2027 DWSRF PROJECT PLAN AMENDMENT

Water Main & Lead Service Line Replacements

Prepared for
The City of Mount Clemens

Prepared By:

ANDERSON, ECKSTEIN & WESTRICK, INC.
CIVIL ENGINEERS - SURVEYORS - ARCHITECTS
Shelby Township - Roseville - Livonia
586.726.1234 | www.aewinc.com

TABLE OF CONTENTS

Executive Summary

The City of Mount Clemens (City) has engaged Anderson Eckstein, and Westrick, Inc. (AEW), the City's consulting engineer, to develop a Project Plan in order to apply for a Drinking Water State Revolving Fund (DWSRF) loan through the Michigan Department of Environment, Great Lakes and Energy (EGLE). This Project Plan was prepared for in accordance with DWSRF Project Planning Document Preparation Guidance (January 2023). This Project Plan has been prepared based upon the City's Drinking Water Asset Management Plan, historical records of the water distribution system and Lead Service Line inventory.

Financial assistance for this project is being sought through EGLE. The DWRF provides for financial assistance in the form of low interest loans of which portions of the principal may be forgiven. DWRF rules call for compliance with basic federal planning requirements of the National Environmental Policy Act (NEPA). The Final Project Plan serves as a basis of project prioritization by EGLE.

The intent of the DWSRF Project is to replace several City water mains that are past their useful life and replace lead service lines located at various locations identified throughout the City. The goal of the DWSRF Project is to improve the efficiency and reliability of the existing drinking water system and address public health concerns related to lead water services.

The City of Mount Clemens is a strong steward of drinking water management, and takes a proactive position in protecting its residents and property owners. Through development and implementation of the City's Drinking Water Asset Management Plan and Water Reliability Study, the insight and understanding of the system's drinking water assets has significantly improved. A comprehensive investigation included condition assessment of assets, capital improvement needs, and counts of all assets and services. Based on this investigation, the City estimates that 43 miles of water main are beyond the expected design life cycle of 50 years and there is estimated to be several hundred water services in the City that contain lead with 2,400 that are an unknown material. Michigan's Lead and Copper Rule requires that a minimum of 5% of lead service lines be replaced by the year 2041.

The City desires to replace and upgrade critical water mains in the City and replace lead water by utilizing a 20-year DWSRF low-interest loan in the amount of $7,200,000.

Background

Study and Service Area

This section is unchanged and can be referenced in the original project planning document.

Existing Environment Evaluation

This section is unchanged and can be referenced in the original project planning document.

Fauna and Flora

This section is unchanged and can be referenced in the original project planning document.

Existing System

This section is unchanged and can be referenced in the original project planning document.

Need for the Project

The City is currently in compliance with all drinking water standards and has the capacity to serve the affected area. The City has many sections of water main that have surpassed their useful design life that also experience several water main breaks each year. Significant costs are accumulated over the course of a year for the repairs of these breaks. In addition, many of the older sections of water main in the City are believed to have lead service lines, which could indicate a large number of lead service lines that are required to be replaced per the Lead and Copper Rule.

Therefore, the City is seeking to apply for the DWSRF loan with the total amount of $7,200,000 for water distribution system improvements. The system improvements would seek to replace two critical runs of water mains along Jones Street from North Gratiot Avenue to North Broadway Street and along Esplanade Street from Westlawn Street to Wellesley Drive which has a dual water main. These water mains experience water main breaks, are past their useful design life and contain many known lead water services requiring replacement. The project also includes the replacement of lead water service lines at various locations throughout the City. Both proposed water main replacements and lead service line replacements can be found as recommendations in the City's Drinking Water Asset Management Plan in the Capital Improvement Plan, found in Appendix H.

Lead water service replacement is required due to the new community requirements established in EGLE's revised Lead and Copper Rule. The Lead and Copper Rule enacted in June 2018 mandated new actions levels for lead and copper based on a 90th percentile level of tap water samples. In Michigan, a lead Action Level of 15 parts per billion (ppb) was established and is expected to decrease to 12 ppb January 2025. Along with this, new sampling requirements and methods were developed to improve lead detection in a community's drinking water. An action level exceedance is not a violation but triggers a set of requirements that must be completed to minimize exposure to lead and copper in drinking water. This includes water monitoring/treatment, public education, and lead service line replacement.

Compliance with Drinking Water Standards Defined in Act 399
Orders or Enforcement Actions
Drinking Water Quality Problems
Projected Future Needs

These sections are unchanged and can be referenced in the original project planning document.

Analysis of Alternatives

The City of Mount Clemens has analyzed different alternatives to address the replacement of the aging water distribution system and are summarized as follows:

No Action

This section is unchanged and can be referenced in the original project planning document.

Water Main Replacement by Open Cut Excavation

This section is unchanged and can be referenced in the original project planning document.

Water Main Replacement by Directional Drilling Installation

This section is unchanged and can be referenced in the original project planning document.

Water Main Replacement by Pipe Bursting

This section is unchanged and can be referenced in the original project planning document.

Lead Service Replacement by Open Cut Excavation

The open-cut excavation method involves installing a new water service line by excavating a continuous trench from the watermain connection to the building entry point. This technique provides full access to the existing lead water service line, allowing crews to remove the line entirely and install the replacement pipe within a fully exposed trench. Open-cut method offers the highest degree of construction control and is typically selected when the existing service contains bends, obstructions, or mixed materials. However, this method results in the greatest surface disruption, with excavation often impacting lawns, driveways, landscaping, and any buried features within the service alignment. Restoration requirements are therefore more extensive, contributing to longer construction durations and higher overall costs compared to minimally invasive alternatives. Open-cut excavation remains a reliable and widely applicable replacement technique but is generally used when site conditions preclude trenchless options or when a municipality requires full removal of the original line with visual verification. This option is a potential alternative; however, based upon a cost analysis proves to be at a higher cost and more extensive disruption in mainly residential areas.

Lead Water Service Replacement by Trenchless Pulling

The trenchless pulling method replaces an existing water service line by utilizing the original pipe as a pathway for installation of the new line. Crews will expose the service at the water main connection and at the building entry, then insert a pulling cable or rod through the existing lead pipe. A new copper of HDPE service line is attached and drawn back through the alignment as the old line is removed, enabling a full replacement with only two small excavations and minimal surface disruption. This method significantly reduces impacts to pavements and landscaping, resulting in faster installation times and lower restoration costs. Trenchless pulling is best suited for existing service lines that are continuous and free of blockages. While not suitable for all alignments, trenchless pulling provides a cost-effective and minimally invasive solution when site conditions allow.

Lead Water Service Replacement by Directional Drilling

The directional drilling method is a trenchless technology used to install the new water service line by creating a guided bore path beneath the ground surface without disturbing the full alignment of the existing service. A pilot bore is drilled along a predetermined, engineered alignment toward a receiving pit located near the building entry point or connection location. A drill head can be steered to maintain precision and avoid utilities. Once the pilot bore is completed, a new copper of HDPE service is pulled back through the bore path to complete the installation. Directional drilling offers a high flexibility in routing and depth, making it valuable at sites with complex utility crossings or mature landscaping. This method significantly reduces surface disruption, minimizes restoration requirements, and can expedite project timelines. However, directional drilling generally involves higher mobilization costs and requires specialized equipment. When implemented appropriately, directional drilling provides a precise, minimally invasive, and efficient solution for lead water service replacements.

Regionalization

Currently, the City maintains an emergency connection to the Great Lakes Water Authority (GLWA) at the intersection of Crocker Boulevard and 16 Mile Road. It consists of locked gate valves, which can only be opened in the event of an emergency by authorized Mount Clemens and Harrison Township personnel.

During the fiscal year 2024 loan program the City submitted a project to connect their drinking water distribution system to GLWA and have their Water Treatment Plant decommissioned. Construction of the GLWA connection project underway and continuing but is separate from this project.

Monetary Evaluation

The following table provides an overall cost summary comparing the potential alternatives for water main replacement if the City were to replace all water mains that have surpassed their useful design life in 2026 dollars:

End of Useful Life Water Main

Alternative	Quantity	Unit	Unit Cost	Total
Open Cut	0.60	Miles	$ 2.4M	$ 1.44M
Directional Drill	0.60	Miles	$ 2.9M	$ 1.74M
Pipe Bursting	0.60	Miles	$ 3.5M	$ 2.10M

All costs summarized in Appendix I include engineering, permits, construction administration, construction inspection, construction staking and layout, material testing and restoration of all sites. Updated costs for 2026 pricing for the watermain construction have been reflected in the cost estimates. The original 40 miscellaneous lead service replacements were moved into the lead service replacement project total. The preliminary construction cost estimates are included in the Appendix I.

Sunk Costs
Present Worth
Salvage Value
Escalation
Interest During Construction

These sections are unchanged and can be referenced in the original project planning document.

User Costs

The drinking water system is made up of 9,799 residential equivalency units (REU's). Based on the present worth analysis, the equivalent annual cost of the DWSRF projects is $298,516.63. Therefore, the estimated annual costs per REU is $30.46.

Project Delivery Method

This section is unchanged and can be referenced in the original project planning document.

Environmental Evaluation

This section is unchanged and can be referenced in the original project planning document.

Technical Considerations

This section is unchanged and can be referenced in the original project planning document.

Selected Alternative

The option to upgrade and replace water mains by open cut excavation is the selected alternative as it is the most cost-effective solution and is the only viable alternative to accomplish the mandated removal of lead impacted water services and provide the required level of service for water main flow. The City of Mount Clemens is looking to apply for a $7,200,000 loan through the Drinking Water State Revolving Fund loan program to accomplish critical water main replacement and lead service line replacements. The critical water mains have been selected based upon the Business Risk Exposure score provided as part of the development of the City's Water Asset Management Plan, revised in December 2019 and based upon the age of the water main, location, number of lead and galvanized water services to be replaced and frequency of water main breaks. The proposed project consists of the replacement of water mains along Jones St. from N. Gratiot to Broadway St. and Esplanade St. from S. Gratiot to Westlawn St. In addition, approximately 80 lead and galvanized water services would be replaced as part of this project exceeding the requirement of replacing a minimum of 5% of known lead and galvanized services in the system each year.

Design Parameters

Based upon a loan amount of $7,200,000 approximately 3,150 feet of critical water main will be replaced and approximately 180 lead water services will be replaced. Replacement of lead water services will be completed by means of directional drilling. All replaced water services will be Type K Seamless Copper tubing, compliant with lead-free regulations (NSF-372 and NSF-61G). All installations will be in accordance with the City of Mount Clemens, AWWA and MDOT construction standards. Replacements of water main will be completed by means of open cut trench excavation. All replaced water main will be ductile iron pipe. All installations will be in accordance with the City of Mount Clemens, AWWA and MDOT construction standards.

Useful Life

The useful life of ductile iron water main is typically 80-100 years. The useful life of HDPE and PVC water main is 70-80 years. This project plan and the DWRF loan is for a 20-year period; therefore, the useful life far surpasses the DWRF planning period.

Project Maps

See Appendix A for a map identifying all work areas associated with the proposed DWSRF Projects.

Water and Energy Efficiency

This section is unchanged and can be referenced in the original project planning document.

Schedule for Design and Construction

A preliminary schedule for design and construction of the selected alternatives is presented below:

Publish public hearing notice	4/10/2026
Conduct formal public meeting	4/20/2026
Public comment period ends	4/20/2026
City Commission approves resolution to proceed with project plan	4/20/2026
Project plan submittal to EGLE	6/1/2026
Submit engineering plans for required permits	12/31/2026
Part I application due (financial documentation and assurances)	5/12/2027
Part II application due (submit approved UCS and project plans)	5/12/2027
Publish advertisement for bids	5/21/2027
Part III application due (bid tabulation with tentative award)	7/7/2027
Order of Approval issued	8/4/2027
Loan close	8/26/2027
Conduct preconstruction meeting and issue notices to proceed	9/1/2027
Start construction	9/15/2027
Mitigation of environmental impacts	9/15/2027
Project completion	12/31/2028

Cost Summary

The total cost of the DWSRF Project is estimated to be $7,200,000. The DWSRF loan is anticipated to be financed for a 20-year term at 2.50%.

Debt service must be financed by a sewer system user charge system (UCS) that is consistent with the Environmental Protection Agency (EPA) and EGLE guidelines.

Implementability

The City of Mount Clemens is a municipal unit organized under the State of Michigan Constitution and statutes and is legally able to own and operate public utilities. The city owns and operates its public water system and combined sewer system. All improvements proposed as a part of this

project will be completed within city owned utility infrastructure and city owned property. All city-owned watermains are located within a city owned utility easement or public rights-of-way.

The selected alternatives will not pose any issues related to the implementability of the project. Mount Clemens has the legal authority, managerial capability, and financial means to build, operate, and maintain the system. Mount Clemens passed a resolution to adopt this Project Plan at the May 20, 2024 City Commission special meeting.

Environmental and Public Health Impacts

This section is unchanged and can be referenced in the original project planning document.

Mitigation

This section is unchanged and can be referenced in the original project planning document.

Public Participation

Public Meeting

A public meeting was held at Mount Clemens City Hall on April 20 at 5:30 PM. The following items were discussed.

1. A description of the water quality problems to be addressed by the project and the principal alternatives that were considered.
2. A description of the recommended alternative, including its capital costs and a cost breakdown by project components.
3. A discussion of project financing and costs to users, including the proposed method of project financing and estimated monthly debt retirement; the proposed annual, quarterly, or monthly charge to the typical residential customer; and any special fees that will be assessed.
4. A description of the anticipated social and environmental impacts associated with the recommended alternative and the measures that will be taken to mitigate adverse impacts.

Public Meeting Advertisement

In accordance with the Project Planning Document Preparation Guidance, the advertisement was published on the City's website on Thursday, April 9, 2026, and is available in City Hall. The public meeting advertisement is included in Appendix K.

Public Meeting Summary

The following elements from the public meeting are included in Appendix K:

- Summary of the meeting held and what was covered during the meeting in the form of a presentation.

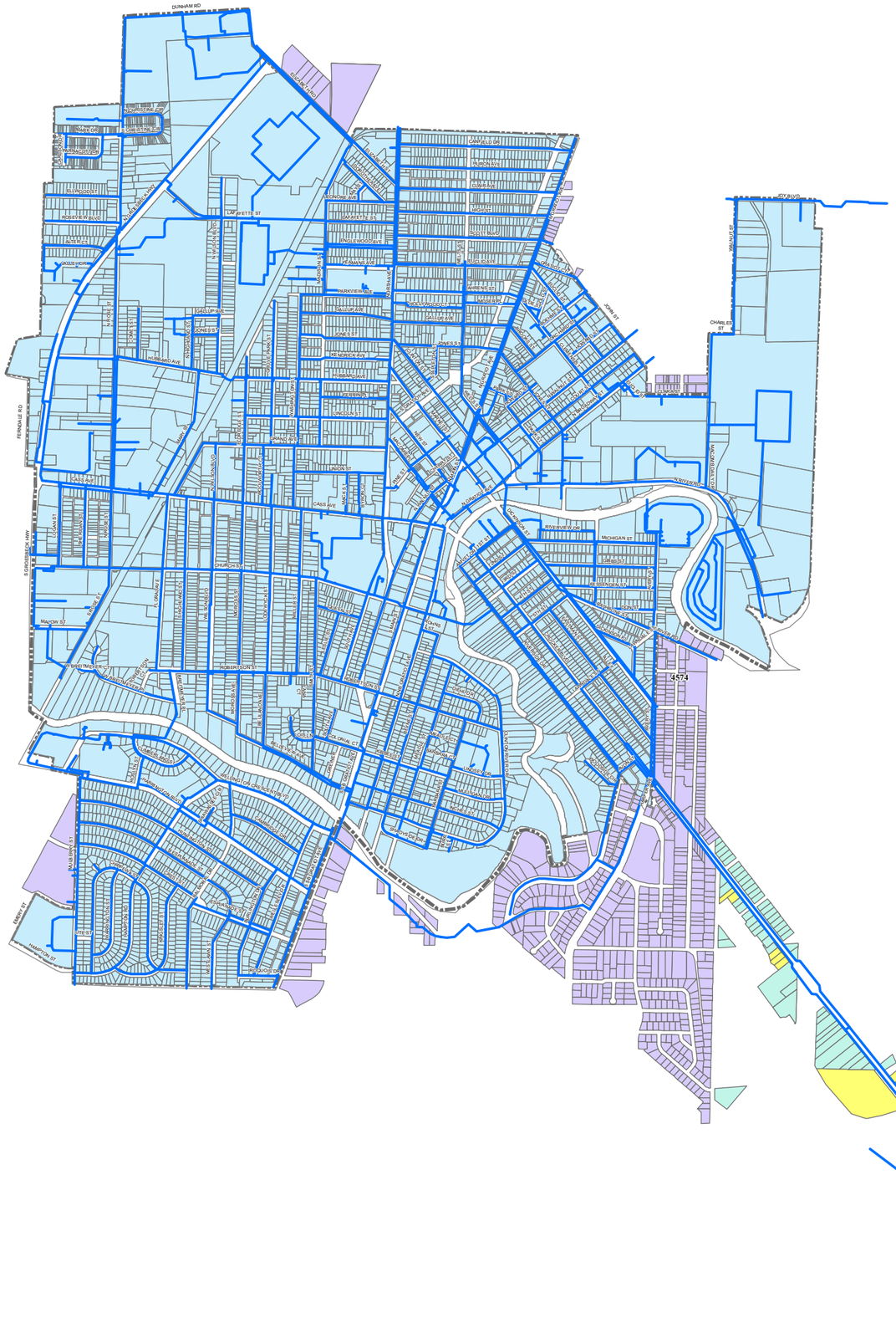
Adoption of the Project Planning Document

The resolution to adopt this Project Plan passed at the April 20, 2026 City Commission meeting is included in Appendix L.

Appendix A

Maps of Service Area with Proposed Projects Locations

N



Mt Clemens Water Service Area

CAUTION

THIS MAP IS INTENDED FOR REFERENCE PURPOSES ONLY

ANDERSON, ECKSTEIN AND WESTRICK, INC. AND THE CITY OF MT. CLEMENS DO NOT GUARANTEE THE ACCURACY OF THIS INFORMATION AND DISCLAIMS ALL LIABILITY FROM ALL CLAIMS, SUITS, DEMANDS AND JUDGEMENTS ARISING FROM THE USE OF THIS INFORMATION

N

Panel Number:

ANDERSON, ECKSTEIN AND WESTRICK, INC.
CIVIL ENGINEERS SURVEYORS ARCHITECTS
51301 Schoenherr Rd
Shelby Township
Michigan 48315
Phone 586 726 1234
Fax 586 726 8780
www.aewinc.com

Legend

- Water Main
- Harrison Twp. Water Customers
- Suspected HT Water Customers
- Clinton Twp. Water Customers
- Mt Clemens Parcels

DATE PRINTED: January 22, 2024	DATE CREATED: January 22, 2024
SCALE: N.T.S.	MAP DOCUMENT: DWSRF.mxd
PROJECT NO: 0220-0243	CREATED BY: AEK / CHECKED BY: AMC

Water Main Replacement Locations

CAUTION

THIS MAP IS INTENDED FOR REFERENCE PURPOSES ONLY

ANDERSON, ECKSTEIN AND WESTRICK, INC. AND THE CITY OF MT. CLEMENS DO NOT GUARANTEE THE ACCURACY OF THIS INFORMATION AND DISCLAIMS ALL LIABILITY FROM ALL CLAIMS, SUITS, DEMANDS AND JUDGEMENTS ARISING FROM THE USE OF THIS INFORMATION

Panel Number:

ANDERSON, ECKSTEIN AND WESTRICK, INC.
CIVIL ENGINEERS SURVEYORS ARCHITECTS
51301 Schoenherr Rd
Shelby Township
Michigan 48315
Phone 586 726 1234
Fax 586 726 8780
www.aewinc.com

Replacement Locations

Water Main

DATE PRINTED: January 29, 2024	DATE CREATED: January 29, 2024
SCALE: N.T.S.	MAP DOCUMENT: Water Main ReplacementLocations.mxd
PROJECT NO: 0220-0243	CREATED BY: AEK / CHECKED BY: AMC

Appendix B

SEMCOG Community Profile

City of Mount Clemens Profile

4

Square Miles

15,697

Total Population (2020)

1 Crocker Blvd., Mt. Clemens, MI 48043

http://www.cityofmountclemens.com/

Powered by Esri

Go to: Community Explorer Map | 2020 Census Map | Demographic Emphasis Areas Map

People | Economy and Jobs | Housing | Transportation | Environment and Land Use

Population and Households

Reports and Resources:

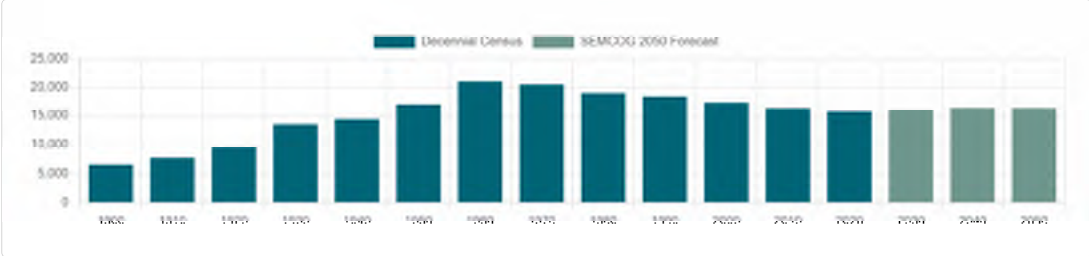
Population and Household Estimates Southeast Michigan, 2025

Historic Population and Employment by Minor Civil Division, Southeast Michigan

American Community Survey (ACS) Websites:

