AGENDA ITEM

TO: Tim Vandall, City Administrator

FROM: Anthony J. Zell, Jr., Wastewater Utility Director

DATE: December 13, 2023

SUBJECT: 2023 Sanitary Sewer Master Plan Update

George Butler and Associates has completed the flow study and updates to the City's sanitary sewer master plan. A consultant from GBA presented the new information and updates to the City Council at the September work session. Due to the size of the document, only the executive summary is included with the agenda. A full report is on file at the City Clerk's office if a more detailed review is necessary. Some of the key highlights include:

- Detailed where CCTV work and manhole inspections should occur in sub-basins showing excessive inflow/infiltration,
- Provided updated locations to remove inflow/infiltration,
- Revised the surcharge maps under various scenarios for the main interceptors to be used when planning future developments,
- Recommends the City formally adopt a 10-year storm interval vs. a 50-year storm interval when planning future developments,
    - Will need to be formally adopted by the City during Tech Spec/Design Criteria update.
- Included the agreement with KDHE and the City regarding future pipe sizes in the 9 Mile basin affected by the McIntyre interceptor,
- Included the agreement with Evergy (Westar) for the electrical poles that were installed on top of the City's sewer main during the DeSoto Road project.

The adoption of these updates to the plan does not bind the City Council to future actions or commit the funds required to perform the necessary work. Once approved, a copy of this plan will be delivered to KDHE for review.

Policy Consideration: N/A

Financial Consideration: N/A

Recommended Action: A motion to adopt the 2023 sanitary sewer master plan update from George Butler Associates, as presented.

City of Lansing, Kansas
Supplemental Report to the Sanitary Sewer Collection System Master Plan

December 2023

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GBA

PN: 15190

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EXECUTIVE SUMMARY

A. Project Purpose

The Sanitary Sewer Collection System Master Plan Update project was initiated to: a) determine the results of recent sewer improvements; and b) to determine the needs of the sanitary sewer collection system into the future.

This Master Plan Update is intended to review the success of past projects and strategically layout additional capital improvements to the collection system to provide safe and efficient sanitary sewer flow collection. One goal of the Master Plan Update was to identify necessary improvements to the existing collection system so the City can schedule the improvements to be completed to allow for growth in the region. Overall the sewer improvements projects that the city has undertaken since the last Master Plan have greatly improved the collection system, and eliminated the need for multiple projects that were previously outlined.

B. Results and Recommendations

One component of an aging collection system that does remain in the City's collection system is excessive infiltration and inflow (I/I). During the project it was determined by flow and rainfall monitoring that excessive I/I enters the system. I/I is rain water and ground water that enters the system through system defects. I/I is caused by the deterioration of the system and direct connections of storm drainage such as roof downspouts piped to the sanitary sewer collection system. I/I can reduce system capacity and can also inundate a system if left unchecked.

The growth of the city and excessive I/I has caused key interceptors in the City's collection system to be undersized for a 50-year design storm. Growth is expected to continue in Lansing, which will continue to reduce system capacity unless improvements are made.

To properly plan for improvements and expansion of the City's sewer system, the following study objectives were met:

1. Conducted flow and rainfall monitoring of the system and determined the current reaction of the system to rainfall.

2. Developed a computer capacity model and determined the current and future capacity needs of the main interceptors in the sanitary sewer collection system.

3. Developed a recommended plan to address existing and future capacity improvements. A phased plan for these recommendations is included to break down the improvements into manageable projects with a logical sequence of construction.

The project provided the following conclusions and recommendations:

1. Of the twelve basins established in the system during the flow monitoring stage, four basins were found to have excessive I/I that could be identified through I/I

inspections and potentially removed. It is recommended that these basins be inspected to identify and remove cost-effective I/I sources.

Removal of excessive I/I has the benefit of decreasing flow to the wastewater treatment plant, thereby extending the timeframe for a future plant expansion. Removal of excessive I/I will also extend the useful life of major interceptors by not overloading them.

2. A 50-year storm event was selected for storm protection and future growth design flow criteria for the City. This protection is Lansing's current design storm event, and is used by other municipalities. It provides extensive protection when combined with I/I removal. Further discussion of the design storm event is provided later in this section.

3. The hydraulic model identified the need for both relief sewers for existing conditions as well as areas that require relief for future growth conditions. Relief sewers are proposed for the following conditions:

   a. Current Capacity Issues: Relief sewers to address pipes undersized under current conditions are shown as Project 1. These relief sewers are sized to provide capacity for existing flows as well as future growth.

   b. Future Capacity Issues: Relief sewers were defined where pipes are not currently undersized, but do not have the capacity to serve future growth.

C. Phasing of Improvements

The phasing of these improvements should consider the following concepts:

- Current undersized sewers should be considered a higher priority than sewers needed to serve growth.

- The areas of excessive I/I resulted from many years of deterioration. Most I/I removal programs are completed over many years to spread costs of system renewal. However, the need for relief sewers for these areas is dependent on the understanding of the amount of I/I that can be removed. Therefore, the investigations to determine the potential for I/I reduction should be completed before the relief sewer improvements are implemented.

- The funding of the rehabilitation program should also consider that areas that currently do not exhibit excessive I/I will deteriorate and need attention in the future.

- The City needs to consider the available capacity in existing sewers in the approval process for proposed developments. Until capacity improvements are completed, the perceived cause of a basement backup or overflow will be new upstream developments, regardless of the actual cause (i.e. blockage).

The recommended phased plan is summarized in Table ES-1 and shown on

Figure ES- 1, Figure ES- 2-, and Figure ES- 3. The detailed plan for each project including figures showing project locations is presented in CHAPTER 4 of this report.

