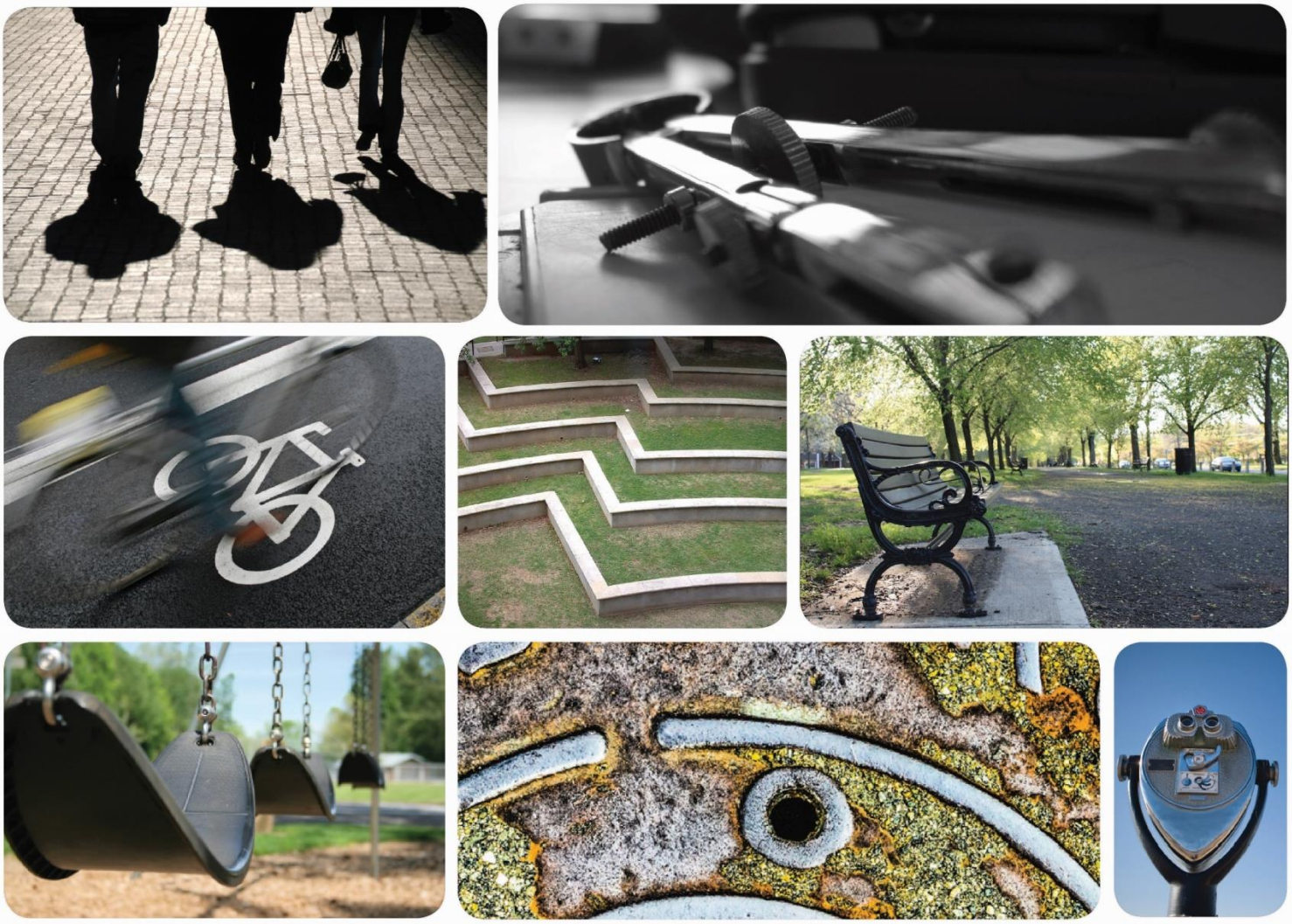

City of Lathrup Village
Water System Reliability Study

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Supersedes; May 15,2017

DRAFT

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Tables

Executive Summary

REQUIREMENTS

This Water Systems Reliability Study and General Plan (Reliability Study/General Plan) for the City of Lathrup Village water distribution system has been prepared in accordance with requirements of the Department of Environment, Great Lakes, and Energy (EGLE), and the Michigan Safe Drinking Water Act (Part 12 and Part 16 of the Administrative Rules). EGLE requires that the Reliability Study/General Plan be updated every 5 years. This report summarizes the results of the Reliability Study/General Plan, which consists of the following elements:

- A general description of the existing water distribution system.
- Estimates of system demands, including average day, maximum day, and fire flow for the existing system and the projected water system for the years 2028 and 2043.
- The results of a WaterGEMS hydraulic analysis of the distribution system under various design scenarios.
- A brief summary of the Emergency Response Plan that is kept on file with the City of Lathrup Village.
- A description of how the Lathrup Village water system can continue to deliver water through the distribution system when normal power is interrupted.
- A five (5) year and twenty (20) year Capital Improvement Plan (CIP).

In addition to the requirements summarized above, Part 16 of the administrative rules for the Safe Water Drinking Act requires that an asset management plan be implemented by January 1, 2018. The hydraulic model and CIP provided in this report will form a foundation for the future updated asset management plan.

HYDRAULIC MODEL ANALYSIS AND RESULTS

The water distribution system was input into the WaterGEMS hydraulic modeling program, and the model was used to analyze the distribution system's capabilities under various demand scenarios. All the known pipes that distribute water through the system were included in the model, including the major twelve inch (12") mains and the minor six inch (6") and eight inch (8") mains. The two metered connections to the South Oakland County Water Authority (SOCWA) were modeled as reservoirs. The following is a brief summary of the existing water system, and the results of the analysis performed with hydraulic model.

Water System Reliability Study
Project: 16496.50

Existing and Future Conditions

The existing water system is fairly well looped and provides redundancy. Most of the system feeds to residentially zoned areas, so demands are distributed evenly throughout the City. The system has two metered connections to the SOCWA system, however only the 11 Mile Rd. connection is active. We understand that the 12 Mile Rd. connection is not functional and requires a new meter and power source. Approximately 48% (down from 55% in 2016) of the distribution system was constructed before 1930 with un-lined cast iron pipe and has reached the end of its useful life. This un-lined iron pipe is susceptible to tuberculation, a form of corrosion that reduces the effective diameter of the pipe, and thus the capacity of the system.

The existing population is approximately 4,000 people and is not projected to increase over the next 20 years. Thus, future water demands are expected to be approximately the same as existing demands. The hydraulic model was developed and tested with 3 demand scenarios: a) average day demands; b) maximum day demands; and c) fire flow plus maximum day demands. A peak hour demand scenario was not developed because peak hour demands are less than maximum day plus fire demands.

Hydraulic Model Results

An initial model was developed based on available distribution system maps, system demands, and available pressure data at the SOCWA connections. The model was then calibrated to simulate fire flow tests recently performed by the Southfield Fire Department. The calibration process involved assigning friction factors to pipe groups based on age & material, such that the modeled results closely matched the fire flow tests results. New pipes generally have Hazen-Williams C-Factors of 115 to 130, and older corroded pipes have much lower C-Factors. The calibrated C-Factors ranged from 21 for the oldest pipes to 115 for recently installed pipe segments. Most of the system had low C-Factors indicating that the capacity of these pipes has been significantly reduced by tuberculation. Cement lined cast iron water mains installed in the late 1950s were calibrated with C-Factors of 53 which is surprisingly low for this type of pipe. The calibration could be distorted by one or more closed valves, and it is recommended that the city methodically perform additional flow tests to verify that all valves are fully open.

The calibrated model showed that the water system can deliver average day and maximum day demands while maintaining a minimum pressure of 50 psi. However, the water system is not capable of delivering recommended fire flows to certain areas of the City. See Table 5 for recommended fire flows, and Appendix B for available fire flow maps. The recommended fire flow of 2,000 gallons per minute (gpm) for commercial, and other non-single family uses can only be delivered along 11 Mile Rd. and along Southfield Rd. immediately adjacent to 11 Mile Rd. The recommended fire flow in single family residential areas is 1,000 gpm and the system is not capable of delivering this fire flow to approximately 45% of the city. The nodes that fell below the recommended fire flows are at dead ends or are affected by the tuberculation in the older pipes.

The distribution system needs extensive capital improvements to increase its capacity to deliver recommended fire flows. To determine the most effective approach to increase the system's capacity, several capital improvement scenarios were modeled. Appendix B provides maps that graphically show the modeled fire flow results. The following is a brief summary of each scenario:

- Scenario 2022 modeled the improvements made to the existing system between 2018 and 2022. This scenario shows that improvements constructed over the past 5 years have significantly increased the fire flows within the areas of the improvements.
- Scenario 2022(a) models the improvements made to the existing system between 2018 and 2022 if both meters were in operation. This scenario shows that improvements constructed over the past 5 years have significantly increased the fire flows within the areas of the improvements and if the 12 Mile meter were opened, flows would have been increased along the 12 Mile corridor and into the adjacent neighborhoods.
- Scenario 2023 models the flows from the improvements made in 2023. This scenario shows that improvements constructed in 2023 have significantly increased the fire flows within the areas of the improvements.
- Scenarios 2024 through 2028 model the independent benefit of specific system improvements on available fire flows based on the proposed improvements in the 5 year CIP. This scenario shows that individual improvements proposed over the next 5 years will provide increased fire flows within the areas of the improvements.
- Scenario 2024(a) through 2028(a) (both meters open) models the combined benefits of Scenarios 2023 through 2028 with the 12 Mile meter pit refurbished and open. This scenario shows that proposed improvements over the next 5 years will significantly increase the fire flows within the areas of the improvements and if the 12 Mile meter were opened, flows would have been increased along the 12 Mile corridor and into the adjacent neighborhoods.

CAPITAL IMPROVEMENT PLAN (CIP)

A detailed 20 year CIP is provided in Appendix A, Figure 7 of this report and is focused primarily on improving the fire flow capacity of the system, and secondarily on replacing the older and undersized 6" water mains. The city should carefully review this CIP and develop a financial strategy for implementing the CIP.

Water System Reliability Study
Project: 16496.53

CONCLUSIONS & RECOMMENDATIONS

The majority of the City's water distribution system is 90 plus years old, and with the exception of the water mains that have recently been replaced, the remainder of the system is 40 to 65 years old. This water system has served the City of Lathrup Village well, but it must be recognized that it is an old system that will eventually need to be replaced. As stated above the water system is not capable of delivering recommended fire flows to significant areas of the City. Thus, the City should begin developing a strategy for making significant improvements to the water system. The following is a summary of recommendations developed in this report:

1. The City should test and inspect the system to verify that all valves are fully open. The hydraulic model was difficult to calibrate, and we suspect that one or more valves could be closed or partially closed. A methodical approach of performing fire flow tests while monitoring hydrant pressures could be used to verify that all valves are fully opened. If closed valves are found, then the hydraulic model should be re-calibrated based on new fire flow tests.
2. The water system is not capable of delivering recommended fire flows to significant areas of the city. This is due primarily to the age of the system, pipe sizes, and the related tuberculation that restricts water flow.
3. The proposed Capital Improvement Plan is focused primarily on improving the fire flow capacity of the system, with a secondary focus of replacing water mains that are nearly 90 years old, over a 10-20 year time frame. The city should review the CIP and develop a financial strategy for implementing the plan.

Existing Water Supply System

Lathrup Village purchases its water from the Southeastern Oakland County Water Authority (SOCWA). See Appendix A, Figure 1 for an overall map of the water system.

The Water Service Contract between SOCWA and the City of Lathrup Village dated April 1960 (Appendix C) and subsequent amendments provide the terms for Lathrup Village to purchase water from SOCWA.

The City has engineering design standards, standard detail sheets, and a utility ordinance providing the construction standards for the system. The following is a summary of some of the more significant attributes & characteristics of the existing distribution system:

AGE AND GENERAL CONDITION

As shown in Appendix A, Figure 4.0, the majority of the water system was installed when Lathrup Village was initially developed in the late 1920's. This includes most of the water mains north of 11 Mile, and the water mains south of 11 Mile along Southfield Road. The material used in that time period was unlined cast-iron pipe, which is subject to deterioration from within due to tuberculation. Tuberculation is a corrosion process wherein iron from the unlined pipe combines with calcium and other minerals within the water to form tubercles. Tuberculation diminishes the effective diameter of the pipe, weakens the pipe, and is also the cause of red water problems due to the oxidized iron being drawn out of the pipe. Image 1 below is a photograph of a pipe with severe tuberculation.

Image 1 – Pipe with Severe Tuberculation

The water mains south of 11 Mile were installed later in Lathrup Village's history, starting near the time the village was incorporated as a city in 1953 and continuing into the early 1970's. The water mains installed were generally cement-lined cast-iron pipe with mechanical joints. The cement lining protects the pipe from corrosion by neutralizing the corrosive properties of the water. These pipes should be functioning more efficiently than the older unlined pipe; however, a few of the fire flow tests in this area came back with some questionably poor results. These poor fire flow tests could be the result of the recently discovered closure of the existing 6" water main crossing Southfield Road at Lincoln which is restricting flow from east and west sides of the City.

In recent years, older undersized water mains have been replaced with new 8" and 12" plastic PVC water mains. In the 1980's the water mains along 11 Mile were replaced as part of the I-696 construction project. These newer cement-lined ductile iron pipes are connected directly to the 11 Mile meter, and substantially increase the capacity of the distribution system along 11 Mile Rd.

As described above, approximately 48% of the water distribution system was installed prior to 1930 and approximately 74% was installed prior to 1958. This water system has served the City of Lathrup Village well, but it must be recognized that it is an old system that will eventually need to be replaced. The system is showing signs of its age and needs to be upsized and reconstructed in many areas. The city should budget for the replacement of water mains as necessary to improve fire flows and should also consider replacing water mains installed before 1930 within the next 30 years, starting with the undersized 6" water mains and the mains with frequent breaks (Appendix A, Figure 1).

CONNECTIONS TO SOCWA

There are two metered connections to SOCWA's system: one at Southfield and 12 Mile and one at Southfield and 11 Mile. Currently, only the connection at 11 Mile is active while the connection at 12 Mile remains off. With these connections, Lathrup Village's entire water distribution system falls into one pressure zone. Table 1 provides a summary of each meter pit and its operating specifications.

Table 1 - Meter Pit Operations Summary

Meter Pit ID	Location	Ground Elevation (ft.)	Top of Pipe Elevation (ft.)	2022 SOCWA Average Pressure (PSI)
LV-1	11 Mile & Southfield	695.00	689.00	52
LV-2	12 Mile & Southfield	710.00	704.00	-

INVENTORY OF WATER DISTRIBUTION SYSTEM

Lathrup Village's water system includes approximately 32.6 miles of water mains that include pipes, fire hydrants, and gate valves all varying from 6 inches to 12 inches in diameter. Table 2 provides an inventory of the water system components.

Table 2 – Water Distribution System Inventory

Water Main Components	Installation Year	Quantity (LF)	% of Total Main
Meter Pits	-	2	-
Hydrants	-	243	-
Gate Valves	-	303	-
6" Inside Dia. Water Main	Before 1930	32,700	19.0%
	1931 - 1958	9,700	5.6%
	1959 - 1972	18,620	10.8%
	1973 - 2000	1,300	0.8%
	After 2001	380	0.2 %
8" Inside Dia. Water Main	Before 1930	38,300	22.3%
	1931 - 1958	7,000	4.1%
	1959 - 1972	10,000	5.8%
	1973 - 2000	20,800	12.1%
	After 2001	13,200	7.7%
12" Inside Dia. Water Main	Before 1930	11,200	6.5%
	1973 - 2000	2,700	1.5%
	After 2001	6,200	3.6%

STUDY AREA

Lathrup Village currently consists of mostly residentially zoned areas with a few commercially zoned areas along 11 Mile, 12 Mile, and Southfield Roads. For the most part, the area is fully developed with very little available land for expansion in either residential or commercial zones. The City has no land zoned for industrial use. Consequently, most of the water distribution system is also fully developed. See Appendix A, Figure 2 for a detailed zoning map of the City.