2020-2024 Social Demographic

Population Forecast



Population and Households

Population And Households	Census 2020	Census 2010	Change 2010-2020	Percent Change 2010-2020	SEMCOG Jul 2025	SEMCOG 2050
Total Population	15,697	16,314	-617	-3.8%	15,917	16,345
Group Quarters Population	838	1,584	-746	-47.1%	1,307	1,641
Household Population	14,859	14,730	129	0.9%	14,610	14,704
Housing Units	7,432	7,582	-150	-2.0%	7,495	-
Households (Occupied Units)	6,982	6,714	268	4.0%	7,070	7,259
Residential Vacancy Rate	6.1%	11.4%	-5.4%	-	5.7%	-
Average Household Size	2.13	2.19	-0.07	-	2.07	2.03

Components of Population Change

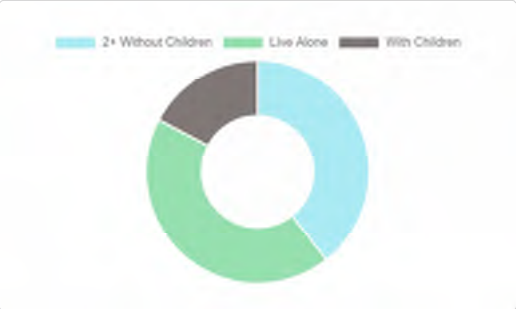
Components Of Population Change	2010-2020 Avg	2020-2023 Avg
Natural Increase (Births - Deaths)	-10	-82
Births	185	137
Deaths	195	219

Net Migration (Movement In - Movement Out)	-51	133
Population Change (Natural Increase + Net Migration)	-62	50

Household Types

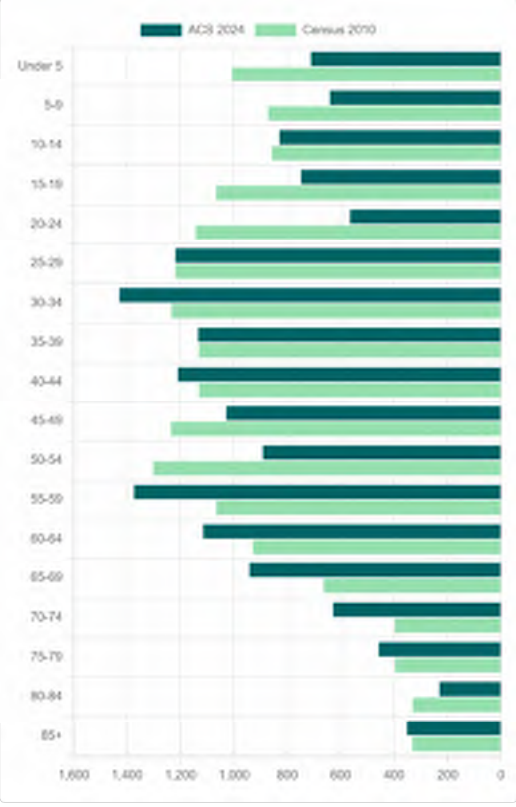
ACS 2024

SEMCOG 2050



Household Types	Census 2010	ACS 2024	Change 2010-2024	Percent Change 2010-2024	SEMCOG 2050
With Seniors 65+	1,626	2,007	381	23.4%	2,912
Without Seniors	5,088	4,776	-312	-6.1%	4,347
Live Alone, 65+	872	1,081	209	24.0%	-
Live Alone, < 65:	1,793	1,559	-234	-13.1%	-
2+ Persons, with Children	1,739	1,444	-295	-17.0%	1,254
2+ Persons, without Chil...	2,310	2,699	389	16.8%	2,866
Total Households	6,714	6,783	69	1.0%	7,259

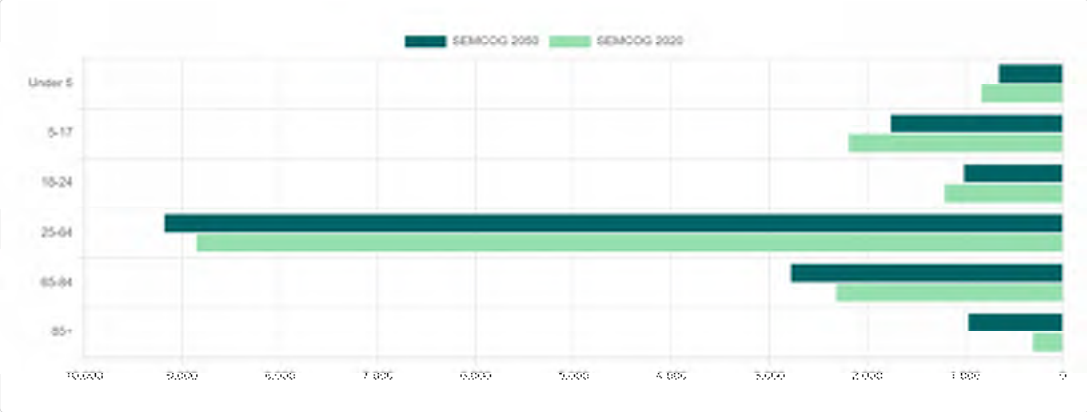
Population Change by Age, 2010-2024



Age Group	Census 2010	Change 2000-2010	ACS 2024	Change 2010-2024
Under 5	1,007	-103	712	-295
5-9	872	-202	641	-231
10-14	858	-104	830	-28
15-19	1,067	75	749	-318
20-24	1,143	-15	565	-578
25-29	1,219	-218	1,219	0

30-34	1,234	-279	1,429	195
35-39	1,131	-404	1,134	3
40-44	1,131	-327	1,210	79
45-49	1,235	-67	1,029	-206
50-54	1,302	196	892	-410
55-59	1,066	268	1,374	308
60-64	929	384	1,115	186
65-69	664	118	942	278
70-74	397	-198	629	232
75-79	396	-111	458	62
80-84	331	-34	231	-100
85+	332	23	352	20
Total	16,314	-998	15,511	-803
Median A...	38.3	1.9	42.0	3.7

Forecasted Population Change 2020-2050



Age Group	2020	2025	2030	2035	2040	2045	2050	Change 2020-2050	Percent Change 2020-2050
Under 5	831	785	755	712	735	717	654	-177	-21.3%
5-17	2,187	1,978	1,901	1,821	1,784	1,779	1,758	-429	-19.6%
18-24	1,206	1,158	1,102	1,101	999	976	1,010	-196	-16.3%
25-64	8,853	8,882	8,981	9,033	9,136	9,231	9,181	328	3.7%
65-84	2,316	2,681	2,797	2,927	2,985	2,918	2,779	463	20.0%
85+	304	339	443	601	734	887	963	659	216.8%
Total	15,697	15,823	15,979	16,195	16,373	16,508	16,345	648	4.1%

Older Adults and Youth Populations

Older Adults And Youth Population	Census 2010	ACS 2024	Change 2010-2024	Percent Change 2010-2024	SEMCOG 2050
65 and over	2,120	2,612	492	23.2%	3,742
65 to 84	1,788	2,260	472	26.4%	2,779
85 and Over	332	352	20	6.0%	963
Under 18	3,353	2,650	-703	-21.0%	2,412
5 to 17	2,346	1,938	-408	-17.4%	1,758
Under 5	1,007	712	-295	-29.3%	654

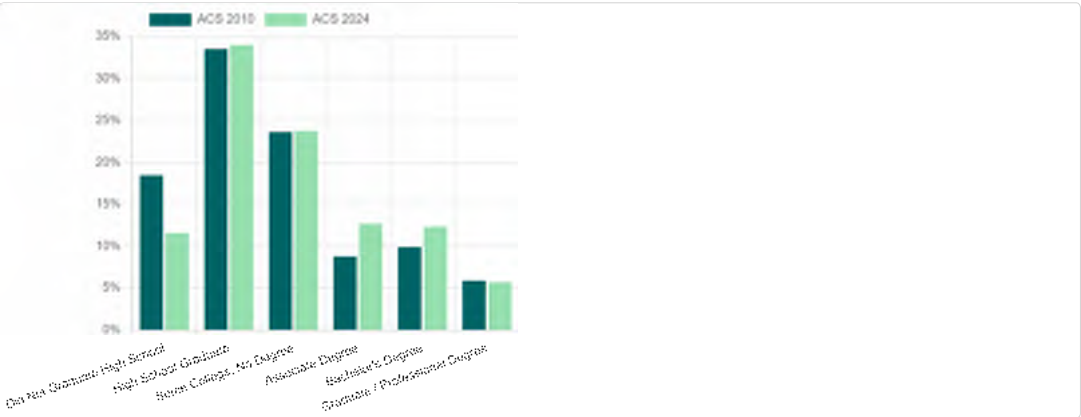
Race and Hispanic Origin

Race and Hispanic Origin	Census 2010	Percent Of Population 2010	ACS 2024	Percent of Population 2024	Percent Change 2010-2024
Non-Hispanic	15,837	97.1%	14,895	96.0%	-1.0%
White	11,150	68.3%	10,118	65.2%	-3.1%
Black	3,993	24.5%	3,098	20.0%	-4.5%

Asian	79	0.5%	46	0.3%	-0.2%
Multi-Racial	533	3.3%	1,531	9.9%	6.6%
Other	82	0.5%	75	0.5%	0.0%
Hispanic	477	2.9%	616	4.0%	1.0%
Total	16,314	100.0%	15,511	100.0%	0.0%

Highest Level of Education

Highest Level Of Education	ACS 2010	ACS 2024	Percent Change 2010-2024
Did Not Graduate High S...	18.4%	11.6%	-6.8%
High School Graduate	33.5%	34.0%	0.5%
Some College, No Degree	23.6%	23.8%	0.2%
Associate Degree	8.7%	12.7%	4.0%
Bachelor's Degree	9.9%	12.3%	2.4%
Graduate / Professional ...	5.8%	5.7%	-0.2%



SEMCOG Homepage

City of Mount Clemens Profile

4

Square Miles

15,697

Total Population (2020)

1 Crocker Blvd., Mt. Clemens, MI 48043

http://www.cityofmountclemens.com/

Go to: Community Explorer Map | 2020 Census Map | Demographic Emphasis Areas Map

People | Economy and Jobs | Housing | Transportation | Environment and Land Use

Economy and Jobs

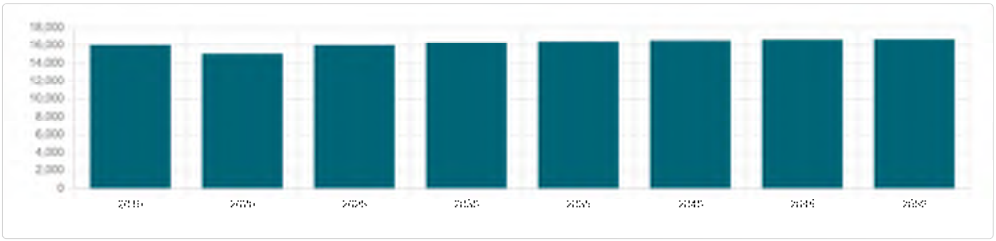
Reports and Resources:

Historic Population and Employment by Minor Civil Division, Southeast Michigan

American Community Survey (ACS) Website:

2020-2024 Economic

Forecasted Jobs

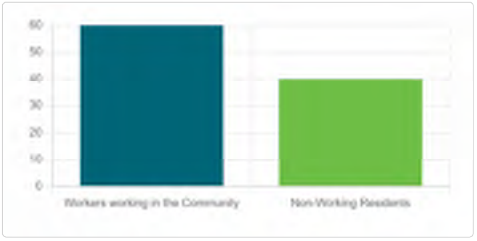


Forecasted Jobs by Industry Sector

Forecasted Jobs by Industry Sector	2019	2020	2025	2030	2035	2040	2045	2050	Change 2019-2050	
Natural Resources, Mining, & Construction	930	854	971	1,020	1,027	1,031	1,032	1,041	111	11
Manufacturing	1,469	1,274	1,473	1,454	1,459	1,388	1,325	1,316	-153	-10
Wholesale Trade	258	232	248	230	225	224	218	224	-34	-13
Retail Trade	721	682	735	657	647	641	621	595	-126	-17
Transportation, Warehousing, & Utilities	528	510	617	645	658	651	654	648	120	22
Information & Financial Activities	1,116	1,065	1,072	1,107	1,107	1,130	1,114	1,098	-18	-1.
Professional and Technical Services & Corporate HQ	844	811	848	885	899	927	953	955	111	13
Administrative, Support, & Waste Services	708	638	686	719	747	774	793	817	109	15
Education Services	569	538	566	538	550	560	559	558	-11	-1.
Healthcare Services	4,369	4,259	4,352	4,493	4,591	4,636	4,760	4,831	462	10
Leisure & Hospitality	839	640	789	869	870	892	918	920	81	9.7
Other Services	911	859	867	877	899	911	912	916	5	0.5
Public Administration	2,765	2,701	2,781	2,808	2,817	2,831	2,824	2,813	48	1.7
Total Employment Numbers	16,027	15,063	16,005	16,302	16,496	16,596	16,683	16,732	705	4.4

Daytime Population

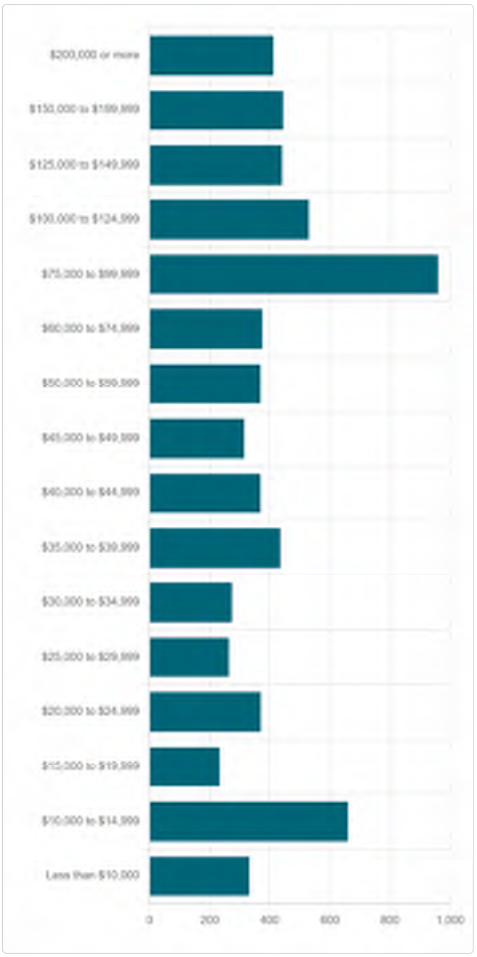
Daytime Population (ACS 2024)	Population
Workers working in the Community	12,160
Non-Working Residents	8,106
Age 15 and under	2,341
Not in labor force	5,228
Unemployed	537
Daytime Population	20,266



Household Income

Income (in 2024 dollars)	ACS 2010	ACS	Change 2010-2024	Percent Change 2010-2024
Median Household Income	$44,922	$52,310	$7,388	16.4%
Per Capita Income	$30,254	$35,984	$5,730	18.9%

Annual Household Income



Annual Household Income (ACS 2024)	Households
$200,000 or more	412
$150,000 to $199,999	444
$125,000 to $149,999	441
$100,000 to $124,999	530
$75,000 to $99,999	960
$60,000 to $74,999	375
$50,000 to $59,999	369
$45,000 to $49,999	315
$40,000 to $44,999	369
$35,000 to $39,999	435
$30,000 to $34,999	274
$25,000 to $29,999	264
$20,000 to $24,999	370
$15,000 to $19,999	233
$10,000 to $14,999	660
Less than $10,000	332
Total	6,783

Poverty

Poverty	Census 2010	Percent Of Total 2010	ACS 2024	Percent of Total 2024	Percent Change 2010-2024
Persons in Poverty	3,139	21.5%	2,340	16.3%	-5.1%
Households in Poverty	1,438	21.4%	1,169	17.2%	-4.2%

City of Mount Clemens Profile

4

Square Miles

15,697

Total Population (2020)

1 Crocker Blvd., Mt. Clemens, MI 48043

http://www.cityofmountclemens.com/

Powered by Esri

Go to: Community Explorer Map | 2020 Census Map | Demographic Emphasis Areas Map

People | Economy and Jobs | Housing | Transportation | Environment and Land Use

Housing

Reports and Resources:

Population and Household Estimates Southeast Michigan, 2025

American Community Survey (ACS) Website:

2020-2024 Housing

Building Permits 2010-2025

Year	Single Family	Two Family	Attach Condo	Multi-Family	Total Units	Total Demos	Net Total
2010	0	0	0	0	0	0	0
2011	0	0	0	0	0	0	0
2012	0	0	0	0	0	6	-6
2013	0	0	0	0	0	2	-2
2014	0	0	0	0	0	1	-1
2015	1	0	0	0	1	1	0
2016	1	0	0	0	1	0	1
2017	2	0	0	0	2	5	-3
2018	5	0	0	0	5	0	5
2019	0	0	0	0	0	0	0
2020	0	0	0	0	0	0	0
2021	1	0	0	30	31	22	9
2022	0	0	0	0	0	1	-1
2023	0	0	0	0	0	1	-1
2024	1	0	0	0	1	1	0
2025	5	0	0	0	5	1	4
2010 to 2025 tot...	16	0	0	30	46	41	5

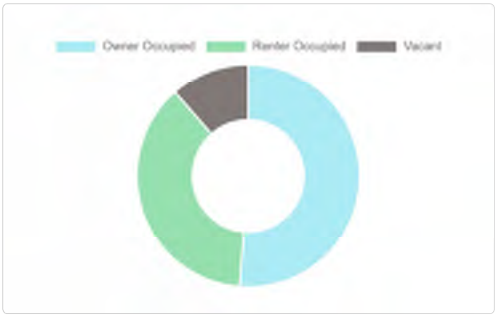
Housing Types

Housing Type	ACS 2010	ACS 2024	Change 2010-2024	New Units Permitted Since 2024
Single Unit	4,477	4,317	-160	5
Multi-Unit	3,446	2,685	-761	0
Mobile Homes or Other	168	164	-4	0
Total	8,091	7,166	-925	5
Units Demolished				-1

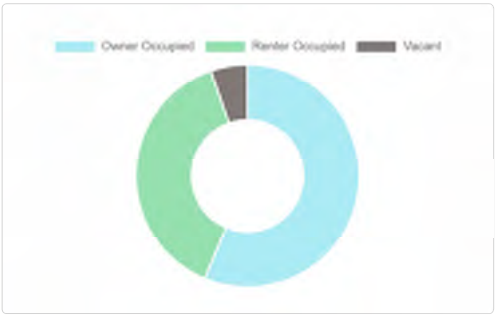
Housing Tenure

Housing Tenure	Census 2010	ACS 2024	Change 2010-2024
Owner Occupied	3,886	4,032	146
Renter Occupied	2,828	2,751	-77
Vacant	868	383	-485
Seasonal/Migrant	15	12	-3
Other Vacant Units	853	371	-482
Total Housing Units	7,582	7,166	-416

Census 2010



ACS 2024



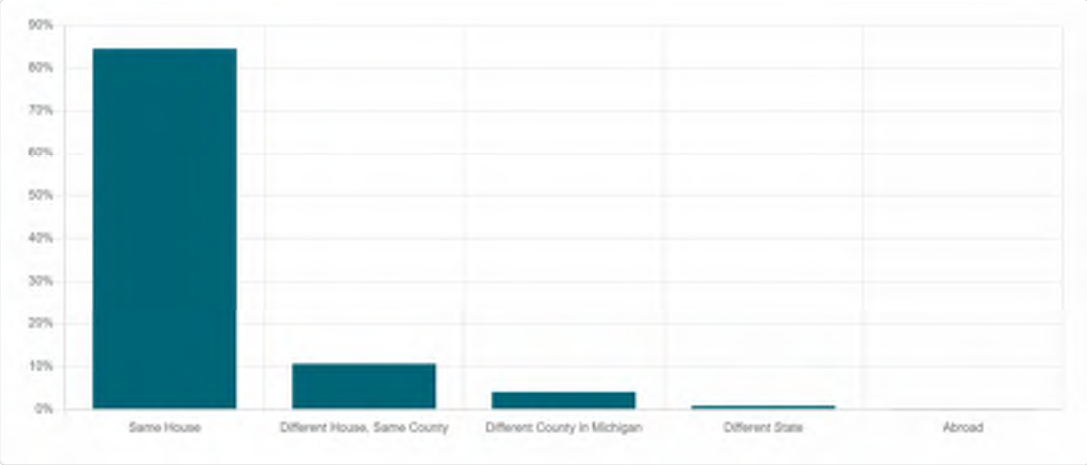
Housing Value and Rent

Housing Value (in 2024 dollars)	ACS 2010	ACS	Change 2010-2024	Percent Change 2010-2024
Median housing value	$185,806	$179,400	-$6,406	-3.4%
Median gross rent	$838	$847	$9	1.1%

Housing Value

$1,000,000 or more	23
$500,000 to $999,999	36
$300,000 to $499,999	430
$250,000 to $299,999	330
$200,000 to $249,999	747
$175,000 to $199,999	545
$150,000 to $174,999	714
$125,000 to $149,999	373
$100,000 to $124,999	269
$80,000 to $99,999	251
$60,000 to $79,999	94
$40,000 to $59,999	122
$30,000 to $39,999	20
$20,000 to $29,999	28
$10,000 to $19,999	12
Less than $10,000	38
Owner-Occupied Units	4,032

Residence One Year Ago



City of Mount Clemens Profile

4

Square Miles

15,697

Total Population (2020)

1 Crocker Blvd., Mt. Clemens, MI 48043

http://www.cityofmountclemens.com/

Go to: Community Explorer Map | 2020 Census Map | Demographic Emphasis Areas Map

People | Economy and Jobs | Housing | Transportation | Environment and Land Use

Transportation

Miles of Public Road

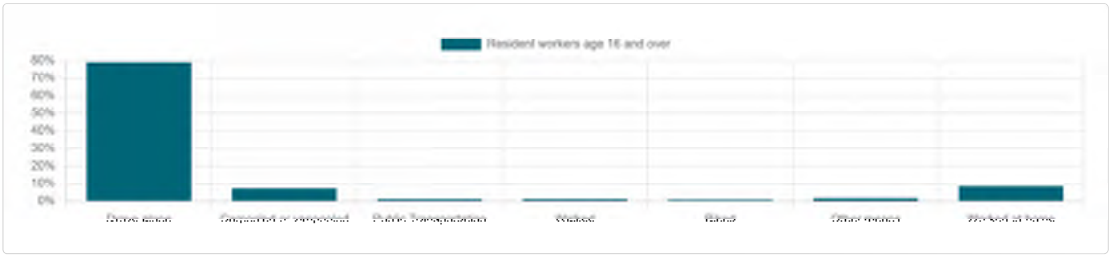
Type	Miles
Miles of public road (including boundary roads)	65.0

