidable Real Losses (UARL). The ILI score ranges from 0 to 10 with a lower score representing a more robust and efficient distribution system.

In addition to the performance indicators specifically identified above, several other ones are calculated as well and are intuitive by name. These include the following:

- Non-Revenue Water as Percent of Operating System
- Apparent Losses Per Service Connection Per Day
- Real Losses Per Service Connection Per Day
- Real Losses Per Length of Main Per Day
- Real Losses Per Service Connection Per Day Per psi of Pressure

3.7 Water Audit Metric Comparison

Currently, there are no non-revenue water, or water loss, regulatory requirements or standards that apply to the City of Joliet. However, to establish a reasonable goal for non-revenue water, it is recommended that the benchmarking indicators of other utilities be reviewed for comparison. In 2011, as a result of a water audit data collection initiative, the AWWA Water Loss Control Committee created its first dataset of validated water audit data. The data has been posted for review by water utility stakeholders. AWWA has subsequently provided brief updates since that time. The document is titled Validated Water Audit Data for Reliable Utility Benchmarking. In 2017, seventeen (17) utilities provided their water audit data for review and careful validation by members of the Committee's Water Audit Software Subcommittee. Data from the entire group of utilities was assembled with results that document the 2017 North American benchmark performance indicators using the AWWA water audit methodology. This is a significant step toward improving the level of accountability and the robustness of water audit data within North America.

Table 1 presents a comparison of the City of Joliet's performance indicators alongside the North American Data set in 2017.

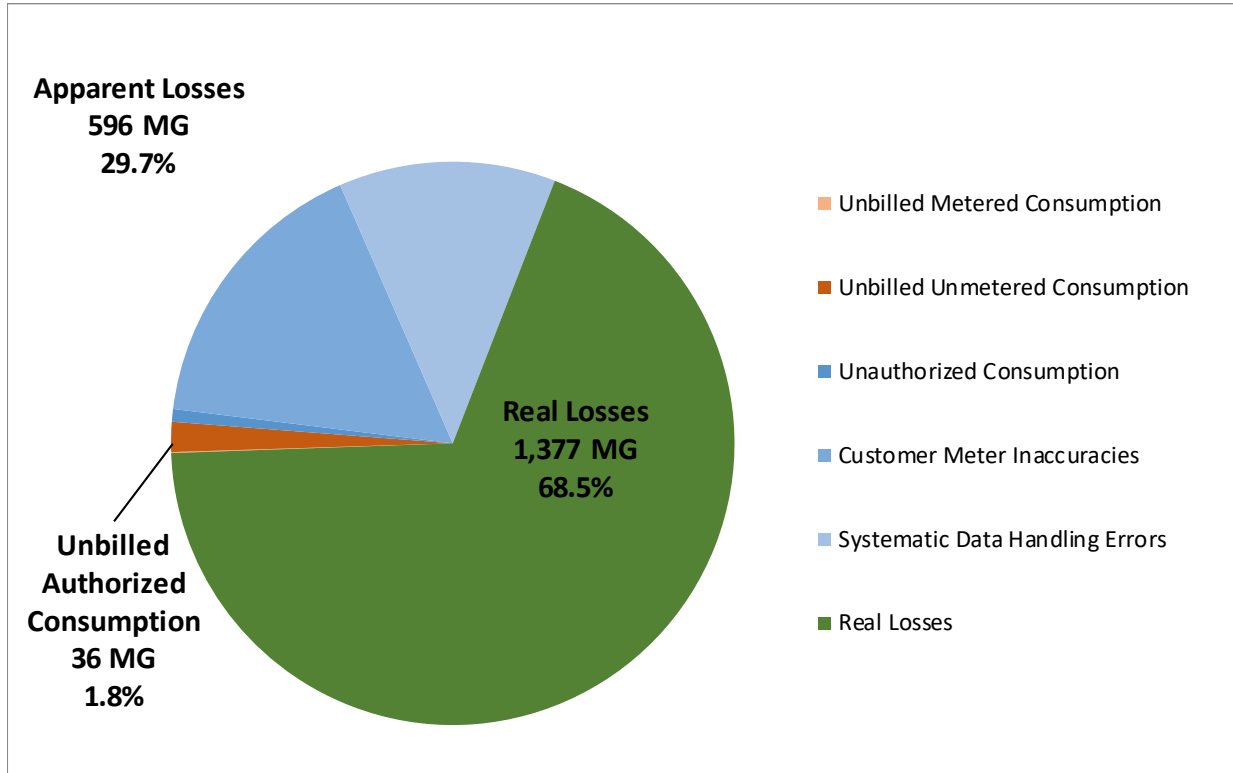
Table No. 1: Water Audit Summary and Comparison