Table ES-1 Recommended Plan Summary

PROGRESS	TASK		UNIT	AMOUNT	UNIT COST ($/unit)	Estimated Cost ($)	Completed Cost ($)	Future Project Cost [(1)] ($)
	I/I Investigation and Reduction							
Future	I/I Investigation (Basins 2B, 6, 8, 9)		LF	55,000	10	N/A	N/A	$ 550,000
Future	System Repair (Basins 2B, 6, 8, 9)		LF	14,000	130	$ 1,820,000	N/A	$ 2,548,000
		SUBTOTAL				**$ 1,820,000**	**$ -**	**$ 3,098,000**
	Relief Sewer for Existing System							
	Description	**Location**						
Completed	7-Mile Action Plan (12" to 36")	7-Mile Interceptor	LF	12,726		$ 5,408,550	$ 4,706,835	$ -
Completed	Project 1 (10"-12" Pipe)	Basin 1 [(3)]	LF	3,500		$ 437,500	$ 397,706	$ -
In Progress	Project 2 (12"-15" Pipe)	Basin 1 [(3)]	LF	3,300	130	$ 429,000	$ 429,000	$ -
Eliminated	Project 3 (10" Pipe)	Basin 3	LF	2,100		ELIMINATED	$ -	$ -
Completed	Project 4 (10"-15" Pipe)	Basins 6, 9	LF	3,400		$ 1,066,000	$ 2,502,801	$ -
Future	Project 4 (10"-15" Pipe)	Basins 6, 9	LF	4,800	160	$ 429,000		$ 600,600
Completed	Project 5 (12"-18" Pipe)	Basin 8	LF	3,200		$ 480,000	$ 422,000	$ -
Completed	Project 6A (36" Pipe)	9-Mile Interceptor	LF	4,700		$ 2,350,000	$ 2,068,000	$ -
Future	Project 6B (36" Pipe)	9-Mile Interceptor	LF	4,700	620	$ 2,914,000		$ 4,079,600
		2014 SUBTOTAL		**29,700**		**$ 15,718,850**	**$ 10,526,342**	
		2022 SUBTOTAL		**9,500**		**$ 3,343,000**		**$ 4,680,200**
	Future Relief Sewers for Growth							
	Phase 1							
Future	9-Mile Interceptor (54" Pipe), Mary St to Main St		LF	4,500	580	$ 2,610,000	$ -	$ 3,654,000
Future	Basin 10 (15"-21" Pipe)		LF	4,400	200	$ 880,000	$ -	$ 1,232,000
	Phase 2							
Future	9-Mile Interceptor (48" Pipe), Main St SW		LF	6,800	740	$ 5,032,000	$ -	$ 7,044,800
		SUBTOTAL		**15,700**		**$ 8,522,000**	**$ -**	**$11,930,800**
		TOTAL						**$19,709,000**

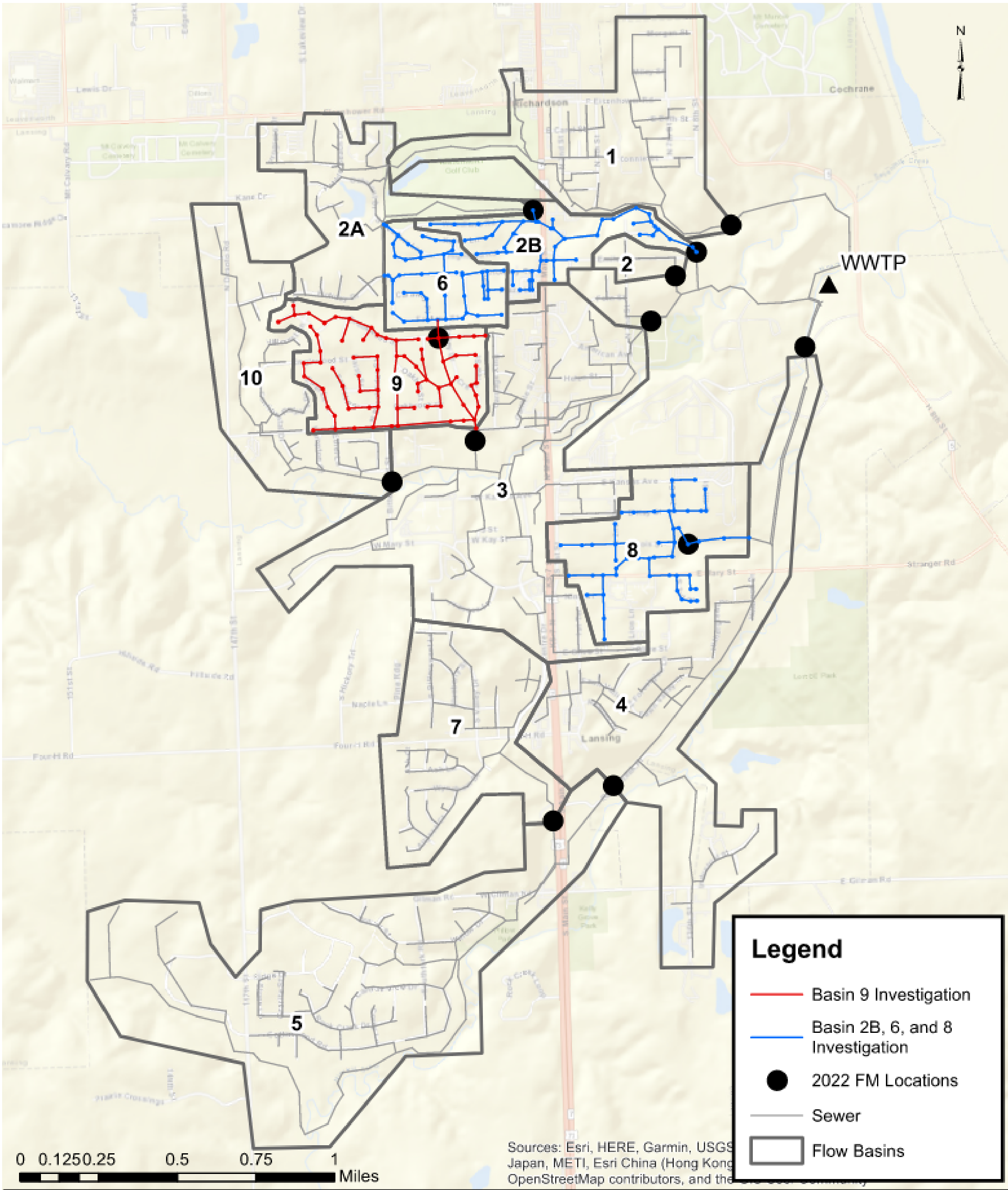
Notes:
(1) Includes a contingency for project costs of 40%