Pavement Condition (in Lane Miles)

Past Pavement Conditions 2021

Current Pavement Conditions 2023-2024

Transportation to Work, 2024



Transportation to Work	ACS 2010	Percent Of Total ACS 2010	ACS 2024	Percent of Total ACS 2024	Percentage Point Change 2010-2024
Drove alo...	5,247	85.5%	5,726	79.2%	-6.3%

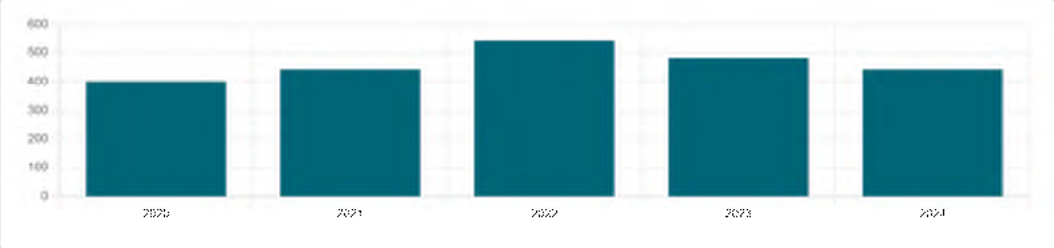
Carpoole...	563	9.2%	516	7.1%	-2.0%
Public Tra...	92	1.5%	93	1.3%	-0.2%
Walked	92	1.5%	91	1.3%	-0.2%
Biked	20	0.3%	65	0.9%	0.6%
Other me...	0	N/A	131	1.8%	1.8%
Worked at...	122	2.0%	611	8.4%	6.5%
Resident ...	6,136	100.0%	7,233	100.0%	N/A

Mean Travel Time to Work

Mean Travel Time To Work	ACS 2010	ACS 2024	Change 2010-2024
For reside...	23.4 minu...	26.5 minu...	3.1 minutes

Crash Data

Crashes, 2020-2024



Crash Severity

Crash Severity	2020	2021	2022	2023	2024	Change From 2020-2024	Percent Of Crashes 2020-2024
Fatal	1	3	1	1	3	200.0%	0.4%
Serious in...	10	6	9	3	4	-60.0%	1.4%
Other inj...	88	118	116	113	106	20.5%	23.4%
Property ...	303	316	419	365	330	8.9%	74.9%
Total cras...	402	443	545	482	443	10.2%	100.0%

Crashes by Type

Crashes By Type	2020	2021	2022	2023	2024	Change From 2020-2024	Percent Of Crashes 2020-2024
Head-on	8	14	3	6	7	-12.5%	1.6%
Angle or ...	103	99	117	113	100	-2.9%	23.0%
Rear-end	113	137	153	102	104	-8.0%	26.3%
Sideswipe	80	103	153	120	100	25.0%	24.0%
Single Ve...	50	48	45	51	41	-18.0%	10.2%
Backing	23	20	25	25	19	-17.4%	4.8%
Other or ...	25	22	49	65	72	188.0%	10.1%

Crashes by Involvement

Crashes By Involvement	2020	2021	2022	2023	2024	Change From 2020-2024	Percent Of Crashes 2020-2024
Red-light ...	10	6	7	18	21	110.0%	2.7%
Lane Dep...	54	44	63	55	46	-14.8%	11.3%
Alcohol	19	33	26	22	20	5.3%	5.2%
Drugs	8	8	6	4	2	-75.0%	1.2%
Deer	1	1	2	1	2	100.0%	0.3%

Train	0	0	0	0	0	N/A	N/A
Commerc...	18	26	30	28	21	16.7%	5.3%
School Bus	2	3	5	0	1	-50.0%	0.5%
Emergen...	4	5	4	5	10	150.0%	1.2%
Motorcyc...	8	2	8	4	5	-37.5%	1.2%
Intersecti...	172	213	192	208	165	-4.1%	41.0%
Work Zone	1	3	6	13	3	200.0%	1.1%
Pedestrian	5	6	5	8	5	N/A	1.3%
Bicyclist	1	8	4	5	8	700.0%	1.1%
Older Dri...	81	87	108	113	98	21.0%	21.0%
Young Dri...	64	54	81	59	48	-25.0%	13.2%
Distracte...	40	62	80	61	41	2.5%	12.3%
Driveway	41	39	40	37	21	-48.8%	7.7%
Speeding	19	15	14	6	11	-42.1%	2.8%
Unbelted	8	13	9	7	8	N/A	1.9%
Secondary	6	34	4	2	1	-83.3%	2.0%

High Frequency Intersections

Filters

Ranked by 2020-2024 Five-Year Fatalities and Serious Injuries

Local Rank	County Rank	Region Rank	Intersection	Jurisdiction	Avg. 2(
1	47	296	Groesbeck Hwy N @ Eliz...	State,County	
2	133	716	Groesbeck Hwy N @ Hu...	State,City/Village	
2	133	716	Cass Ave @ Groesbeck H...	State,County	
2	133	716	Gratiot Ave N @ Roberts...	State,City/Village	
2	133	716	Crocker Blvd @ Harper A...	County,City/Village	
6	295	1887	Dunham Rd @ Rose St N	County,City/Village	
6	295	1887	North Ave @ Huron Ave	County	
6	295	1887	Gratiot Ave S @ Huron A...	State	
6	295	1887	Gratiot Ave @ Clair Ave	State,County,City/Village	
6	295	1887	Groesbeck Hwy N @ Ros...	State,City/Village	
6	295	1887	Hubbard Ave @ Grove P...	City/Village	
6	295	1887	Gratiot Ave S @ Main St	State,Private/Other	
6	295	1887	Gratiot Ave S @ Market St	State,City/Village	
6	295	1887	Grand Ave @ Grove Park...		
6	295	1887	Gratiot Ave S @ North A...	State,City/Village	
6	295	1887	Cass Ave @ Rose St N	County,City/Village	
6	295	1887	Gratiot Ave N @ River R...	State,City/Village	
6	295	1887	Cass Ave @ Gratiot Ave S	State,County	
6	295	1887	Dickinson St @ 1st St	City/Village	
6	295	1887	Cass Ave @ Gratiot Ave N	State,City/Village	
6	295	1887	Groesbeck Hwy S @ Chu...	State,City/Village	
6	295	1887	Gratiot Ave N @ Church ...	State,City/Village	
6	295	1887	Gratiot Ave N @ Clinton ...	State	
6	295	1887	Gratiot Ave N @ Kibbee ...	State	
6	295	1887	Gratiot Ave S @ Harringt...	State,County,City/Village	
6	295	1887	Gratiot Ave S @ Iroquois...	State	
6	295	1887	Cass Ave @ Floral Ave		
6	295	1887	↳ Cass Ave @ Floral Ave	County	
6	295	1887	Main St @ Gratiot Ave N		

6	295	1887	↳ Main St @ Main St N	City/Village

High Frequency Road Segments

Filters

Ranked by 2020-2024 Five-Year Fatalities and Serious Injuries

Local Rank	County Rank	Region Rank	Road Name	From Road - To Road	Jurisdiction
1	42	251	Groesbeck Hwy N	Cass Ave - Hubbard Ave	State
2	116	691	Gratiot Ave S	Metropolitan Pkwy - Harr...	State
2	116	691	Gratiot Ave S	Clair Ave - Gratiot Ave	State
2	116	691	North Ave	Elizabeth St - Groesbeck ...	County
5	210	1304	Crocker Blvd	Gratiot Ave N - Harper Ave	City/Village
5	210	1304	Gratiot Ave N	Wellington Cres - Robert...	State
5	210	1304	Gratiot Ave S	Cass Ave - North Ave	State
5	210	1304	Groesbeck Hwy N	Rose St N - Elizabeth Rd	State
5	210	1304	Groesbeck Hwy S	Church St - Cass Ave	State
5	210	1304	Harper Ave	Wellington Cres - Crocke...	County
5	210	1304	Henry B Joy Blvd	Gratiot Ave - W I 94	County
12	406	2611	Cass Ave	Rose St N - Gratiot Ave S	County
12	406	2611	Church St	Groesbeck Hwy S - Rose ...	City/Village
12	406	2611	Dickinson St	Rathbone St - Gratiot Av...	City/Village
12	406	2611	Dunham Rd	Rose St N - Elizabeth Rd	County
12	406	2611	Elizabeth Rd	Dunham Rd - Groesbeck ...	County
12	406	2611	Gratiot Ave N	Robertson St - Church St	State
12	406	2611	Gratiot Ave N	Church St - Cass Ave	State
12	406	2611	Gratiot Ave N	Cass Ave - Market St	State
12	406	2611	Gratiot Ave N	River Rd N - Gratiot/River...	State
12	406	2611	Gratiot Ave S	Church St - Cass Ave	State
12	406	2611	Gratiot Ave S	Welts St - Clair Ave	State
12	406	2611	Groesbeck Hwy S	Harrington St - Church St	State
12	406	2611	Hubbard Ave	Rose St N - North Ave	City/Village
12	406	2611	Market St	Gratiot Ave S - Hubbard ...	City/Village
12	406	2611	River Rd N	Gratiot/River Cutoff - W I...	City/Village
12	406	2611	Rose St N	Hubbard Ave - Groesbec...	City/Village
12	406	2611	Rose St S	Church St - Cass Ave	City/Village

City of Mount Clemens Profile

4

Square Miles

15,697

Total Population (2020)

1 Crocker Blvd., Mt. Clemens, MI 48043

http://www.cityofmountclemens.com/

Powered by Esri

Go to: Community Explorer Map | 2020 Census Map | Demographic Emphasis Areas Map

People | Economy and Jobs | Housing | Transportation | Environment and Land Use

Environment and Land Use

2020 Land Use

Parcel Land Use	Acres 2015	Acres 2020	Change 2015–2020	Percent Change 2015–2020
Single-Family Residential	907.3	888.1	-19.2	-2.1%
Attached Condo Housing	34.0	34.0	0	N/A
Multi-Family Housing	67.0	87.3	20.3	30.3%
Mobile Home	17.0	17.0	0	N/A
Agricultural/Rural Residential	10.9	0	-10.9	-100.0%
Mixed Use	0.3	3.1	2.8	893.7%
Retail	165.6	151.8	-13.8	-8.3%
Office	76.6	71.8	-4.8	-6.3%
Hospitality	16.3	20.4	4.1	24.9%
Medical	24.7	51.5	26.8	108.6%
Institutional	177.3	132.8	-44.5	-25.1%
Industrial	264.6	233.9	-30.7	-11.6%
Recreational/Open Space	86.8	92.3	5.5	6.3%
Cemetery	0	0	0	N/A
Golf Course	0	0	0	N/A
Parking	30.1	32.1	1.9	6.4%
Extractive	0	0	0	N/A
TCU	87.0	87.0	0	N/A
Vacant	163.4	227.8	64.4	39.4%
Water	72.9	72.9	0	N/A
Not Parceled	485.1	483.2	-1.8	-0.4%
Total	2,686.8	2,686.8	0.0	0.0%

2020 Land Cover

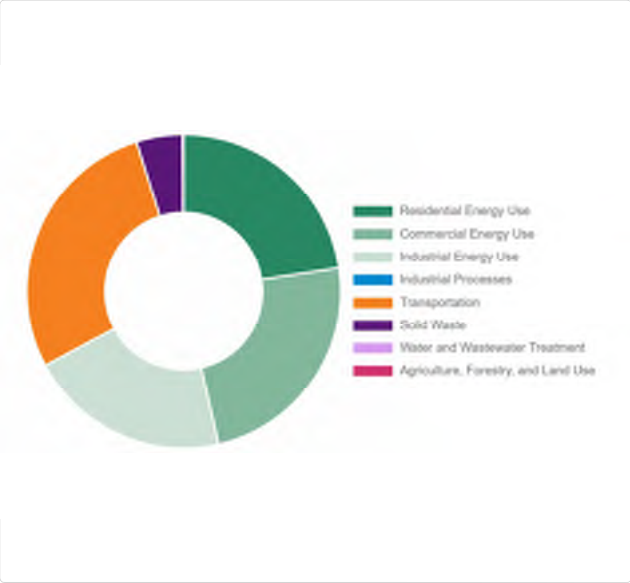
Type	Description	Acres	Percent
Impervious	buildings, roads, driveways, parking lots	1,269.2	47.2%
Trees	woody vegetation, trees	494.0	18.4%
Open Space	agricultural fields, grasslands, turfgrass	788.4	29.3%
Bare	soil, aggregate piles, unplanted fields	60.9	2.3%
Water	rivers, lakes, drains, ponds	74.1	2.8%
Total		2,686.6	100.0%

2022 Tree Canopy

Type	Acres	Percent
Tree Canopy	733.7	27.3%

2019 Greenhouse Gas Emissions

Type	CO2e (MT)	Percent Of Total
Residential Energy...	63,498.1	22.62%
Commercial Energ...	66,829.7	23.81%
Industrial Energy ...	58,168.0	20.72%
Industrial Processes	7.7	0.00%
Transportation	78,521.0	27.97%
Solid Waste	13,381.5	4.77%
Water and Wastew...	295.7	0.11%
Agriculture, Forest...	0	N/A
Total	280,701.7	100.00%

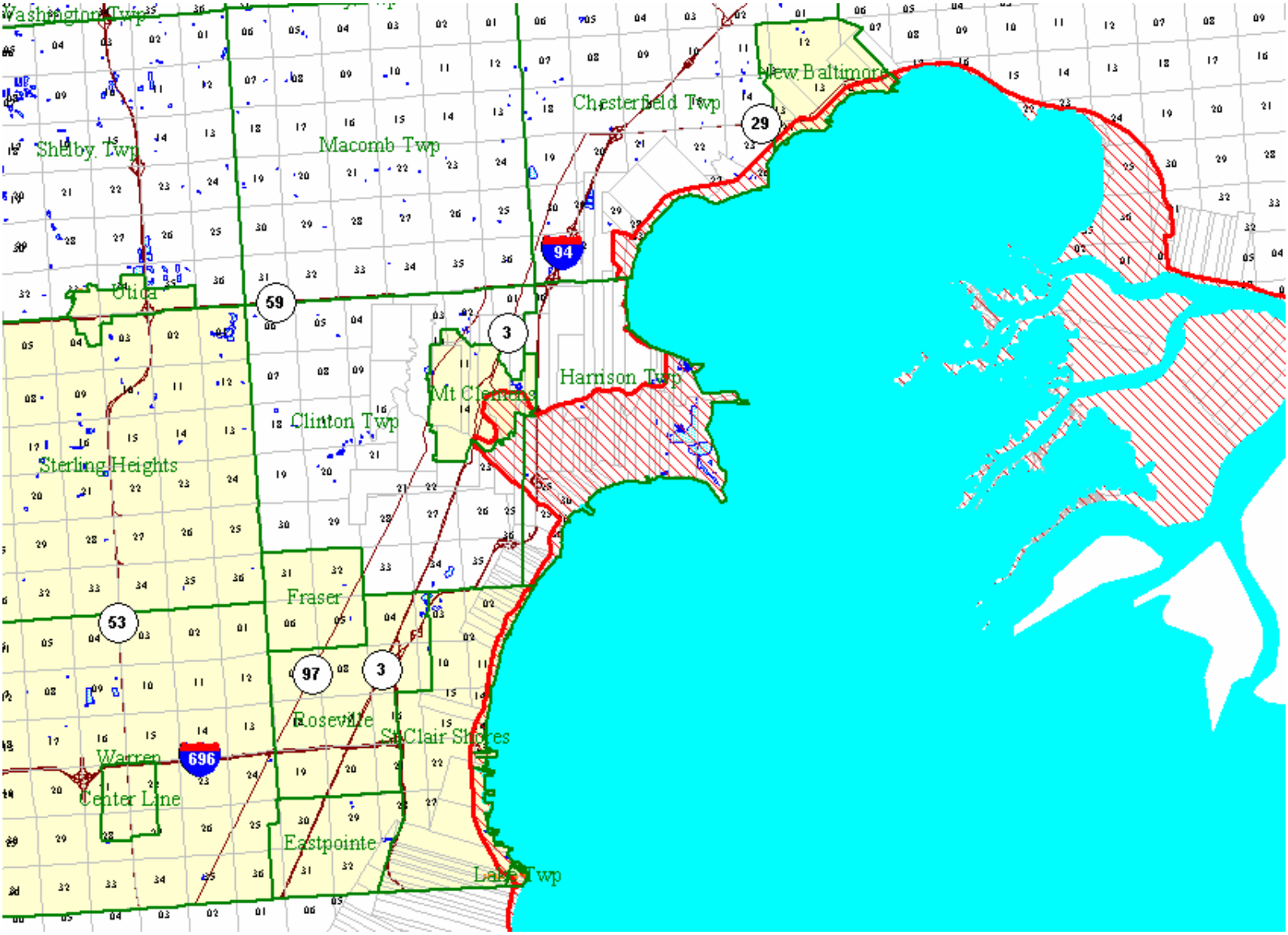


Appendix C

Great lakes Shorelands, Coastal Zones, and Coastal Management Areas

Macomb County
Chesterfield Township, T3N R14E
Harrison Township and Mt. Clemens, T2N R14E
Clinton Township, T2N R13E, T2N R14E
St. Clair Shores, T2N R13E, T1N R13E
Lake Township, T1N R13E

The heavy red line is the ***Coastal Zone Management Boundary***
The red hatched area is the ***Coastal Zone Management Area***.



Appendix D

FEMA Flood Maps

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Michigan State Plane South zone 6401 (FIPSZONE 2113). The **horizontal datum** was NAD83. Differences in datum, spheroid, projection or state plane zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov/ or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at **(301) 713-3242**, or visit its website at http://www.ngs.noaa.gov/.

Base Map information shown on this FIRM was provided in digital format by Macomb County Planning and GIS Mapping. This information was photogrammetrically compiled at a scale of 1:1200 feet from aerial photography dated 2000.

This map reflects more detailed and up-to-date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

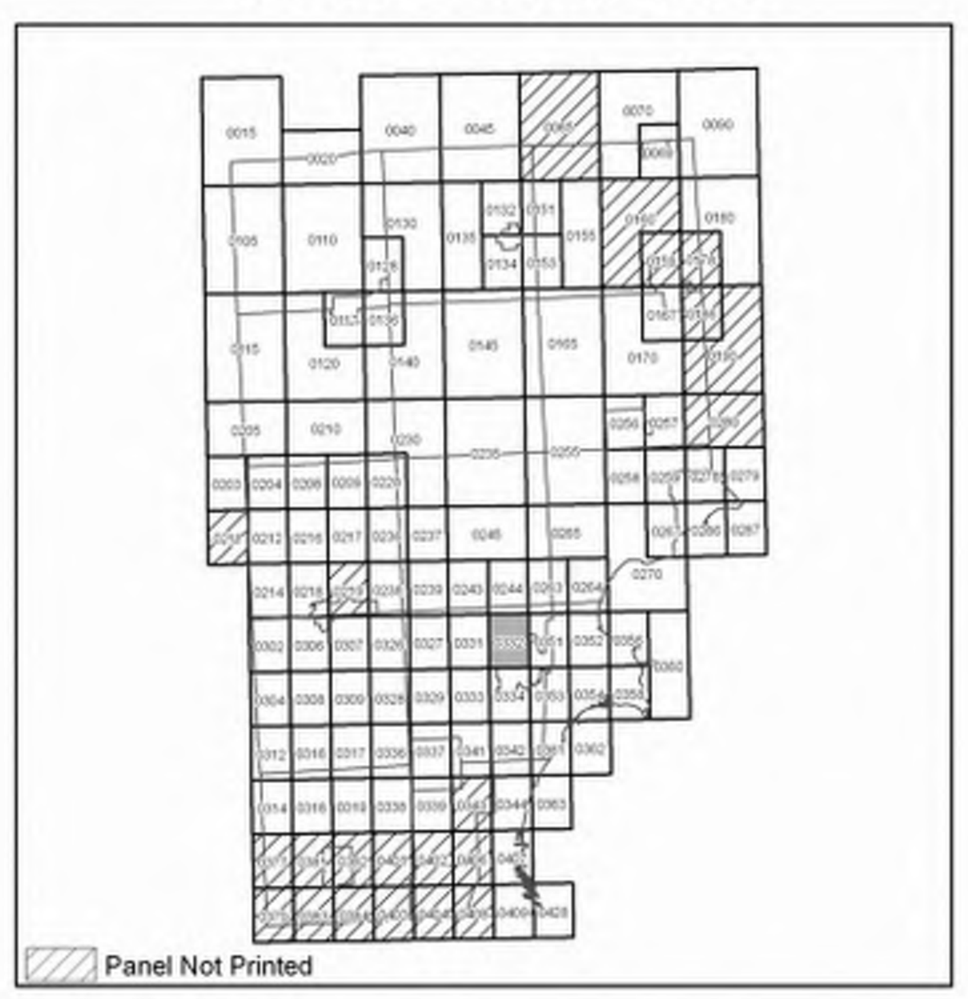
Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

Contact the **FEMA Map Service Center** at 1-800-358-9616 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study report, and/or digital versions of this map. The FEMA Map Service Center may also be reached by Fax at 1-800-358-9620 and its website at http://msc.fema.gov/.

If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMA MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/business/nfip/.

The **profile base lines** depicted on this map represent the hydraulic modeling baselines that match the flood profiles in the FIS report. As a result of improved topographic data, the **profile base line**, in some cases, may deviate significantly from the channel centerline or appear outside the SFHA.