EXISTING WATER USAGE

Table 3 provides a summary of existing water demands from 2016 through 2022 and shows that annual water demands increased significantly. This increase was attributed to an existing 2" water service break that was undetected until the summer of 2022 when the leak was repaired.

[1]Table 3 – Water System Existing Demands				
Year	Average Day (gpm)	Maximum Day (gpm)	Minimum Day (gpm)	Total Year (MG)
2016	264	403	160	139.42
2017	264	396	167	140.17
2018	333	472	278	174.08
2019	326	417	271	169.74
2020	319	444	243	168.79
2021	312	403	364	163.46
2022	278	417	153	146.26

POPULATION

According to the Southeast Michigan Council of Government's (SEMCOG's) 2008 Land Use data, the City of Lathrup Village's water system has a customer base that is approximately 85% single family residential and 15% nonresidential. As stated earlier, the majority of the study area is fully developed, and the population of the City is projected to increase slightly over the next 20 years, as the average household size remains somewhat constant. The projected population for the City of Lathrup Village is shown in Table 4 and is based on recent census data provided by SEMCOG.

Table 4 – Population Data									
Year	-	2010	2020	2022	2030	2035	2040	2050	-
Population	-	4,075	4,088	3,928	4,033	4,131	4,151	4,092	-
Growth (%)	-	-	0.32%	-3.6%	-1.0%	1.4%	1.9%	0.4%	-
Household Size (Person/House)	-	2.53	2.41	2.41	-	-	-	2.39	-

[1] Existing water demands were taken from the Southeast Oakland County Water Authority (SOCWA) Annual Pumpage/Usage Reports for Community Water Supply.

Water Supply Requirements and Capacity

METERED WATER DEMANDS

As stated earlier, Lathrup Village is mostly built out, and metered water demand patterns are not expected to change significantly over the next 5 to 20 years. Because of this, the average day and max day demands from 2022 (see Table 3) were used as conservative estimates for future average day and maximum day demands.

FIRE FLOW DEMANDS

The International Fire Code was used for establishing minimum fire flows for residential and commercial buildings. Per section B105, fire flow requirements for buildings, the minimum fire flow for one and two family dwellings is 1,000 gpm for a 1-hour duration. Commercial buildings have varying requirements based on the size of the building, type of construction, and whether the building is sprinkled. Table 5 shows the recommended minimum fire flow requirements for Lathrup Village and was based on the average of the larger commercial properties in the city at 25,000 sf. Fire flow maps for existing and proposed future improvements can be found in Appendix B.

Table 5 – Recommended Minimum Fire Flows (GPM) @ 20 psi Residual Pressure

ZONING	FIRE FLOW
Single Family Residential	1,000
Commercial, Multiple Family, Office & Mixed Use	2,000

CAPACITY OF WATERWORKS SYSTEM

Lathrup Village purchases water from SOCWA and the water services contract does not provide a maximum flow rate.

2018 – 2023 WATER MAIN SYSTEM IMPROVEMENT

Lathrup Village has made extensive water main improvements over the past 5 years as summarized below:

2018 / 2019 SANTA BARBARA DISTRIBUTION MAIN

In 2018 and 2019, the City completed the installation of a 12” distribution water main from 11 Mile to Roseland. The main intent of this project was to provide a north-south distribution main near the west side of the City to increase the water flow and volume and to increase fire flows within the northwest quadrant of the City. Work included the installation of 4,796 lft of 12” WM, 1,197 lft of 8” WM for adjacent street tie-ins, 8 fire hydrants, and 29 isolation gate valves.

2019 LINCOLN EAST WATER MAIN LINING

In 2019, the City completed the lining of an existing 6" water main that had been prone to breaks. Lining was selected due to the location of the main between residential houses and the east City boundary. The work included the lining of 383 lft of 6" water main.

2020 ROSELAND DISTRIBUTION / REPLACEMENT MAIN

In 2020 and as part of the Santa Barbara project, the City completed the installation of a 12" distribution water main from Roseland to Bloomfield and along 12 Mile road to the tie-in to the existing 12" main on 12 Mile. The main intent of this project was to replace the existing 8" WM with a 12" main to increase water flow and volume to the northwest quadrant of the City. Work included the installation of 1,013 lft of 12" WM, 205 lft of 8" WM for adjacent street tie-ins, and 1 isolation gate valve. Included in this project was the installation of a new 8" WM from Roseland to Eldorado to loop Eldorado to Bloomfield.

2021 SAN ROSA REPLACEMENT MAIN

In 2021, the City completed the replacement of a deteriorated and aged 6" WM with a new 8" main from Southfield Road to Lathrup Boulevard. The main intent of this project was to replace the existing 6" WM and to increase water flow and volume to the northeast quadrant of the City. Work included the installation of 972 lft of 8" WM, 3 fire hydrants, and 7 isolation gate valves.

2021 WILTSHIRE REPLACEMENT MAIN

In 2021, the City completed the replacement of a deteriorated and aged 6" WM with a new 8" main from Southfield Road to Lathrup Boulevard. The main intent of this project was to replace the existing 6" WM and to increase water flow and volume to the northeast quadrant of the City. Work included the installation of 880 lft of 8" WM, 4 fire hydrants, and 7 isolation gate valves.

2022 GOLDENGATE WEST REPLACEMENT MAIN

In 2022, the City completed the replacement of a deteriorated and aged 6" WM with a new 8" main from 11 Mile to California Drive SW. The main intent of this project was to replace the existing 6" WM and to increase water flow and volume to the southern section of the northeast quadrant of the City. Work included the installation of 1,642 lft of 8" WM, 3 fire hydrants, and 7 isolation gate valves.

2023 GLENWOOD REPLACEMENT MAIN

In 2023, the City completed the replacement of a deteriorated and aged 6" WM with a new 8" main from Santa Barbara to Sunset Boulevard. The main intent of this project was to replace the existing 6" WM and to increase water flow and volume in an east-west direction by connecting into the new Santa Barbara main. Work included the installation of 1,451 lft of 8" WM, 4 fire hydrants, and 2 isolation gate valves.

2023 SAN DIEGO REPLACEMENT MAIN

In 2023, the City completed the replacement of a deteriorated and aged 6" WM with a new 8" main from Rackham to Stanford Court. The main intent of this project was to replace the existing 6" WM and to increase water flow and volume in an east-west direction by tying into the 2004 Rackham WM and new Santa Barbara main. Work included the installation of 2,135 lft of 8" WM, 5 fire hydrants, and 4 isolation gate valves.

2023 BLOOMFIELD LOOP MAIN

In 2023, the City completed the installation of a new 8" main in order to provide a looped system and increase water volume and flow. Work included the installation of 337 lft of 8" WM and 1 isolation gate valve.

2023 LINCOLN / SOUTHFIELD CONNECTION REPLACEMENT

In the fall of 2023, the City is scheduled to replace an existing 6" water main that crosses Southfield road at Lincoln with a new 12" HDPE water main. The existing 6" water main has been out of service for over 20 years which restricts flow from the east / west sides of Southfield road. Work includes the directional drilling of 304 lft of 12" WM, replacement of 3 gate valves and 1 fire hydrant.

2021 - 2023 FIRE HYDRANT REPLACEMENT AND GAP REPLACEMENT

Between 2021 and 2023, the City completed the installation of 62 replacement fire hydrants, refurbished 2 hydrants, and installed 15 new hydrants to provide increased hydrant coverage.

2021 - 2023 GATE VALVE UPGRADES

Between 2021 and 2023, the City has completed the refurbishment of 75 Gate Valves and installed 2 new gate valves to increase the isolation of water mains.

2018 – 2023 SUMMATION OF WORK COMPLETED

Between 2018 and 2023, the City has completed the following work to the overall water distribution system:

New 12" distribution main = 4,796 lft

Replaced 6" and 8" aged water mains = 10,136 lft

Installed new fire hydrants = 107 ea

Refurbished / replaced / installed new gate valves = 138 ea

Hydraulic Model

DEVELOPMENT OF MODEL

To create a comprehensive reliability study for the water distribution system in Lathrup Village, the design of a functioning hydraulic model was necessary. Giffels Webster utilized the latest version of Bentley's WaterGEMS (V8i) to create the hydraulic model representing the water distribution system in the City of Lathrup Village.

WaterGEMS has the capability to translate Geographic Information System (GIS) data into a working model. This information was not available for this study, however. The hydraulic model was created using existing Microstation drawings, as-built drawings, demand information from SOCWA, population and growth data from SEMCOG, and fire flow data from the City of Southfield's Fire Department.

Water Demands

Average day, maximum day and fire flow demands are summarized in Tables 3 & 5 in the previous section. Demands are not expected to increase over the next 20 years; therefore year 2022 demands were used in both existing and future demand scenarios. Fire flow scenarios were modeled with both fire flow and maximum day demands. Peak hour demands were not modeled because peak hour demands are less than maximum day plus fire flow demands.

To accurately simulate how Lathrup Village's water system functions, the demands had to be distributed throughout the model. Since the City consists of mostly residential customers, the overall demand of the system was evenly distributed throughout all the nodes in the hydraulic model.

Model Calibration

The Bentley WaterGEMS Darwin Calibrator was utilized for this project. The Darwin Calibrator allows the modeler to calibrate a model manually or automatically using fire flow data to adjust the Hazen Williams C-Factors of the modeled pipes. Smooth pipes with less internal friction will have high C-Factors, while older pipes with significant tuberculation and internal friction will have lower C-Factors.

For the 2017 Water Reliability Report the water system was divided into the following 5 pipe groups based on the age of the main and pipe material. Figure 4 in Appendix A. The 5 groups were as follows:

1) 1928-1930: Original water main of Lathrup Village which includes most of the pipe north of 11 Mile Road and along Southfield Road.

2) 1931-1958: The southeast quadrant that was initially developed when Lathrup Village officially became a city.

3) 1959-1972 : Consists of most of the area south of 11 Mile

4) 1973-2000: Water main that was installed along 11 Mile when 696 was constructed

5) 2001-2022: Includes recent repairs and PVC pipe installed through 2022.

The model was then calibrated using WaterGEMS Darwin Calibrator along with fire flow tests that were performed in 2016. This 2016 calibration study assigned Hazen Williams C factors to each pipe segment, but it was noted that pipes constructed around 1960, particularly those south of 11 Mile Rd. were assigned unusually low C factors. The 2017 Water Reliability Study noted these unusually low C factors and suggested that the low C factors might be caused by closed valves. As recommended by the 2017 Reliability Report the City investigated and found several abandoned pipes and closed valves that affected the fire flow tests south of 11 Mile Rd.

In the spring of 2023, the City of Southfield's Fire Department performed 20 fire hydrant flow tests (the tests were performed prior to the 2023 water main replacement projects). Data from the fire flow tests were then used with the Darwin Calibrator to recalibrate the WaterGEMS model. Prior to recalibration the WaterGEMS model was revised to account for the abandoned pipes and closed valves that the City found after the 2017 Reliability Report.

These groups were put into the Darwin Calibrator along with the hydrant flow test data, and the model generated Hazen-Williams C-Factors for each of the pipe groups. The solution initially tried to give the pipes (pipe group 1959 to 1972) in the southeast quadrant of the city a much lower C-Factor than water main installed in the 1920's. This was attributed to hydrant flow test #1 and could be a sign that there is some sort of blockage or partially closed valve between the southeast section of the city and the meter pit. This test was removed from the calibration study, but still the C-Factor of 53 for the pipes installed between 1959 & 1972 is lower (higher friction) than expected. Table 6 provides a summary of the Hazen-Williams C-Factors used in the hydraulic model. New plastic or cement lined pipes generally have C-Factors of 115 to 140. The low C-Factors shown in Table 6 are indicative of old unlined cast iron pipe with heavy tuberculation.

Table 6 – Darwin Calibration Results[2]

Installation Group	Hazen-Williams C-Factors
1928-1930	21
1931-1958	32
1959-1972	53
1973-2000	100
2001-2017	115

[2] Records of water main installation years, size, and material were obtained from City records.

HYDRAULIC MODEL OF CURRENT WATER SYSTEM

The calibrated model was initially used to test the water system's performance under various demand scenarios including average day, maximum day, and maximum day with fire flow. These initial demand scenarios showed that the system can deliver average day and maximum day demands while maintaining pressures around 45-50 psi (pressures between 35 psi and 100 psi are considered acceptable). However, the model showed the system is not able to deliver recommended fire flows to certain areas of the City while maintaining residual pressures of 20 psi (see Appendix B, Scenario 2022). The following is a discussion of the deficiencies of the existing system:

A. Northwest Quadrant (north of 11 Mile Rd. & west of Southfield Rd.):

   1. The water system can provide recommended fire flows of 2,000 gpm in the multifamily district along 11 Mile Rd., and the very southern part of the mixed use district along Southfield Rd. The cement-lined ductile iron pipe in 11 Mile Rd., constructed in the 1980s, can deliver much better fire flows than the older unlined pipes. The system is not able to provide the recommended fire flows to the remainder of the multifamily, commercial, mixed use, village center and gateway overlay districts along 12 Mile Rd., Evergreen Rd., 11 Mile Rd. and Southfield Rd. However, flow in these areas is adequate and along 12 Mile, flow has increased by 500 – 750 gpm. The deficiencies in these non-single family residential areas can be attributed to both the age of the pipe (and related tuberculation), and the size of the water mains. Modern design standards generally require 12" water mains in these types of non-single family residential districts.

   2. The system can provide recommended fire flows of 1,000 gpm to the single family neighborhood in the Rainbow Circle area where the water mains are constructed of cement-lined ductile iron and PVC pipe that is less susceptible to tuberculation. The installation of the Santa Barbara 12" distribution main has had a positive effect along the corridor. The water system cannot deliver recommended fire flows to approximately 50% of the single family neighborhoods in the northwest district which is an improvement from 2017. The deficiencies are attributed to the age of the pipe (and related tuberculation) and size of the mains. Modern design standards generally require a minimum of 8" water mains in single family residential areas.

B. Northeast Quadrant (north of 11 Mile Rd., and east of Southfield Rd.):

   1. The water system is not able to provide recommended fire flows of 2,000 gpm to most of the mixed use, commercial, and village center districts. This is attributed primarily to the age of the pipe and related tuberculation.

   2. The water system is not able to provide recommended fire flows to the residential districts. This is attributed primarily to the age (and related tuberculation) of the pipe, and to the dead-end 6" diameter water mains along the east side of the city.

3. The two (2) new water main projects constructed in 2021 along San Rosa and Wiltshire did not have as positive of an effect as modeled or anticipated but did provide an additional 250 – 500 gpm of flow.

C. Southeast Quadrant (south 11 Mile Rd., and west of Southfield Rd.):

1. The fire flow tests, and thus the calibrated model, indicate that the water system cannot provide recommended fire flows to significant parts of the southeast quadrant. These findings are somewhat suspect, because the water mains were generally installed in the mid 1950's with cement-lined cast iron pipe that should have better Hazen Williams C-Factors. It is possible that there may be closed (or partially closed) valves that negatively affected the fire flow tests. This would also cause the calibration model to calculate lower C-Factors. In 2022, the City discovered the 6"/8" main crossing Southfield Road at Lincoln has been closed for numerous years. The city should also methodically perform additional flow testing to verify that all valves are fully open.