Short term improvements include inflow and infiltration investigations for Basins 2B, 6, 8, and 9. These can be phased over multiple years to enable cost efficiencies.

Table ES-2 Recommended Short-Term Improvements

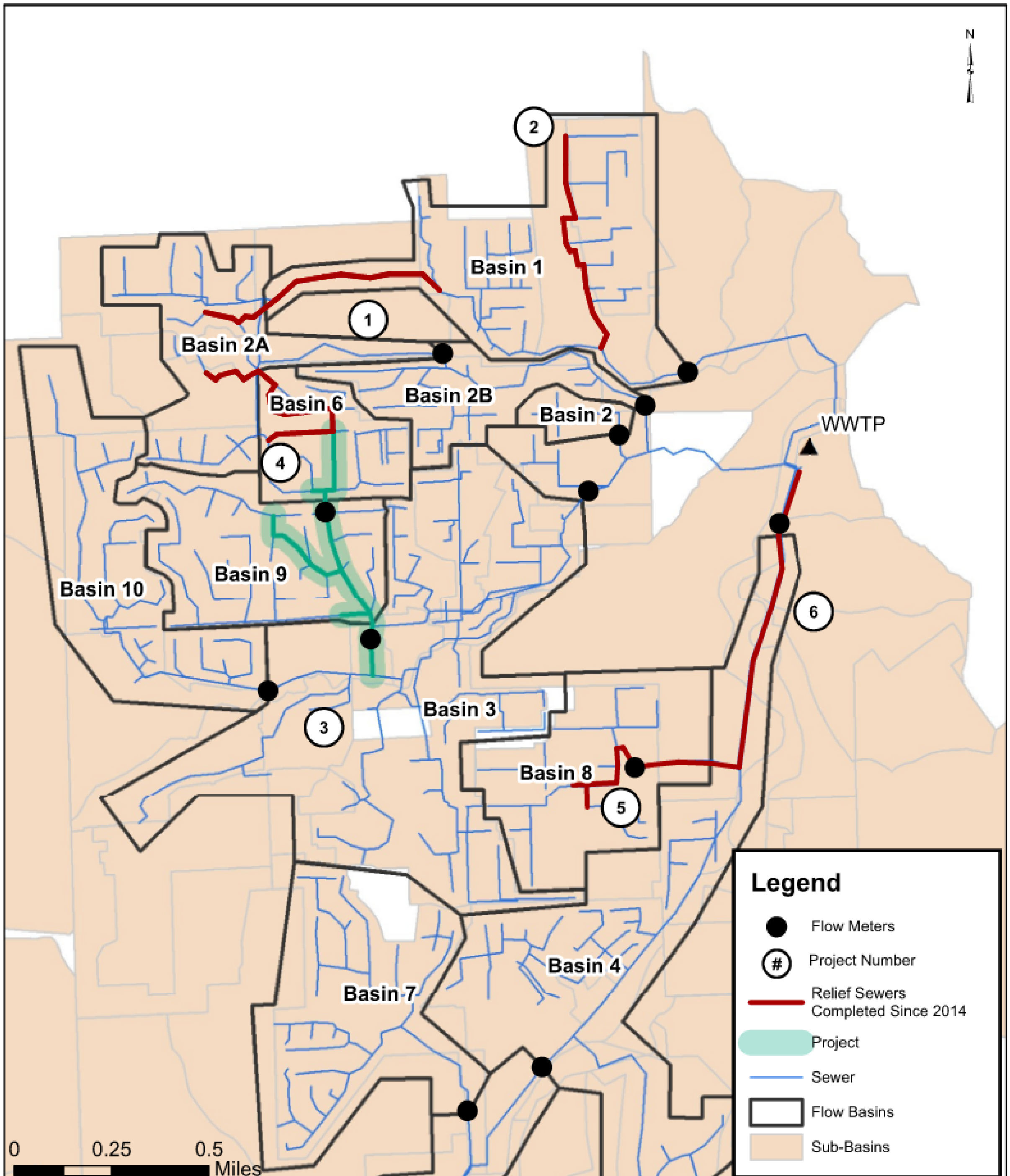
Short Term Improvements	Estimated Project Cost
I/I Investigations: Investigation of areas with excessive I/I would help the City decided whether to initially fund rehabilitation to remove excessive I/I or relief sewers to provide capacity for the peak flows.	$550,000
Total	**$550,000**