PANEL INDEX



LEGEND

SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100 year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard may include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Area of special flood hazard formerly protected from the 1% annual chance flood event by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood event by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X	Areas determined to be outside of the 0.2% annual chance floodplain.
ZONE D	Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

	1% annual chance floodplain boundary
	0.2% annual chance floodplain boundary
	Floodway boundary
	Zone D boundary
	CBRS and OPA boundary
	Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
~~ 513 ~~~	Base Flood Elevation line and value; elevation in feet*
(EL 10)	Base Flood Elevation value where uniform within zone; elevation in feet*

*Referenced to the North American Vertical Datum of 1988

A —— A	Cross section line
23 - - - - 23	Transect line
85° 03' 45.0", 41° 24' 22.5"	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere
4587000 M	1000-meter Universal Transverse Mercator grid values, zone 17
2250000 FT	5000-foot grid ticks: Michigan State Plane South Coordinate System, 6401 zone (FIPSZONE 2113), Lambert Conformal Conic projection
KA0015 ×	Bench mark (see explanation in Notes to Users section of this FIRM panel)
● M1.5	River Mile

MAP REPOSITORY
Refer to listing of Map Repositories on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
SEPTEMBER 29, 2006

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 500'

250 0 500 1000 FEET

150 0 150 300 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0332G

FIRM
FLOOD INSURANCE RATE MAP
MACOMB COUNTY, MICHIGAN
(ALL JURISDICTIONS)

PANEL 332 OF 428
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
CLINTON, CHARTER TOWNSHIP OF	260121	0332	G
MOUNT CLEMENS, CITY OF	260124	0332	G

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
26099C0332G

EFFECTIVE DATE
SEPTEMBER 29, 2006

Federal Emergency Management Agency

FLOOD HAZARD INFORMATION

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

THE INFORMATION DEPICTED ON THIS MAP AND SUPPORTING DOCUMENTATION ARE ALSO AVAILABLE IN DIGITAL FORMAT AT

HTTPS://MSC.FEMA.GOV

SPECIAL FLOOD HAZARD AREAS

- Without Base Flood Elevation (BFE) *Zone A,V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD

- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS

- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES

- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES

- E 18.2 / 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
- 8 Coastal Transect
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary

NOTES TO USERS

For information and questions about this Flood Insurance Rate Map (FIRM), available products associated with this FIRM, including historic versions, the current map date for each FIRM panel, how to order products, or the National Flood Insurance Program (NFIP) in general, please call the FEMA Map Information eXchange at 1-877-FEMA-MAP (1-877-336-2627) or visit the FEMA Flood Map Service Center website at https://msc.fema.gov. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the website.

Communities annexing land on adjacent FIRM panels must obtain a current copy of the adjacent panel as well as the current FIRM Index. These may be ordered directly from the Flood Map Service Center at the number listed above.

For community and countywide map dates refer to the Flood Insurance Study Report for this jurisdiction.

To determine if flood insurance is available in this community, contact your Insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

Base map information shown on this FIRM was provided in digital format by the National Agriculture Imagery Program (NAIP). This information was derived from digital orthophotography at a 2-foot resolution from photography dated 2016.

SCALE

N

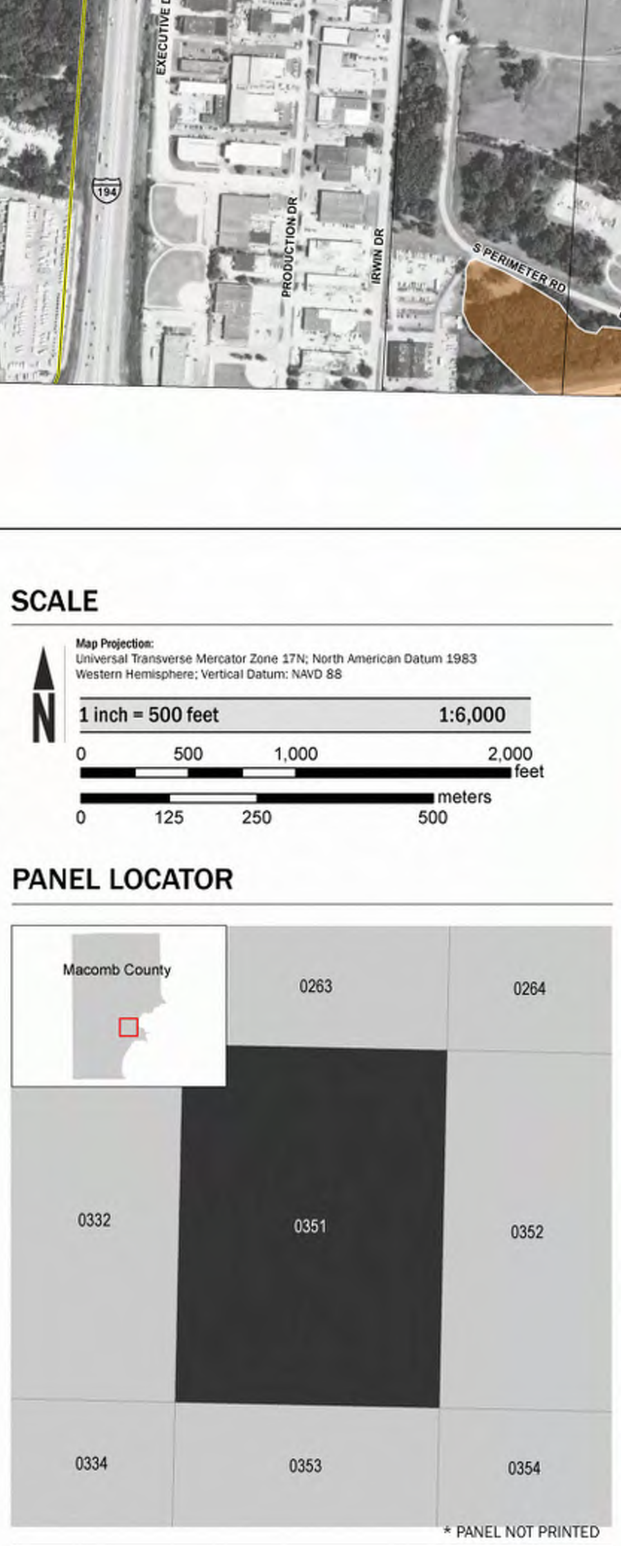
Map Projection:
Universal Transverse Mercator Zone 17N; North American Datum 1983
Western Hemisphere; Vertical Datum: NAVD 88

1 inch = 500 feet 1:6,000

0 500 1,000 2,000 feet

0 125 250 500 meters

PANEL LOCATOR



* PANEL NOT PRINTED

NATIONAL FLOOD INSURANCE PROGRAM
FLOOD INSURANCE RATE MAP

MACOMB COUNTY, MICHIGAN
(All Jurisdictions)

PANEL 351 OF 430

FEMA

Panel Contains:

COMMUNITY	NUMBER	PANEL	SUFFIX
CLINTON, CHARTER TOWNSHIP OF	260121	0351	J
HARRISON, TOWNSHIP OF	260123	0351	J
MOUNT CLEMENS, CITY OF	260124	0351	J

VERSION NUMBER
2.4.3.5

MAP NUMBER
26099C0351J

MAP REVISED
DECEMBER 30, 2020

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Michigan State Plane South zone 6401 (FIPSZONE 2113). The **horizontal datum** was NAD83. Differences in datum, spheroid, projection or state plane zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov/ or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at **(301) 713-3242**, or visit its website at http://www.ngs.noaa.gov/.

Base Map information shown on this FIRM was provided in digital format by Macomb County Planning and GIS Mapping. This information was photogrammetrically compiled at a scale of 1:1200 feet from aerial photography dated 2000.

This map reflects more detailed and up-to-date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

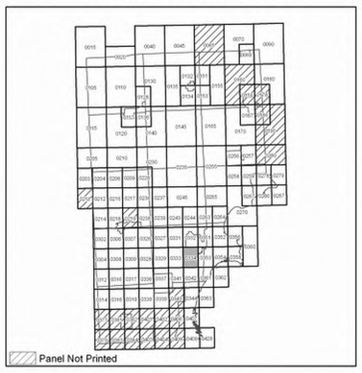
Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

Contact the **FEMA Map Service Center** at 1-800-358-9616 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study report, and/or digital versions of this map. The FEMA Map Service Center may also be reached by Fax at 1-800-358-9620 and its website at http://msc.fema.gov/.

If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMA MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/business/nfip/.

The **profile base lines** depicted on this map represent the hydraulic modeling baselines that match the flood profiles in the FIS report. As a result of improved topographic data, the **profile base line**, in some cases, may deviate significantly from the channel centerline or appear outside the SFHA.

PANEL INDEX



LEGEND

SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100 year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard may include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Area of special flood hazard formerly protected from the 1% annual chance flood event by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood event by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X	Areas determined to be outside of the 0.2% annual chance floodplain.
ZONE D	Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

	1% annual chance floodplain boundary
	0.2% annual chance floodplain boundary
	Floodway boundary
	Zone D boundary
	CBRS and OPA boundary
	Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
513	Base Flood Elevation line and value; elevation in feet*
(EL 10)	Base Flood Elevation value where uniform within zone; elevation in feet*

*Referenced to the North American Vertical Datum of 1988

A — A	Cross section line
23 — 23	Transect line
85° 03' 45.0", 41° 24' 22.5"	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere
4587000 M	1000-meter Universal Transverse Mercator grid values, zone 17
2250000 FT	5000-foot grid ticks: Michigan State Plane South Coordinate System, 6401 zone (FIPSZONE 2113), Lambert Conformal Conic projection
KA0015	Bench mark (see explanation in Notes to Users section of this FIRM panel)
M1.5	River Mile

MAP REPOSITORY
Refer to listing of Map Repositories on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
SEPTEMBER 29, 2006

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 500'
250 0 500 1000 FEET
150 0 150 300 METERS

NFIP
NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0334G

FIRM
FLOOD INSURANCE RATE MAP
MACOMB COUNTY, MICHIGAN
(ALL JURISDICTIONS)

PANEL 334 OF 428
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

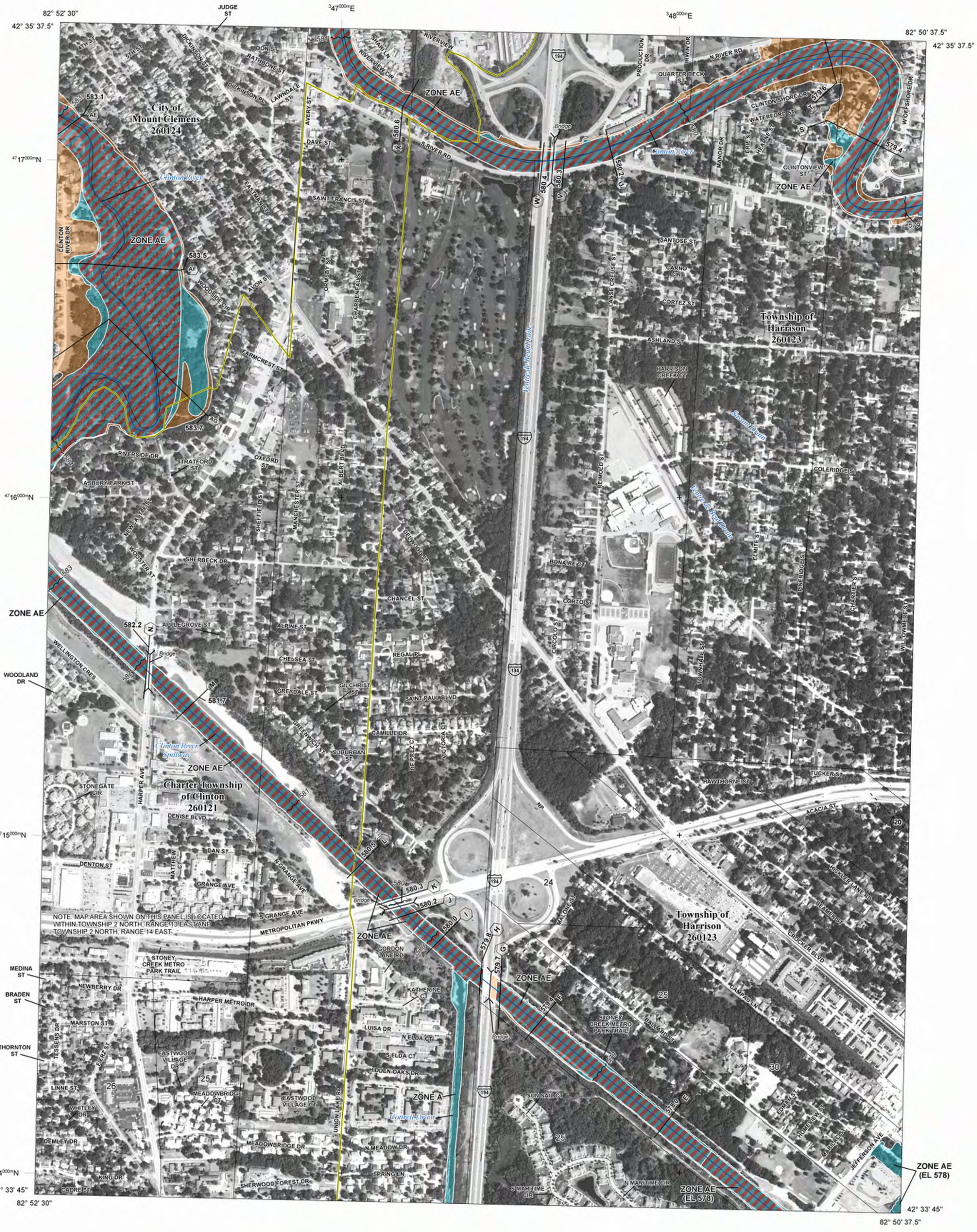
COMMUNITY	NUMBER	PANEL	SUFFIX
CLINTON, CHARTER TOWNSHIP OF	260121	0334	G
MOUNT CLEMENS, CITY OF	260124	0334	G

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
26099C0334G

EFFECTIVE DATE
SEPTEMBER 29, 2006

Federal Emergency Management Agency



FLOOD HAZARD INFORMATION

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

THE INFORMATION DEPICTED ON THIS MAP AND SUPPORTING DOCUMENTATION ARE ALSO AVAILABLE IN DIGITAL FORMAT AT

HTTPS://MSC.FEMA.GOV

SPECIAL FLOOD HAZARD AREAS	Without Base Flood Elevation (BFE) *Zone A,V, A99*
	With BFE or Depth *Zone AE, AO, AH, VE, AR*
	Regulatory Floodway
OTHER AREAS OF FLOOD HAZARD	0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
	Future Conditions 1% Annual Chance Flood Hazard *Zone X*
	Area with Reduced Flood Risk due to Levee See Notes. *Zone X*
	Area with Flood Risk due to Levee *Zone D*
OTHER AREAS	NO SCREEN Area of Minimal Flood Hazard *Zone X*
	Area of Undetermined Flood Hazard *Zone D*
GENERAL STRUCTURES	Channel, Culvert, or Storm Sewer
	Levee, Dike, or Floodwall
OTHER FEATURES	18.2 / E / 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
	8 Coastal Transect
	Coastal Transect Baseline
	Profile Baseline
	Hydrographic Feature
	513 Base Flood Elevation Line (BFE)
	Limit of Study
	Jurisdiction Boundary

NOTES TO USERS

For information and questions about this Flood Insurance Rate Map (FIRM), available products associated with this FIRM, including historic versions, the current map date for each FIRM panel, how to order products, or the National Flood Insurance Program (NFIP) in general, please call the FEMA Map Information eXchange at 1-877-FEMA-MAP (1-877-336-2627) or visit the FEMA Flood Map Service Center website at https://msc.fema.gov. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the website.

Communities annexing land on adjacent FIRM panels must obtain a current copy of the adjacent panel as well as the current FIRM Index. These may be ordered directly from the Flood Map Service Center at the number listed above.

For community and countywide map dates refer to the Flood Insurance Study Report for this jurisdiction.

To determine if flood insurance is available in this community, contact your Insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

Base map information shown on this FIRM was provided in digital format by the National Agriculture Imagery Program (NAIP). This information was derived from digital orthophotography at a 2-foot resolution from photography dated 2016.

SCALE

N

Map Projection:
Universal Transverse Mercator Zone 17N; North American Datum 1983
Western Hemisphere; Vertical Datum: NAVD 88

1 inch = 500 feet 1:6,000

0 500 1,000 2,000 feet

0 125 250 500 meters

PANEL LOCATOR

* PANEL NOT PRINTED

FEMA National Flood Insurance Program

NATIONAL FLOOD INSURANCE PROGRAM
FLOOD INSURANCE RATE MAP

MACOMB COUNTY, MICHIGAN
(All Jurisdictions)

PANEL 353 OF 430

FEMA

Panel Contains:

COMMUNITY	NUMBER	PANEL	SUFFIX
CLINTON, CHARTER TOWNSHIP OF	260121	0353	J
HARRISON, TOWNSHIP OF	260123	0353	J
MOUNT CLEMENS, CITY OF	260124	0353	J

VERSION NUMBER
2.4.3.5

MAP NUMBER
26099C0353J

MAP REVISED
DECEMBER 30, 2020

Appendix E

USGS Topographic Map

U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

The National Map US Topo

MOUNT CLEMENS WEST QUADRANGLE
MICHIGAN - MACOMB COUNTY
7.5-MINUTE SERIES

Produced by the United States Geological Survey
North American Datum of 1983 (NAD83)
World Geodetic System of 1984 (WGS84). Projection and
1 000-meter grid:Universal Transverse Mercator, Zone 17T

This map is not a legal document. Boundaries may be generalized for this map scale. Private lands within government reservations may not be shown. Obtain permission before entering private lands.

Imagery.....NAIP, June 2020 - June 2020
Roads..... U.S. Census Bureau, 2016
Names.....GNIS, 1980 - 2023
Hydrography.....National Hydrography Dataset, 2006 - 2019
Contours.....National Elevation Dataset, 2019
Boundaries.....Multiple sources; see metadata file 2021 - 2022
Public Land Survey System.....BLM, 2018
Wetlands.....FWS National Wetlands Inventory Not Available

MN
GN
7°39'
136 MILS
1°19'
23 MILS
UTM GRID AND 2023 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

U.S. National Grid
100,000 - m Square ID
LH
Grid Zone Designation
17T

SCALE 1:24 000

1 0.5 0 KILOMETERS 1 2
1000 500 0 METERS 1000 2000
1 0.5 0 1
MILES
1000 0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10000
FEET

CONTOUR INTERVAL 5 FEET
NORTH AMERICAN VERTICAL DATUM OF 1988

This map was produced to conform with the National Geospatial Program US Topo Product Standard.

MICHIGAN
QUADRANGLE LOCATION

1	2	3
4		5
6	7	8

ADJOINING QUADRANGLES
1 Utica
2 Waldenburg
3 New Haven
4 Warren
5 Mount Clemens East
6 Highland Park
7 Grosse Pointe
8 Grosse Pointe OE E

ROAD CLASSIFICATION
Expressway
Secondary Hwy
Ramp
Local Connector
Local Road
4WD
Interstate Route
US Route
State Route

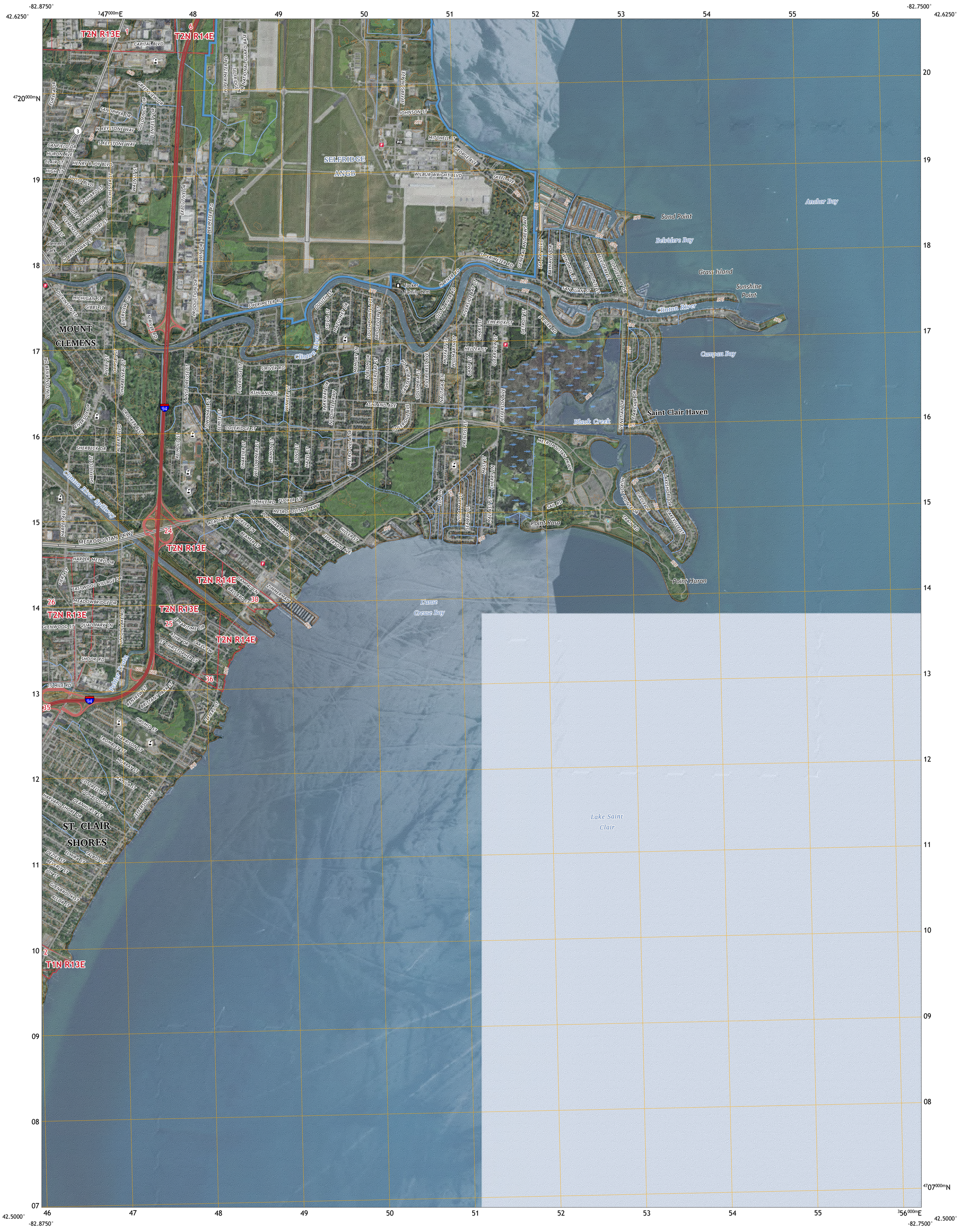
MOUNT CLEMENS WEST, MI
2023

NSN 7643011631403
NGA REF NO.USGSX24K30538

U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

The National Map US Topo

MOUNT CLEMENS EAST QUADRANGLE
MICHIGAN - MACOMB COUNTY
7.5-MINUTE SERIES



Produced by the United States Geological Survey
North American Datum of 1983 (NAD83)
World Geodetic System of 1984 (WGS84). Projection and
1 000-meter grid:Universal Transverse Mercator, Zone 17T

This map is not a legal document. Boundaries may be generalized for this map scale. Private lands within government reservations may not be shown. Obtain permission before entering private lands.