2. Another factor that reduces the capacity of the water system in the southeast quadrant is the water main size. Many of the mains are 6" diameter, which lose pressure quickly when subjected to large fire demands. There are also a couple of dead-end mains along the east side of the city and a newly discovered dead-end main at the east end of Ramsgate at Lathrup Blvd.

D. Southwest Quadrant (south of 11 Mile Rd., and west of Southfield Rd.):

1. The water system is not able to provide recommended fire flows of 2,000 gpm to most of the commercial and mixed use properties along Southfield Rd. This is attributed primarily to the age and size of the water main in Southfield Rd.

2. The water system can provide recommended fire flows of 1,000 gpm to approximately 70% of the residentially zoned properties in the southwest quadrant of the city. However, there are a few areas where the system cannot deliver recommended fire flows (see Appendix B, Scenario 2022). These deficiencies are at least partially attributed to the low Hazen-Williams C-Factors assigned to the cement lined cast iron pipes. As described in Southeast Quadrant paragraph above, a closed valve could be affecting the fire flow tests and the resulting model calibration. The 6" diameter water mains also reduce available fire flows.

HYDRAULIC MODEL SCENARIOS

During the course of the study, many different alternative scenarios were modeled to determine the benefits that specific improvements would have on the performance of the water system. The following is a description of 6 scenarios that were developed and analyzed using the WaterGEMS hydraulic modeling program:

- Scenario 2022 models the improvements made to the existing system between 2018 and 2022.
- Scenario 2022(a) models the improvements made to the existing system between 2018 and 2022 if both meters were in operation.
- Scenario 2023 models the completed improvements made to the existing system in 2023.
- Scenarios 2024 through 2028 model the independent benefit of specific system improvements on available fire flows based on the proposed improvements in the 5 year CIP.
- Scenario 2024(a) through 2028(a) (both meters open) models the combined benefits of Scenarios 2024 through 2028 with the 12 Mile meter refurbished and open.

See Appendix B for the fire flow contour maps corresponding with each scenario listed below.

Scenario 2022 - Current System Max Day Fire Flow 2022

A. The current system has only one active meter located at 11 Mile and Southfield Road. The meter at 12 Mile and Southfield Rd is inactive.

B. The age of most of the existing pipe was a major contributor to the low calibrated roughness coefficients (C-Factors). Specific areas of the system cannot sustain the minimum fire flow, in part, because of this. See Table 6 for a list of calibrated C-Factors by installation year.

C. As flow travels away from the meter pit, the available fire flow decreases rapidly because of the size and friction in the old water mains.

Scenario 2022(a) - Current System Fire Flow with Both Meters Open (11 & 12 Mile)

A. Both metered connections to the SOCWA system (11 Mile and 12 Mile) were opened in the model to test the benefit the 2nd connection at 12 Mile Rd.

B. Opening the 12” meter at 12 Mile Rd and Southfield Rd increases available fire flows only in the immediate surrounding area of the 12 Mile metered connection and the far northeast corner of the City, and the system is still not able to deliver recommended fire flows to large sections of the city.

Scenario 2023 – Modeled System Flows with Completed 2023 Projects

A. In this scenario, the completed installation of new 8" water mains on Glenwood (Santa Barbara to Sunset), San Diego (Rackham to Stanford Court), and the loop on Bloomfield (LaCrosse to Sunset) and the proposed fall of 2023 installation of a 12" HDPE pipe on Lincoln across Southfield Road was modeled.

B. These water mains were selected strategically to replace undersized mains every 3 – 4 blocks with tie-ins to the new Santa Barbara distribution main.

C. Fire flow increased along these new mains and in the immediate adjacent areas. As the water mains branch outside of the immediate areas, fire flow availability declines rapidly because of friction in the old pipes.

Scenario 2024 and 2024(a) - Modeled System Flows with Proposed 2024 Projects

A. In this scenario, the existing 6" diameter dead end water mains on Avilla, Roseland, Redwood, and Catalpa (all from Lathrup Boulevard to the east border with the City of Southfield) are replaced with 8" water mains.

B. These water mains were selected to provide increased reliability and flow for fire protection on dead end streets where the fire department has a difficult time maneuvering. With the pipe replacement along these dead-end mains, fire flow is projected to increase by approximately 250 gpm. When the 12 Mile meter is opened, the flows in this area increase significantly near the northeast but not in the central portion of the east side of Lathrup Blvd.

C. With the pipe replacement along these dead-end mains, fire flow is projected to increase by approximately 250 gpm. With the 12 Mile meter open, the flows in this area increase significantly near the northeast but not in the central portion of the east side of Lathrup Blvd.

Scenario 2025 and 2025(a) - Modeled System Flows with Proposed 2025 Projects

A. In this scenario, new water mains south of 696 are being installed with 8" water mains and one water main is being replaced.

B. Four of the five projects include new water main installations to increase flow and reliability by constructing additional loops in the system. The Rainbow Drive water main was selected as a central corridor main that has had numerous water main breaks over the years and connects indirectly to the Southfield and 11 Mile water mains.

C. The installation of the new looped water mains has limited improvement in the southwest quadrant but did increase flow along Lincoln West. The southeast quadrant had limited improvements and increased flow by approximately 250 gpm for approximately 50% of the quadrant. The opening of the 12 Mile meter had no effect on the area south of 11 Mile.

Scenario 2026 and 2026(a) - Modeled System Flows with Proposed 2026 Projects

A. In this scenario, the 8" water main along Southfield Road from 11 Mile to Lincoln was replaced with new 12" water main. This is one of the oldest water mains in the city, which means that it is most likely corroded and does not provide sufficient flow for the south side of the city.

B. With the pipe replacement along Southfield Road, fire flow has increased significantly along the new water main and out into the residential districts. Available fire flow does decline as the distance from Southfield Rd. increases.

C. The installation of a new 12" water main has significant improvements to the flows in the southeast district. Approximately 75% of the area has acceptable fire flows. The Lathrup Boulevard corridor flows increased by 500 gpm. The opening of the 12 Mile meter had no effect on the area south of 11 Mile.

Scenario 2027 and 2027(a) - Modeled System Flows with Proposed 2027 Projects

A. In this scenario, the existing 6" / 8" water main along Eldorado from Southfield Road to Bloomfield is replaced with a new 8" water main. This main was installed in 1928, which means that it is most likely corroded and does not provide sufficient flow.

B. This scenario falls into the strategy of replacing water mains every 3 – 4 blocks to increase flows in the immediate corridor.

C. The installation of a new 8" water main, fire flow is projected to increase by 250 - 500 gpm in the immediate and adjacent area. With the 12 Mile meter open, the flow in this area increases but does not carry-over to adjacent areas.

Scenario 2028 and 2028(a) - Modeled System Flows with Completed 2028 Projects

A. In this scenario, the 8" water main along the east side of Southfield Road from 12 Mile to California Drive NE was replaced with new 12" water main. This is one of the oldest water mains in the city, which means that it is most likely corroded and does not provide sufficient flow for the north side of the city.

B. With the pipe replacement along Southfield Road, fire flow has increased significantly along the new water main and out into the residential districts in the northeast section of the City. Available fire flow does not vary in the central area of the City east of Southfield Road.

C. The installation of a new 12" water main has significant improvements to the flows along Southfield Road and in the northeast district. Approximately 50% of the area has acceptable fire flows. The opening of the 12 Mile meter had a small effect in the immediate area and into the residential district in the northeast.

Interruption of Power Service

As previously discussed, the City of Lathrup Village receives its water from SOCWA through one active metered connection but has access to two connections in total. Lathrup Village itself does not have any means of supplying water in the event of a power failure. The City does not have any independent wells, pumps or storage tanks feeding into or throughout their distribution system.

However, Lathrup Village's supplier, SOCWA, has approximately thirty-two million gallons of storage throughout their distribution system, consisting of both elevated and ground storage tanks. SOCWA also has several generators in place throughout their system which can be utilized to power water storage tank pumps and/or booster pumps in the event of a power loss.

As an example of a recent interruption of power service, in 2003 there was a regional power grid blackout. SOCWA's system was able to provide an emergency supply of water to all of its customers for all 3 days of the blackout. There were of course restrictions on water use during this time; however, there was still a water supply.

Interruption of Water Service

If the source of water for Lathrup Village experiences a failure and is unable to provide water service to Lathrup Village's distribution system, the water used shall be disinfected in a manner approved by the Department of Environment, Great Lakes, and Energy (EGLE), and in compliance with the state drinking water standards. This includes additional bacterial testing.

Due to the tuberculation in the aging pipe network, maintenance activities, water main breaks, or high demands can cause brown, rusty water to be distributed to consumers. The City's website addresses what consumers can do to clean out the residue of agitated tuberculation in their service lines, as well as what to look for when identifying a water main break.

General Plan Requirements

The purpose of this section is to satisfy the Department of Environment, Great Lakes, and Energy (EGLE), the Michigan Safe Drinking Water Act (SDWA), and the rules that reference this Act (also known as 1976 P.A. 399). Part 16 of PA 399 indicates that certain public suppliers of water shall submit and maintain an up to date waterworks system General Plan. The principal elements of the General Plan that are necessary to satisfy these requirements are provided below and include:

GENERAL LAYOUT OF THE ENTIRE WATERWORKS SYSTEM

An entire water distribution system map of the City of Lathrup Village has been included in this report and can be found in Appendix A, Figure 1.

PEAK DEMANDS

Since the system is relatively small, it was determined that the necessary Fire Flow would put a greater strain on the system than current or future peak hour demands. For this report, the fire flow was used as the major influence for future adjustments to the system.

IDENTIFICATION OF SERVICE AREA

The area serviced by the City of Lathrup Village can be found in Appendix A, Figure 1 which is the overall water system map of the City.

INVENTORY OF WATER MAIN

The inventory of the existing water main can be found earlier in the report under the ‘Existing Water Supply System’ section on page 4.

RATED CAPACITY OF WATERWORKS SYSTEM

Rated Capacity of the Waterworks System can be found under the ‘Water Supply Requirements and Capacity’ section.

EMERGENCY RESPONSE PLAN

The emergency response plan is kept on file with the City of Lathrup Village

CAPITAL IMPROVEMENT PLAN

CIP #1 (2024) – Replace water mains on dead end streets:

Replacing the existing 6" dead end mains bordering the east side of Lathrup Village's border with the City of Southfield will increase constant flow to the residents in those areas. The corroded 6" pipes have no redundancy and reliability is questionable if fire flow is required. This project would include approximately 1,700 lft of 8" pipe and terminate with a new fire hydrant. Of the modeled scenario, this project will increase fire protection flow by approximately 250 gpm and replace water mains installed in the 1920's. This scenario will be enhanced by bringing the 12 Mile meter on-line.

CIP #2 (2025) – Place new and replace water mains south of 11 Mile:

This improvement increases fire flows south of 11 Mile and increases reliability by looping water main segments. Fire flows are increased in the southwest quadrant by approximately 250 gpm and slightly in the southeast quadrant. This project involves removing and replacing approximately 1,300 lineal feet of 8" water main along Rainbow Drive and installing 1,225 lft of new 8" water mains at four separate locations.

CIP #3 (2026) – Replace water main on Southfield Rd. between 11 Mile and Lincoln:

This improvement involves replacing the 8" water main along the east side of Southfield Road from 11 Mile to Lincoln. This project will increase available fire flow along Southfield Rd and into the residential district on both the east and west sides of Southfield Road. This project involves replacing approximately 2,400 lft of 8" water mains with 12" water mains and completing the loop from Rainbow Drive to Lincoln.

CIP #4 (2027) – Replace water main on Eldorado

This improvement involves replacing the existing 6" / 8" water main on Eldorado from Southfield Road to Bloomfield. This project will increase flows along the corridor and slightly into the adjacent residential districts. This project involves replacing 2,800 lft of water main installed in the late 1920's.

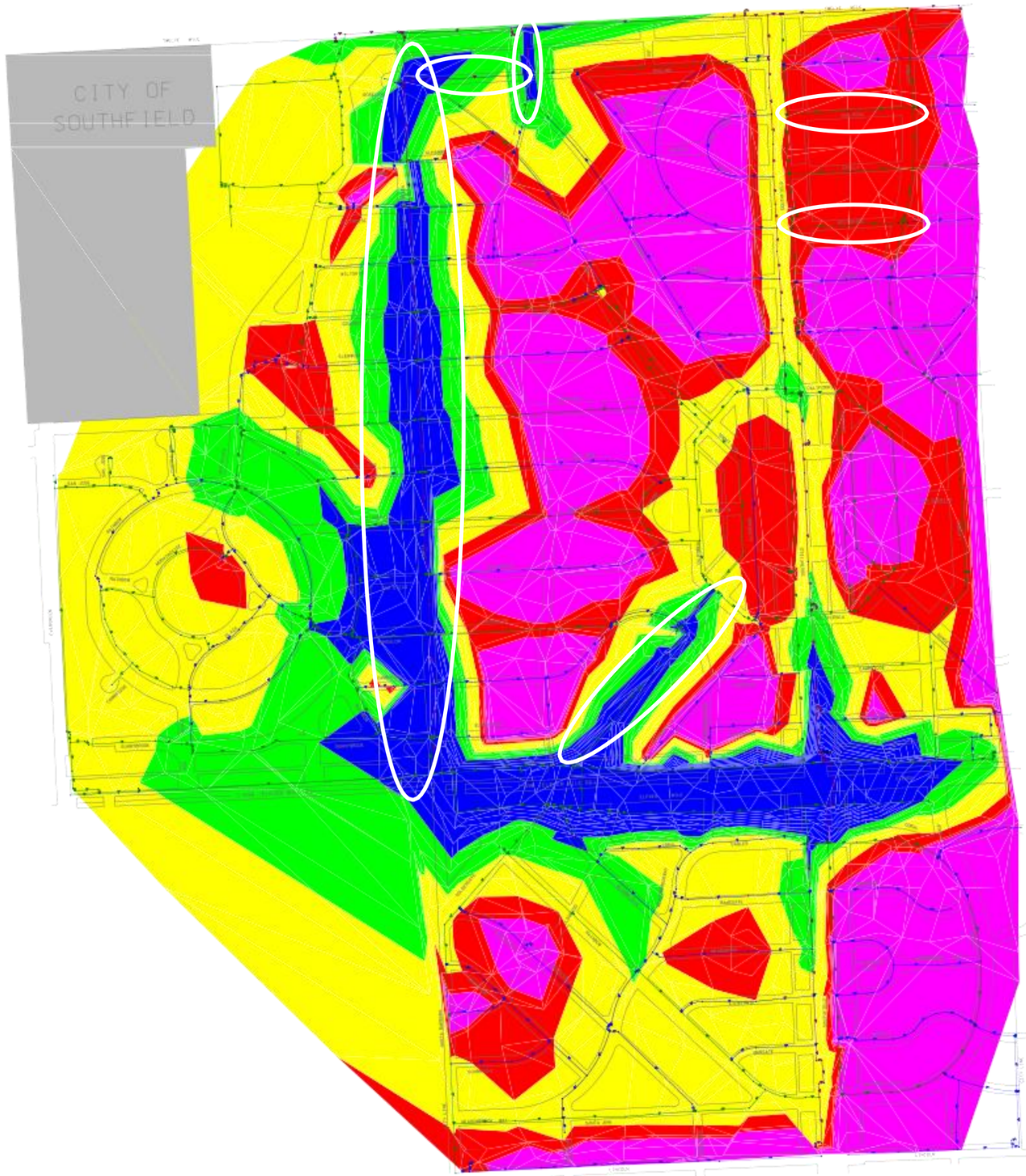
CIP #5 (2028) – Replace water main on Southfield Rd. between California and 12 Mile:

This improvement involves replacing approximately 2,500 lineal feet of 8" water main along the east side of Southfield Road between 12 Mile Rd. and California Drive NW. This will increase available fire flow along Southfield Rd. and into portions of the residential district on the east side of Southfield Road. This scenario will be enhanced by bringing the 12 Mile meter on-line.