Key Performance Indicators	FY2016	FY2017	FY2018	Federal FY 2019	North American Data Set (2017 Average)
System Attributes					
Apparent Losses (MG/Year)	612.4	602.8	613.0	596.3	NA
Real Losses (MG/Year)	1,395.6	1,224.0	1,489.1	1,377.3	NA
Total Water Loss (MG/Year)	2,007.9	1,826.8	2,102.1	1,973.6	NA
Unavoidable Real Losses (MG/Year)	323.8	323.8	363.5	364.4	NA
Financial Indicators					
Non-Revenue Water as Percent by Volume of Water Supplied:	33.9%	32.4%	34.9%	34.5%	NA
Non-Revenue Water as Percent by Cost of Operating System:	23.4%	25.8%	33.6%	28.3%	10.1%
Annual Cost of Apparent Losses:	\$ 2,137,110	\$ 2,326,911	\$ 3,291,754	\$ 3,184,575	N/A
Annual Cost of Real Losses:	\$ 891,539	\$ 824,117	\$ 641,030	\$ 695,018	N/A
Total Annual Cost of Water Loss:	\$ 3,028,649	\$ 3,151,028	\$ 3,932,783	\$ 3,879,593	N/A
Operational Efficiency Indicators					
Apparent Losses Per Service Connection Per Day (gallons/connection/day):	35.8	35.3	31.4	30.5	11.0
Real Losses Per Service Connection Per Day (gallons/connection/day):	81.7	71.6	76.3	70.5	67.0
From Above, Real Losses = Current Annual Real Losses (CARL) (million gallons/year):	1395.6	1224.0	1489.1	1377.3	NA
Infrastructure Leakage Index (ILI) [CARL/UARL]:	4.31	3.28	4.10	3.78	3.13
Validity Score	53	54	65	65	80