Imagery.....NAIP, June 2020 - June 2020
Roads..... U.S. Census Bureau, 2016
Names.....GNIS, 1980 - 2023
Hydrography.....National Hydrography Dataset, 2006 - 2019
Contours.....National Elevation Dataset, 2019
Boundaries.....Multiple sources; see metadata file 2020 - 2022
Public Land Survey System.....BLM, 2018
Wetlands.....FWS National Wetlands Inventory Not Available

MN
GN
7°45'
138 MILS
1°14'
22 MILS
UTM GRID AND 2023 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

U.S. National Grid
100,000 - m Square ID
LH
Grid Zone Designation
17T

SCALE 1:24 000

1 0.5 0 KILOMETERS 1 2
1000 500 0 METERS 1000 2000
1 0.5 0 1
MILES
1000 0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10000
FEET

CONTOUR INTERVAL 5 FEET
NORTH AMERICAN VERTICAL DATUM OF 1988

This map was produced to conform with the National Geospatial Program US Topo Product Standard.

QUADRANGLE LOCATION

1	2	3
4		5
6	7	

ADJOINING QUADRANGLES
1 Waldenburg
2 New Haven
3 New Baltimore
4 Mount Clemens West
5 Saint Clair Flats
6 Grosse Pointe
7 Grosse Pointe OE E

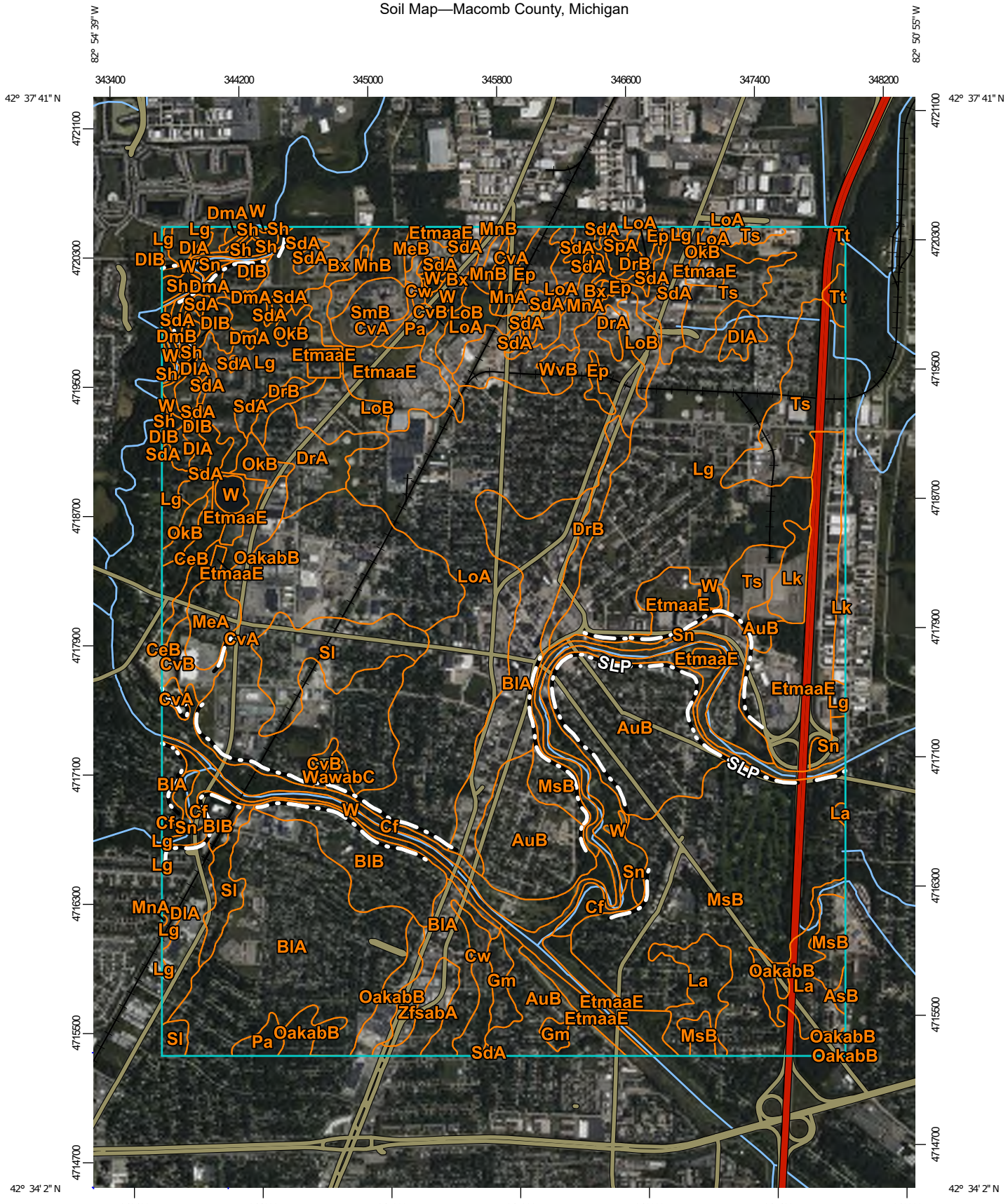
ROAD CLASSIFICATION
Expressway
Secondary Hwy
Ramp
Local Connector
Local Road
4WD
Interstate Route
US Route
State Route

MOUNT CLEMENS EAST, MI
2023

NSN. 7643016371402
NGA REF NO. USGSX24K30537

Appendix F

NRCS Soils Map



Map Scale: 1:32,900 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 450 900 1800 2700

Feet
0 1500 3000 6000 9000

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 17N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Macomb County, Michigan
Survey Area Data: Version 22, Sep 4, 2025

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jul 5, 2020—Sep 19, 2020

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
AsB	Pipestone sand, Erie-Huron Lake Plain, 0 to 3 percent slopes	3.3	0.1%
AuB	Pipestone sand, loamy substratum, 0 to 6 percent slopes	359.0	6.6%
BlA	Blount loam, Erie-Huron Lake Plain, 0 to 2 percent slopes	556.0	10.3%
BlB	Blount loam, 2 to 6 percent slopes	100.5	1.9%
BsB	Boyer sandy loam, 2 to 6 percent slopes	1.2	0.0%
Bx	Brevort-Selfridge complex	36.9	0.7%
CeB	Celina loam, 2 to 6 percent slopes	23.1	0.4%
Cf	Ceresco fine sandy loam	117.7	2.2%
CvA	Conover loam, 0 to 2 percent slopes	413.7	7.7%
CvB	Conover loam, 2 to 6 percent slopes	46.1	0.9%
Cw	Corunna sandy loam	33.8	0.6%
DlA	Del Rey loam, 0 to 2 percent slopes	111.0	2.1%
DlB	Del Rey loam, 2 to 6 percent slopes	11.5	0.2%
DmA	Del Rey-Metamora sandy loams, 0 to 2 percent slopes	27.5	0.5%
DmB	Del Rey-Metamora sandy loams, 2 to 6 percent slopes	4.6	0.1%
DrA	Dryden sandy loam, 0 to 2 percent slopes	64.2	1.2%
DrB	Dryden sandy loam, 2 to 6 percent slopes	48.9	0.9%
Ep	Ensley-Parkhill complex	103.3	1.9%
EtmaaE	Udorthents and Udipsamments, nearly level to hilly	357.5	6.6%
Gm	Granby loamy fine sand	23.8	0.4%
La	Lamson fine sandy loam	95.6	1.8%
Lg	Lenawee silty clay loam, 0 to 1 percent slopes	624.5	11.6%
Lk	Lenawee-Selfridge complex, 0 to 3 percent slopes	42.0	0.8%

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
LoA	Locke sandy loam, 0 to 2 percent slopes	629.2	11.6%
LoB	Locke sandy loam, 2 to 6 percent slopes	22.3	0.4%
MeA	Metamora fine sandy loam, 0 to 2 percent slopes	33.9	0.6%
MeB	Metamora fine sandy loam, 2 to 6 percent slopes	4.2	0.1%
MnA	Metea sand, 0 to 2 percent slopes	5.1	0.1%
MnB	Metea sand, 2 to 6 percent slopes	36.5	0.7%
MsB	Minoa fine sandy loam, 0 to 4 percent slopes	492.0	9.1%
OakabB	Oakville fine sand, Erie-Huron Lake Plain, 0 to 6 percent slopes	84.4	1.6%
OkB	Oakville fine sand, loamy substratum, 0 to 6 percent slopes	35.5	0.7%
Pa	Parkhill loam, 0 to 1 percent slopes	24.7	0.5%
SdA	Selfridge loamy sand, 0 to 3 percent slopes	111.4	2.1%
Sh	Shoals loam	30.1	0.6%
Sl	Sims clay loam	130.4	2.4%
SmB	Sisson fine sandy loam, 2 to 6 percent slopes	32.0	0.6%
Sn	Sloan loam	143.3	2.7%
SpA	Spinks loamy sand, 0 to 2 percent slopes	2.3	0.0%
SpB	Spinks loamy sand, 2 to 6 percent slopes	7.4	0.1%
Ts	Toledo silty clay loam	189.9	3.5%
Tt	Toledo clay	9.5	0.2%
W	Water	126.6	2.3%
WawabC	Wawasee loam, 6 to 12 percent slopes	7.7	0.1%
WvB	Wasepi-Pipestone complex, 0 to 4 percent slopes	12.7	0.2%
ZfsabA	Ziegenfuss clay, 0 to 1 percent slopes	27.1	0.5%
Totals for Area of Interest		**5,403.8**	**100.0%**

Appendix G

Rare Species Review

MICHIGAN STATE UNIVERSITY | Extension

Dylan Crooks
Anderson, Eckstein, and Westrick, Inc.
51301 Schoenherr Road
Shelby Township, MI 48315

April 15, 2024

Re: Rare Species Review #4925 – Replacement of watermains and their associated service lines City of Mount Clemens, Macomb County, MI

Hello:

The location for the proposed project was checked against known localities for rare species and unique natural features, which are recorded in the Michigan Natural Features Inventory (MNFI) natural heritage database. This continuously updated database is a comprehensive source of existing data on Michigan's endangered, threatened, or otherwise significant plant and animal species, natural plant communities, and other natural features. Records in the database indicate that a qualified observer has documented the presence of special natural features. The absence of records in the database for a particular site may mean that the site has not been surveyed. The only way to obtain a definitive statement on the status of natural features is to have a competent biologist perform a complete field survey.

Under Act 451 of 1994, the Natural Resources and Environmental Protection Act, Part 365, Endangered Species Protection, "a person shall not take, possess, transport, …fish, plants, and wildlife indigenous to the state and determined to be endangered or threatened," unless first receiving an Endangered Species Permit from the Michigan Department of Natural Resources (MDNR), Wildlife Division. Responsibility to protect endangered and threatened species is not limited to the lists below. Other species may be present that have not been recorded in the database.

Several at-risk species and/or natural communities have been documented within 1.5 miles of the project location and it is possible that adverse impacts will occur. This response reflects a desktop review of the database and MNFI cannot fully evaluate this project without visiting the area. MNFI offers several levels of Rare Species Reviews, including field surveys which I would be happy to discuss with you.

Sincerely,

Michael Sanders

Michael Sanders
Environmental Review Specialist/Zoologist
Michigan Natural Features Inventory

MSU EXTENSION

Michigan Natural Features Inventory

PO Box 13036
Lansing MI 48901

(517) 284-6200
Fax (517) 373-9566

mnfi.anr.msu.edu

Comments for Rare Species Review #4925

It is important to note that it is the applicant's responsibility to comply with both state and federal threatened and endangered species legislation. Therefore, if a state listed species occurs at a project site, and you think you need an endangered species permit please contact: DNR-Wildlife Division, DNR-StateTEPermit@michigan.gov. If a federally listed species is involved and, you think a permit is needed, please contact Jessica Pruden, U.S. Fish and Wildlife Service, East Lansing office, 517-351-8316, or Jessica_Pruden@fws.gov.

NOTE: Special concern species and natural communities are not protected under endangered species legislation, but efforts should be taken to minimize any or all impacts. Please consult MNFI's Rare Species Explorer for additional information on Michigan's rare plants and animals.

NOTE: Freshwater mussels (*Unionida*) require a fish host to complete their life cycle. Eggs are fertilized and develop into larvae within the gills of the female mussel. These larvae, called glochidia, are released into the water and must attach to a suitable fish host to survive and transform into the adult mussel. As zebra mussel (*Dreissena polymorpha*) infestation has led to the extirpation of many native mussel communities, boat hulls and trailers, fishing gear and scuba equipment should be thoroughly cleaned before moving between waterbodies, to prevent the spread of zebra mussel larvae and adults.

Stream Group Designations

NOTE: Michigan rivers and streams have been grouped according to existing information of mussel distribution and individual species conservation status. The Mussel Protocol Stream Groups are designed to document the **potential** presence or absence of state or federally listed mussel species. The layer was created by modeling the habitat suitability for each mussel species and may not correspond directly with a documented location for a listed mussel. A segment may be predicted as suitable for a number of mussel species, so the stream group number was assigned to the most restrictive of the potential mussel species present.

This stretch of the Clinton River is designated a Group 3 mussel stream which means that federally listed mussel species occur/may occur here and that certain surveys and possibly relocation procedures apply. I encourage you to read the ***Michigan Freshwater Mussel Survey Protocols and Relocation Procedures*** publication **if in-stream work and/or land clearing activities occur that result in streambed disturbance and erosion and sedimentation into the river. A copy of the publication is being provided to you in this mailing.**

The Mussel Map Viewer is an interactive tool to allow users to explore listed native mussels across the Michigan landscape. Watershed level species lists are available alongside the Mussel Protocol Stream Groups.

Table 1: Occurrences of Threatened & Endangered Species within 1.5 miles of Project Site

Element Category	Scientific Name	Common Name	Federal Status	State Status	G Rank	S Rank	EO Rank	First Observed Date	Last Observed Date
Animal	*Alasmidonta viridis*	Slippershell		T	G4G5	S2S3	H	1935-pre	1935-pre
Animal	*Alasmidonta viridis*	Slippershell		T	G4G5	S2S3	H	1935-pre	1977-78
Animal	*Alasmidonta viridis*	Slippershell		T	G4G5	S2S3	H	1933	1935-pre
Animal	*Alasmidonta viridis*	Slippershell		T	G4G5	S2S3	E	2012	2012

Animal	*Cyclonaias tuberculata*	Purple wartyback		T	G5	S2	H	1933-06-23	1933-06-23
Animal	*Epioblasma rangiana*	Northern riffleshell	LE	E	G1	S1	H	1965-08-13	1968-08-13
Animal	*Epioblasma triquetra*	Snuffbox	LE	E	G2G3	S1S2	H	1933-06-23	1977-78
Animal	*Epioblasma triquetra*	Snuffbox	LE	E	G2G3	S1S2	H	1933-06-23	1933-06-23
Animal	*Epioblasma triquetra*	Snuffbox	LE	E	G2G3	S1S2	E	2017	2017
Animal	*Epioblasma triquetra*	Snuffbox	LE	E	G2G3	S1S2	E	2012	2012
Animal	*Epioblasma triquetra*	Snuffbox	LE	E	G2G3	S1S2	H	1965-08-13	1965-08-13
Animal	*Falco peregrinus*	Peregrine falcon		T	G4	S3	B	2005	2022
Animal	*Lampsilis fasciola*	Wavyrayed lampmussel		T	G5	S2	H	1933	1988-08-28
Animal	*Lampsilis fasciola*	Wavyrayed lampmussel		T	G5	S2	H	1933-06-23	1933-06-23
Animal	*Ligumia recta*	Black sandshell		T	G4G5	S1?	H	1933	1933
Animal	*Ligumia recta*	Black sandshell		T	G4G5	S1?	H		
Animal	*Obovaria subrotunda*	Round hickorynut	LT	E	G3	S1	H	1933	1988-08-28
Animal	*Obovaria subrotunda*	Round hickorynut	LT	E	G3	S1	H	1933	1933-post
Animal	*Paetulunio fabalis*	Rayed bean	LE	E	G2	S1S2	H	1935-pre	1935-pre
Animal	*Paetulunio fabalis*	Rayed bean	LE	E	G2	S1S2	H	1933-06-23	1933-06-23
Animal	*Paetulunio fabalis*	Rayed bean	LE	E	G2	S1S2	E	2012	2012
Animal	*Pantherophis gloydi*	Eastern fox snake		T	G3	S2	H	1948	1980
Animal	*Pantherophis gloydi*	Eastern fox snake		T	G3	S2	E	2020-07-07	2020-07-07
Animal	*Sagittunio nasutus*	Eastern pondmussel		E	G4	S2	H	1933	1933
Animal	*Sagittunio nasutus*	Eastern pondmussel		E	G4	S2	H	1940-pre	1940-pre
Animal	*Toxolasma lividus*	Purple lilliput		E	G3	S1	E	2012	2012
Animal	*Toxolasma parvum*	Lilliput		E	G5	S1	H	1933-06-23	1933-06-23

Comments for Table 1

This stretch of the Clinton River is designated a Group 3 mussel stream which means that federally listed mussel species occur/may occur here and that certain surveys and possibly relocation procedures apply. I encourage you to read the ***Michigan Freshwater Mussel Survey Protocols and Relocation Procedures*** publication **if in-stream work and/or land clearing activities occur that result in streambed disturbance and erosion and sedimentation into the river. A copy of the publication is being provided to you in this mailing.**

Peregrine falcon (*Falco peregrinus*)

Habitat

Peregrine falcons historically nested on cliff faces but they have been introduced in several Michigan cities and are fairing quite well where they nest on many types of man-made structures and feed on the abundance of small city birds like Rock pigeons.

Management Recommendations

Historically, Peregrine falcon populations plummeted because of the bioaccumulation of pesticides in their food chain. Recently, however, their numbers are increasing. They are tolerant of human activity but nest sites should not be disturbed during the early nesting season. Routine ROW maintenance should not affect them. Bridge or building maintenance that includes active nest sites must be scheduled outside of the breeding season, between October and February whenever possible.

For more information, see the *Falco peregrinus* species page on the MNFI website.

Table 2: Occurrences of Special Concern Species and Natural Communities within 1.5 miles of Project Site

Element Category	Scientific Name	Common Name	Federal Status	State Status	G Rank	S Rank	EO Rank	First Observed Date	Last Observed Date
Animal	*Alasmidonta marginata*	Elktoe		SC	G4	S3?	H	1933	1935-pre
Animal	*Alasmidonta marginata*	Elktoe		SC	G4	S3?	H	1977	1978
Animal	*Alasmidonta marginata*	Elktoe		SC	G4	S3?	E	2012	2012
Animal	*Alasmidonta marginata*	Elktoe		SC	G4	S3?	H	1965-08-13	1965-08-13
Animal	*Cambarunio iris*	Rainbow		SC	GNR	S3	H	1933-06-23	1978
Animal	*Cambarunio iris*	Rainbow		SC	GNR	S3	H	1933-06-23	1935-pre
Animal	*Cambarunio iris*	Rainbow		SC	GNR	S3	E	2017	2017
Animal	*Cambarunio iris*	Rainbow		SC	GNR	S3	E	2017	2017
Animal	*Cambarunio iris*	Rainbow		SC	GNR	S3	E	2012	2012
Animal	*Lasmigona compressa*	Creek heelsplitter		SC	G5	S3	E	1933-06-23	2011-08-10
Animal	*Lasmigona compressa*	Creek heelsplitter		SC	G5	S3	H	1965-08-13	1965-08-13
Animal	*Lasmigona costata*	Flutedshell		SC	G5	SNR	H	1933-06-23	1933-06-23
Animal	*Lasmigona costata*	Flutedshell		SC	G5	SNR	H	1965-08-13	1965-08-13

Animal	*Lasmigona costata*	Flutedshell		SC	G5	SNR	H	1978-06-12	1978-06-12
Animal	*Lasmigona costata*	Flutedshell		SC	G5	SNR	H	1933-06-33	1933-06-33
Animal	*Moxostoma duquesnei*	Black redhorse		SC	G5	S2	H	1932-04-15	1932-04-15
Animal	*Pleurobema sintoxia*	Round pigtoe		SC	G4G5	S3	H	1933	1977-78
Animal	*Pleurobema sintoxia*	Round pigtoe		SC	G4G5	S3	H	1933-06-23	1935-pre
Animal	*Pleurobema sintoxia*	Round pigtoe		SC	G4G5	S3	E	2012	2012
Animal	*Potamilus alatus*	Pink heelsplitter		SC	G5	SNR	E	2017	2017
Animal	*Potamilus alatus*	Pink heelsplitter		SC	G5	SNR	E	2012	2012
Animal	*Ptychobranchus fasciolaris*	Kidney shell		SC	G4G5	S2	H	1933-06-23	1933-06-23
Animal	*Ptychobranchus fasciolaris*	Kidney shell		SC	G4G5	S2	H	1933-06-23	1933-06-23
Animal	*Ptychobranchus fasciolaris*	Kidney shell		SC	G4G5	S2	H	1936-pre	1936-pre
Animal	*Ptychobranchus fasciolaris*	Kidney shell		SC	G4G5	S2	E	2017	2017
Animal	*Ptychobranchus fasciolaris*	Kidney shell		SC	G4G5	S2	E	2012	2012
Animal	*Ptychobranchus fasciolaris*	Kidney shell		SC	G4G5	S2	E	2012	2012
Animal	*Ptychobranchus fasciolaris*	Kidney shell		SC	G4G5	S2	H	1978-06-12	1978-06-12
Animal	*Ptychobranchus fasciolaris*	Kidney shell		SC	G4G5	S2	H	1965-08-13	1965-08-13
Animal	*Truncilla truncata*	Deertoe		SC	G5	S2S3	E	2012	2012
Animal	*Utterbackia imbecillis*	Paper pondshell		SC	G5	S2S3	E	2017	2017
Animal	*Venustaconcha ellipsiformis*	Ellipse		SC	G4	S3	E	2017	2017
Other	*Great Blue Heron Rookery*	Great Blue Heron Rookery			G5	SU	E	2005-04-20	2005-04-20
Plant	*Rorippa aquatica*	Lake cress		SC	G4?	S2	H	1848	1848-06-22
Plant	*Sporobolus heterolepis*	Prairie dropseed		SC	G5	S3	H	1978-09-10	1978-09-10

Comments for Table 2

This stretch of the Clinton River is designated a Group 3 mussel stream which means that federally listed mussel species may occur here and that certain surveys and possibly relocation procedures apply. I encourage you to read the ***Michigan Freshwater Mussel Survey Protocols and Relocation Procedures*** publication if in-stream work and/or land clearing activities occur that result in streambed disturbance and erosion and sedimentation into the river. A copy of the publication is being provided to you in this mailing.