CIP (FUTURE) – Aged/Undersized Mains

Overall, the system that was installed in the 1920's warrants replaced. This mostly includes 6" unlined cast-iron pipe and contributes considerably to the constriction of flow to the neighborhoods. At a minimum, it is recommended that all 6" water mains installed in the 1920's and 1930's should be replaced in the next 10-20 years. This equates to roughly 1,200 to 2,400 feet of pipe per year.

Appendices



DIAMETER LEGEND

- 6" PIPE
- 8" PIPE
- 12" PIPE

FIREFLOW LEGEND

- < 750 gpm
- 750 gpm - 1000 gpm
- 1000 gpm - 1500 gpm
- 1500 gpm - 2000 gpm
- OVER 2000 gpm

N

0 400' 800'

SCALE: 1" = 400'

SCENARIO 2022 - CURRENT SYSTEM MAX DAY FIRE FLOW 2022

- THE CURRENT SYSTEM HAS ONLY ONE ACTIVE METER LOCATED AT 11 MILE AND SOUTHFIELD ROAD. THE METER AT 12 MILE AND SOUTHFIELD RD IS INACTIVE.

- THE AGE OF MOST OF THE EXISTING PIPE WAS A MAJOR CONTRIBUTOR TO THE LOW CALIBRATED ROUGHNESS COEFFICIENTS (C-FACTORS). THE MAJORITY OF THE SYSTEM CANNOT SUSTAIN THE MINIMUM FIRE FLOW, IN PART, BECAUSE OF THIS. SEE TABLE 6 FOR A LIST OF CALIBRATED C-FACTORS BY INSTALLATION YEAR.

- AS FLOW TRAVELS AWAY FROM THE METER PIT, THE AVAILABLE FIRE FLOW DECREASES RAPIDLY BECAUSE OF THE SIZE AND FRICTION IN THE OLD WATER MAINS.

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Designer:	B.D.M.
Quality Control	J.P.K.

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LATHRUP VILLAGE WATER SYSTEM RELIABILITY STUDY

CITY OF LATHRUP VILLAGE
OAKLAND COUNTY
MICHIGAN

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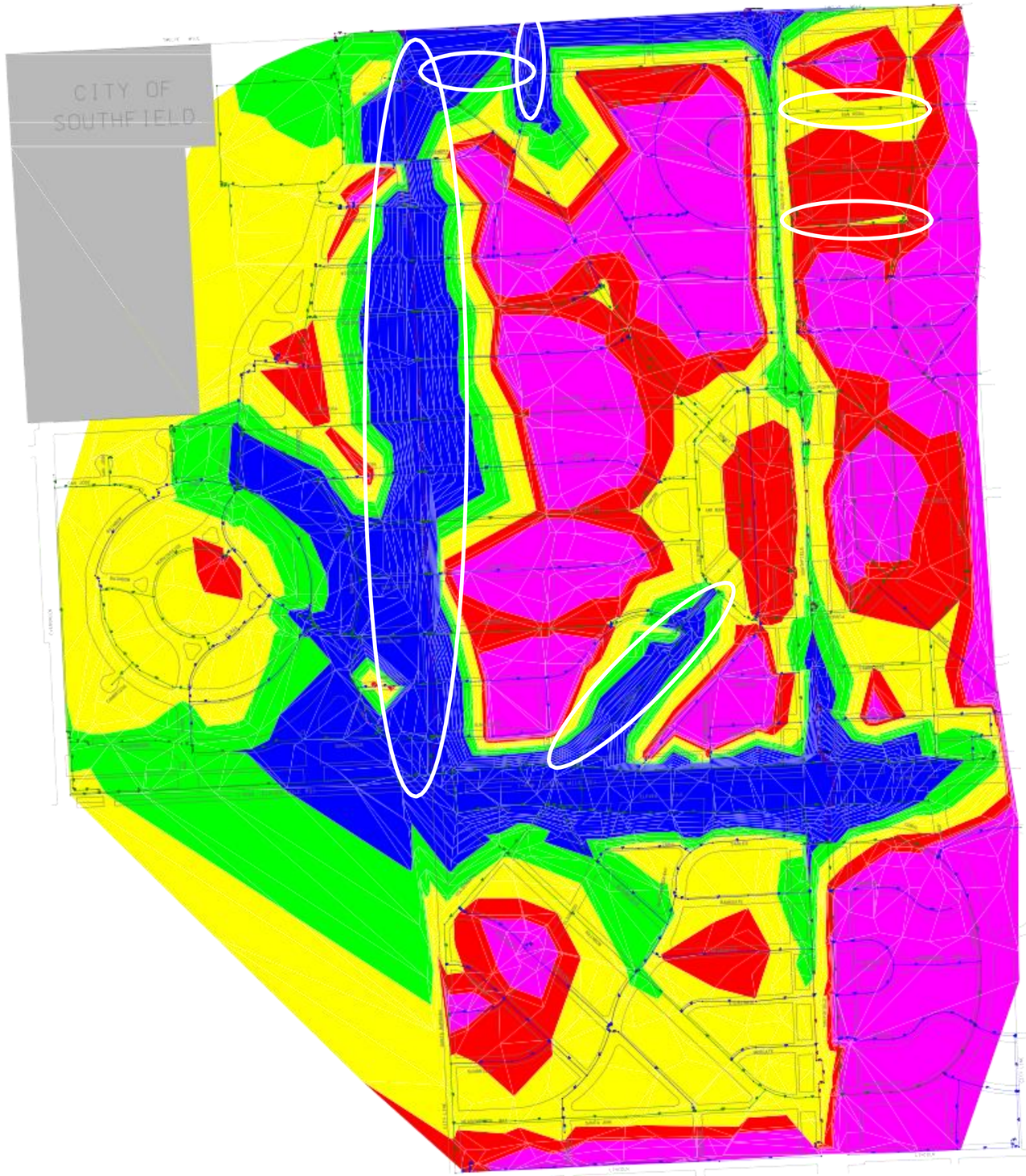

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FIREFLOW LEGEND

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- OVER 2000 gpm

N

0 400' 800'

SCALE: 1" = 400'

SCENARIO 2022a - CURRENT SYSTEM FIRE FLOW WITH BOTH METER PITS OPEN (11 & 12 MILE)

- BOTH METERED CONNECTIONS TO THE SOCWA SYSTEM (11 MILE AND 12 MILE) WERE OPENED IN THE MODEL TO TEST THE BENEFIT OF USING THE 2ND/ CONNECTION AT 12 MILE RD.

- OPENING THE 12" METER AT 12 MILE RD AND SOUTHFIELD RD INCREASES AVAILABLE FIRE FLOWS ONLY IN THE IMMEDIATE SURROUNDING AREA OF THE 12 MILE RD. METERED CONNECTION, AND THE SYSTEM IS STILL NOT ABLE TO DELIVER RECOMMENDED FIRE FLOWS TO LARGE SECTIONS OF THE CITY.

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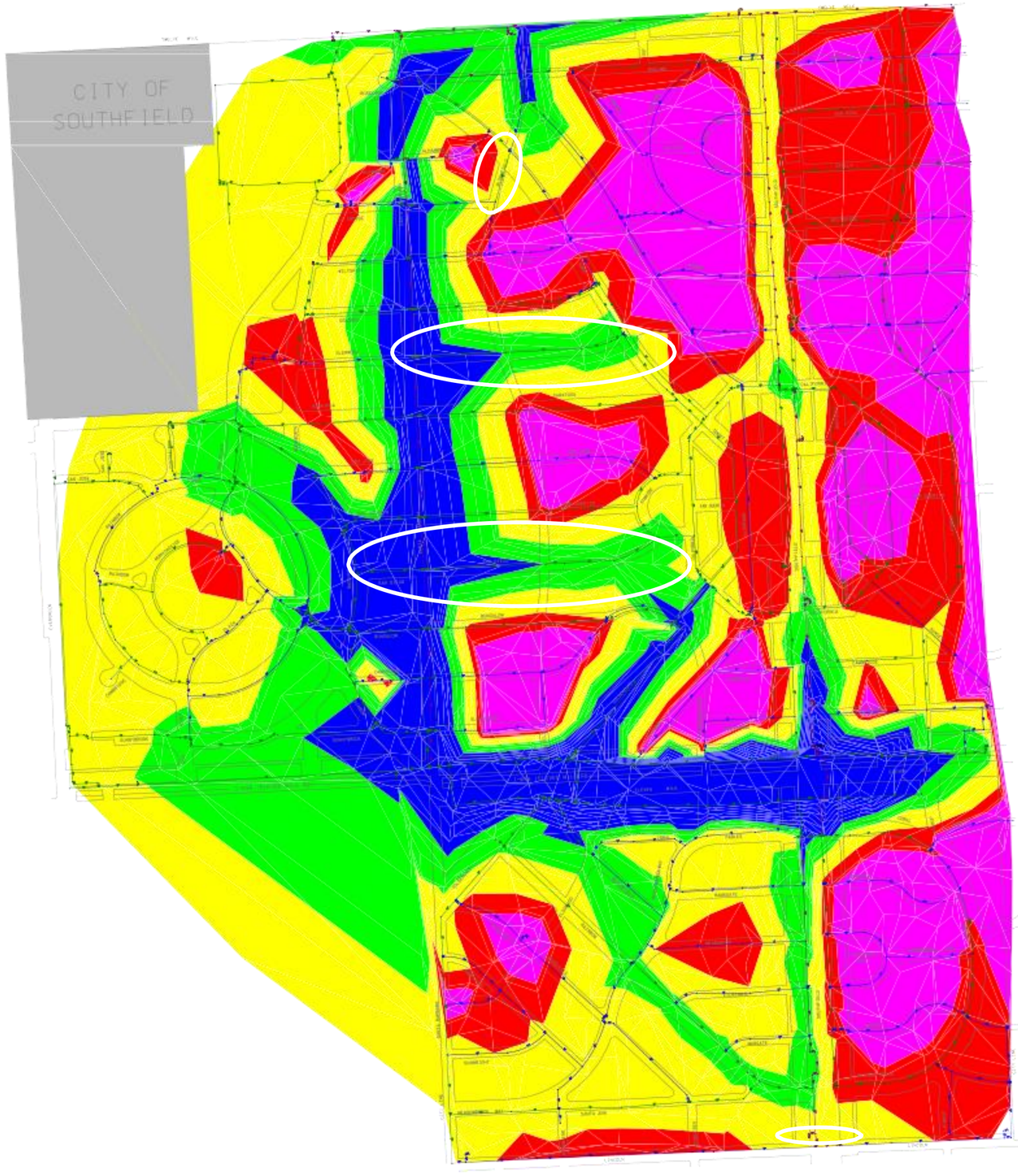

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- 1500 gpm - 2000 gpm
- OVER 2000 gpm

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SCALE: 1" = 400'

SCENARIO 2023 - MODELED SYSTEM FLOWS WITH COMPLETED 2023 PROJECTS

- IN THIS SCENARIO, THE COMPLETED INSTALLATION OF NEW 8" WATER MAINS ON GLENWOOD (SANTA BARBARA TO SUNSET), SAN DIEGO (RACKHAM TO STANFORD COURT), AND LOOP ON BLOOMFIELD (LACROSSE TO SUNSET) ALONG SOUTHFIELD RD NORTH OF 11 MILE WAS REPLACED WITH NEW 12" WATER MAIN.

- THE SOUTHFIELD RD WATER MAIN WAS CHOSEN BECAUSE IT IS A MAJOR COMMERCIAL ARTERY TO THE NORTH SIDE OF THE CITY WHERE LARGER FIRE FLOWS ARE NEEDED. THE REPLACEMENT OF THESE PIPES CAN BE INCORPORATED INTO THE FUTURE SOUTHFIELD ROAD RECONSTRUCTION PROJECT.

- FIRE FLOW INCREASED ALONG SOUTHFIELD RD AND IN THE IMMEDIATE AREAS ADJACENT TO THE NEW SOUTHFIELD RD. WATER MAIN. THE MAJOR PROBLEM AREAS NORTH OF 11 MILE REDUCED ONLY SLIGHTLY. AS THE WATER MAIN BRANCHES INTO THE NEIGHBORHOODS, FIRE FLOW AVAILABILITY DECLINES RAPIDLY BECAUSE OF FRICTION IN THE OLD PIPES.

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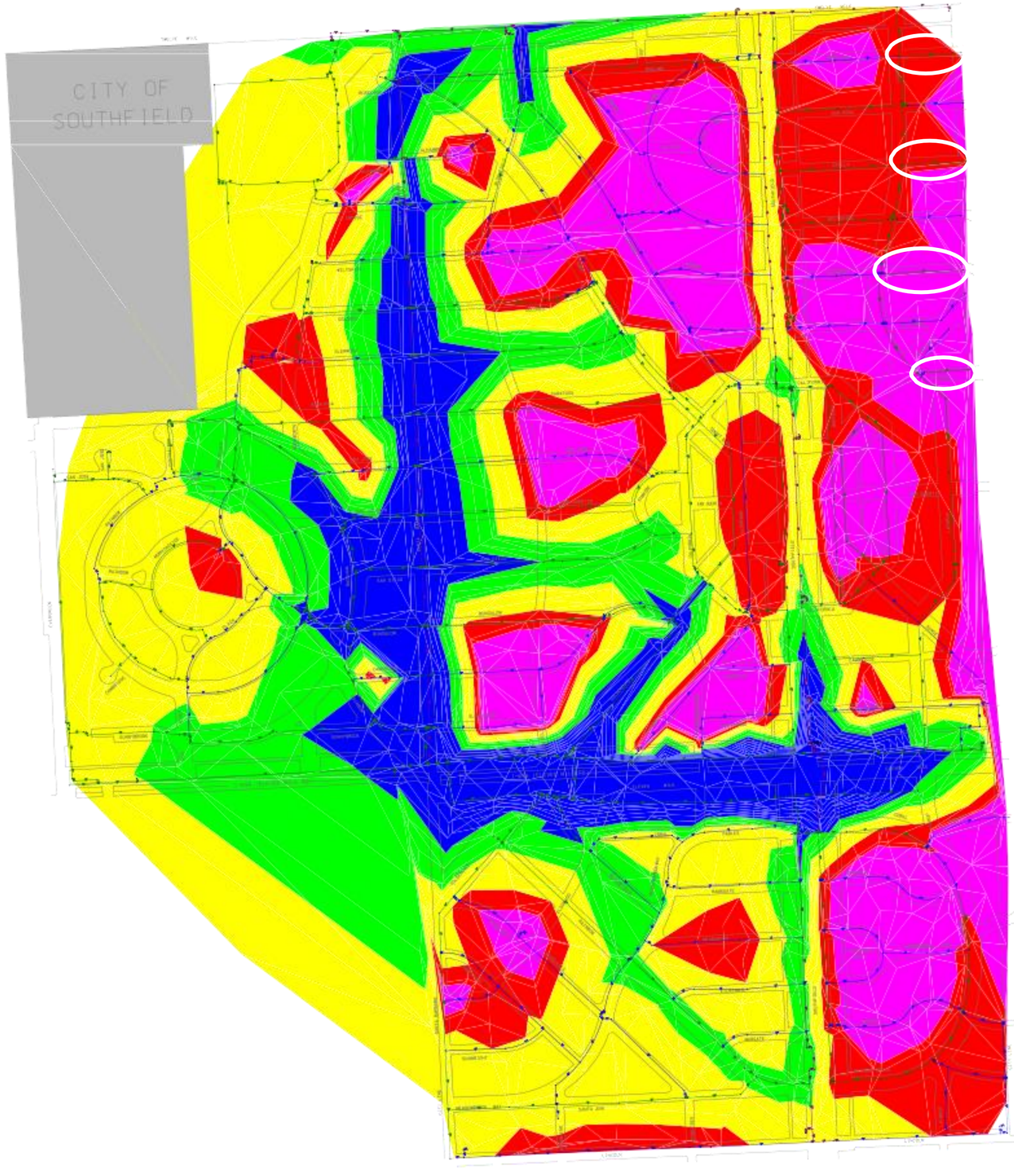

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FIREFLOW LEGEND

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- 1500 gpm - 2000 gpm
- OVER 2000 gpm

N

0 400' 800'

SCALE: 1" = 400'

SCENARIO 2024 - MODELED SYSTEM FLOWS WITH COMPLETED 2024 PROJECTS

- IN THIS SCENARIO, THE EXISTING 6" DIAMETER DEAD END WATER MAINS ON AVILLA, ROSELAND, REDWOOD, AND CATALPA (ALL FROM LATHRUP BOULEVARD TO THE EAST BORDER WITH THE CITY OF SOUTHFIELD) ARE REPLACED WITH 8" WATER MAINS.

