

Feasibility Study

Lake Michigan Supply

Prepared for
City of Kalamazoo

March 2022

2210003

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1 INTRODUCTION

The City of Kalamazoo has entered into an Administrative Consent Order (ACO) with the Michigan Department of Environment, Great Lakes, and Energy (EGLE) that is intended to address issues with the City's drinking water supply system as identified by EGLE, including a review of source consolidation.

The intent of this report is to review the feasibility of changing the City of Kalamazoo Drinking Water supply from multiple groundwater sources to a single Lake Michigan surface water source.

The Kalamazoo water system is currently supplied by 90 wells in 13 well fields. Water quality varies over these multiple sources. A map showing an overview of the City of Kalamazoo Water System is provide as Figure 1. Source water chemistry varies from well field to well field and can also vary between individual wells within the same well field. This variability requires significant water blending, treatment, and use management to effectively operate the water system. Additionally, maintenance activities are sometimes difficult given the geographic spread of the well fields.

2 LAKE MICHIGAN SOURCE

In reviewing the feasibility of a Lake Michigan Source, several factors have been considered. They are:

- System capacity
- Raw water or potable water transmission
- Location of water treatment plant and intake
- Transmission main route options

2.1 System Capacity

The City of Kalamazoo water system has a current peak demand of approximately 60 MGD. To provide this volume of water with a pipe velocity around 5 feet per second requires a minimum 60-inch diameter transmission main. When evaluating the required transmission capacity, water demands for communities west of Kalamazoo along potential transmission main routes were reviewed along with the potential to serve Battle Creek to the east. Although discussed in more

detail later in this report, the I-94 corridor contains the highest density of communities/potential water users when compared to corridors farther north or farther south. The peak water demands for the I-94 corridor communities are summarized below. It should be noted that all the listed communities currently utilize ground water supplies which could be abandoned if they utilize a Lake Michigan supply.

TABLE 2

Community	Peak Water Use (MGD)
City of Kalamazoo	60
City of Portage	27
City of Battle Creek	24
Coloma/Watervliet	1.7
Hartford	0.5
Lawrence	0.3
Paw Paw	0.7
Lawton	1
Mattawan	1
TOTAL	116.2

Summing the peak water demands for the communities reveals that the peak demands of all the communities can be provided using two, 60-inch diameter transmission mains. A double transmission main system can provide peak flow capacities as well as emergency interconnections in case of a required repair/replacement on one of the mains. Rounding off the current capacity requirements translates to an approximate treatment plant capacity of 120 MGD.

2.2 Raw or Potable Water Transmission

Utilizing a Lake Michigan surface water supply will require the use of water treatment, either at the water source near Lake Michigan or at each user community. Regardless of the treatment location, the quality and consistency of Lake Michigan water will eliminate the need for iron removal and other contaminant removal processes currently used by the communities indicated in Table 2.

Although the transmission of raw water will not require a large, finished water plant near Lake Michigan, some form of source treatment will be required for clarification and preliminary biological treatment. Additionally, each user community will be required to operate and maintain their own treatment plant for their individual distribution system. Given these considerations, the economies of scale provided by a centralized, large volume treatment plant near a Lake Michigan intake the most feasible option.

2.3 Intake and Treatment Plant Location

In reviewing various transmission main route options, the following items were considered:

- Existing Lake Michigan intake/treatment facilities
- Potential partner communities between Lake Michigan and Kalamazoo
- Treatment plant land availability at or near the intake site
- Existing public right-of-way, potential inactive rail line corridors, and topographic obstacles

On the Lake Michigan shoreline west of Kalamazoo, there are 4 existing intake locations:

- South Haven
- Covert
- Benton Harbor
- St. Joseph

All of the existing intake locations will require significant upsizing of both the intakes and supply lines to meet the required water demand. Because of this, none of the four existing intakes provides an advantage over any other.

Factoring in the potential partner communities between Kalamazoo and Lake Michigan, the I-94 corridor has the best potential to provide a new water supply to the most communities. Utilizing the I-94 corridor for transmission puts the Benton Harbor intake as the closest existing intake.

The Benton Harbor water plant was recently renovated and has a capacity of 12 MGD. The current treatment plant site does not have the space available for the required 120 MGD plant and there is not enough readily available adjacent land for plant expansion. Approximately 6.5 miles of double transmission mains would need to be constructed to get water from Benton Harbor up to the I-94 corridor inflection point near Coloma.