Codes to accompany tables

State Protection Status Code Definitions
E = Endangered
T = Threatened
SC = Special concern

Federal Protection Status Code Definitions
LE = listed endangered
LT = listed threatened
LELT = partly listed endangered and partly listed threatened
PDL = proposed delist
E(S/A) = endangered based on similarities/appearance
PS = partial status (federally listed in only part of its range)
C = species being considered for federal status

Global Heritage Status Rank Definitions (G RANK)
The priority assigned by NatureServe's national office for data collection and protection based upon the element's status throughout its entire world-wide range. Criteria not based only on number of occurrences; other critical factors also apply. Note that ranks are frequently combined.
G1 = critically imperiled globally because of extreme rarity (5 or fewer occurrences range-wide or very few remaining individuals or acres) or because of some factor(s) making it especially vulnerable to extinction.
G2 = imperiled globally because of rarity (6 to 20 occurrences or few remaining individuals or acres) or because of some factor(s) making it very vulnerable to extinction throughout its range.
G3 = Either very rare and local throughout its range or found locally (even abundantly at some of its locations) in a restricted range (e.g. a single western state, a physiographic region in the East) or because of other factor(s) making it vulnerable to extinction throughout its range; in terms of occurrences, in the range of 21 to 100.
G4 = Apparently secure globally, though it may be quite rare in parts of its range, especially at the periphery.
G5 = Demonstrably secure globally, though it may be quite rare in parts of its range, especially at the periphery.
Q = Taxonomy uncertain

State Heritage Status Rank Definitions (S RANK)
The priority assigned by the Michigan Natural Features Inventory for data collection and protection based upon the element's status within the state. Criteria not based only on number of occurrences; other critical factors also apply. Note that ranks are frequently combined.
S1 = Critically imperiled in the state because of extreme rarity (5 or fewer occurrences or very few remaining individuals or acres) or because of some factor(s) making it especially vulnerable to extirpation in the state.
S2 = Imperiled in state because of rarity (6 to 20 occurrences or few remaining individuals or acres) or because of some factor(s) making it very vulnerable to extirpation from the state.
S3 = Rare or uncommon in state (on the order of 21 to 100 occurrences). S4 = apparently secure in state, with many occurrences.
S5 = demonstrably secure in state and essentially ineradicable under present conditions.
SX = apparently extirpated from state.

EO Rank Codes

Element Occurrence (EO) ranks refer to the viability or ecological integrity of the occurrence; they provide an assessment of the likelihood that if current conditions prevail the EO will persist for a defined period of time, typically 20-100 years.

A - Excellent estimated viability/ecological integrity
A? - Possibly excellent estimated viability/ecological integrity
AB - Excellent or good estimated viability/ecological integrity
AC - Excellent, good, or fair estimated viability/ecological integrity
B - Good estimated viability/ecological integrity
B? - Possibly good estimated viability/ecological integrity
BC - Good or fair estimated viability/ecological integrity
BD - Good, fair, or poor estimated viability/ecological integrity
C - Fair estimated viability/ecological integrity
C? - Possibly fair estimated viability/ecological integrity
CD - Fair or poor estimated viability/ecological integrity
D - Poor estimated viability/ecological integrity
D? - Possibly poor estimated viability/ecological integrity
E - Verified extant (viability/ecological integrity not assessed)
F - Failed to find
F? - Possibly failed to find
H - Historical
H? - Possibly historical
X - Extirpated
X? - Possibly extirpated
U - Unrankable
NR - Not ranked

Section 7 Comments for Rare Species Review #4925
Replacement of watermains and their associated service lines City of Mount Clemens, Macomb County, MI

Dylan Crooks
Anderson, Eckstein, and Westrick, Inc.
51301 Schoenherr Road
Shelby Township, MI 48315

April 15, 2024

For projects involving Federal funding or a federal agency authorization

The following information is provided to assist you with Section 7 compliance of the Federal Endangered Species Act (ESA). The ESA directs all Federal agencies "to work to conserve endangered and threatened species. Section 7 of the ESA, called "Interagency Cooperation," is the means by which Federal agencies ensure their actions, including those they authorize or fund, do not jeopardize the existence of any listed species."

The project falls within the range of the following federally listed/proposed/candidate species which have been identified by the U.S. Fish and Wildlife Service (USFWS) to occur in Macomb County, Michigan:

Federally Endangered

Indiana bat – there appears to be suitable habitat within 1.5 miles of the project. Indiana bats (*Myotis sodalis*) are found only in the eastern United States and are typically confined to the southern three tiers of counties in Michigan. Indiana bats that summer in Michigan winter in caves in Indiana and Kentucky. This species forms colonies and forages in riparian and mature floodplain habitats. Nursery roost sites are usually located under loose bark or in hollows of trees near riparian habitat. Indiana bats typically avoid houses or other artificial structures and typically roost underneath loose bark of dead elm, maple and ash trees. Other dead trees used include oak, hickory and cottonwood. Foraging typically occurs over slow-moving, wooded streams and rivers as well as in the canopy of mature trees. Movements may also extend into the outer edge of the floodplain and to nearby solitary trees. A summer colony's foraging area usually encompasses a stretch of stream over a half-mile in length. Upland areas isolated from floodplains and non-wooded streams are generally avoided.

Management and Conservation: Every March, the USFWS publishes survey guidelines to assist project proponents (both Federal and non-Federal) with conservation planning for Federally listed bats in Michigan. We strongly encourage project managers and their designated representatives to use the U.S. Fish and Wildlife Service (USFWS) online planning tool Information for Planning and Consultation (IPaC) to evaluate potential effects of proposed activities on listed bats and other Federally listed species in Michigan. Projects that complete consultation or coordination through IPaC automatically adhere to the recommendations provided in these guidelines and are not required to implement any additional conservation measures for listed bats.

Piping plover - there does not appear to be suitable habitat within 1.5 miles of the project. In the Great Lakes region, the federally and state endangered piping plover *(Charadrius melodus)* prefers to nest and forage on sparse or non-vegetated sand-pebble beaches with less than 5% vegetative cover. Nests are simple depressions in the sand are generally placed in level areas between the water's edge and the first dune. Associated bodies of water and interdunal wetlands enhance these areas by increasing food availability. Optimal foraging areas are especially crucial along Lake Superior, where shoreline and benthic invertebrate communities are known to be naturally sparse. While feeding, open shoreline is preferred to vegetated beach areas. Piping plovers begin arriving in mid- to late-April. The nesting season is under way by mid-May and lasts until mid-August.

Management and Conservation - this species is declining throughout the Midwest due to habitat destruction and disturbance. The nests are simple depressions in the sand and are difficult to see. People walking on the beach may inadvertently destroy nests. Dogs on the beach can be especially dangerous for chicks and adults. Piping plovers are

protected under the Federal Endangered Species Act and are very sensitive to human disturbance. Please avoid activity along the shoreline in this compartment between May and September.

Snuffbox – there is a known occurrence within 1.5 miles of the project. The snuffbox mussel (*Epioblasma triquetra)* inhabits rivers and streams with cobble, gravel, or sand bottoms in swift currents and usually is deeply buried in the substrate. Freshwater mussels require a fish host to complete their life cycle. Eggs are fertilized and develop into larvae within the gills of the female mussel. These larvae, called glochidia, are released into the water and must attach to a suitable fish host to survive and transform into the adult mussel. In Michigan, the only host fish known for snuffbox is the log perch (*Percina caprodes*). In other parts of their range the banded sculpin (*Cottus carolinae*) is also a known host. After completing the parasitic stage and reaching adulthood, this mussel remains relatively sessile on the river bottom, living between 8-10 years. The best time to survey for snuffbox is April through September.

Management and Conservation: this mussel is sensitive to river impoundment, siltation and disturbance, due to its requirement for clean, swift current and relative immobility as an adult. To maintain the current populations in Michigan, rivers need to be protected to reduce silt loading and run-off. Maintaining or establishing vegetated riparian buffers can aid in controlling many of the threats to mussels. Control of zebra mussels is critical to preserving native mussels. And as with all mussels, protection of their host's habitat is also crucial. Because the life cycle of the snuffbox is inherently linked with that of the logperch in Michigan, conservation and management of this fish species is needed to ensure that of the snuffbox.

Rayed bean mussel – there is a known occurrence within 1.5 miles of the project. The federally and state endangered rayed bean mussel *(Villosa fabalis)* occurs in fine mud substrates and riffles among roots of aquatic vegetation. Limits of the breeding season are not known but gravid specimens have been found in May.

Management and Conservation: like other mussels, threats to the rayed bean include natural flow alterations, siltation, channel disturbance, point and non-point source pollution, and exotic species. Maintenance or establishment of vegetated riparian buffers can help protect mussel habitats from many of their threats. Control of zebra mussels is critical to preserving native mussels. And as with all mussels, protection of their hosts habitat is also crucial.

Northern long-eared bat – Northern long-eared bat (*M. septentrionalis*) numbers in the northeast US have declined up to 99 percent. Loss or degradation of summer habitat, wind turbines, disturbance to hibernacula, predation, and pesticides have contributed to declines in Northern long-eared bat populations. However, no other threat has been as severe to the decline as White-nose Syndrome (WNS). WNS is a fungus that thrives in the cold, damp conditions in caves and mines where bats hibernate. The disease is believed to disrupt the hibernation cycle by causing bats to repeatedly awake thereby depleting vital energy reserves. This species was federally listed in May 2015 primarily due to the threat from WNS.

Although no known hibernacula or roost trees have been documented within 1.5 miles of the project site, this activity occurs within the designated WNS zone (i.e., within 150 miles of positive counties/districts impacted by WNS. Also, there appears to be suitable habitat within 1.5 miles of the project.

Also called northern bat or northern myotis, this bat is distinguished from other *Myotis* species by its long ears. In Michigan, northern long-eared bats hibernate in abandoned mines and caves in the Upper Peninsula; they also commonly hibernate in the Tippy Dam spillway in Manistee County. This species is a regional migrant with migratory distance largely determined by locations of suitable hibernacula sites.

Northern long-eared bats typically roost and forage in forested areas. During the summer, these bats roost singly or in colonies underneath bark, in cavities or in crevices of both living and dead trees. Roost trees are selected based on the suitability to retain bark or provide cavities or crevices. Common roost trees in southern Lower Michigan include species of ash, elm and maple. Foraging occurs primarily in areas along woodland edges, woodland clearings and over small woodland ponds. Moths, beetles, and small flies are common food items. Like all temperate bats this species typically produces only 1-2 young per year.

Management and Conservation: Every March, the USFWS publishes survey guidelines to assist project proponents (both Federal and non-Federal) with conservation planning for Federally listed bats in Michigan. We strongly encourage project managers and their designated representatives to use the U.S. Fish and Wildlife Service (USFWS) online planning tool Information for Planning and Consultation (IPaC) to evaluate potential effects of proposed activities on listed bats and other Federally listed species in Michigan. Projects that complete consultation or coordination through IPaC automatically adhere to the recommendations provided in these guidelines and are not required to implement any additional conservation measures for listed bats.

Federally Threatened

Rufa red knot – there does not appear to be suitable habitat within 1.5 miles of the project. The federally threatened rufa red knot (*Calidris canutus rufa*) is one of the longest-distance migrants in the animal kingdom, flying some 18,000 miles annually between its breeding grounds in the Canadian Arctic to the wintering grounds at the southern-most tip of South America. Primarily occurring along the Atlantic and Gulf coasts, small groups of this shorebird regularly use the interior of the United States such as the Great Lakes during the annual migration. The Great Lakes shorelines provide vital stopover habitat for resting and refueling during their long annual journey.

The largest concentration of rufa red knots is found in May in Delaware Bay, where the birds stop to gorge on the eggs of spawning horseshoe crabs; a spectacle attracting thousands of birdwatchers to the area. In just a few days, the birds nearly double their weight to prepare for the final leg of their long journey to the Arctic. This species may be especially vulnerable to climate change which affects coastal habitats due to rising sea levels.

Management and Conservation: applies to actions that occur along coastal areas during the Red Knot migratory window of MAY 1 - SEPTEMBER 30.

Eastern massasauga rattlesnake (EMR) –The project **falls outside Tier 1/Tier 2 EMR** habitat as designated by the U.S. Fish & Wildlife Service (USFWS). The federally threatened and state special concern Eastern massasauga rattlesnake *(Sistrurus catenatus)* is Michigan's only venomous snake and is found in a variety of wetland habitats including bogs, fens, shrub swamps, wet meadows, marshes, moist grasslands, wet prairies, and floodplain forests. Eastern massasaugas occur throughout the Lower Peninsula but are not found in the Upper Peninsula. Populations in southern Michigan are typically associated with open wetlands, particularly prairie fens, while those in northern Michigan are better known from lowland coniferous forests, such as cedar swamps. These snakes normally overwinter in crayfish or small mammal burrows often close to the groundwater level and emerge in spring as water levels rise. During late spring, these snakes move into adjacent uplands they spend the warmer months foraging in shrubby fields and grasslands in search of mice and voles, their favorite food.

Often described as "shy and sluggish", these snakes avoid human confrontation and are not prone to strike, preferring to leave the area when they are threatened. However, like any wild animal, they will protect themselves from anything they see as a potential predator. Their short fangs can easily puncture skin and they do possess potent venom. Like many snakes, the first human reaction may be to kill the snake, but it is important to remember that all snakes play vital roles in the ecosystem. Some may eat harmful insects. Others like the massasauga consider rodents a delicacy and help control their population. Snakes are also a part of a larger food web and can provide food to eagles, herons, and several mammals.

Management and Conservation: protection of extant populations and suitable wetland and adjacent upland habitats is crucial for successful conservation of the Eastern Massasauga. Maintaining or restoring open habitat conditions is critical for this species. Fragmentation of suitable wetland-upland habitat complexes by roads or other barriers should be avoided or minimized. Land management practices such as timber harvesting, mowing, disking or prescribed burning should be conducted in such a manner so as to minimize the potential for adverse impacts to massasaugas (e.g., conducting management activities during the snakes' inactive season (November through early March) or on days when snakes are less likely to be active on the surface during the active season). Protecting suitable hibernation sites also is critical.

USFWS Section 7 Consultation Technical Assistance can be found at:

https://www.fws.gov/service/esa-section-7-consultation

The website offers step-by-step instructions to guide you through the Section 7 consultation process with prepared templates for documenting “no effect” as well as requesting concurrence on "may affect, but not likely to adversely affect" determinations.

Please let us know if you have questions.

Michael Sanders
Environmental Review Specialist/Zoologist
Michigan Natural Features Inventory

Appendix H

Drinking Water Asset Management Plan

City of Mount Clemens Drinking Water Asset Management Plan

Prepared for:

City of Mount Clemens
Drinking Water Treatment Plant
36570 Jefferson Avenue
Harrison Township, Michigan 48045
WSSN: 04510

Jan 1, 2018
December 23, 2019 (Rev. Per EGLE)

AEW Project No. 0220-0120

Civil Engineers
Surveyors
Architects

Anderson, Eckstein and Westrick, Inc.

Table of Contents

List of Figures

List of Tables

EXECUTIVE SUMMARY

Rule 1606 of Michigan Public Act 399 states that, “A community water supply that serves more than 1,000 people shall implement an asset management program…beginning January 1, 2018”. In order to fulfill the requirements set forth in Public Act 399, the City of Mount Clemens has requested an asset management plan be prepared by Anderson, Eckstein and Westrick, Inc. (AEW).

The purpose of this asset management plan is to identify major drinking water system assets owned by the City of Mount Clemens, establish a baseline condition of the assets, estimate remaining life of the assets and estimate annual maintenance, repair and replacement costs of the assets.

The City of Mount Clemens, located near Lake St. Clair in Macomb County, owns and operates a water treatment plant and distribution system, which serves the City of Mount Clemens, Selfridge Air National Guard Base, a portion of Harrison Township and a portion of Clinton Township.

The City’s assets include a drinking water treatment plant, consisting of 19 major contributing assets, a one million gallon water tower, 88 miles of drinking water distribution pipes, 775 distribution isolation valves and 750 hydrants. The City operates on an annual budget of approximately $3.5 Million and services 5,950 customers.

The results highlighted below are intended to provide the City with a formal approach for estimating the amount of capital dollars to budget in order to maintain the assets owned by the City.

Capital Improvement Plan

The Twenty Year Capital Improvement Plan (CIP) is shown in Table 1. This plan will be updated every year when the budget is completed.

The complete Asset Management Plan summarizing the calculations used to make this determination is attached. Also summarized in the attached engineering report, is an inventory of the assets, baseline condition of the assets, and a detailed recommendation for the capital dollars.