3.8 Non-Revenue Water Distribution

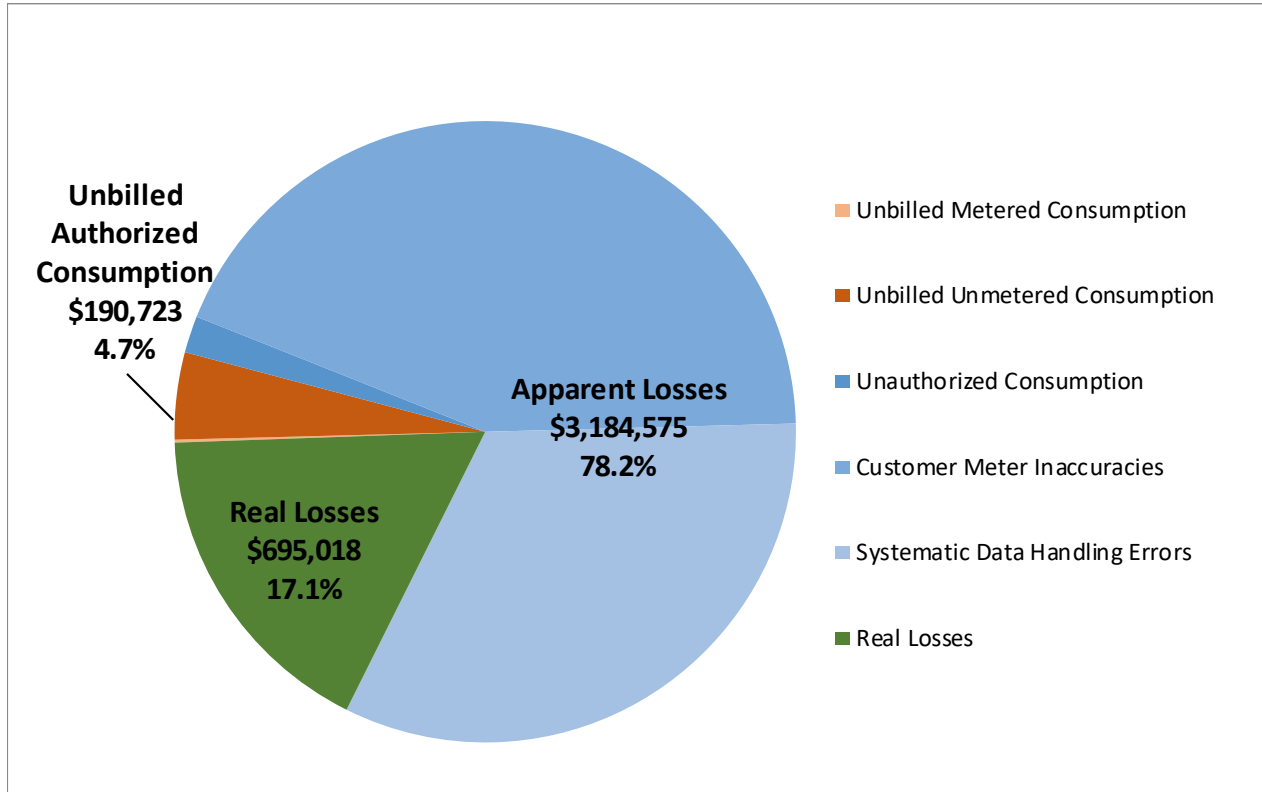
A common operational efficiency performance indicator that many utilities refer to is the Infrastructure Leakage Index (ILI). As discussed in Section 2, NRW is comprised of Apparent Losses, Real Losses, and Unbilled Authorized Consumption. Exhibit A provides the distribution of NRW volume amounts and percentages for the City of Joliet 2019 water loss audit.

Exhibit A: 2019 Non-Revenue Water – Components By Volume



The blue pie shapes are associated with apparent losses, green aligns with real losses, and the orange aligns with the Unbilled Authorized Consumption. From a volume perspective, real losses clearly account for the majority of the NRW. However, when comparing the costs associated with losses, as is shown in Exhibit B, the value of the apparent losses becomes greater than the real losses due to the minimal operational costs associated with the current water distribution system that is based on well supply and treatment.

Exhibit B: 2019 Non-Revenue Water – Components By Cost



It is worth noting that the unavoidable water loss calculated by the M36-based software is approximately 6%. No distribution system is perfect, and unavoidable water loss is that which would typically be expected in the distribution system. This 6% of unavoidable real loss is less than the 10% maximum NRW requirements of a Lake Michigan supplied system.

4.0 Non-Revenue Water Reduction Motivation

Since a Lake Michigan allocation is sought, the Illinois Department of Natural Resources (IDNR) requires all permittees to submit an annual water audit form (LMO-2). The LMO-2 form details the amount of water used, sold and lost by a permittee in the past water year (October – September) and also utilizes the M36 methodology. This form is used to track individual users' compliance with the conditions of their allocation permits. By regulation, all permittees shall have a NRW percentage below 10%. If the permittee's NRW percentage is above 10%, the permittee is required to submit a Non-Revenue Water Reduction Plan to IDNR. The City of Joliet City Council has memorialized its commitment to achieve the 10% NRW requirement by passing Resolution No. 7613 on January 5, 2021 stating that goal.