North of Benton Harbor, between Lake Michigan and the I-94 corridor, there is an apparent transmission main route from Coloma, westerly along Coloma Road, to Lake Michigan. Although crossing both the Paw Paw River and I-196, there are parcels near Coloma Road and M-63 which are large enough to provide the 60 acres potentially needed for a 120 MGD plant. There are also vacant parcels west of M-63 which provide access for the intake pipelines/station. This location with current parcel mapping is illustrated in Figure 2.

Farther northward near the interchange of I-196 and Hagar Shore Road, there are again parcels which provide access to Lake Michigan for intake pipelines/station and larger parcels east of I-196 suitable for a 120 MGD treatment plant. This location with current parcel mapping is illustrated in Figure 3.

2.4 Transmission Main Route

The location of the water treatment plant is dictated primarily by the preferred transmission main route and the availability of land for the plant. As noted in the previous section, there are two currently identified potential intake/plant locations: Coloma Road and Hagar Shores Road.

The potential transmission main routes are illustrated in Figure 4 with additional detail on the south side of Kalamazoo illustrated in Figure 5.

Route 1: Starting on Coloma Road near Lake Michigan, the first route option runs eastward on Coloma Road through the City of Coloma and Watervliet then bearing northeast on Red Arrow Highway towards Hartford.

Route 2: Starting on Hagar Shores Road near Lake Michigan, the second route option runs eastward on Hagar Shores Road, past 70th Street, to the intersection with the Van Buren Trail. The route then turns southeasterly along the Van Buren Trail (currently gravel section) into Hartford. This section of the trail could be paved as part of the transmission main project.

Conjoined Route: From Hartford, there is a singular route which runs from Hartford, along Red Arrow Highway to M-681, then northward on M-681 approximately 900 feet to the intersection with an unused section of rail controlled by West Michigan Railroad. The route then runs easterly along the unused rail line from Hartford to Paw Paw. *As a side note, this section of railroad right-of-way could be made into a non-motorized trail and paved as part of the transmission line construction.* After reaching Paw Paw, the route runs along the north right-of-way of I-94 to Almena Drive, then northward to Red Arrow Highway, then northeasterly along Red Arrow Highway to Parkview Avenue. The route then extends eastward along Parkview, under US-131, continuing along Parkview, then Whites Road, then Cork Street to the intersection with Milcork Street, turning north to Miller Road, then east on Miller Road to River Street, then north on River Street to East Michigan Avenue, then east on West Michigan Avenue to Oran Avenue which transitions to Worden Avenue. The route then turns eastward on East JK

Avenue to 28th Street, the northward on 28th Street to East Main Street, then eastward to North 33rd Street.

Route Length: Route 1 (including the conjoined section) is approximately 54.4 miles long.

Route 2 (including the conjoined section) is approximately 53.1 miles long.

These routes utilize existing public rights-of-way (except for the two rail /trail sections) with both transmission mains running parallel but sufficiently separated. Other parallel routes could be explored and may be required if significant conflicts with other utilities/infrastructure are discovered. It is the intent of this report to examine feasibility rather than specific design issues.

As can be seen in Figure 4, the I-94 corridor route allows all the communities west of Kalamazoo listed in Table 2 to utilize the Lake Michigan source and decommission all of their groundwater supply wells along with any iron or other contaminant treatments. The route through the south side of Kalamazoo, as detailed in Figure 5, runs between many of the current well fields and therefore links with several larger diameter distribution mains. This southern route will also allow relatively straight forward connections for the City of Portage. Extending at least one of the transmission mains eastward to 33rd Street will allow continued extension through Galesburg, Augusta, Fort Custer, and ultimately to Battle Creek.

3 Water Authority

Given that utilizing a Lake Michigan supply will require transmission across multiple governmental boundaries, it will be necessary to establish a Kalamazoo Water Authority to operate and maintain the water intake, treatment plant, and transmission mains. Municipal partners will continue to operate and maintain their local distribution networks. Additional development of this organizational structure is needed and will require significant coordination with local, county, and state representatives.