- WITH THE PIPE REPLACEMENT ALONG SOUTHFIELD ROAD, FIRE FLOW IS INCREASED ALONG THE NEW WATER MAIN. THE AREA SOUTH OF 11 MILE WAS DEVELOPED MORE RECENTLY THAN THE AREA NORTH OF 11 MILE, SO THE POSITIVE EFFECTS OF THE NEW MAIN ARE MORE SUBSTANTIAL IN THIS SCENARIO THAN IN SCENARIO 2. HOWEVER, AVAILABLE FIRE FLOW STILL DECLINES RAPIDLY AS THE DISTANCE FROM SOUTHFIELD RD. INCREASES.

- AS DISCUSSED EARLIER THERE IS SOME SUSPICION THAT FIRE FLOW TESTS, AND THUS MODEL CALIBRATION MAY HAVE BEEN AFFECTED BY CLOSED VALVES. IF A CLOSED VALVE IS FOUND, THEN THE RE-CALIBRATED MODEL WOULD LIKELY SHOW THAT SCENARIO 3 HAS LARGER BENEFITS THAN SHOWN IN APPENDIX B.

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SCENARIO 2024

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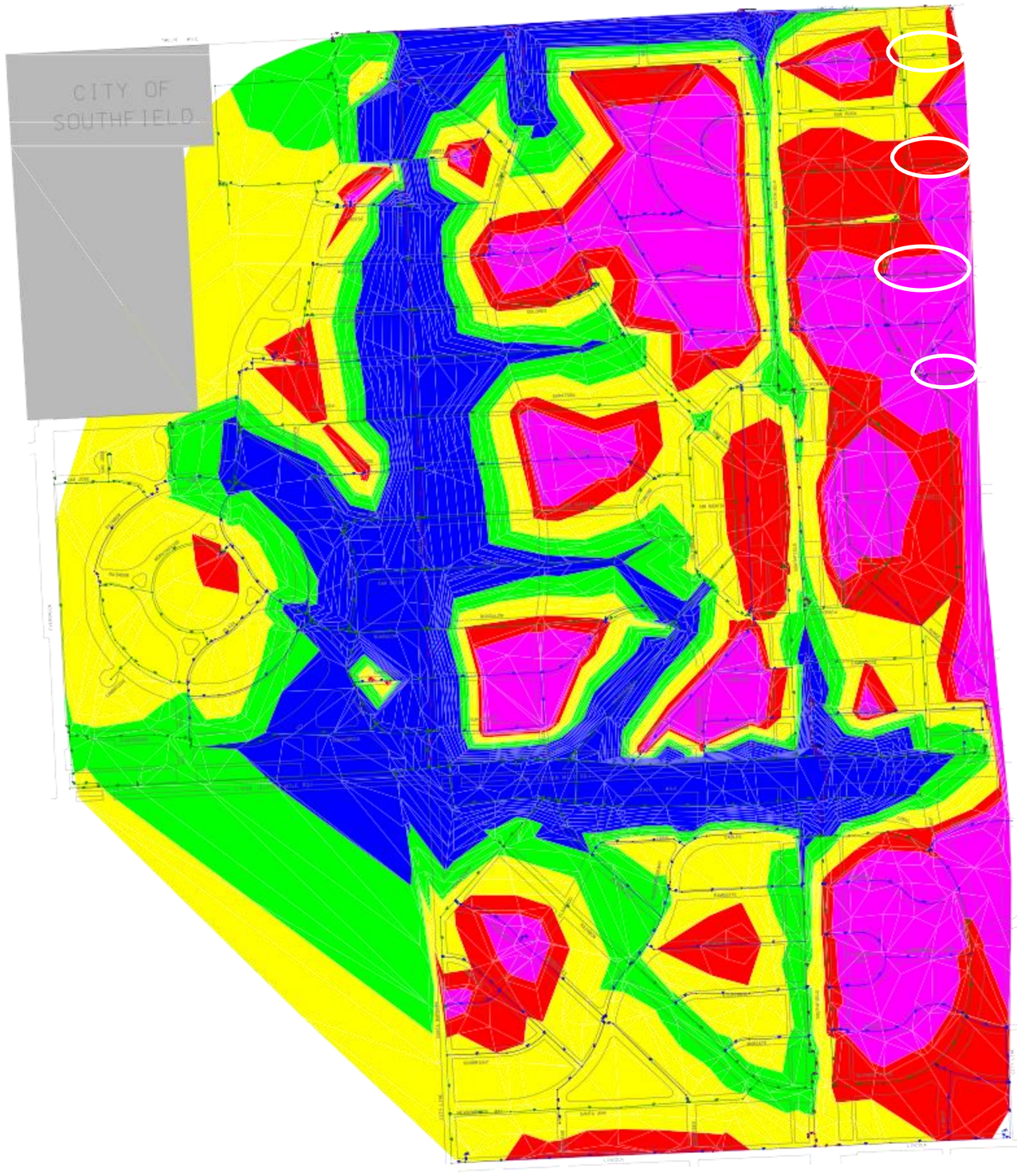

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- OVER 2000 gpm

N

0 400' 800'

SCALE: 1" = 400'

SCENARIO 2024a - MODELED SYSTEM FLOWS WITH COMPLETED 2024 PROJECTS WITH BOTH METER PITS OPEN (11 AND 12 MILE)

- IN THIS SCENARIO, THE EXISTING 6" DIAMETER DEAD END WATER MAINS ON AVILLA, ROSELAND, REDWOOD, AND CATALPA (ALL FROM LATHRUP BOULEVARD TO THE EAST BORDER WITH THE CITY OF SOUTHFIELD) ARE REPLACED WITH 8" WATER MAINS.

- WITH THE PIPE REPLACEMENT ALONG SOUTHFIELD ROAD, FIRE FLOW IS INCREASED ALONG THE NEW WATER MAIN. THE AREA SOUTH OF 11 MILE WAS DEVELOPED MORE RECENTLY THAN THE AREA NORTH OF 11 MILE, SO THE POSITIVE EFFECTS OF THE NEW MAIN ARE MORE SUBSTANTIAL IN THIS SCENARIO THAN IN SCENARIO 2. HOWEVER, AVAILABLE FIRE FLOW STILL DECLINES RAPIDLY AS THE DISTANCE FROM SOUTHFIELD RD. INCREASES.

- AS DISCUSSED EARLIER THERE IS SOME SUSPICION THAT FIRE FLOW TESTS, AND THUS MODEL CALIBRATION MAY HAVE BEEN AFFECTED BY CLOSED VALVES. IF A CLOSED VALVE IS FOUND, THEN THE RE-CALIBRATED MODEL WOULD LIKELY SHOW THAT SCENARIO 3 HAS LARGER BENEFITS THAN SHOWN IN APPENDIX B.

- OPENING THE 12" METER AT 12 MILE RD AND SOUTHFIELD RD INCREASES AVAILABLE FIRE FLOWS ONLY IN THE IMMEDIATE SURROUNDING AREA OF THE 12 MILE RD. METERED CONNECTION, AND THE SYSTEM IS STILL NOT ABLE TO DELIVER RECOMMENDED FIRE FLOWS TO LARGE SECTIONS OF THE CITY.

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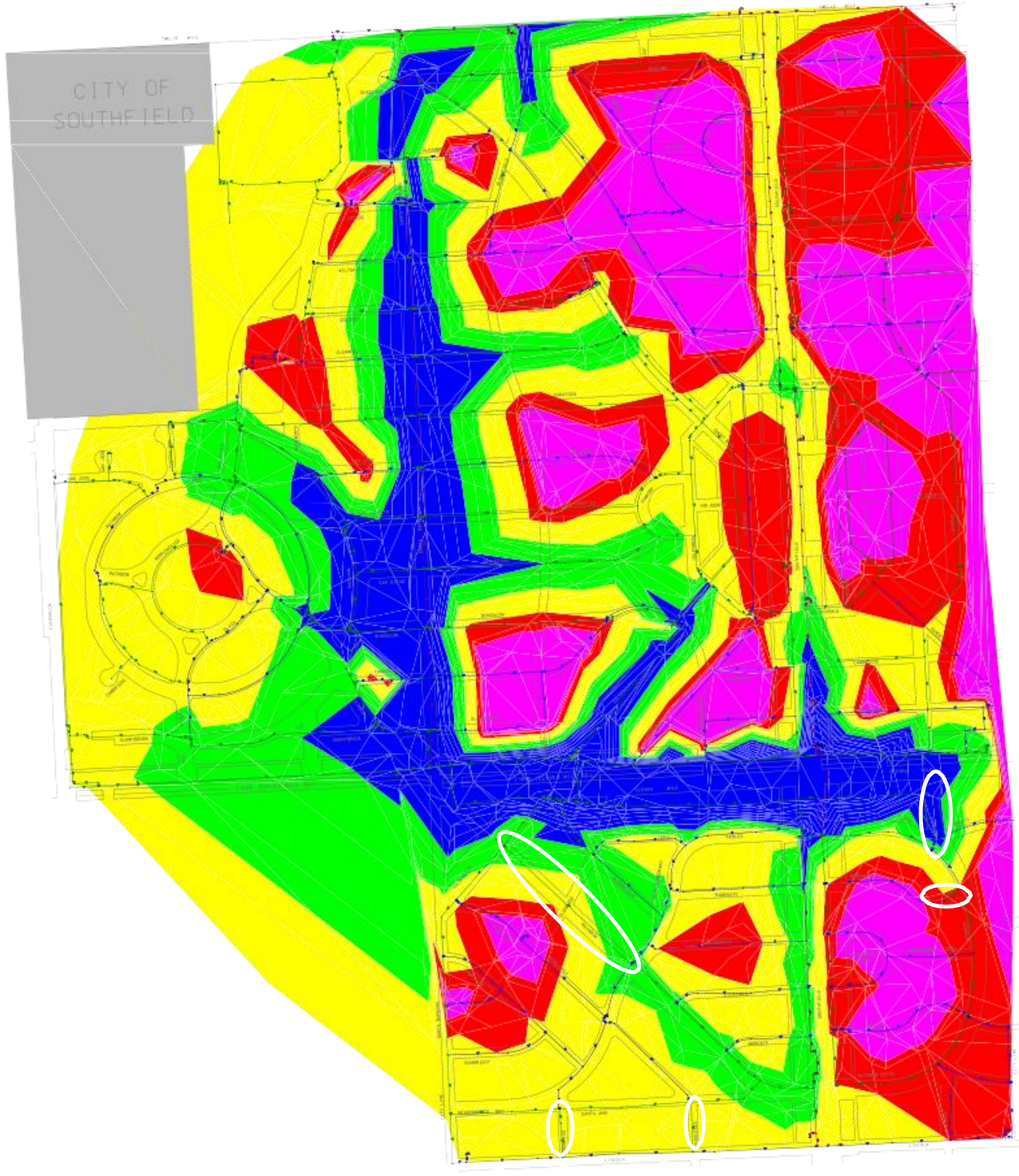

DIAMETER LEGEND

- 6" PIPE
- 8" PIPE
- 12" PIPE

FIREFLOW LEGEND

- < 750 gpm
- 750 gpm - 1000 gpm
- 1000 gpm - 1500 gpm
- 1500 gpm - 2000 gpm
- OVER 2000 gpm

N

0 400' 800'

SCALE: 1" = 400'

SCENARIO 2025 - MODELED SYSTEM FLOWS WITH COMPLETED 2025 PROJECTS

- THIS WATER MAIN PROJECT WILL REPLACE EXISTING 6 INCH WATER MAIN LINES WITH 8 INCH LINES ON SAN ROSA AND WILTSHIRE FROM SOUTHFIELD RD TO LATHRUP BLVD. THIS PROJECT WILL ALSO INVOLVE REPLACING 8 INCH WATER MAIN ON GOLDENGATE DR FROM 11 MILE TO CALIFORNIA DR WHICH INCLUDES REMOVING WATER MAIN ON THE SOUTH SIDE OF GOLDENGATE DR FROM MEADOWBROOK WAY TO CALIFORNIA AND RE-ROUTING TO THE NORTH SIDE OF GOLDENGATE DR IN THAT SECTION.

- WITH THIS WATER MAIN, FIRE FLOW IS INCREASED AND ABLE TO REACH A LARGER PORTION OF LATHRUP VILLAGE BY CONNECTING THE 12 INCH MAIN ON 11 MILE ROAD TO LARGER PIPES THAT RUN INTO MORE OF THE CITY.