5.0 Non-Revenue Water Reduction Strategy & Action

A robust NRW strategy addresses Apparent and Real Losses simultaneously. Table No. 2 summarizes the recommended actions and associated timeframes. The recommendations are divided into Apparent Losses and Real Losses as well as time periods (Short-Term, Mid-Term, Long-Term).

Table No. 2: Non-Revenue Water Reduction Strategies

Apparent Losses	
Short-Term	Anticipated Deadline
Annual water loss audit completion	On-going
Flowchart the customer billing process for various users (residential, commercial, exported)	2021
Initiate an Education and Outreach Program to City Staff Regarding Water Efficiency and Water Loss Reduction Strategies for Operations	Complete
Provide fire hydrant meters to all Public Works staff to better track water used by City Staff	2021
Implement bulk water stations	2021
Perform bench testing on customer meters for accuracy	2021
Audit billing records and visit sites/customers to determine potential missed billings	On-going
Implement new ordinance/procedures to meter all construction related water use	Complete
Implement Sensus Analytics at Joint meeting(s) with Water Staff, Billing, and meter manufacturer	Complete
Request the third-party contractor who performs customer meter testing to provide a summary spreadsheet in Excel of the meters, size, and meter accuracy	On-going
Prepare and implement illegal water use policies/ordinances	On-going
Exported Water Users Improvement	
Install meter(s) for SEJSD	Complete
Inventory Customer Meters and Develop a Customer Meter Change-out Program	2021
Long-Term	
Implement improvements based on discovered AMR capabilities	TBD
Consider simplifying rate structure to minimize potential billing errors	2025
Conduct exported water meter replacement programs	TBD
Real Losses	
Short-Term	Anticipated Deadline
Conduct water main break analysis	Complete, Continue to Monitor
Hydraulic analysis to review pressures	Complete, Continue to Monitor
Leak detection (Annual)	On-going
Increase water main replacement program based on NRW desired goals	2022
Investigate the Potential of implementing District Metered Areas (DMAs) or, at a minimum, areas that could potentially just be monitored to better narrow down the locations of water loss.	Complete
Mid-Term	
If applicable (once DMAs are reviewed), construct the necessary valves, meters, and distribution improvements to implement smaller metered areas or DMAs to better narrow down the location of the water loss.	2023
Long-Term	
Monitor water main replacement rate and water reduction to determine impact on NRW and adjust accordingly	On-going

5.1 Apparent Loss Reduction Strategy and Action Plan

Additional explanation of the short-term strategy and action plan for apparent loss reductions is as follows:

- a. Annual Water Loss Audit Completion – The City began preparing detailed audits in 2016 and is intending to continue to complete them on an annual basis.
- b. Flowchart the customer billing process for various users (residential, commercial, exported) - Develop a flowchart to track the customer meter reading and billing process as a starting point to reduce the apparent water losses. Identify any loopholes in the process where errors could occur.
- c. Construct and implement three bulk water stations to replace current paper tracking system for sale of water to contractors
- d. Meet with Water Staff, Billing, and meter manufacturer to identify the most accurate reporting tools for billed water use. Create standard reports that can be prepared routinely with minimal effort to obtain the following information on any time interval:
 - I. Exported Water Use (The Exported Water Use should be audited by the Public Utilities Department every billing cycle and the water use trended.)
 - II. Billed Metered Water Use
 - III. Unbilled Metered Water Use

Furthermore, the goal is to eventually be able to provide this metered water data from a specific date to another specific date (i.e. 10/1/20 through 9/30/21).

- e. Exported Water Users Improvement – Install meters for Southeast Joliet Sanitary District (SEJSD) [Note: Completed in July 2020]

In addition to the items above, the City should continue with the initiatives that they began that were mentioned in the introductory part of this section (i.e. continue with annual master meter testing program at distribution entry locations, continue with the annual meter testing program for majority of the Exported Water Meters, etc.)