Table 1. Twenty Year Capital Improvement Plan

Fiscal Year	Projects	Project Cost	Total Project Costs
2018-19	Replace Chart Recorder with Digital Readout	$ 5,000	$302,700
	Replace Cells in Madison Water Tower	$ 5,000	
	Replace Raw Water Flow Meter	$ 7,700	
	Replace Valve Actuator for High Service Pump No. 2	$ 6,000	
	Install Level Indicator for 1929 Basin	$ 3,000	
	Repair Lake Station Pump No. 1	$ 30,000 [1]	
	Repair Streaming Monitor in Laboratory	$ 3,000	
	Replace/Rebuild Raw Water Pumps (3)	$ 90,000 [1]	
	Replace Troughs for 1929 Filters	$ 54,000	
	Replace Valve in Sludge Drying Bed No. 2	$ 16,000 [1]	
	Replace Plant Main Water Meter	$ 60,000 [1]	
	Replace Plant Main Water Line	$ 15,000	
	Replace Two CL2 Indicators for Flash Mixers	$ 8,000	
2019-20	Replace Equalization Decant Valves and Actuators	$ 20,000 [1]	$414,250
	Investigate Derailing of Equalization Tank No. 1 Decant	$ 7,500 [1]	
	Purchase and Install Flygt Dewatering Pump for Equalization Basin	$ 28,000	
	Replace Media for all 8 Filters	$ 40,000 [1]	
	Repair Air Manifold Assembly under Filters	$ 8,750	
	Replace Venturi Flow Meter in 1959 High Service PS	$ 60,000 [1]	
	Install WTP Generator	$ 250,000	
2020-21	Replace Clearwell to High Service PS Valve	$ 16,000 [1]	$853,550
	Replace Valve in Sludge Drying Bed No. 2	$ 16,000 [1]	
	Replace Filter No. 3 Washwater Valve	$ 16,000 [1]	
	Replace Drain Valve for Filter No. 6	$ 16,000 [1]	
	Upgrade Compressed Air System for all Filters	$ 10,000 [1]	
	Replace Water Supply Line for Agitators	$ 15,000 [1]	
	Rebuild Filter No. 8 Agitators	$ 10,000 [1]	
	Rebuild Washwater Pump for Office and Pump Bldg	$ 30,000 [1]	
	Replace Sampling Station Sink	$ 10,000	
	Replace Control Panel and Flow Meter for Washwater PS	$ 85,000 [1]	
	Replacement Asphalt Pavement for Entire Facility	$ 270,000 [1]	
	Replace Cabinet and Guts for Switchgear	$ 162,000	
	Replace Electrical in Chemical Room	$ 5,000	
	Replace Electrical in 59 Basin	$ 10,000	
	Replace Flocculator, B1, in 59 Basin	$ 31,050	
	Replace Critical Fire Hydrants	$ 60,000 [1]	
	Replace Filter Gallery Dehumidifier	$ 9,000 [1]	
	Replace all Gas Furnaces in WTP (6)	$ 42,000 [1]	
	Replace Windows in Office and Pump Bldg (11)	$ 10,000 [1]	
	Replace Riding Mower	$ 7,500 [1]	
	Purchase Confined Space Equipment	$ 21,000	
	Replace Main Air Line in Pipe Gallery	$ 2,000	
2021-22	Replace Critical Gate Valves	$ 316,500 [1]	$996,500
	Repalce Water Main on W Breitmeyer from Breitmeyer to Robertson	$ 275,000 [1]	
	Loop Ellwood and Roseview Watermain	$ 120,000 [1]	
	Replace Water Main on Alter from N Rose to Dead End	$ 285,000 [1]	
2022-23	Replace Ozonator (1 of 2)	$ 1,000,000	$1,107,400
	Repair N2 Boost Compressor System for Ozone Tanks	$ 50,000 [1]	
	Repair O3 Residual Indicators for Ozone Tanks	$ 7,400	
	Replace Ozone Analyzers	$ 50,000 [1]	

2024-25	Replace Ozonator (1 of 2)	$ 1,000,000 [1]	$1,060,000
	Replace Ozone Building Gas Detector	$ 15,000 [1]	
	Equalization Basin 1 Structural Study	$ 5,000 [1]	
	Transmission Line Inspection	$ 40,000 [1]	
2024-25	Replace Water Main on Riverview from Michigan to Michigan	$ 285,000 [1]	$929,400
	Madison Water Tower Structure & Paint Inspection	$ 10,000 [1]	
	Replace Ozone Deck Gas Detector	$ 15,000 [1]	
	Equalization Basin 2 Structural Study	$ 5,000 [1]	
	Install SCADA System	$ 55,000 [1]	
	Replace Water Main on Balmoral from Esplanade to SCL	$ 330,000 [1]	
	Bolt Replacement in Lower Pump Room	$ 16,000 [1]	
	Valve Operational Audit	$ 10,000 [1]	
	Sludge Disposal Clean Up	$ 30,000 [1]	
	Clearwell Structural Inspection & Documentation	$ 40,000 [1]	
	Effluent Corrosion Control	$ 10,000 [1]	
	Replace Plant Braces & Supports	$ 16,000 [1]	
	Replace O3 Residual Indicators	$ 7,400 [1]	
	Paint 1929 Section Ceilings	$ 5,000 [1]	
	Replace Mezzanine & Lab Floors	$ 5,000 [1]	
	Paint 1959 Section Walls	$ 5,000 [1]	
	Madison Water Tower Elevation SCADA Updates	$ 5,000 [1]	
	Transmission Line Repairs	$ 80,000 [1]	
2025-26	Paint & Repair Madison Water Tower	$ 1,000,000 [1]	$1,206,000
	Replace Critical Fire Hydrants	$ 80,000 [1]	
	Replace Critical Valves	$ 80,000 [1]	
	Sludge Disposal Clean Up	$ 30,000 [1]	
	Bolt Replacement in Lower Pump Room	$ 16,000 [1]	
2026-27	Replace Critical Fire Hydrants	$ 80,000.0 [1]	$1,206,000
	Replace Critical Valves	$ 80,000 [1]	
	Sludge Disposal Clean Up	$ 30,000 [1]	
	Bolt Replacement in Lower Pump Room	$ 16,000 [1]	
	Replace 4" Water Main in Distribution System	$ 1,000,000 [1]	
2027-28	Replace Critical Fire Hydrants	$ 80,000.0 [1]	$1,016,000
	Replace Critical Valves	$ 80,000 [1]	
	Bolt Replacement in Lower Pump Room	$ 16,000 [1]	
	Replace 8" Water Main in Distribution System	$ 500,000 [1]	
	Sludge Disposal Clean Up	$ 30,000 [1]	
	Build Brick Wall on Back of 59 Basin	$ 100,000	
	Update Filter Backwash System to SCADA	$ 170,000	
	Transmission Line Repairs	$ 40,000 [1]	
2028-29	Madison Water Tower Structure & Paint Inspection	$ 10,000 [1]	$1,015,000
	Replace 8" Water Main in Distribution System	$ 500,000 [1]	
	Sludge Disposal Clean Up	$ 30,000 [1]	
	Replace Water Main on Chippewa from Hampton to Balmoral	$ 475,000 [1]	
2029-30	Replace 8" Water Main in Distribution System	$ 600,000 [1]	$715,000
	Madison Water Tower Elevation SCADA Updates	$ 5,000 [1]	
	Sludge Disposal Clean Up	$ 30,000 [1]	
	Repair Lake Station Pump No. 1	$ 30,000 [1]	
	Replace High Service Pump No. 1 Pump & Motor	$ 50,000	

2030-31	Replace 8" Water Main in Distribution System	$ 600,000 [1]	$762,000
	Sludge Disposal Clean Up	$ 30,000 [1]	
	Replace Drain Valve for Filter No. 6	$ 16,000 [1]	
	Replace High Service Pump No. 2 Pump & Motor	$ 50,000	
	Install Security System with Cameras & Alarms	$ 50,000	
	Replace Filter No. 3 Washwater Valve	$ 16,000 [1]	
2031-32	Madison Water Tower Structure & Paint Inspection	$ 20,000 [1]	$1,055,000
	Valve Operational Audit	$ 10,000 [1]	
	Replace Water Main on Hampton from Mulberry to Hampton	$ 350,000 [1]	
	Replace High Service Pump No. 3 Pump & Motor on Variable Speed Drive	$ 75,000	
	Build New Meter Pit at Selfridge with Bypass	$ 600,000 [1]	
2032-33	Replace Critical Fire Hydrants	$ 80,000 [1]	$810,000
	Replace Critical Valves	$ 80,000 [1]	
	Replace Water Main on Crest from Mulberry to Balmoral	$ 500,000 [1]	
	Replace High Service Pump No. 4 Pump & Motor on Variable Speed Drive	$ 75,000	
	Replace Washwater Pump	$ 50,000	
	Remove High Service Pumps No. 5 & 6	$ 25,000	
2033-34	Replace Critical Fire Hydrants	$ 80,000 [1]	$1,010,000
	Replace Critical Valves	$ 80,000 [1]	
	Replace Water Main on Riverside from 2nd to Avon	$ 850,000 [1]	
2034-35	Madison Water Tower Structure & Paint Inspection	$ 10,000 [1]	$1,134,000
	Replace Critical Fire Hydrants	$ 80,000 [1]	
	Replace Critical Valves	$ 80,000 [1]	
	Sludge Disposal Clean Up	$ 30,000 [1]	
	Replace Ozone Deck Gas Detector	$ 15,000 [1]	
	Replace Troughs for 1929 Filters	$ 54,000 [1]	
	Replace Low Lift No. 1 Pump & Motor	$ 50,000 [1]	
	Replace All Chemical Feed Pumps	$ 50,000 [1]	
	Install New Cathodic Protection System for Madison Tower	$ 200,000 [1]	
	Rebuild 29 Filters With Complete Change Out of Media	$ 550,000 [1]	
	Effluent Corrosion Control	$ 10,000 [1]	
	Madison Water Tower Elevation SCADA Updates	$ 5,000 [1]	
2035-36	Paint 1929 Section Ceilings	$ 5,000 [1]	$1,091,000
	Sludge Disposal Clean Up	$ 30,000 [1]	
	Bolt Replacement in Lower Pump Room	$ 16,000 [1]	
	Replace Low Lift No. 2 Pump & Motor	$ 50,000	
	Replace Doors & Windows at Treatment Plant	$ 75,000	
	Tuck & Point Bricks on Main Building	$ 350,000	
	Rebuild 59 Filters With Complete Change Out of Media	$ 550,000	
	Replace Ozone Deck Gas Detector	$ 15,000 [1]	
2036-37	Replace Riding Mower	$ 7,500 [1]	$877,500
	Transmission Line Repairs	$ 80,000 [1]	
	Replace Venturi Flow Meter in 1959 High Service PS	$ 60,000 [1]	
	Paint all Hydrants with Protective Coatings	$ 30,000	
	Replace Low Lift No. 3 Pump & Motor	$ 50,000	
	Inspect & Line Water Intake Pipe	$ 300,000	
	Replace All Chemical Storage Tanks & Piping	$ 350,000	
2037-38	Madison Water Tower Structure & Paint Inspection	$ 10,000 [1]	$1,039,000
	Clearwell Structural Inspection & Documentation	$ 40,000 [1]	
	Replacement Asphalt Pavement for Entire Facility	$ 270,000 [1]	
	Replace/Rebuild Raw Water Pumps (3)	$ 90,000 [1]	
	Replace Level Indicator for 1929 Basin	$ 3,000	
	Paint All Plant Pipibng With Rust Proof Coating	$ 100,000	
	Replace 59 Basin Transfer Pumps & Drives	$ 75,000	
	Line (2) 24" Transmission Mains From Plant to City	$ 400,000	
	Replace Filter Gallery Dehumidifier	$ 9,000 [1]	
	Replace all Gas Furnaces in WTP (6)	$ 42,000 [1]	
20 Year Total			**$18,600,300**

Notes: [1]Indicates estimated cost. Actual quote not obtained.

Table 2. Five Year Capital Improvement Costs vs. Anticipated Budget

Fiscal Year	Anticipated Capital Budget[1]	Planned Project Costs	Difference
2018-19	$ 313,604	$ 302,700	$ 10,904
2019-20	$ 412,242	$ 414,250	$ (2,008)
2020-21	$ 877,456	$ 853,550	$ 23,906
2021-22	$ 1,003,274	$ 996,500	$ 6,774
2022-23	$ 1,139,576	$ 1,107,400	$ 32,176
Total	**$ 3,746,152**	**$ 3,674,400**	**$ 71,752**

Notes: [1]Anticipated Capital Budget is tabulated from the existing rate structure, adopted June 5, 2017.

1.0 STUDY BACKGROUND AND PURPOSE

A utility system is comprised of several assets, as the system ages and deteriorates, incidental costs are likely to occur. These unforeseen costs include: level of service, operation costs, maintenance costs, and replacement costs. An approach to managing these aging assets is defined as asset management. The International Infrastructure Management Manual defines the goal of asset management;

> "Meeting a required level of service in the most cost-effective way through the creation, acquisition, operation, maintenance, rehabilitation, and disposal of assets to provide for present and future customers."

The intent of the asset management plan is to ensure long-term funding strategies in order to preserve the longevity of the City's assets.

2.0 INTRODUCTION

Rule 1606 of Michigan Public Act 399 states that, "A community water supply that serves more than 1,000 people shall implement an asset management program…beginning January 1, 2018". In order to fulfill the requirements set forth in Public Act 399, the City of Mount Clemens has requested an asset management plan be prepared by Anderson, Eckstein and Westrick, Inc. (AEW). With growing concerns over an aging system, economic cataclysms, and deteriorating infrastructure, AEW has analyzed five core questions set forth by the Michigan Department of Environmental Quality:

1. What current, major assets do I possess?
2. What is my required sustained level of service?
3. Which assets are critical to sustained performance?
4. What are my most advantageous O&M and CIP investment strategies?
5. What is the best long-term funding strategy?

Shown in Figure 1 below, is a visual representation of the process in creating the asset management plan.

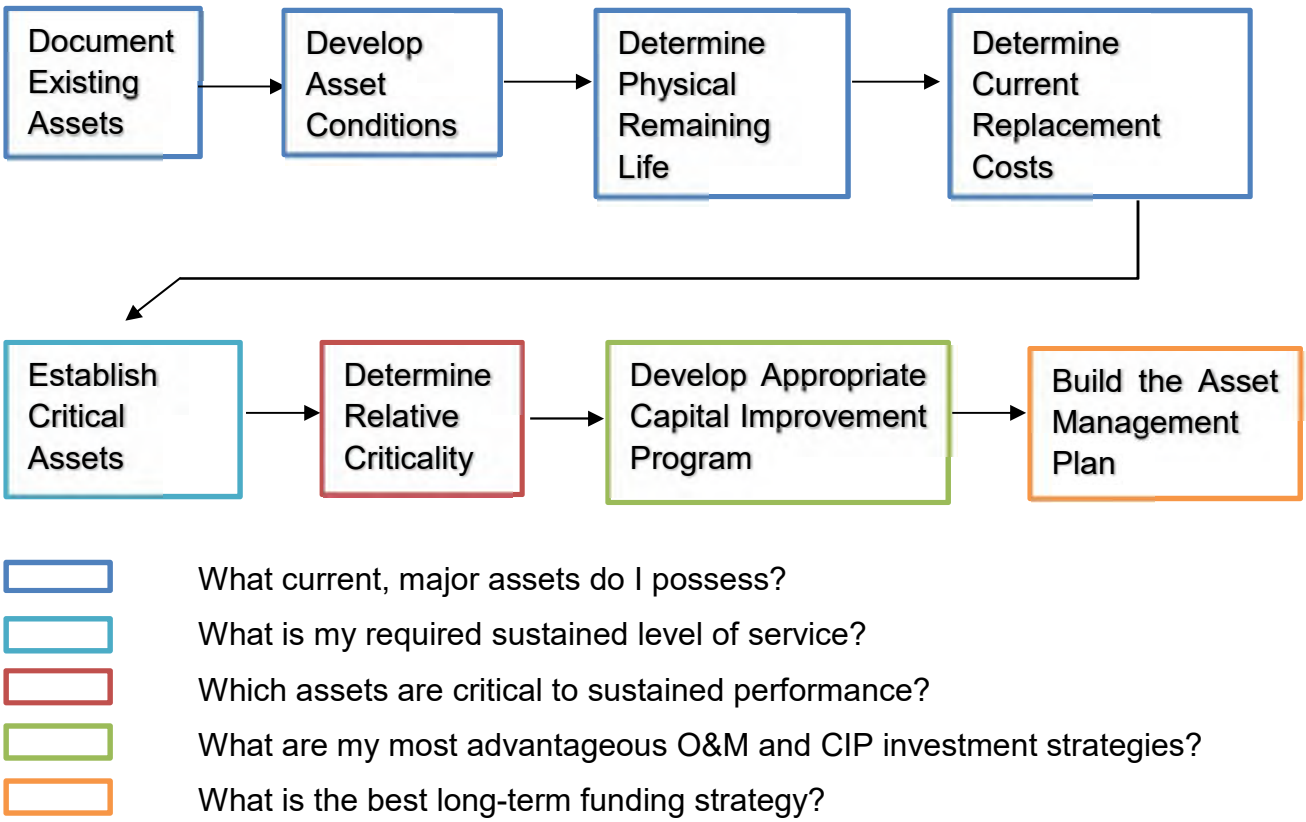


Figure 1. Process for Asset Management Plan Development

3.0 ASSET REGISTRY

The City of Mount Clemens, located near Lake St. Clair in Macomb County, owns and operates a water treatment plant and distribution system, which serves the City of Mount Clemens, Selfridge Air National Guard Base, a portion of Harrison Township and a portion of Clinton Township. The Water Treatment Plant, which is located on Lake St. Clair in Harrison Township draws raw water from the Lake. Once treated, water is stored in a 4 million gallon underground reservoir and is pumped throughout the distribution system via high-service pumps at a pressure of 70-80 psi.

The known major assets owned by the City that are included in this evaluation are as follows:

1. Water Mains
    - Approximately 88 miles

2. Water Structures and Valves
    - Approximately 775 valves, including Gate Wells and D-Boxes
3. Fire Hydrants
    - Approximately 750 Fire Hydrants

4. Water Tower
    - 1,000,000 Gallon Storage Tank

Water Treatment Plant

- 1929 Coagulation Basin
- 1929 Filter Building
- 1959 Chemical Building
- 1959 Clarifier Building
- 1959 Filter Building
- 1959 High Service Pump Station
- 1959 Wash Water Pump Station
- Chlorine Storage Structure
- 2007 Equalization Basin
- Garage
- Laboratory
- Lake Intake Chamber
- Lake Pump Station Building
- 1929 Office and Pump Building
- 2002 Ozone Generator Building
- 2002 Ozone Tanks
- Sludge Drying Beds
- 1929 Underground Filter Water Reservoir

Asset data was compiled from engineering plans, City of Mount Clemens operational plans, and correspondence from City Staff and field inspections. The data was then consolidated into a single workspace. Consolidated groups were divided into subcategories. The following sections summarize existing assets, remaining life, rehabilitation and replacement costs, and determination of critical assets for each subcategory.

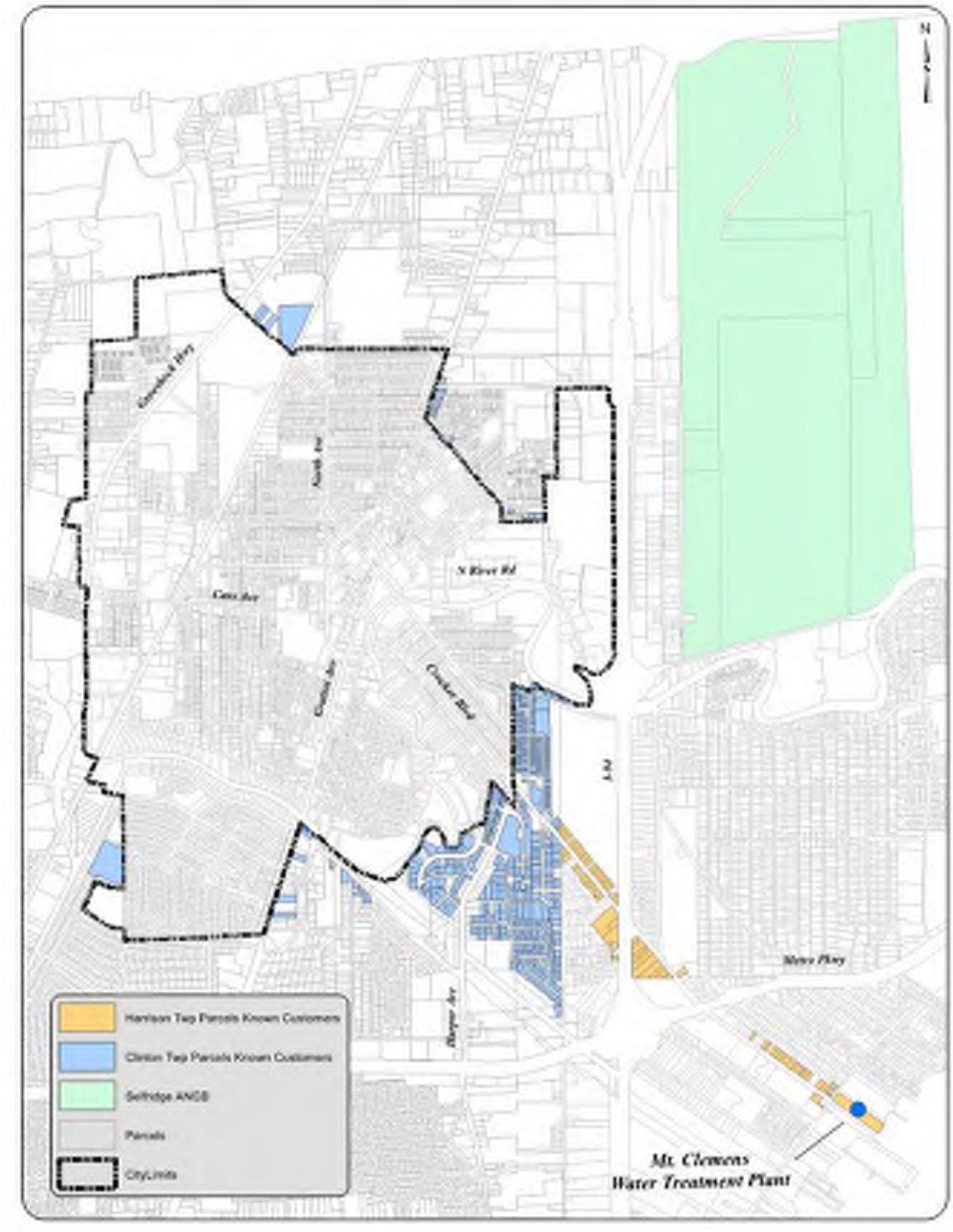


Figure 2. City of Mount Clemens Water Distribution Map

3.1 Water Mains

3.1.1 Assets

The City of Mount Clemens owns approximately 88 miles of water mains ranging in size from 4 inch to 24 inch. Table 3 shows the total length of water main for each size pipe. Water mains comprising the City's water system were constructed between 1927 and 2012, with an average construction year of 1975. Water mains are located underneath a variety of surfaces, the most common being under City Minor Roads. The completed drinking water main asset inventory can be found in Appendix A.

Table 3. Water Main Inventory – Pipe Size and Length

Pipe Diameter (Inches)	Length of Water Main (Ft)	Percentage (%)
4	30,676	7%
6	229,069	49%
8	61,734	13%
10	9,980	2%
12	66,126	14%
14	2,092	0%
16	18,242	4%
20	16,469	4%
24	5,926	1%
Unknown	23,597	5%
Total	**463,911**	**100.0%**

Table 4. Water Main Inventory – Pipe Location and Length

Road Type	Length of Water Main (Ft)	Percentage (%)
Private/Greenbelt	114,733	24.7%
City Minor	196,501	42.4%
City Major	106,779	23.0%
County Local	5,297	1.1%
County Primary	27,328	5.9%
State Trunkline	13,274	2.9%
Total	**463,911**	**100.0%**

Table 5. Water Main Inventory – Pipe Age and Length

Pipe Age (Year)	Length of Water Main (Ft)	Percentage (%)
Pre 1950	25,118	5.4%
1950-1959	26,918	5.8%
1960-1969	81,641	17.6%
1970-1979	91,922	19.8%
1980-1989	64,979	14.0%
1990-1999	66,073	14.2%
Post 1999	54,334	11.7%
Unknown	52,926	11.4%
Total	**463,911**	**100.0%**

3.1.2 Remaining Service Life

The remaining service life of an asset is considered the design life less the years in service. The material, quality of construction, usage and environment can all affect the remaining service life of water mains. An industry researcher of water main pipe, Ductile Iron Pipe Research Association, indicates a service life of approximately 90-100 years for ductile iron water main pipe. Since the pipe material for the majority of the drinking water system is unknown, a service life of 90 years was assumed.