- THIS SCENARIO PROVIDES SUBSTANTIAL BENEFITS, AS IT IMPROVES FIRE FLOW IN LARGE PORTIONS OF THE CITY AND PAVES THE WAY TO EXPANDED IMPROVEMENTS IN THE FUTURE

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SCENARIO 2025

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Project:	16496.53

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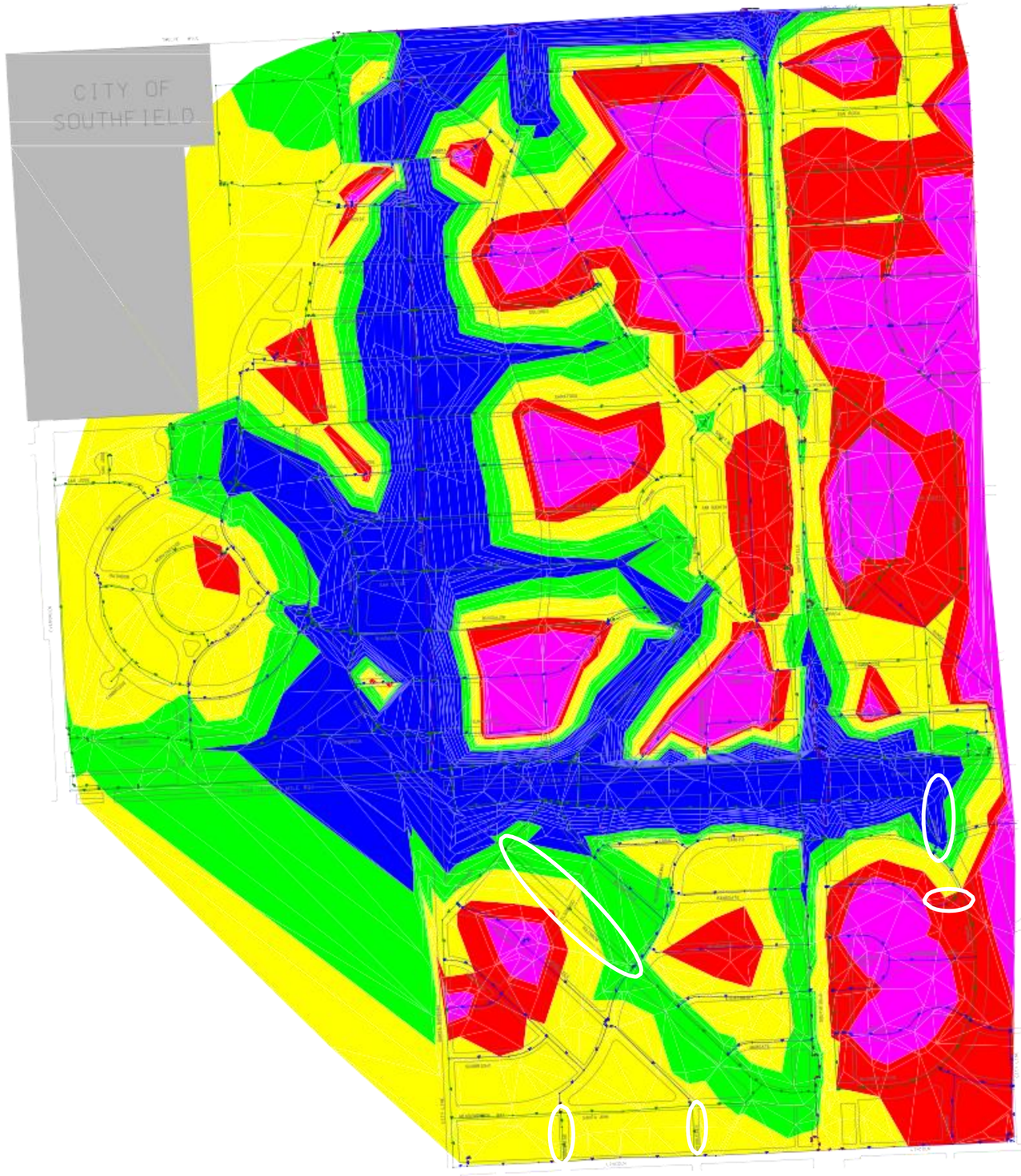

DIAMETER LEGEND

- 6" PIPE
- 8" PIPE
- 12" PIPE

FIREFLOW LEGEND

- < 750 gpm
- 750 gpm - 1000 gpm
- 1000 gpm - 1500 gpm
- 1500 gpm - 2000 gpm
- OVER 2000 gpm

N

0 400' 800'

SCALE: 1" = 400'

SCENARIO 2025a - MODELED SYSTEM FLOWS WITH COMPLETED 2025 PROJECTS WITH BOTH METER PITS OPEN (11 AND 12 MILE)

- THIS WATER MAIN PROJECT WILL REPLACE EXISTING 6 INCH WATER MAIN LINES WITH 8 INCH LINES ON SAN ROSA AND WILTSHIRE FROM SOUTHFIELD RD TO LATHRUP BLVD. THIS PROJECT WILL ALSO INVOLVE REPLACING 8 INCH WATER MAIN ON GOLDENGATE DR FROM 11 MILE TO CALIFORNIA DR WHICH INCLUDES REMOVING WATER MAIN ON THE SOUTH SIDE OF GOLDENGATE DR FROM MEADOWBROOK WAY TO CALIFORNIA AND RE-ROUTING TO THE NORTH SIDE OF GOLDENGATE DR IN THAT SECTION.

- WITH THIS WATER MAIN, FIRE FLOW IS INCREASED AND ABLE TO REACH A LARGER PORTION OF LATHRUP VILLAGE BY CONNECTING THE 12 INCH MAIN ON 11 MILE ROAD TO LARGER PIPES THAT RUN INTO MORE OF THE CITY.

- THIS SCENARIO PROVIDES SUBSTANTIAL BENEFITS, AS IT IMPROVES FIRE FLOW IN LARGE PORTIONS OF THE CITY AND PAVES THE WAY TO EXPANDED IMPROVEMENTS IN THE FUTURE.

- OPENING THE 12" METER AT 12 MILE RD AND SOUTHFIELD RD INCREASES AVAILABLE FIRE FLOWS ONLY IN THE IMMEDIATE SURROUNDING AREA OF THE 12 MILE RD. METERED CONNECTION, AND THE SYSTEM IS STILL NOT ABLE TO DELIVER RECOMMENDED FIRE FLOWS TO LARGE SECTIONS OF THE CITY.

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Planners
Landscape Architects

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Manager:	J.R.W.
Designer:	B.D.M.
Quality Control	J.P.K.

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Developed For:

CITY OF
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27400 SOUTHFIELD ROAD
LATHRUP VILLAGE, MI 48076
(248)557-2600

SCENARIO 2025a

LATHRUP VILLAGE WATER SYSTEM RELIABILITY STUDY

CITY OF LATHRUP VILLAGE
OAKLAND COUNTY
MICHIGAN

Date:	08.03.23
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Sheet:	1 of 1
Project:	16496.53

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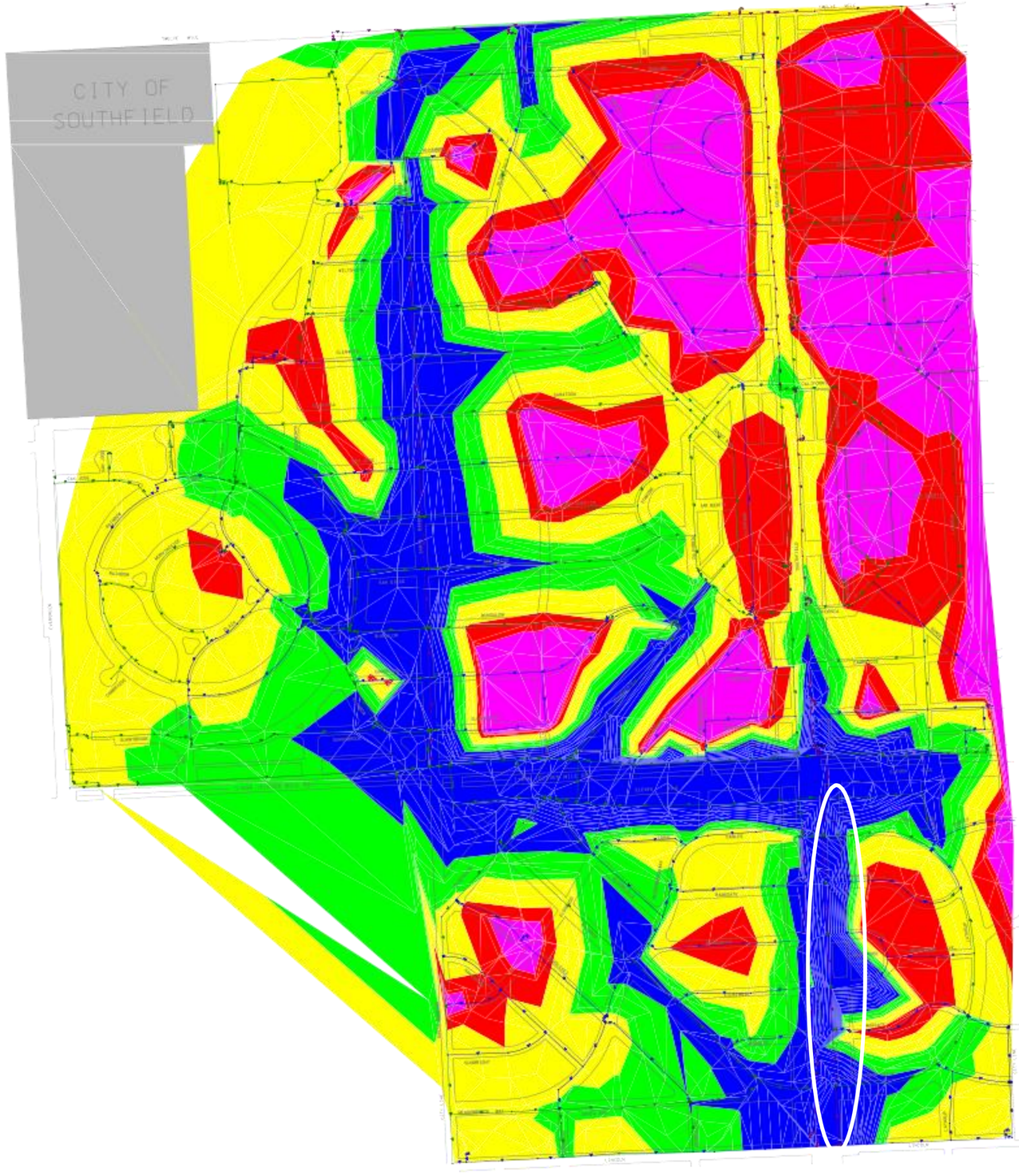

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SCENARIO 2026 - SOUTH SOUTHFIELD ROAD 8" WATER MAIN REPLACED (LINCOLN TO 11 MILE)

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SCENARIO 2026

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OAKLAND COUNTY
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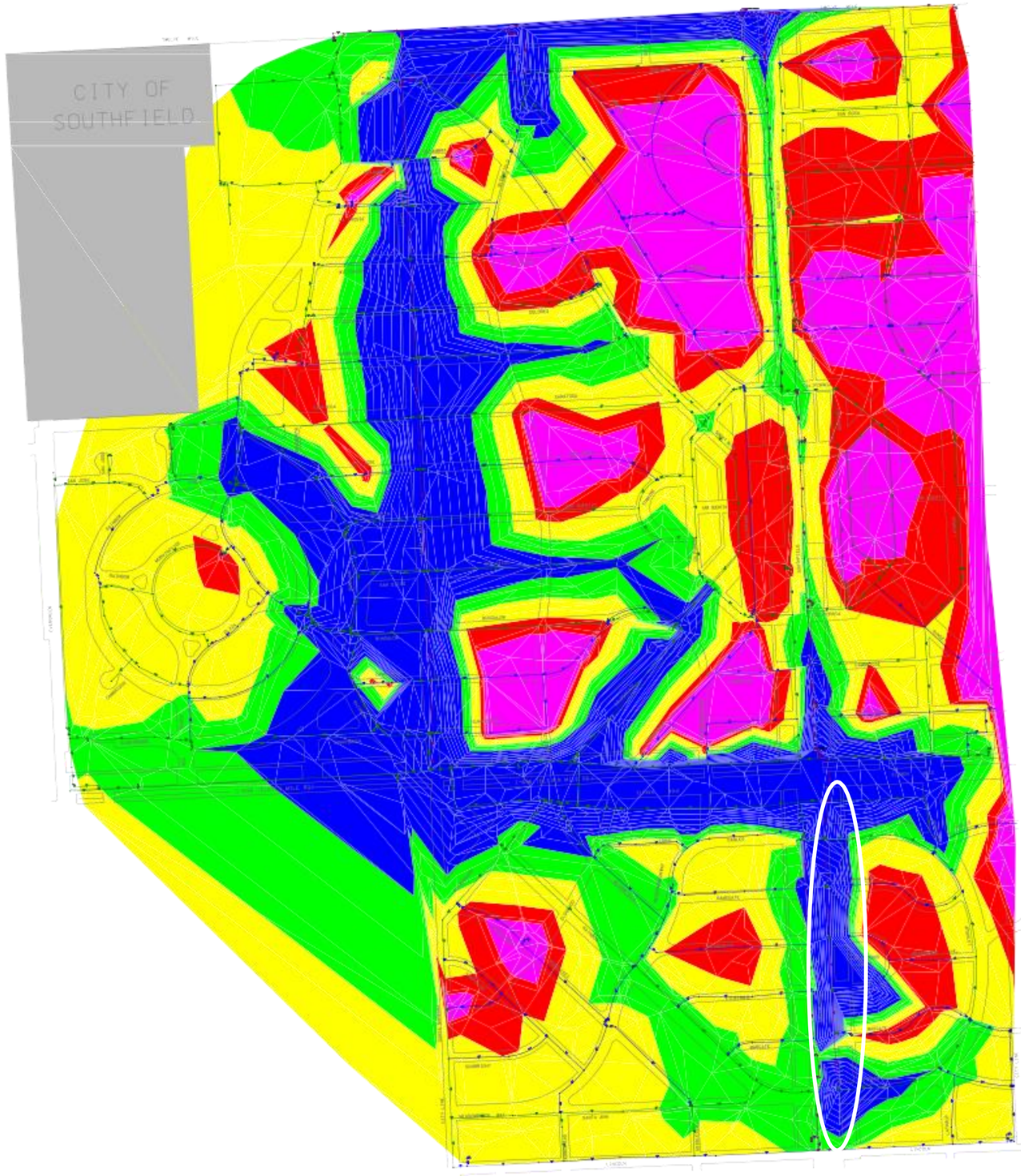

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SCENARIO 2026a

LATHRUP VILLAGE WATER SYSTEM RELIABILITY STUDY

CITY OF LATHRUP VILLAGE
OAKLAND COUNTY
MICHIGAN

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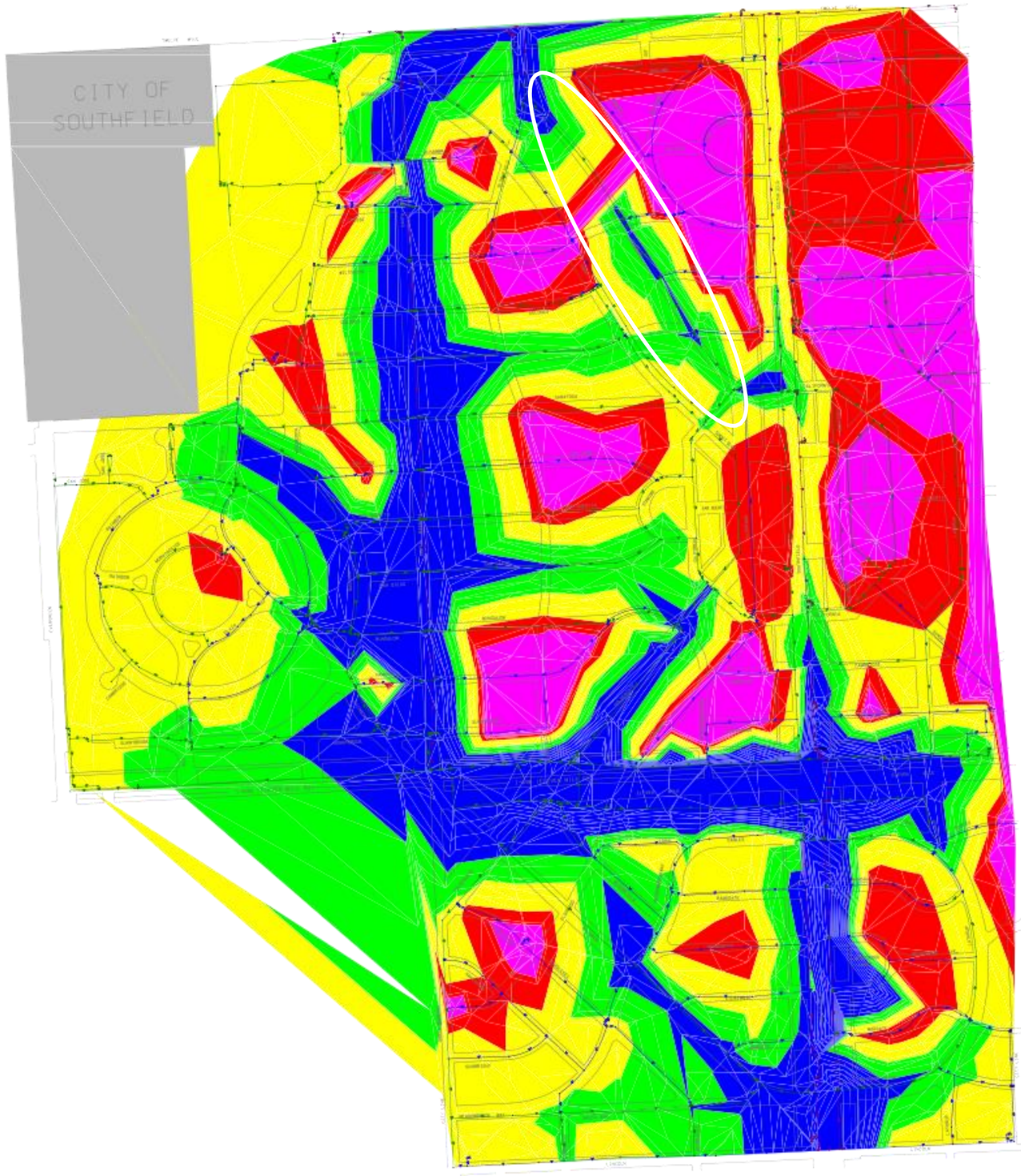