5.2 Real Loss Reduction Strategy and Action Plan

From a volume perspective, real losses comprise the bulk of the water losses. Additional explanation on short-term strategies to reduce real loss reductions are as follows:

- a. Conduct water main break analysis – Over the last three years, the City has averaged approximately 250 water main breaks per year. The City of Joliet’s Water System Master Plan Report, dated August 2019, provides concise priorities and recommendations for water main replacement. Although the water main break analysis was based on various criteria, one critical

item noted was that the majority of the on-going water main breaks occur in the old cast iron/ductile iron pipe installed from the 1940s through the 1960s. While the mains installed from the 1940s to 1960s only comprise 19% of mains in the system, 62% of the breaks analyzed occurred in the mains installed in that time period. Based on this simple analysis, it would seem the City should focus on replacing the mains from this era first along with the older mains that are also experiencing higher than the desirable break rate. Additional discussion and information regarding the recommended water main replacement program is provided later in this report.

Based on AWWA Partnership for Safe Water, 2011, a fully optimized system has a maximum of 15 breaks per 100 miles per year. Furthermore, per AwwaRF Report 91165, "Main Break Prediction, Prevention and Control," Neil S. Grigg, 2007, a maximum acceptable level of breaks for a distribution system is 25 to 27 breaks per 100 miles of water main per year. In a period of 7 years (2012-2018), 811 breaks occurred in approximately 121 miles of water main, which translates to an average of 96 breaks per 100 miles per year. At this level, the City of Joliet's water main break rate is nearly 4X the maximum acceptable rate and over 6X a fully optimized system.

Furthermore, in addition to the water main break analysis, it is recommended to evaluate the water main break repair process and determine if some breaks can be repaired in a shorter period of time. Track the time reported versus time repaired, the type of leak, the size of leak, etc.

- b. Hydraulic analysis to review pressures - This was completed as part of the Water System Master Plan Report dated August 2019. The higher the pressure, then the higher the amount of real water loss that is produced in the system. Therefore, the City should confirm with the model, and through needs assessment calculations for supply and storage, determine whether it is viable to reduce pressure in certain sections of the City or across the whole distribution system. If feasible, without hindering domestic and fire flow service capabilities, the City should consider reducing pressure either across the system or in certain sections of the City to minimize the real losses.
- c. Leak detection (Annual) - Continue annual leak detection efforts.
- d. Review the potential of implementing District Metered Areas (DMA) or, at a minimum, areas that could potentially just be monitored to better narrow locations of water loss. DMA's would be challenging to create given the complex water main network and elevations across the City. However, it may be beneficial to place meters at certain locations to better verify potential locations of water loss.
- e. Increase water main replacement program based on NRW desired goal – The Water System Master Plan recommends a water main replacement program of 1% per year (or replacement of water main every 100 years). For reference, the Utah State Water Main Break Study recommends planning to replace water main every 60 to 100 years (i.e. 1.6% to 1.0% of the total water main per year).

Every water distribution system is unique and has different NRW goals. For well sources, the primary motivation for water loss reduction is the combined need of being a good steward of a