4 Estimated Costs and Funding

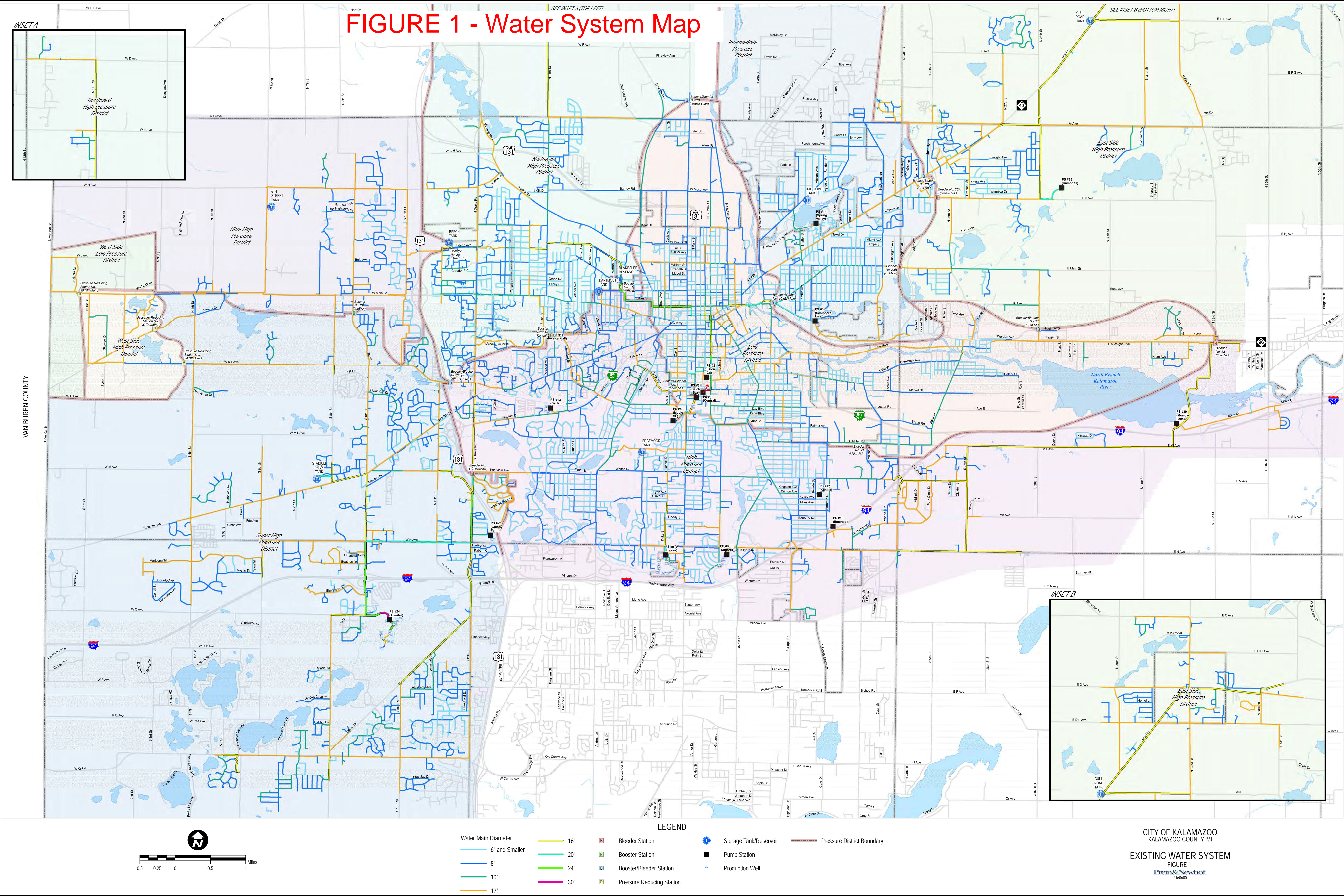
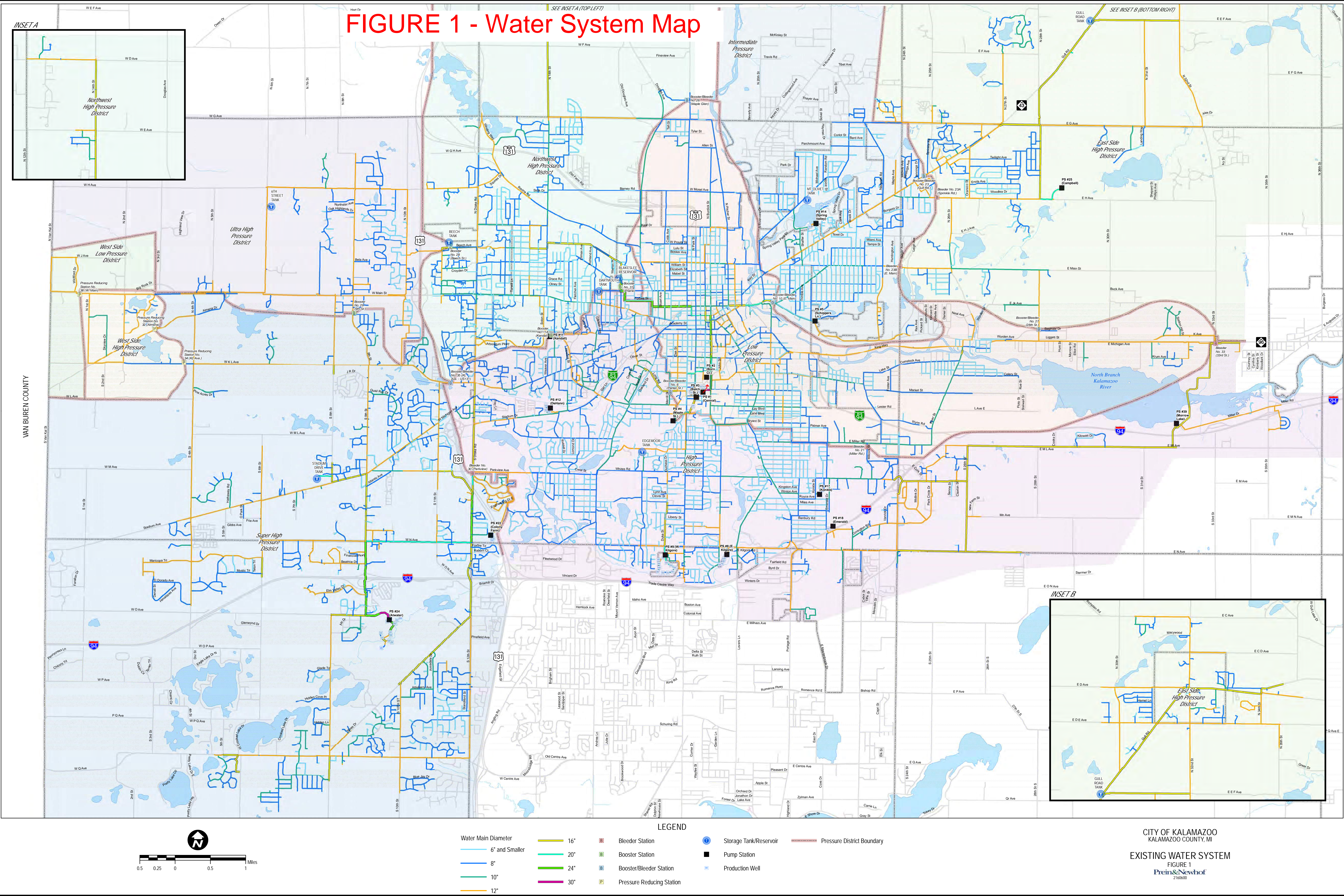
We have compiled an estimated project cost which is included in Appendix A. The estimate is based on the southern transmission main route No. 1 as that route is approximately 1.3 miles longer than the northern route No. 2. The total estimated project cost is approximately \$1,700,000,000 to provide maximum day demand supply to 9 community systems which provide water to around 250,000 people, local businesses, and local industries. The projected costs are intended to provide order of magnitude estimate for evaluating the feasibility of establishing a Lake Michigan supply for southwest Michigan. Given the magnitude of the costs, funding will need to be obtained through a combination of the Federal Water Infrastructure Finance and Innovation Act (WIFIA) program, State of Michigan infrastructure funding, and local rate structures.