Figure ES- 1 – Recommended I/I Investigations



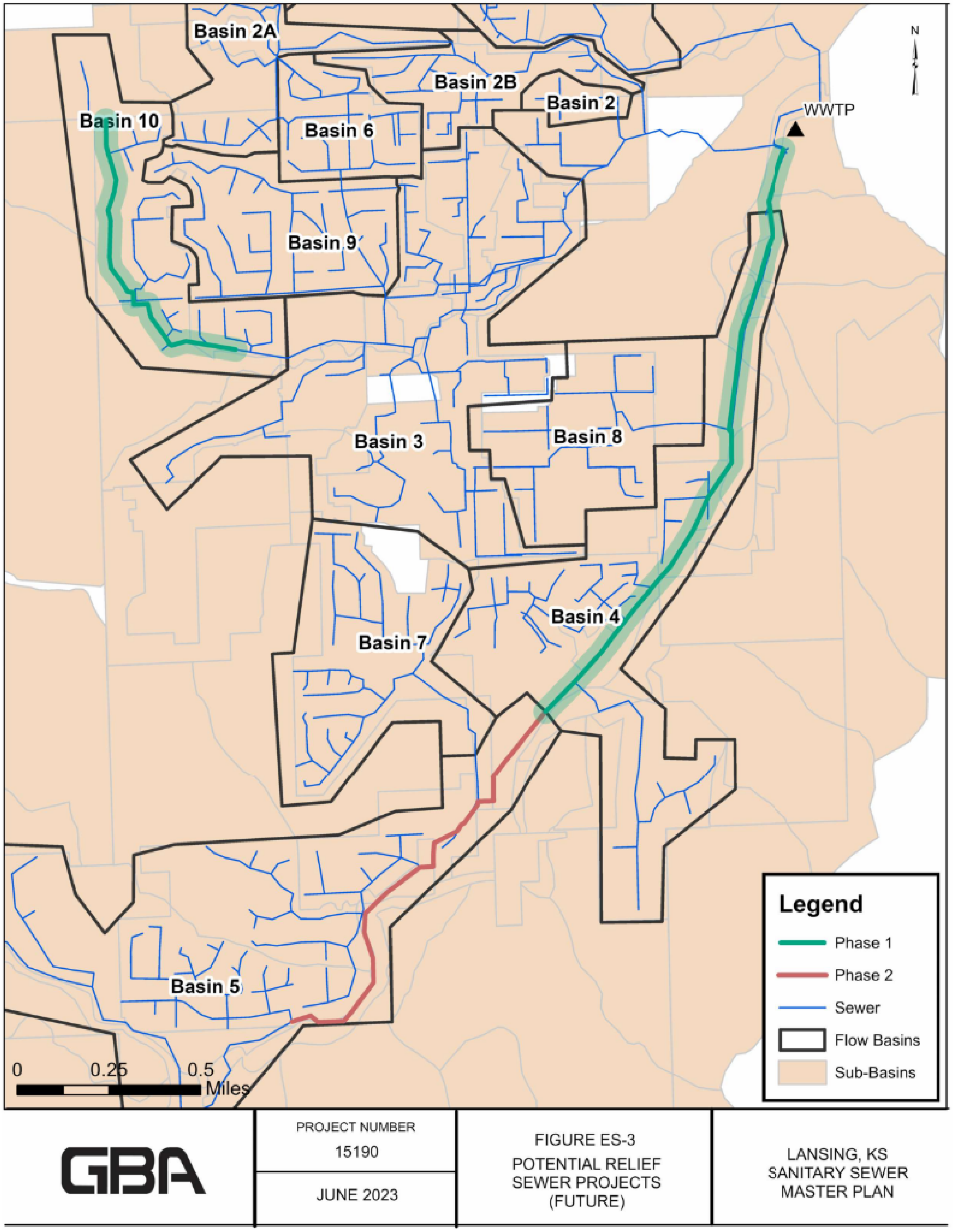
GBA	PROJECT NUMBER 15190	FIGURE ES-1 I/I FUTURE INVESTIGATIONS RECOMMENDATIONS	LANSING, KS SANITARY SEWER MASTER PLAN
	JUNE 2023		

Figure ES- 2- Potential Relief Sewer Projects



GBA	PROJECT NUMBER 15190 / JUNE 2023	FIGURE ES-2 POTENTIAL RELIEF SEWER PROJECTS	LANSING, KS SANITARY SEWER MASTER PLAN

Figure ES- 3 – Potential Relief Sewer Projects (Growth)



D. Additional Considerations: 10-Year vs 50-Year Design Storm

One additional aspect to consider within this master plan document is the differences between designing sanitary sewer systems for a 10-year vs for a 50-year storm event. The City's current design standards are based on a 50-year storm, which can result in an overly conservative sanitary sewer design. Many communities in the region, including Johnson County Wastewater and the City of Olathe, use a 10-year design storm for sanitary sewers. Others use a 25- or 50-year storm for sizing of interceptors. In determining the appropriate design storm for sewer sizing, the City should consider the following parameters: cost vs. appropriate size, system age, pipe material, and risk vs. benefits.

1. Future City Growth

The addition of future growth areas into the city could result in sewer extensions totaling 300,000 linear feet of new polyvinyl chloride (PVC) sewer pipe in the two watersheds. The existing system contains approximately 248,000 LF of pipe, primarily consisting of vitrified clay pipe (VCP). After future developments are complete more than 50% of the City's sewer system will be constructed with PVC pipe. PVC pipe construction will result in less I/I volume in the system, reducing surcharge risk and the amount of flow to be treated. Note that generally, VCP sewers have more joints due to short pipe lengths and have lower quality pipe joints, both of which lead to higher leakage rates.