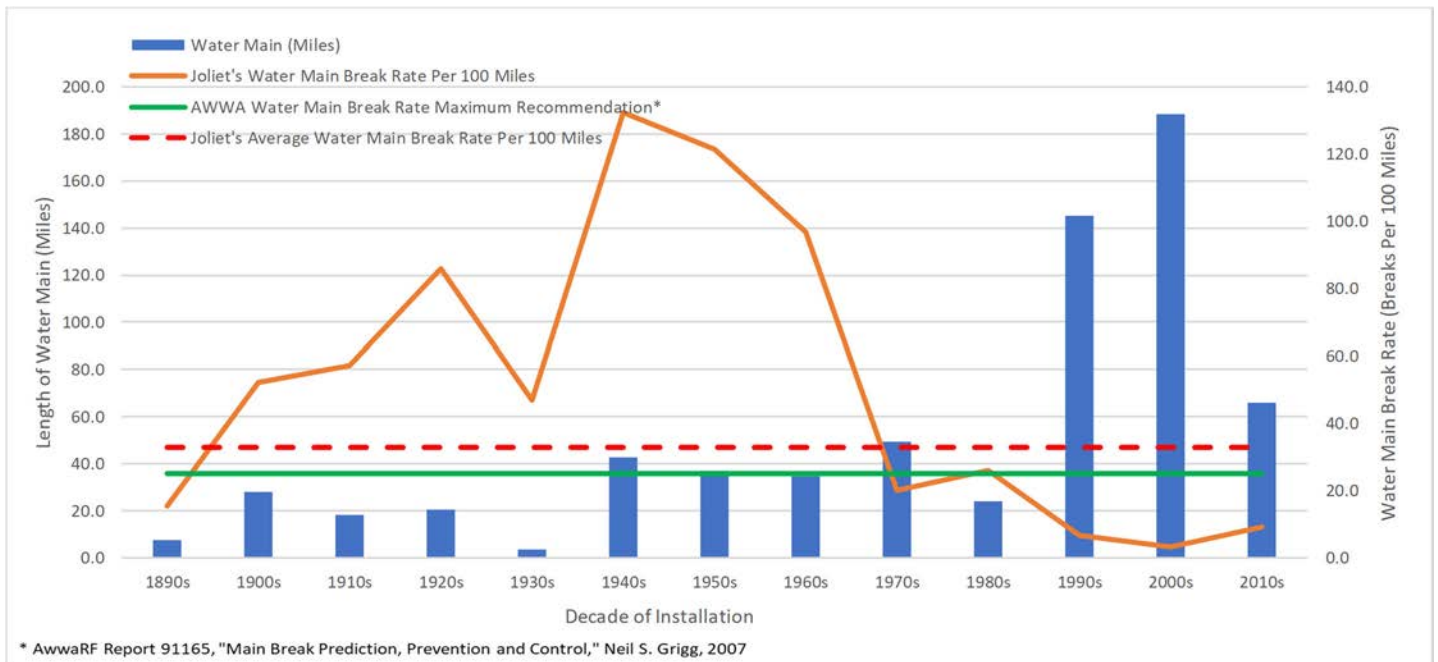
limited resource while balancing an appropriate financial investment into the program to minimize rate increases. However, for Lake Michigan water, the City will also have to contend with achieving the regulatory requirement of a maximum of 10% NRW. It is likely that the current anticipated annual expenditure level of \$8M to \$10M will not allow the City to meet this regulatory goal in a reasonable duration.

To reduce the real losses more aggressively to meet the Non-Revenue Water requirements set forth for Lake Michigan permittees, a more robust and targeted water main replacement program will be required. Therefore, a detailed water main study that included a water main inventory and water main break analysis was completed to determine the most problematic mains and to develop a water main replacement program. A historical analysis of water main breaks based on the age of the water main installation date was completed and is summarized in Table No. 3 and Exhibit C below:

Table No. 3: Water Main Length By Year of Install and Main Breaks

Decade of Installation	Length of WM (Miles)	Water Main Length (%)	Length of WM (Miles) (Aggregate)	Water Main Length (%) (Aggregate)	# of Main Breaks	Breaks Per 100 Miles
1890s	7.6	1.1%	7.6	1.1%	7	15.4
1900s	28.1	4.2%	35.7	5.4%	88	52.3
1910s	18.0	2.7%	53.7	8.1%	62	57.3
1920s	20.5	3.1%	74.3	11.2%	106	86.0
1930s	3.6	0.5%	77.8	11.7%	10	46.8
1940s	42.9	6.4%	120.7	18.1%	340	132.2
1950s	37.0	5.6%	157.7	23.7%	270	121.5
1960s	34.6	5.2%	192.3	28.9%	201	96.9
1970s	49.3	7.4%	241.6	36.3%	59	20.0
1980s	23.8	3.6%	265.4	39.9%	37	25.9
1990s	145.1	21.8%	410.5	61.7%	57	6.5
2000s	188.6	28.4%	599.1	90.1%	37	3.3
2010s	66.0	9.9%	665.1	100.0%	36	9.1
Total	665.1	100.0%			1310	197.0