Assuming that only a portion of the project cost can be borne by local rate structures, calculations indicate that if a 1% income burden is placed on 100,000 households with a median household income of \$50,000, approximately \$50M in annual rate revenue will be generated. Annual payments of \$50M for 40 years at a 2% interest rate will support an initial investment of approximately \$1,367,000,000. Because existing commercial/industrial water use in the corridor has not been evaluated, the rate/financing impacts for that user class has not been included. Approximately \$333,000,000 in State or Federal principal cost support may be required to facilitate developing a Lake Michigan water supply for the southwest Michigan region. Factoring significant commercial/industrial water users into this calculation may reduce the principal cost support required for the project.

Based on this evaluation, it appears that the option of a consolidated Lake Michigan supply warrants further review by the City of Kalamazoo and discussion with the potential partner communities.

Figures

FIGURE 1 - Water System Map



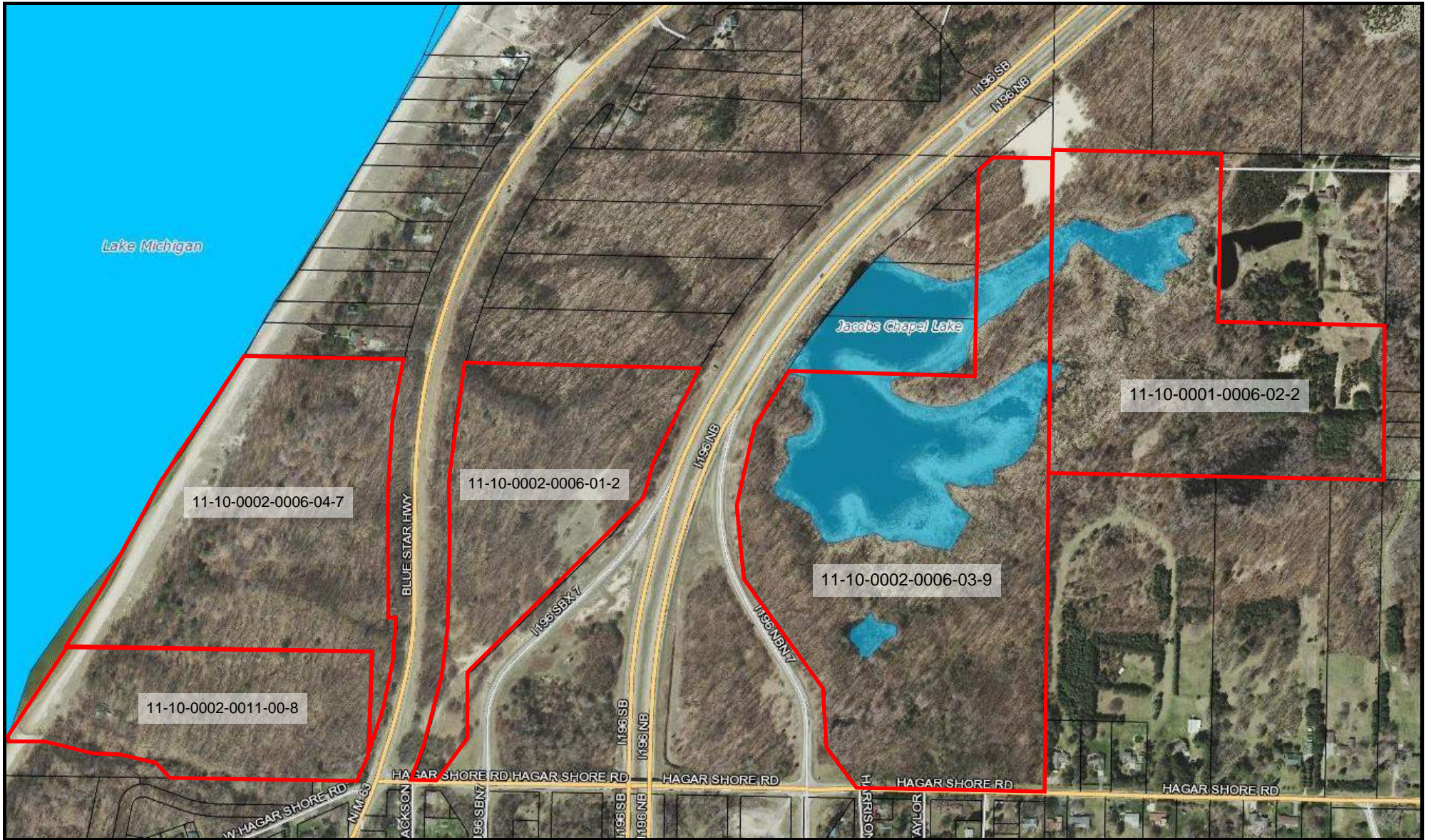


Map Source: Berrien County GIS



CITY OF KALAMAZOO
KALAMAZOO COUNTY, MICHIGAN
COLOMA ROAD PARCELS

FIGURE 2
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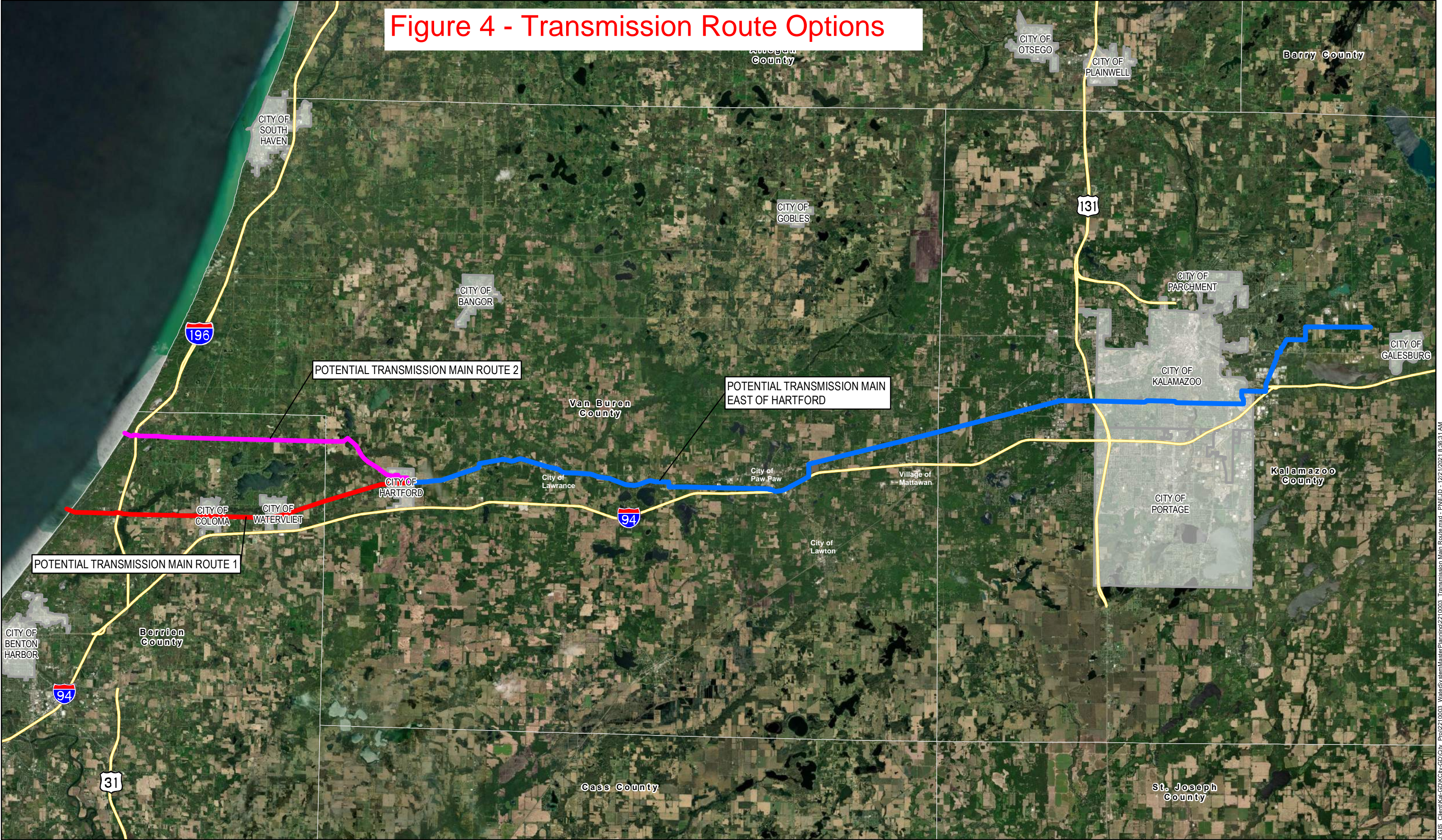
Map Source: Berrien County GIS