2. Comparison

Recent analyses of developing properties in the City have compared 10-year to 50-year design storm events for concrete comparisons of flow reactions in the interceptors. Sewer flows were incrementally different between the 10-year and 50-year analyses (0.2' vs 0.6' in the 9 Mile 21-inch interceptor).

Reviewing results for modeling the existing 9-Mile interceptor indicate an approximate 18-percent increase in pipe size to convey the 50-year design storm and a 14-percent increase in pipe size to convey the 10-year design storm. The table below provides pipe sizing comparisons for different watersheds under different storm parameters.

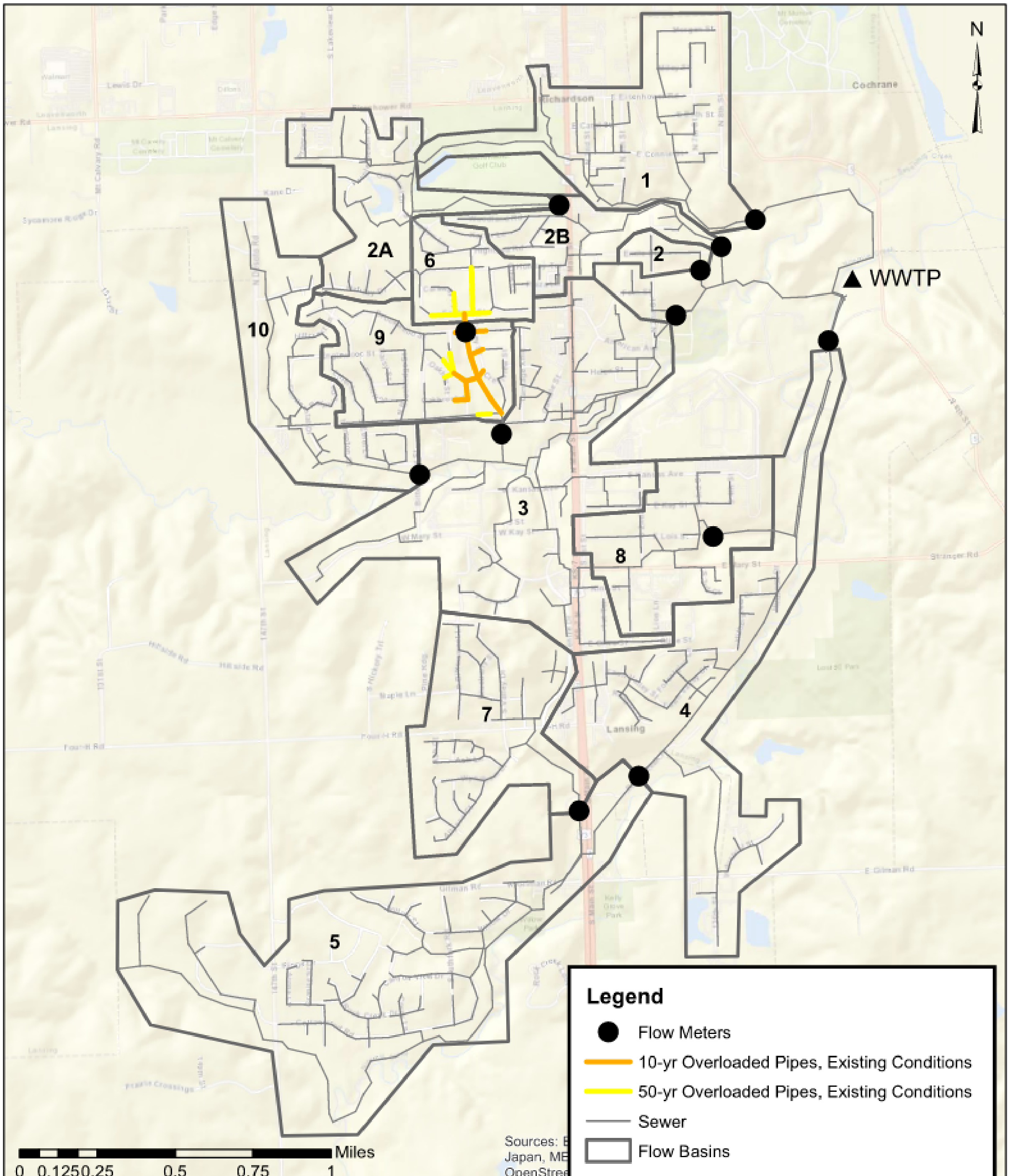
Level of Protection (Storm Return Interval)	Pipe Size Required - 100 Ac. (in)	Pipe Size Required - 1,000 Ac. (in)	Pipe Size Required - 10,000 Ac. (in)
10	10	24	66
50	10	27	72

The City of Lansing is fortunate in that basement backups are rarely reported. These would be indicators that the sewer system is undersized or is experiencing excessive I/I. Smaller pipe diameters result in lower sewer cost per linear foot, reducing overall project cost and capital improvements planning cost. Cost savings at the individual project level may seem small, but over the anticipated growth periods and future sewer expansions could amount to significant savings.