Exhibit C: 2013 - 2018 Water Main Breaks & Breaks Per 100 Miles



As shown in Exhibit C, the water mains that result in water main break rates above the recommended maximums are those water mains that were installed prior to 1970. In addition, the City also identified some additional water mains installed in the 1980s and 1990s that have higher than desired water main break rates. Consequently, to address the water mains that have higher than desired water main break rates, approximately 192 miles of water main will need to be replaced. By replacing approximately 3.2% of water main annually, the City will reach this replacement goal by 2030. This is anticipated to reduce the amount of real losses by approximately 17% per year, ultimately allowing the Non-Revenue Water to reduce to 9.7% by 2030. A summary of the water main replacement program by installation year is provided in Table No. 4 below:

Table No. 4: Water Main Replacement Program 2022-2030

Project Year	Water Main To Be Replaced per Decade														Total (ft)	Total (miles)
	1890	1900	1910	1920	1930	1940	1950	1960	1970	1980	1990	2000	2010	2020		
Miles of Main	7.6	27.4	18.0	20.5	3.6	42.9	28.4	32.4	49.3	23.6	145.1	188.6	66.0	11.7	3,511,694	665.1
Target Replacement Rate (mi/yr)	0.8	3.1	2.0	2.3	0.4	4.8	4.1	3.8	-	-	-	-	-	-	-	-
Target Replacement Rate (ft/yr)	4,457	16,054	10,586	12,052	2,091	25,143	16,685	19,023	-	-	-	-	-	-	-	-
2022	1,700	13,100	10,600	12,100	2,100	27,000	23,800	20,000	0	2,000	0	0	0	0	112,400	21.3
2023	1,000	13,000	10,600	12,100	1,000	27,000	19,200	19,300	0	0	9,200	0	0	0	112,400	21.3
2024	2,000	15,400	10,400	12,100	2,100	27,000	21,600	21,800	0	0	0	0	0	0	112,400	21.3
2025	4,500	13,000	10,000	11,000	2,100	25,700	23,200	19,600	3,300	0	0	0	0	0	112,400	21.3
2026	4,500	15,200	8,000	11,000	2,100	27,000	25,500	19,100	0	0	0	0	0	0	112,400	21.3
2027	3,000	11,300	11,000	12,500	2,100	27,000	23,500	20,000	2,000	0	0	0	0	0	112,400	21.3
2028	5,000	16,900	11,000	15,000	2,100	27,000	13,400	20,000	2,000	0	0	0	0	0	112,400	21.3
2029	7,300	24,000	11,000	17,000	2,100	27,000		20,000	4,000	0	0	0	0	0	112,400	21.3
2030	11,100	22,600	12,700	5,700	3,100	11,600		11,400	34,200	0	0	0	0	0	112,400	21.3
Total (ft)	40,100	144,500	95,300	108,500	18,800	226,300	150,200	171,200	45,500	2,000	9,200	0	0	0	1,011,600	
Total (miles)	7.6	27.4	18.05	20.5	3.6	42.9	28.4	32.4	8.6	0.4	1.7	0.0	0.0	0.0		191.6

This rate of replacement would eliminate the majority of the main constructed prior to 1970, which has been more prone to water main breaks. If the real loss reduction achieves that goal, the real losses would be very close to the Unavoidable Real Loss value calculated by the AWWA software. Furthermore, the analysis also assumed through the Apparent Loss action plan items, approximately 2.5% annually will be reduced through 2035 where the effects will equalize and be maintained through continued efforts.