CITY OF KALAMAZOO
KALAMAZOO COUNTY, MICHIGAN
HAGAR SHORE ROAD PARCELS

FIGURE 3
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Figure 4 - Transmission Route Options



SCALE: 1" = 3 MILES

CITY OF KALAMAZOO
Kalamazoo County, MI
TRANSMISSION MAIN ROUTE OPTIONS

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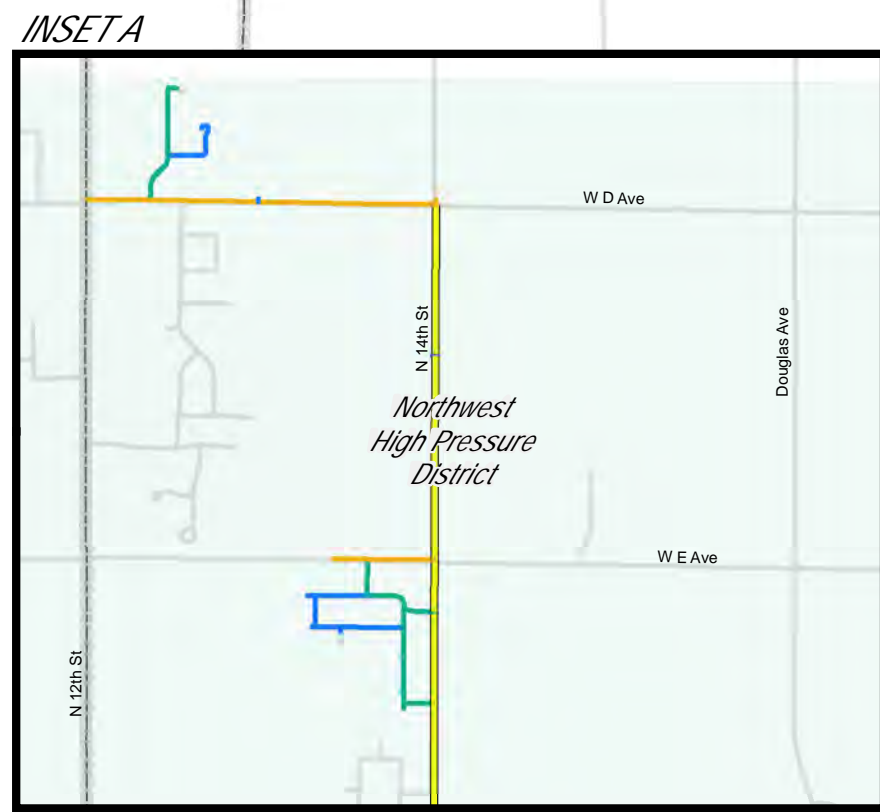
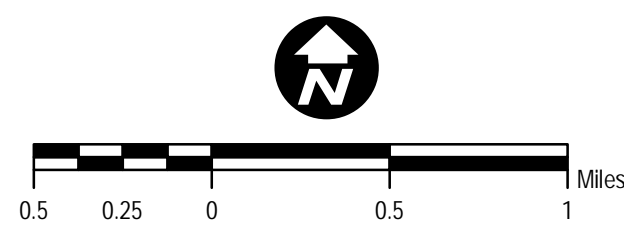
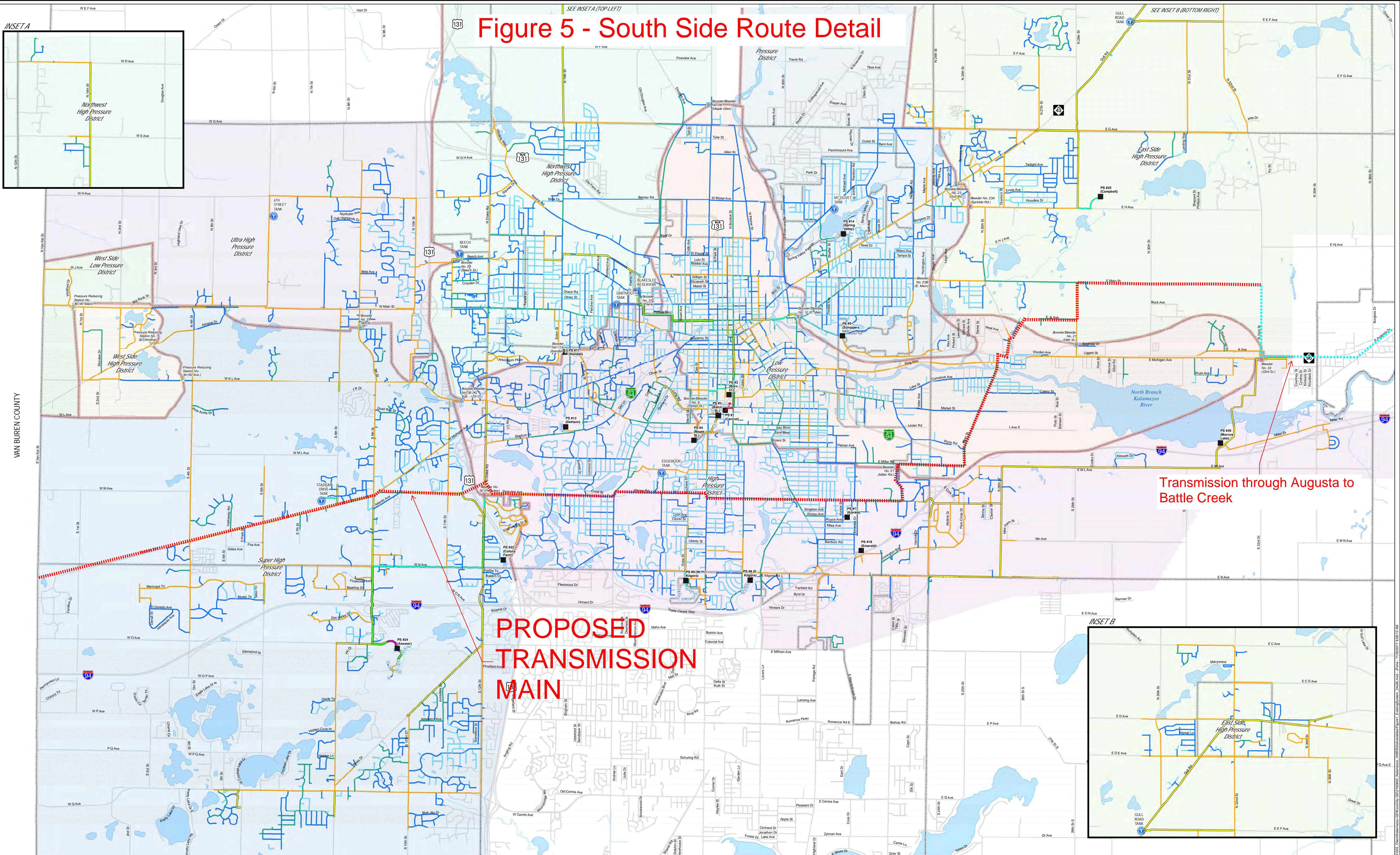