3. Recommendation

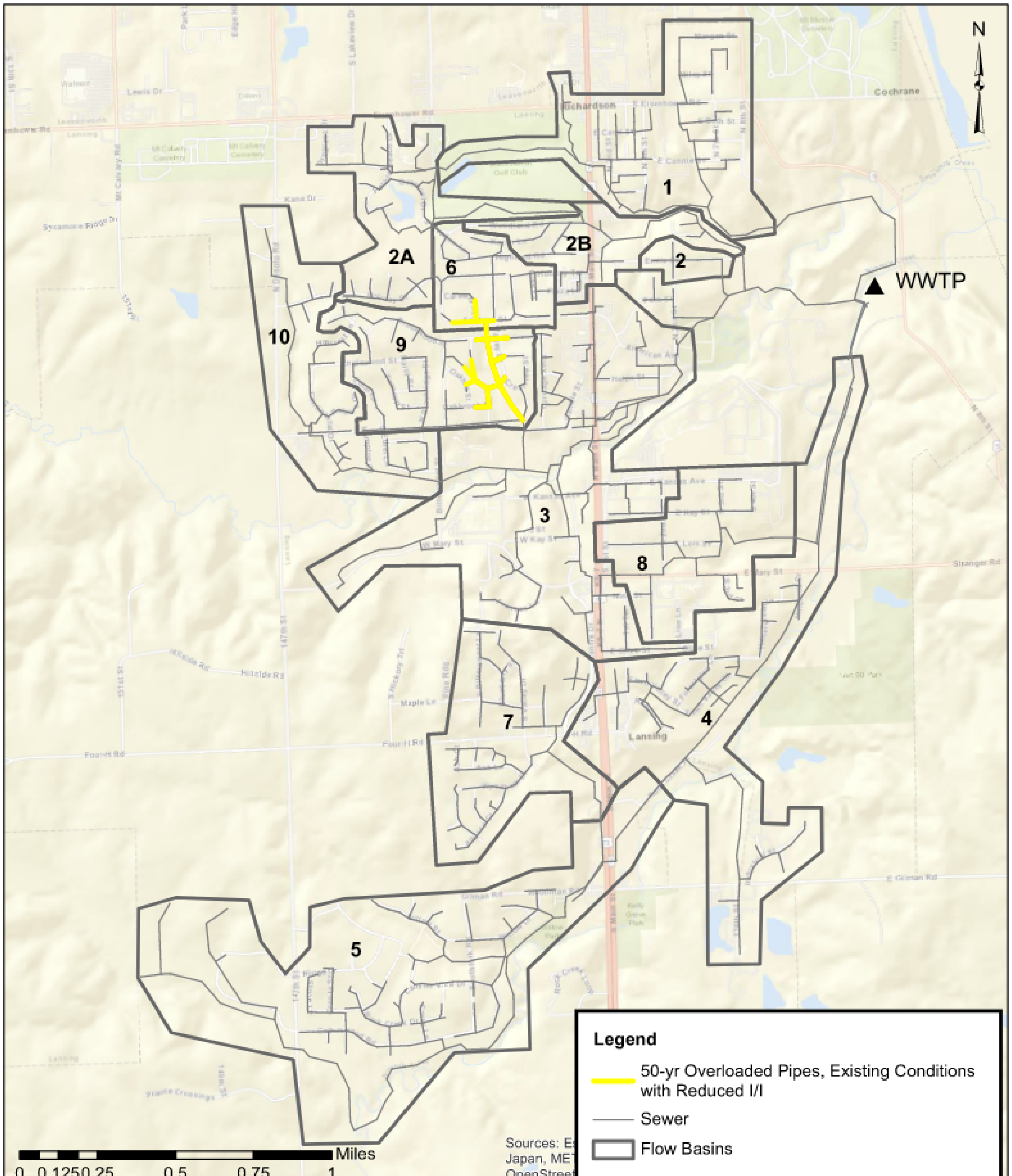
It is recommended that the 10-year design storm be utilized for future collection system planning. This recommendation is based on utilization of PVC pipe installation practices, the amount of PVC that is and will be installed in the City of Lansing collection system, the marginal difference in pipe size increases on the existing system to convey 10-year and 50-year design storm, and the low surcharge levels both seen with modeling and flow monitoring.

Figure 3-1 Model Results – Existing Conditions



GBA	PROJECT NUMBER 15190	FIGURE 3-1 MODEL RESULTS- EXISTING CONDITIONS	LANSING, KS SANITARY SEWER MASTER PLAN
	June 2023		

Figure 3-2 Model Results – Existing Conditions with I/I Reduction



GBA	PROJECT NUMBER 15190 June 2023	FIGURE 3-2 MODEL RESULTS-EXISTING SEWERS WITH POTENTIAL I/I REDUCTION	LANSING, KS SANITARY SEWER MASTER PLAN