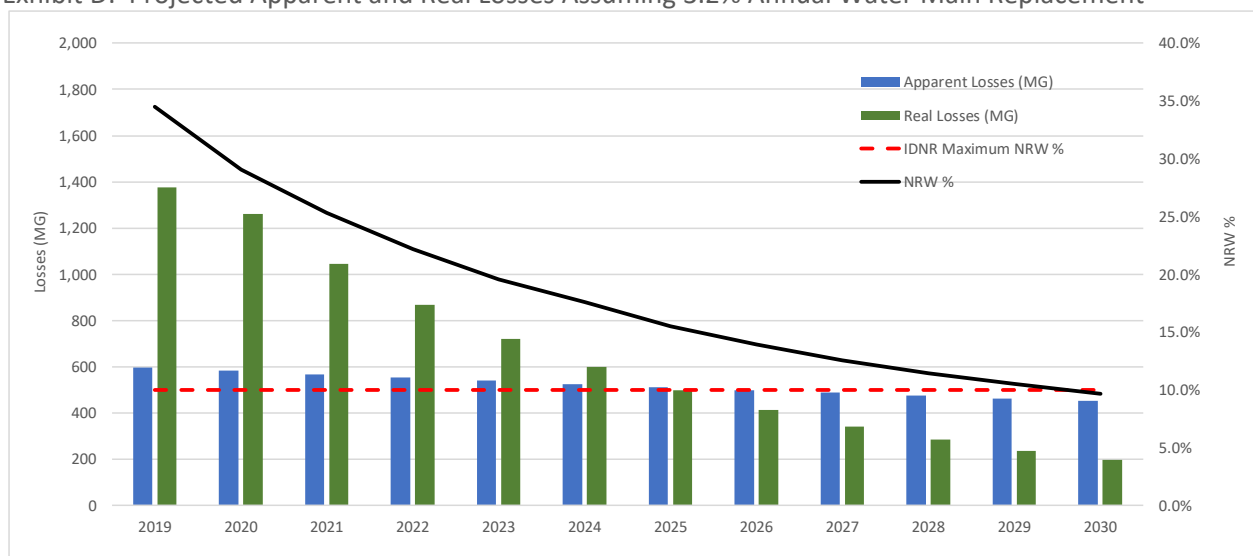
6.0 Recommendations/Conclusions

It is recommended the City integrate a multi-faceted approach by implementing both Apparent and Real Loss reduction strategies to proactively manage and reduce the NRW below 10% by 2030. Furthermore, it is recommended the City continue to focus on improving its data validity in the process.

From an apparent loss perspective, investigating and rectifying the systematic data handling inconsistencies is an initial critical step to reducing the water losses which will also result in a higher confidence in the data presented. Several other apparent loss reduction strategies have also been identified such as a developing a customer meter accuracy testing program.

From a real loss perspective, the City intends to replace 3.2% of the water main annually to achieve a goal of a maximum of 10% NRW by 2030, which is estimated to equate to a 17.0% annual reduction rate at an estimated annual amount of \$33,700,000. It has been determined the water mains with the highest break tendencies are the mains installed prior to 1970. By replacing 3.2% of the water main annually through 2030, 100% of the water main constructed prior to 1970 will be replaced. Such a program shall be monitored in tandem with the water loss audit initiatives to confirm and justify progress over time. Exhibit D graphically depicts the projected Apparent and Real Losses along with the NRW percentages from 2019 through 2030.

Exhibit D: Projected Apparent and Real Losses Assuming 3.2% Annual Water Main Replacement



A detailed list of both the Apparent and Real Loss reduction strategies that are intended to be implemented is identified in Table No. 2 earlier in the report. However, the NRW Reduction Plan is intended to evolve as strategies are implemented and information is processed and uncovered. Therefore, the NRW Reduction Plan shall be reviewed, reevaluated and modified as appropriate on an annual basis in conjunction with the completion of the annual water audit.