Figure 5 - South Side Route Detail



Appendix A

Project Costs

APPENDIX A - Estimated Project Cost

Lake Michigan Supply
Project Cost Estimate

South Route - Coloma Road

Item	Unit	Quantity	Unit Price	Total
Intake structure and pumphouse	LS	1	40,000,000	40,000,000
Raw Water Intake Line	LF	4000	2,000	8,000,000
Property Acquisition for Plant	LS	1	1,000,000	1,000,000
Treatment Plant	LS	1	700,000,000	700,000,000
Finished Water Line 1	LF	288000	800	230,400,000
Line 1 Restoration	LF	288000	200	57,600,000
Finished Water Line 2	LF	288000	800	230,400,000
Line 2 Restoration	LF	288000	200	57,600,000
Valving	EA	28	850,000	23,800,000
Booster Station	EA	2	20,000,000	40,000,000
Connection to Watervliet/Coloma	LS	1	2,000,000	2,000,000
Connection to Hartford	LS	1	2,000,000	2,000,000
Connection to Lawrence	LS	1	2,000,000	2,000,000
Connection to Paw Paw	LS	1	2,000,000	2,000,000
Connection to Mattawan	LS	1	2,000,000	2,000,000
Connection to Portage	LS	2	3,000,000	6,000,000
				1,404,800,000
Engineering			10%	140,480,000
Contingency			10%	140,480,000
TOTAL PROJECT COST				1,685,760,000