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SCENARIO 2027 - SOUTH SOUTHFIELD ROAD 8" WATER MAIN REPLACED (LINCOLN TO 11 MILE)

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SCENARIO 2027

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CITY OF LATHRUP VILLAGE
OAKLAND COUNTY
MICHIGAN

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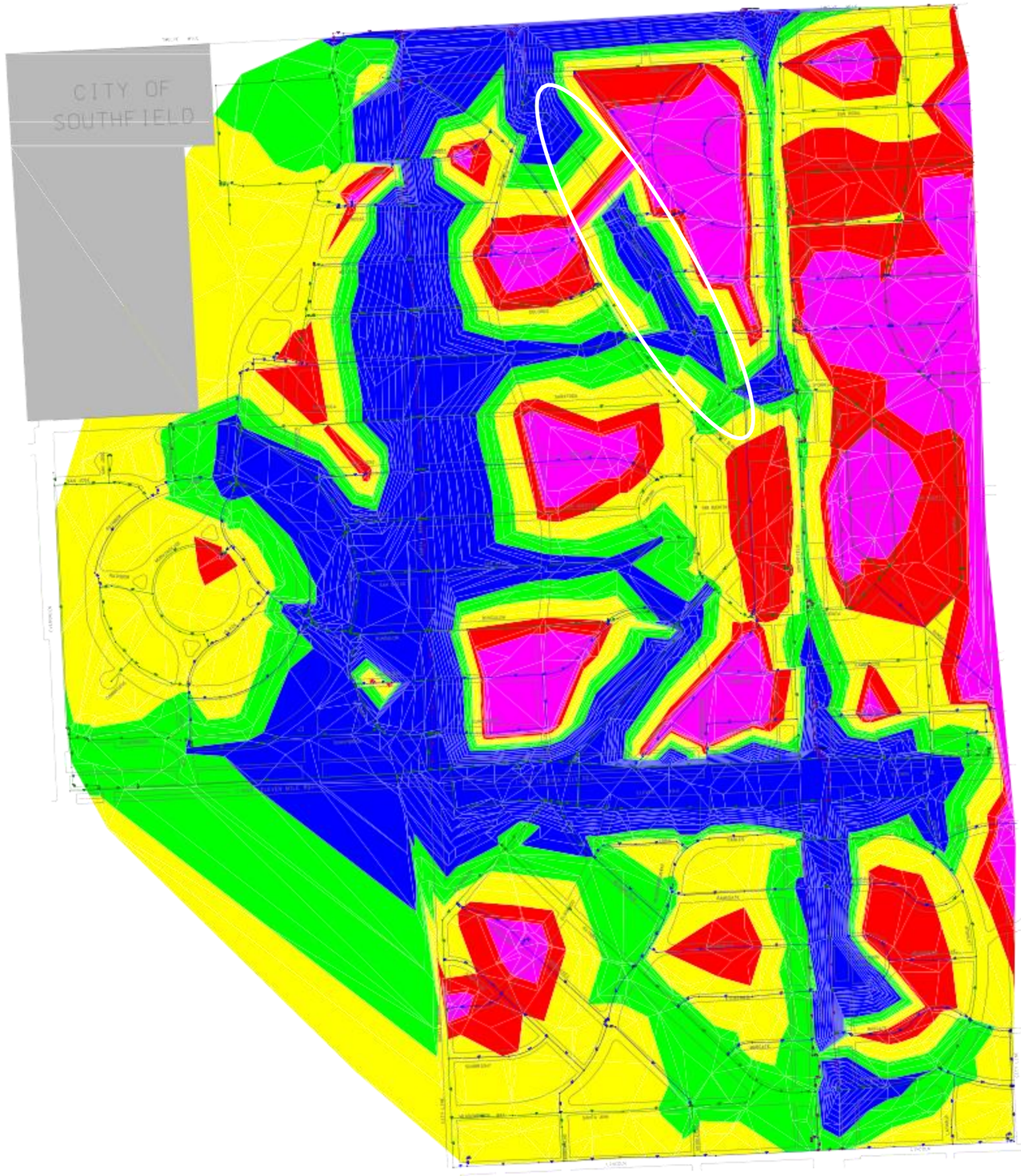

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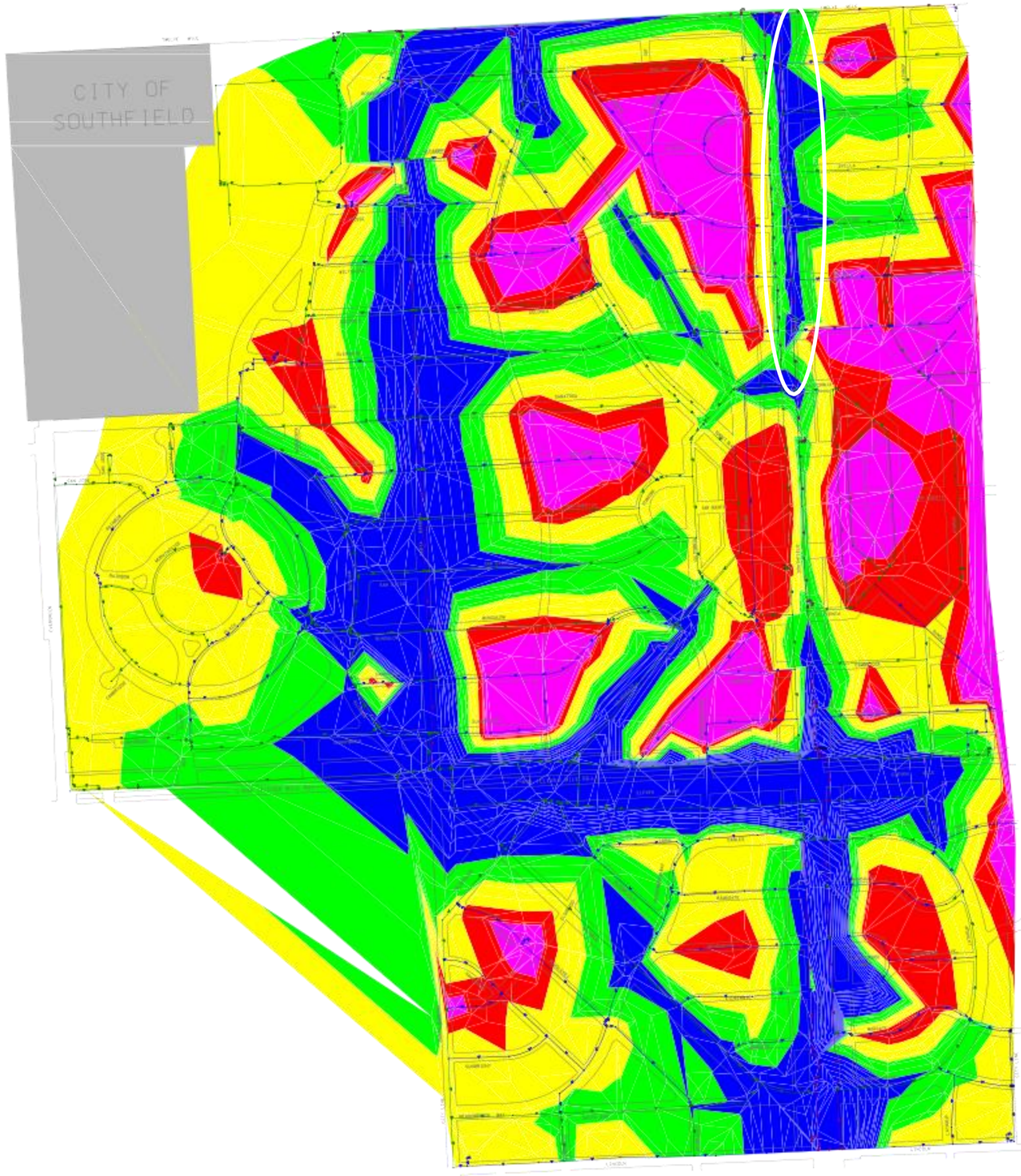

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SCENARIO 2028 - SOUTHFIELD ROAD 8" WATER MAIN REPLACED (12 MILE TO CALIFORNIA)

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SCENARIO 2028

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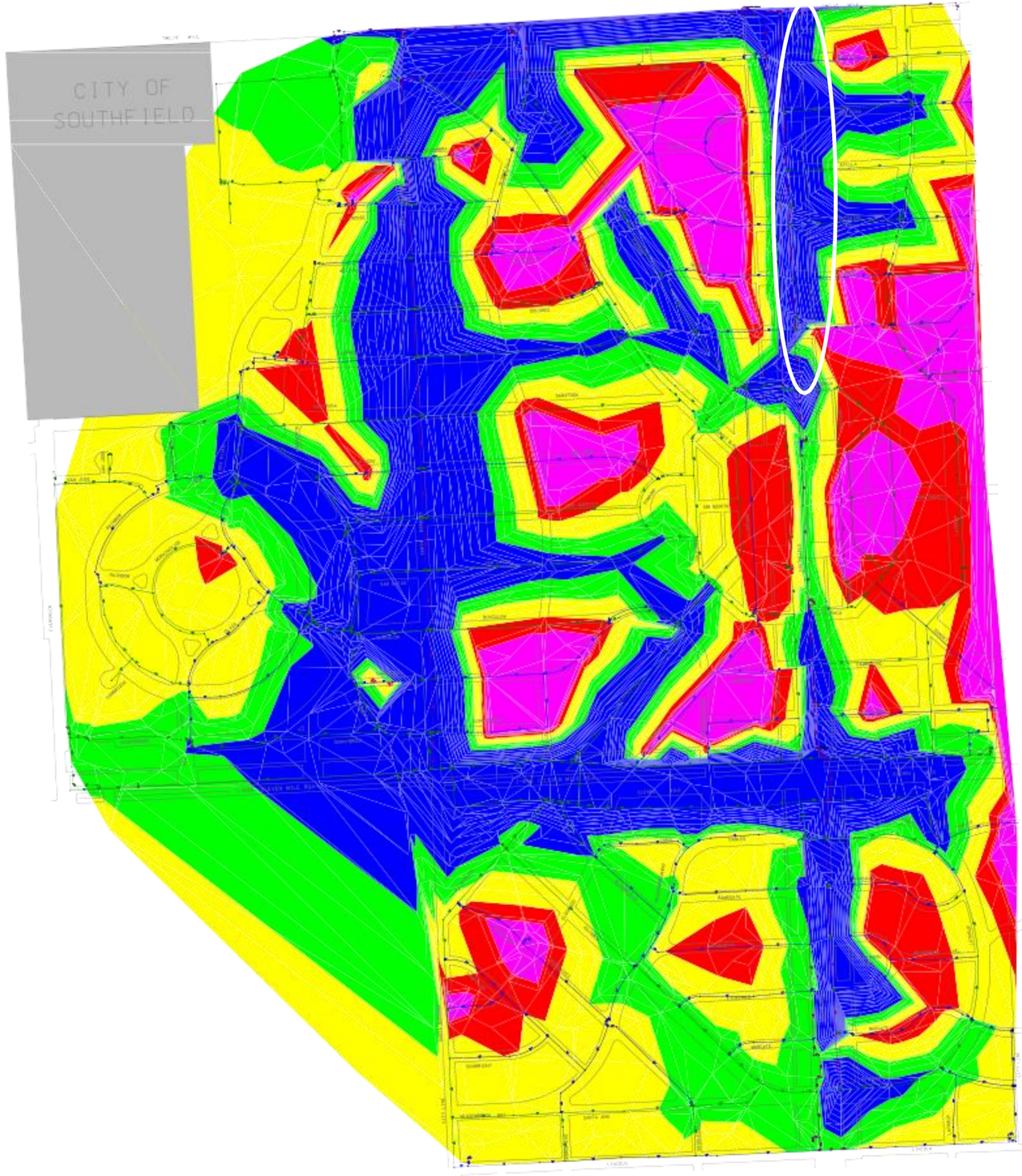