Figure 3-3 Model Results – Interim Growth Conditions

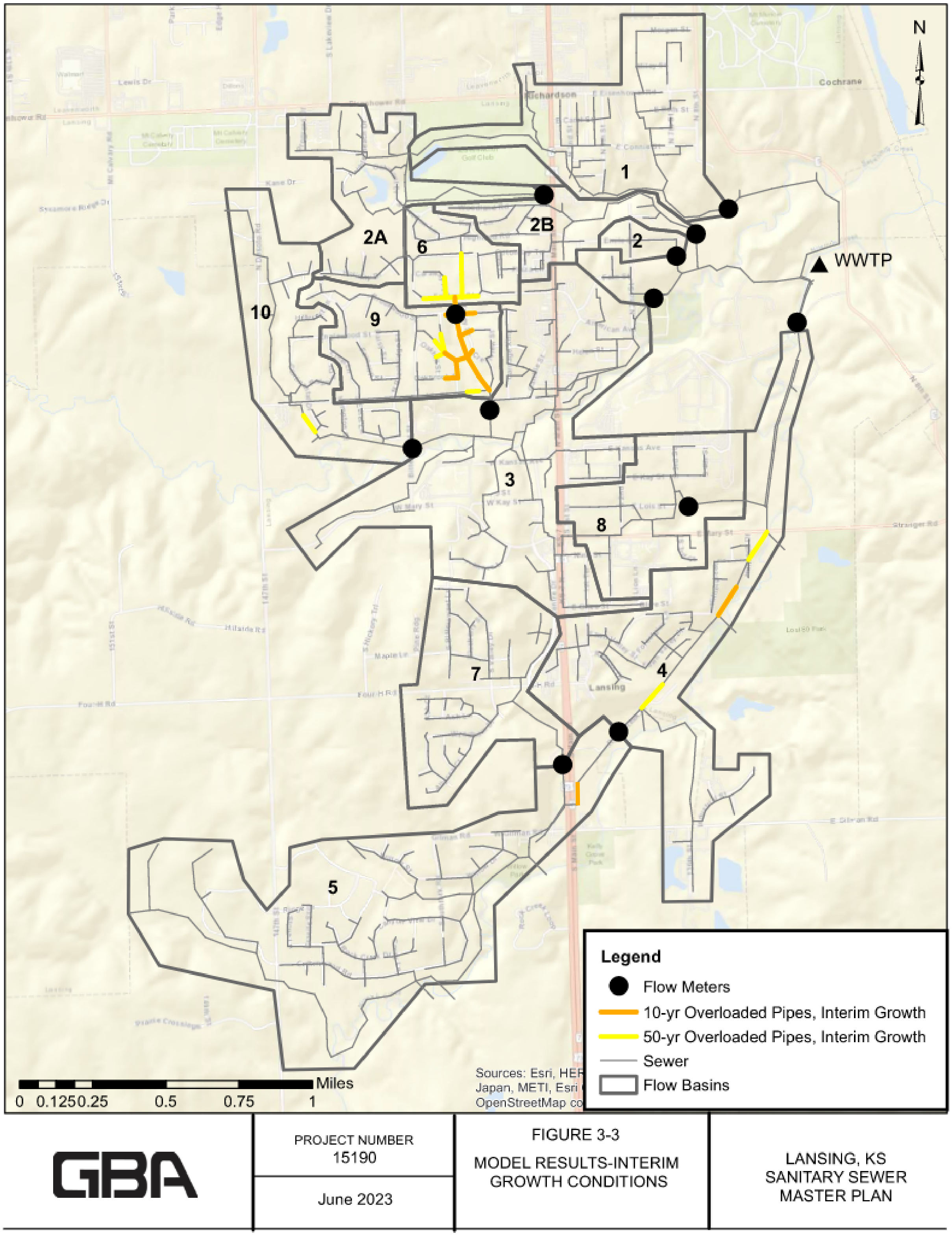
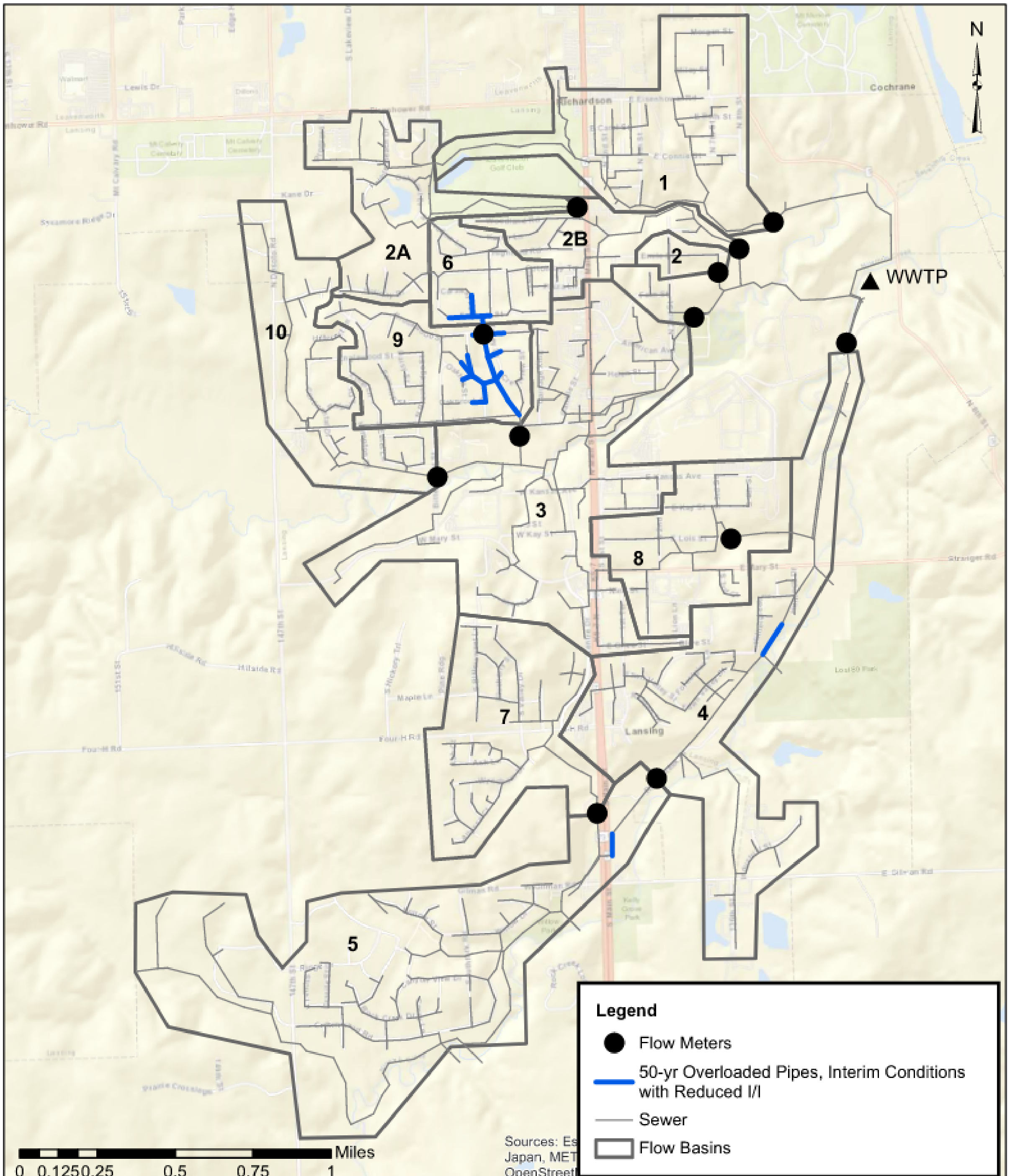
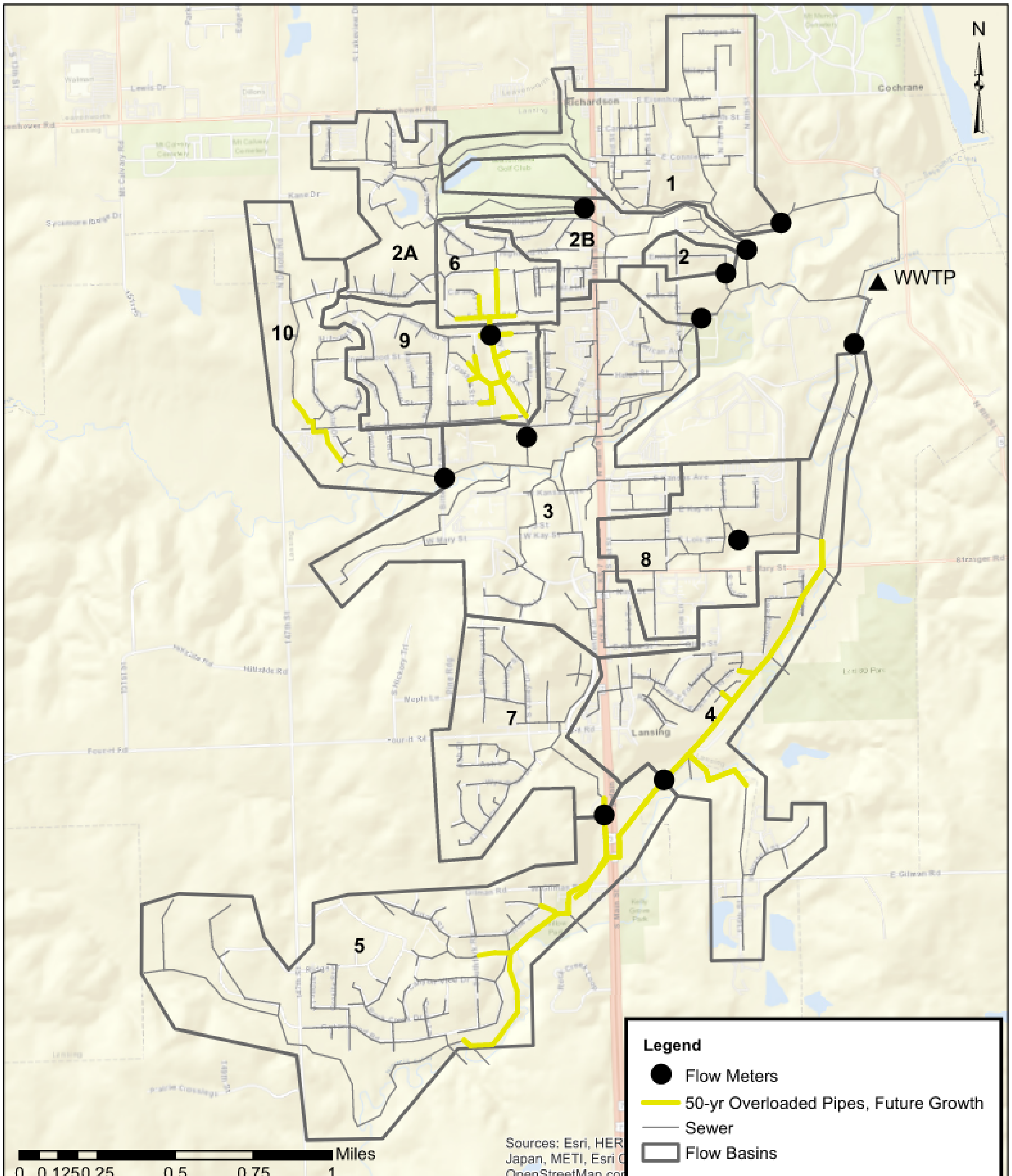


Figure 3-4 Model Results – Interim Growth Conditions with I/I Reduction



GBA	PROJECT NUMBER 15190	FIGURE 3-4	LANSING, KS
	June 2023	MODEL RESULTS-INTERIM GROWTH WITH POTENTIAL I/I REDUCTION	SANITARY SEWER MASTER PLAN

Figure 3-5 Model Results – Future Growth Conditions



GBA	PROJECT NUMBER 15190 June 2023	FIGURE 3-5 MODEL RESULTS-FUTURE GROWTH CONDITIONS	LANSING, KS SANITARY SEWER MASTER PLAN