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FIGURE 6 - HYDRANT FLOW TEST SUMMARY SHEET FOR LATHRUP VILLAGE

PROJECT #: 16496.50 PROJECT #: 16496.53

								2016				2023					
Flow #	Date	Time	Property Name	Residual Hydrant	Flow Hydrant(s)	Main Size	Hydrant Coeffeicient	Static Pressure	Residual Pressure	Flow @ 20psi	2017 Notes	Date	Time	Static Pressure	Residual Pressure	Flow @ 20psi	2023 Notes
1	10/24/2016	9:15 AM	17310 Lincoln	17580 Lincoln	17310 Lincoln	6"	0.90	50	4.00	411 gpm		5/19/2023	8:30 AM	44	19	613 gpm	
2	10/24/2016	9:45 AM	26021 Southfield Rd.	26411 Southfield Rd	26021 Southfield Rd	12"	-	-	-	-	NO TAG / HYDRANT SEIZED 26333 Southfield Rd						
3	10/24/2016	10:15AM	18940 Lincoln	18430 Lincoln	18940 Lincoln	6"	0.90	50	4.00	411 gpm		5/19/2023	8:30 AM	42	20	520 gpm	
4	10/24/2016	10:15AM	18816 Middlesex	26415 Meadowbrookway	18816 Middlesex	6"	0.80	54	42.00	809 gpm		5/19/2023	8:30 AM	44	39	630 gpm	
5	10/24/2016	10:45AM	26735 Lathrup	17350 Rainbow Drive	26735 Lathrup	8"	0.80	50	20.00	461 gpm		5/19/2023	8:30 AM	42	22	617 gpm	
6	10/24/2016	11:00AM	27246 Goldengate	27450 Goldengate	27246 Goldengate	6"	0.90	-	-	575 gpm	Broken Stem						
7	10/24/2016	11:30am	Credit Union	1948 11 Mile Road	11 Mile & Greenfield	8"	0.90	50	44.00	1235 gpm		5/10/2023	8:30 AM	50	44	1297 gpm	
8	10/25/2016	9:30AM	27745 Rackham	19100 San Jose	27745 Rackham	6"	0.90	44	22.00	1229 gpm		6/7/2023	8:30 AM	44	36	1501 gpm	
9	10/25/2016	9:50AM	27850 San Jose Court	19593 San Jose	27850 San Jose /Court	8"	0.90	46	20.00	829 gpm		5/10/2023	8:30 AM	50	36	1251 gpm	
10	10/25/2016	10:00AM	28261 Woodworth	19115 Glenwood	28261 Woodworth	6"	0.80	44	32.00	670 gpm		5/10/2023	8:30 AM	44	37	1097 gpm	
11	10/25/2016	10:20AM	18899 12 Mile	18411 12 Mile	18899 12 Mile	12"	-	-	-	-	Cap Siezed						
12	10/25/2016	10:30AM	17373 12 Mile	18411 12 Mile	17373 12 Mile	12"	0.80	38	20.00	645 gpm		5/17/2023	8:30 AM	34	28	1136 gpm	Flowed hydrant to the west
13	10/25/2016	10:50AM	28500 Southfield Road	28200 Southfield Road	28500 Southfield Road	8"	0.80	40	22.00	632 gpm		5/17/2023	8:30 AM	38	20	1059 gpm	
14	10/25/2016	11:05AM	27486 Lathrup	27720 Lathrup	27486 Lathrup	8"	0.90	38	4.00	368 gpm		5/17/2023	8:30 AM	42	24	782 gpm	
15	10/25/2016	11:15AM	27465 Southfield Road	27305 Southfield Road	27465 Southfield Road	8"	0.80	-	-	-	Stem Siezed / Can't open	6/7/2023	8:30 AM	43	35	1242 gpm	
16			18591 Saratoga	18871 Saratoga	18591 Saratoga	8"	0.84					5/8/2023	8:30 AM	44	34	1352 gpm	
17			18826 Sunnybrook	18710 Sunnybrook	18826 Sunnybrook	8/6	0.84					5/8/2023	8:30 AM	46	38	1624 gpm	
18			27451 Goldengate	27336 Goldengate	27451 Goldengate	8"	0.84					5/8/2023	8:30 AM	42	34	1271 gpm	
19			18411 W 12 Mile	18831 W 12 Mile	18411 W 12 Mile	12"	0.84					5/15/2023	8:30 AM	40	32	1207 gpm	
20			18811 Alhambra	18804 LaCrosse	18811 Alhambra	8"	0.84					5/15/2023	8:30 AM	42	35	1511 gpm	
21			28510 Sunset	28421 Sunset	28510 Sunset	8"	0.84					5/15/2023	8:30 AM	38	34	1119 gpm	
22			28309 Southfield Rd	28280 Redwood	28309 Southfield Rd	6"	0.84					5/15/2023	8:30 AM	38	30	1140 gpm	
23			27208 Southfield Road	27400 Southfield Rd	27208 Southfield Road	12"	0.84					5/17/2023	8:30 AM	42	36	1674 gpm	
24			26301 Southfield Rd	26411 Southfield Road	26301 Southfield Rd	12"	0.84					5/19/2023	8:30 AM	42	34	1382 gpm	

City of Lathrup Village
Water System Reliability Study
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LATHRUP VILLAGE 5 YEAR / 20 YEAR WATER MAIN CAPITAL IMPROVEMENT PROGRAM (CY 2024 - 2045)

8/1/2023

PROJECT	LIMITS	BASIS OF ESTIMATE	CALENDAR YEAR																	
											5 YEAR C.I.P.					20 YEAR C.I.P.				
			16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31-45	Unknown	TOTAL
Roseland / Bloomfield	**Approx. 210 lf at intersection Intersection**	Rule of Thumb	**$42,000**																	**$42,000**
Wiltshire	**Approx. 140 lf between Southfield and Lathrup**	Rule of Thumb	**$28,000**																	**$28,000**
Glenwood	**Approx. 250 lf between Southfield and Lathrup**	Rule of Thumb	**$50,000**																	**$50,000**
Saratoga	**Santa Barbara to Bloomfield**	Rule of Thumb		**$180,000**																**$180,000**
East City Border	**Lincoln to Margate**	Rule of Thumb			**$105,313**															**$105,313**
Santa Barbara	**11 Mile to 12 Mile**	Rule of Thumb			**$340,000**	**$502,500**	**$377,500**													**$1,220,000**
Lead Service Replacement	**5% Minimum Required (assume 8 / yr)**	$7,000 ea									$56,000	$56,000	$56,000	$56,000	$56,000					**$280,000**
Roseland (375 ft)	**Lathrup to Sfld dead end**	$275 / FT (greenbelt)									$112,500									**$112,500**
Avilla (400 ft)	**Lathrup to Dead End (SFLD FD)**	$300 / ft (road)									$120,000									**$120,000**
Redwood (570 ft)	**Southfield to Sfld dead end**	$300 / ft (road)									$171,000									**$171,000**
Catalpa (340 ft)	**Lathrup to Sfld dead end**	$250 / ft (all greenbelt)									$85,000									**$85,000**
Rainbow (1,250 lft)	**Goldengate to Meadowbrook Way**	$275/ft (greenbelt)										$343,750								**$343,750**
Lathrup Loop (325' lft)	**11 Mile to Coral Gables**	$275 (greenbelt, no services)										$89,375								**$89,375**
Arrowhead Loop (360 lft)	**Santa Ann to Lincoln**	$275 (greenbelt, no services)										$99,000								**$99,000**
Middlesex Loop (360 lft)	**Santa Ann to Lincoln**	$275 (greenbelt, no services)										$99,000								**$99,000**
Ramsgate East Loop (180 lft)	**East dead end to lathrup**	$275 (greenbelt, no services)										$49,500								**$49,500**
Southfield Rd (2,400 ft)	**Lincoln to Coral Gables (east side)**	Budget (450 / ft)	(Directional Bore)										$1,080,000							**$1,080,000**
Eldorado (2,800 ft)	**Bloomfield to Southfield**	$350/ft (edge road)												$980,000						**$980,000**
Southfield Road (2,600 LFT)	**California to 12 Mile (east side)**	Budget $500 / lft	(Directional Bore)												$1,312,500					**$1,312,500**
Lincoln East (1,250 lft)	**Southfield to east City limits**	$375 / ft														$468,750				**$468,750**
Lincoln West (2,500 lft)	**West City Limits to Southfield**	$375 / $400 /ft														$468,750	$500,000			**$968,750**
California West (2,300 lft)	**Southfield to Eldorado**	Budget $400 / lft																	$920,000	**$920,000**
California East (2,500 lft)	**Southfield to Southfield**	Budget $400 / lft																	$1,000,000	**$1,000,000**
Southfield Road (2.600 LFT)	**11 Mile to California (west side)**	Budget $500 / lft																	$1,300,000	**$1,300,000**
To Be Determined	**Replace Aged and Undersized Water Mains**	Budget $500k / yr																$6,500,000		**$6,500,000**
	YEAR TOTALS		**$120,000**	**$180,000**	**$445,313**	**$502,500**	**$377,500**	**$0**	**$0**	**$0**	**$544,500**	**$736,625**	**$1,136,000**	**$1,036,000**	**$1,368,500**	**$937,500**	**$500,000**	**$6,500,000**	**$3,220,000**	**$17,604,438**

Dependent other improvements

Improve with any future City Center development

CAPITAL IMPROVEMENT BOND (SPEND IN 3 YEARS)

PROJECT	LIMITS	BASIS OF ESTIMATE	CALENDAR YEAR																	
							20	21	22	23	24	25	26	27	28	29/30	30/31	32-42		TOTAL
Lead & Copper Verification	**500 locations**	$775 ea						$89,500												**$89,500**
Lead & Copper Verification	**500 locations**	$775 ea							$89,500											**$89,500**
Lead & Copper Verification	**500 locations**	$775 ea								$20,800										**$20,800**
Lead Service Replacement	**5% Minimum Required (assume 10 services)**	$5,000 ea						$98,000	$35,000	**$20,000**										**$153,000**
San Rosa	**Southfield to Lathrup**	Rule of Thumb						$250,000												**$250,000**
Wiltshire	**Southfield to Lathrup**	Rule of Thumb						$225,000												**$225,000**
Goldengate	**11 Mile to California West**	Rule of Thumb							$437,500											**$437,500**
Bloomfield	**LaCrosse to Sunset**	Rule of Thumb								**$31,250**										**$31,250**
Glenwood	**Santa Barbara to Sunset**	Rule of Thumb								**$412,500**										**$412,500**
Fire Hydrant Repair	**City Wide (estimate 40 / yr)**	$4,540 ea						$127,000	$143,000	**$129,000**										**$399,000**
Gate Valve Repair	**City Wide (estimate 54 / yr)**	$5,925 ea						$26,000	$19,000	**$83,000**										**$128,000**
Lincoln Directional Bore	**Across Southfield Road**	Rule of Thumb								**$150,000**										**$150,000**
San Diego	**Rackham to Standford)**	Rule of Thumb								**$537,000**										**$537,000**
	YEAR TOTALS							**$815,500**	**$724,000**	**$1,383,550**										**$2,923,050**

		CIP BOND			5 YEAR C.I.P.										
YEAR TOTALS (WATER FUND AND BOND)		**$120,000**	**$180,000**	**$445,313**	**$502,500**	**$377,500**	**$815,500**	**$724,000**	**$1,383,550**	**$544,500**	**$736,625**	**$1,136,000**	**$1,036,000**	**$1,368,500**	**$937,500**	**$500,000**	**$6,500,000**	**$3,220,000**	**$20,527,488**

COMPLETED

UNDER CONSTRUCTION / PERMITTED

COORDINATE WITH CITY CENTER DEVELOPMENT (YEAR OF CONSTRUCTION UNKNOWN)

COORDINATE WITH SOUTHFIELD ROAD RECONSTRUCTION (YEAR OF CONSTRUCTION UNKNOWN)

YR	PROJECT	LIMITS	SERVICE LEADS	EX. SIZE	LFT	$/LFT Budget	COST	NO OF BREAKS	AGE	JUSTIFICATION	12"	8"	Hyd	GV
2016	Roseland / Bloomfield	Approx. 210 lf at intersection	3	6"	210	$200	$42,000	3	1928	Frequent breaks		210		
2016	Wiltshire	Approx. 140 lf between Southfield and Lathrup	3	6"	140	$200	$28,000	7	1928	Frequent breaks		138		
2016	Glenwood	Approx. 250 lf between Southfield and Lathrup	7	6"	250	$200	$50,000	5	1928	Frequent breaks		244		
2016	Saratoga	Santa Barbara to Bloomfield	14	6"	900	$200	$180,000	4	1924	Frequent breaks		892	3	2
2018	East City Border	Rainbow to Margate	-	6"	450	$200	$105,313	2	1969	Frequent breaks / Lined WM Rainbow to Margate ONLY due to 90 deg bends south of Rainbow		383		
2018/2	Santa Barbara	11 Mile to Rosland to 12 Mile	-	-	5150	$200	$1,030,000			Increase reliability / flow to west side of City	5,809	1,402	8	30
2023	San Diego	Rackham to Bloomfield to Stanford Ct	40	6"	2150	$250	$537,500	5	1928	Frequent breaks / old 6" main (1925 - 1928)		2,135	5	4
2021	San Rosa	Southfield to Lathrup	14	6"	1000	$250	$260,203	1	1928	Undersized / fire protection hydraulics		972	3	7
2021	Wiltshire	Southfield to Lathrup	13	6"	900	$250	$234,207	6	1928	Frequent breaks / undersized / fire protection hydraulics		880	4	7
2022	Goldengate	11 Mile to California West	31	6"	1750	$250	$437,500	0	1928	Undersized / fire protection hydraulics		1,642	3	7
2023	Lincoln Directional Bore	Across Southfield Road	0	6"	300	$500	$150,000	1	1928	Undersized / fire protection hydraulics -CURRENTLY CLOSED AT 3 GATE VALVES RESTRICTING FLOW	304		1	3
2023	Glenwood	Santa Barbara to Sunset	26	6"	1500	$275	$412,500	2	1928	Frequent breaks / undersized / fire protection hydraulics		1,451	4	2
2023	Bloomfield	LaCrosse to Sunset	-	-	125	$250	$31,250	-	-	Interconnection for reliability and fire protection		337		1
2024	Roseland (375 ft)	Lathrup to Sfld dead end	8	6	375	$300	$112,500		1928	Undersized and dead ends				
2024	Avilla (400 ft)	Lathrup to Dead End (SFLD FD)	8	8	400	$275	$110,000		1928	Undersized and dead ends				
2024	Redwood (570 ft)	Southfield to Sfld dead end	11	6	570	$300	$171,000		1928	Undersized and dead ends				
2024	Catalpa (340 ft)	Lathrup to Sfld dead end	2	6	340	$250	$85,000		1928	Undersized and dead ends				
2025	Rainbow	Goldengate to Meadowbrook Way	20	8"	1300	$275	$357,500	4	1941	Frequent breaks, Water pressure				
2025	Lathrup Loop (325' lft)	11 Mile to Coral Gables	0		325	$275	$89,375			Increase flow and reliability to SE quadrant				
2025	Arrowhead Loop (360 lft)	Santa Ann to Lincoln	0		360	$275	$99,000			Increase flow and reliability to SE quadrant				
2025	Middlesex Loop (360 lft)	Santa Ann to Lincoln	0		360	$275	$99,000			Increase flow and reliability to SW quadrant				
2025	Ramsgate East Loop (180 lft)	East dead end to lathrup	0		180	$275	$49,500			Increase flow and reliability to SW quadrant				
2026	Southfield Road (directional drill)	Lincoln to 11 Mile (east side)	20	8"	2400	$450	$1,080,000	4	1928	Increase reliability / flow / frequent breaks				
2027	Eldorado	Bloomfield to Sunset	50	6", 8"	2800	$350	$980,000	9	1928	Frequent breaks / undersized / fire protection hydraulics				
2028	Southfield Road (directional drill)	12 Mile to California (East Side)	16	8"	2625	$500	$1,312,500	7	1927-1928	Increase reliability / flow / East side of Southfield Road				
	Lincoln East	Southfield to east City limits	12	6"	1900	$250	$475,000	0	1969	Undersized / fire protection hydraulics				
	Lincoln West (2 Phases)	West City Limits to Southfield	28	6"	3200	$275	$880,000	1	1969	Undersized / fire protection hydraulics				
	California West	Southfield to Southfield	20	8"	2400	$300	$720,000	0	1924	Age / City Center fire protection hydraulics				
	California East	Southfield to Southfield	25	8"	2500	$300	$750,000	1	1928	Age / City Center fire protection hydraulics				
	Southfield Road	11 Mile to California (west side)	32	8"	2700	$500	$1,350,000	2	1924 - 1928	Inrease reliability / flow / future City Center				
	To Be Determined	Replace aged and undersized water mains		6" - 8"	1250	$400	$500,000		Late 1920's	BUDGET - Aged and undersized water main - increase fire flow protection				
			400								6,113	10,686	31	63

Lead & Copper Verification Sunde Building quoted $550 + $75 (service box) + $100 (ave sidewalk) each (average) plus engineering / administration = $775 each

5 YR CIP (CY 2024 - 2028)	**$4,821,625**
20 YR CIP (CY 2024 - 2043)	**$15,979,125**