3.1.3 Rehabilitation/Replacement Costs

Several options are considered for replacing deteriorated water main pipes. Considered rehabilitation options are; open-cut method, pipe bursting and horizontal directional drilling (HDD). Open-cut method, consists of fully excavating the water main influence area and replacing the water main. Pipe bursting is a ‘trenchless’ method of replacing buried water lines. Launching and receiving pits are utilized to ‘burst’ through the host pipe and pull a new pipe into place. HDD, similar to pipe bursting, consists of drilling a pilot borehole along a pre-determined bore bath, from the surface with minimum disturbance. Table 6 shows a comparison of prices for each rehabilitation option per linear foot.

Table 6. Water Main Rehabilitation Prices per Linear Foot

Pipe Size (In.)	Open-Cut Method	HDD	Pipe Bursting
4	$ 220.00	$ 295.00	$ 210.00
6	$ 245.00	$ 305.00	$ 220.00
8	$ 270.00	$ 315.00	$ 230.00
12	$ 305.00	$ 325.00	$ 240.00
16	$ 340.00	$ 335.00	$ 250.00
20	$ 375.00	$ 355.00	$ 270.00
24	$ 410.00	$ 375.00	$ 290.00

Unit Rehabilitation Costs were derived from historic AEW bid tabulations and correlated to the City's asset sizes. Shown in Figure 3 below is the derivation of these prices. Included in the unit price is; pipe bursting, temporary water service, water service reinstatement, traffic maintenance, traffic control, open cut point repair, design services, construction inspection and construction administration.

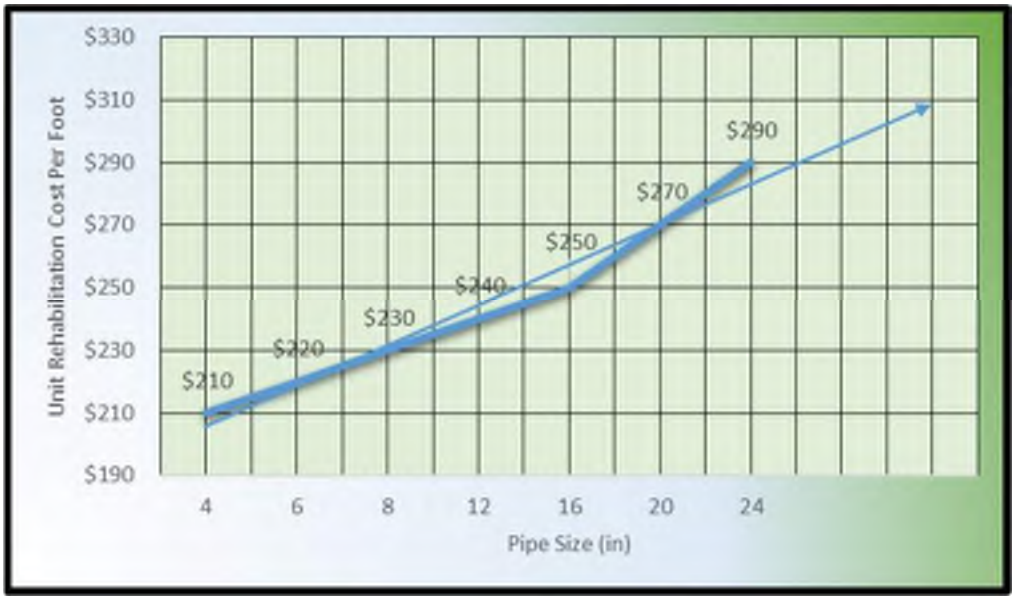


Figure 3. Prediction of Water Main Pipe Bursting Prices

3.1.4 Critical Assets

Not all assets are equally critical to a utility's operation. Some assets are extremely critical to the system while others are less critical. The criticality of City water mains are often managed informally, based on city personnel's judgement and

experience. While this process is both important and functional in final decision making, a slightly more formalized technique was utilized to compare all sections of water main. To determine the criticality of assets, two questions were asked:

1. What is the probability an asset will fail?
2. What is the consequence of failure for the given asset?

To complete this task, MDEQ Asset Management Guide was followed by assigning numerical values, 1-5, for both criticality of failure (COF) and probability of failure (POF). According to the MDEQ, any asset with a combined score of 16 or greater is deemed critical. No water main sections were found to be critical based on MDEQ guidelines. Displayed in Tables 7 and 8, below, are the factors consider for Probability of Failure and Consequence of Failure.

Table 7. Probability of Failure – Water Mains

Description		Expended Life of Asset	Failure based on Service History
Weighting Factor		30%	70%
Performance Rating	5	Percent of Useful Life: 100% (Pre 1928)	Imminent (>4 Breaks on Record)
	4	Percent of Useful Life: 80-100% (1928-1945)	Probable (>=1 Break on Record)
	3	Percent of Useful Life: 60-80% (1946-1963)	Occasional
	2	Percent of Useful Life: 40-60% (1964-1981)	Remote (No Breaks on Record)
	1	Percent of Useful Life: <40% (Post 1981)	Improbable

Table 8. Consequence of Failure – Water Mains

Description		Process Impact	Financial Impact	Disruption to the Communtiy
Weighting Factor		25%	50%	25%
Performance Rating	5	Mission Critical - Unable to accomplish mission	Major Cost (20"-24")	Long term impact; area-wide disruption (State Trunkline)
	4	Process shutdown	Significant Cost (14"-16")	Short term impact but substantial disruption (County Road)
	3	Loss of redundancy	Moderate Cost (10"-12")	Sporadic service disruptions (City Major Road)
	2	Potential process upset	Minor Cost (6"-8")	Minor Disruption (City Minor Road)
	1	No impact on process	Insignificant (4")	No disruption (Private/Greenbelt)

3.2 Water Structures and Valves

3.2.1 Assets

In total, 775 water structures and valves were accounted for during the system inventory. Water structures and valves were considered to be constructed with their corresponding water line segments, unless otherwise noted; with an average construction year of 1977. Water valves are located underneath a variety of surfaces, the most common being under City Minor Roads. It is noted that most structure and valve locations have been recorded utilizing the Global Positioning System (GPS) and North American Vertical Datum of 1988 (NAVD 88). For further detailed information, reference Appendix B.

Table 9. Gate Valve Distribution by Valve Size

Valve Size (Inches)	No. of Gate Valves (Ea)	Percentage (%)
4	57	7.4%
6	383	49.4%
8	97	12.5%
10	16	2.1%
12	101	13.0%
14	6	0.8%
16	21	2.7%
20	16	2.1%
24	7	0.9%
Unknown	71	9.2%
Total	**775**	**100.0%**

Table 10. Gate Valve Inventory – Valve Location

Road Type	No. of Gate Valves (Ea)	Percentage (%)
Private/Greenbelt	139	17.9%
City Minor	368	47.5%
City Major	191	24.6%
County Local	6	0.8%
County Primary	50	6.5%
State Trunkline	21	2.7%
Total	**775**	**100.0%**

Table 11. Gate Valve Inventory – Valve Age

Valve Age (Year)	No. of Gate Valves (Ea)	Percentage (%)
Pre 1950	31	4.0%
1950-1959	44	5.7%
1960-1969	144	18.6%
1970-1979	135	17.4%
1980-1989	81	10.5%
1990-1999	130	16.8%
Post 1999	121	15.6%
Unknown	89	11.5%
Total	**775**	**100.0%**

3.2.2 Remaining Service Life

Historical observation indicates that water valves often need replacement or rehabilitation prior to needed improvement of the water mains. Therefore based on the known service life of water valves and structures within the City, a service life of 70 years has been estimated. With constant monitoring and an annual valve turning program, the service life of the water valve assets may be prolonged. An industry manufacturer of water valves, Mueller Company, recommends implementing a stem replacement program for a prolonged service life.

3.2.3 Rehabilitation/Replacement Costs

The only method analyzed for the repair of water valves and structures was full replacement. Replacement Costs were derived from anticipated pay items for the replacement of one structure and valve. Current weighted average item prices, taken from Michigan Engineers' Resource Library (MERL), were used for unit prices. It was assumed that the water structure and valve being replaced is in the pavement of a City Minor Road. Table 12 displays the estimated replacement cost of typical gate valves and wells/boxes.

Table 12. Water Structures and Valves Replacement Cost

Valve Size (Inches)	Gate Valve and Well	Gate Valve and Box
4	$ 7,400	$ 3,800
6	$ 7,600	$ 4,100
8	$ 7,900	$ 4,300
10	$ 8,400	$ 6,000
12	$ 8,700	$ 5,500
14	$ 10,600	$ 7,250
16	$ 12,400	$ 9,000
20	$ 15,000	$ 11,650
24	$ 17,500	$ 14,300

Note, design services, construction inspection and construction administration prices were not factored into the replacement costs. The rates of these services

for an average sized construction project are: design services (6%), construction inspection (12%) and construction administration (6%).

3.2.4 Critical Assets

The MDEQ Asset Management Guide was also followed for designating the critical water structures and valves. Four water valves were found to be critical based on MDEQ guidelines and 34 more water valves were deemed critical based on their current serviceability. All rows highlighted gray in Appendix B contain assets that are considered critical. Displayed in Tables 13 and 14, below, are the factors consider for Probability of Failure and Consequence of Failure.

Table 13. Probability of Failure – Water Structures and Valves

Description		Expended Life of Asset	Failure based on Service History
Weighting Factor		30%	70%
Performance Rating	5	Percent of Useful Life: 100% (Pre 1947)	Imminent
	4	Percent of Useful Life: 80-100% (1947-1961)	Probable
	3	Percent of Useful Life: 60-80% (1962-1975)	Occasional
	2	Percent of Useful Life: 40-60% (1976-1989)	Remote
	1	Percent of Useful Life: <40% (Post 1989)	Improbable

Table 14. Consequence of Failure – Water Structures and Valves

Description		Process Impact	Financial Impact	Disruption to the Communtiy
Weighting Factor		10%	65%	25%
Performance Rating	5	Mission Critical - Unable to accomplish mission	Major Cost (20"-24")	Long term impact; area-wide disruption (State Trunkline)
	4	Process shutdown	Significant Cost (14"-16")	Short term impact but substantial disruption (County Road)
	3	Loss of redundancy	Moderate Cost (10"-12")	Sporadic service disruptions (City Major Road)
	2	Potential process upset	Minor Cost (6"-8")	Minor Disruption (City Local Road)
	1	No impact on process	Insignificant (4")	No disruption (Private/Greenbelt)

3.3 Fire Hydrants

3.3.1 Assets

The drinking water distribution system contains approximately 750 fire hydrants. Fire hydrants within the City are manufactured from numerous companies, with the most common being East Jordan Iron Works. Fire Hydrants comprising the City's water system were dated between 1929 and 2017, with an average manufacturer year of 1983. In addition, it was found that EJIW 6BR is the most common fire hydrant in the City. Nearly 55% of the City's hydrants were accompanied with a visible hydrant valve and 115 hydrants had Storz Adaptors present. For further detailed information, reference Appendix C.

Table 15. Fire Hydrant Totals by Manufacturer

Fire Hydrant Manufacturer	No. of Hydrants (Ea)	Percentage (%)
A.P. Smith	25	3.3%
East Jordan	496	66.1%
Mueller	50	6.7%
Traverse City	129	17.2%
Other	28	3.7%
Unknown	22	2.9%
Total	**750**	**100.0%**

Table 16. Most Common Fire Hydrants

Fire Hydrant Make and Model	No. of Hydrants (Ea)
EJIW 6BR	230
Traverse City Later Fluted Barrel	120
EJIW BRA-1-C	77
EJIW 5BR250	74
EJIW BR-1-C	36
Mueller Standard	34

Table 17. Pumper Nozzle Size Distribution

Pumper Nozzle Size (Inches)	No. of Hydrants (Ea)	Percentage (%)
2.5	1	0.1%
3.75	1	0.1%
4	399	53.2%
5	134	17.9%
5.25	123	16.4%
6	6	0.8%
Unknown	86	11.5%
Total	**750**	**100.0%**

3.3.2 Remaining Service Life

Fire hydrants longevity tends to mirror the condition of the water mains. Therefore based on the known service life of fire hydrants and water mains within the City, a service life of 90 years has been estimated. With constant monitoring and an annual winter, draw-down program, the service life of the hydrants may be prolonged.

3.3.3 Rehabilitation/Replacement Costs

The only method analyzed for the repair of fire hydrants was full replacement. Current weighted average item prices, taken from Michigan Engineers' Resource Library (MERL), was used for unit prices. Removal of the existing Fire Hydrant was valued at $500 each and fire hydrant replacement cost was valued at $4,000 each, summing to a total unit price of $4,500 per Fire Hydrant Replacement. Note, design services, construction inspection and construction administration prices were not factored into the replacement costs. The rates of these services for an average sized construction project are: design services (6%), construction inspection (12%) and construction administration (6%).

3.3.4 Critical Assets

The MDEQ Asset Management Guide was also followed for designating critical fire hydrants. 13 Fire Hydrants were found to be critical based on MDEQ guidelines and/or AEW's field inspections. Critical fire hydrants are highlighted gray in Appendix C. Displayed in Tables 18 and 19, below, are the factors consider for Probability of Failure and Consequence of Failure.

Table 18. Probability of Failure – Fire Hydrants

Description		Expended Life of Asset	Failure based on Service History & Field Observation
Weighting Factor		20%	80%
Performance Rating	5	Percent of Useful Life: 100% (Pre 1928)	Imminent
	4	Percent of Useful Life: 80-100% (1928-1945)	Probable
	3	Percent of Useful Life: 60-80% (1946-1963)	Occasional
	2	Percent of Useful Life: 40-60% (1964-1981)	Remote
	1	Percent of Useful Life: <40% (Post 1981)	Improbable

Table 19. Consequence of Failure – Fire Hydrants

Description		Process Impact
Weighting Factor		100%
Performance Rating	5	Mission Critical - Unable to accomplish mission
	4	Process shutdown
	3	Loss of redundancy
	2	Potential process upset
	1	No impact on process

3.4 Water Tower

The City of Mount Clemens owns a one million gallon elevated water tank, located at 185 Madison Avenue. The Tower stands approximately 135 feet tall and its tank, located within the top 35 feet, has a 90 foot diameter. Constructed in 1957, the Water Tower was designed to provide pressure on the system and supplement the Plant's pumping for nighttime activity. In the event of a power failure, the water tower's tank is sized to hold about a day's worth of water for the City. The structure is annually inspected for corrosion and other structural deficiencies.

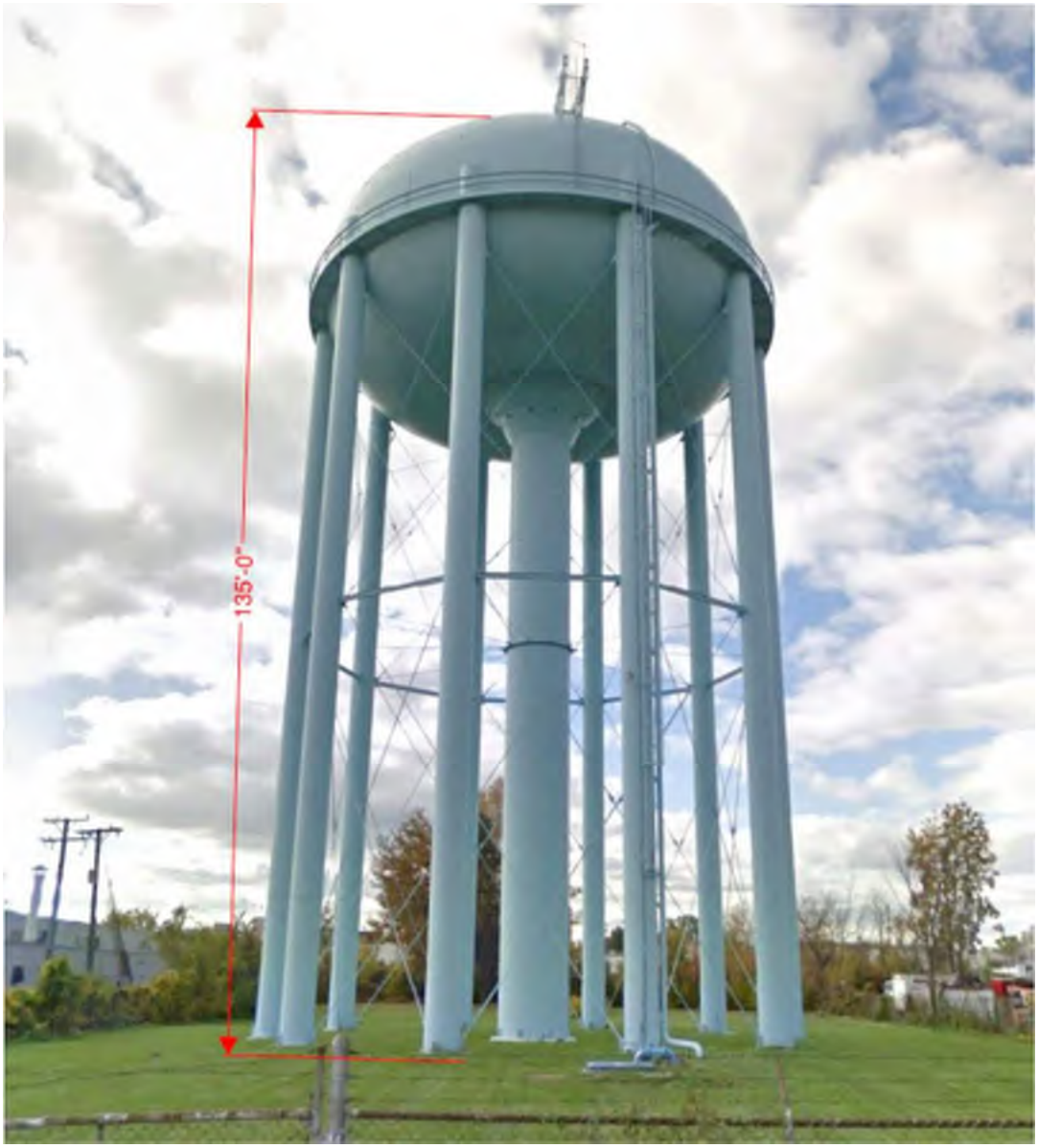


Figure 4. Water Tower, 185 Madison Avenue

3.5 Water Treatment Plant

3.5.1 Assets and Plant Operation

The Water Treatment Plant is located at 36570 Jefferson Avenue, Harrison Township, on the banks of Lake St. Clair. The Filtration Plant draws raw water from Lake St. Clair via a 30 inch, gravity influent pipe. Raw water enters the Plant on the east side of the Office and Pump Building, and is then lifted by three raw water pumps. The raw water pumps lift the raw water to the rapid mix area where liquid

aluminum sulfate (Alum) is added. The Alum allows raw water particles to coagulate. Water is then distributed between two basins in which the coagulated particles settle out. Settled water that endures the flocculation process is transferred to two Ozone Contact Tanks. The 2002 Ozone Disinfection System, which is used as a redundant system to Chlorine Treatment, is a liquid oxygen system (LOX) that is currently utilized in the summer months. This 2002, economic addition, is deteriorating immensely and is considered to be in poor condition. Water then passes through 8 Filter Basins, constructed in 1929 and 1959, consisting of a sand media. As water passes through the filters, it is meeting the regulatory requirements for drinking water and is stored in a 4 million gallon underground clear well prior to final distribution into the system via high service pumps.

In total, over 140 individual assets were analyzed for the Water Treatment Plant. The complete list of assets analyzed can be found in Appendix D. These assets have been sorted by the following, major assets.

- 1929 Coagulation Basin
- 1929 Filter Building
- 1959 Chemical Building
- 1959 Clarifier Building
- 1959 Filter Building
- 1959 High Service Pump Station
- 1959 Wash Water Pump Station
- Chlorine Storage Structure
- 2007 Equalization Basin
- Garage
- Laboratory
- Lake Intake Chamber
- Lake Pump Station Building
- 1929 Office and Pump Building
- 2002 Ozone Generator Building
- 2002 Ozone Tanks
- Sludge Drying Beds
- 1929 Underground Filter Water Reservoir

3.5.2 Remaining Service Life, Rehabilitation/Replacement Costs and Critical Assets

The service life of many assets within the Water Treatment Plant are nearing the end of their design life based on their apparent age and condition. Maintenance may no longer prolong the service life of these assets. The Utility Supervisor has assembled a list of critical assets based on current non-functionality or limited functionality. The repair and replacement costs of these assets have been obtained from contractors or part manufacturers. All assets that are currently not functioning or nearing the end of their useful life are considered critical. Critical Water Treatment Plant Assets are highlighted gray in Appendix D. All critical assets for the Water Treatment Plant have been incorporated into the Five Year Capital Improvement Plan, presented in Table 1, supported by the City's user charge.

4.0 LEVEL OF SERVICE

A baseline inventory of the drinking water assets has been established, and the second question posed by the AMP is; "What is my required sustained level of service?". The definition of Level of Service varies between the community expectations, customer expectations and regulatory requirements. Thought was given to all three opinions when determining a goal for desired level of service.

Service levels are a utility's stated commitment to deliver service to a customer at a specific level of quality and reliability, while maintaining satisfactory treatment quality and regulatory compliance. The long-term effectiveness of the City's asset management plan could be assessed by comparing the City's historical performance to these service goals. Level of Service to the City of Mount Clemens is defined by several key indicators and performance measurements, including the following:

- Ratio of water sold to water produced
- Annual water main breaks
- Primary and secondary drinking water violations

The level of service, ratio of water sold to water produced, is defined as the volume of metered and billed water usage to the volume of water pumped into the distribution system at the Water Treatment Plant. The ratio of water sold to water produced can be used to gauge the overall condition of the distribution system. On average, the City has experienced approximately 20% water loss over the past 3 years.

The level of service, annual water main breaks, is defined as breaks occurring on the water distribution pipes per year. An excessive number of main breaks in a given year can be an indicator of the overall, declining, integrity of the distribution system. The City's goal for water main breaks is to be less than 35 breaks, annually. Figure 5 displays the City's annual water main breaks over the last several years.

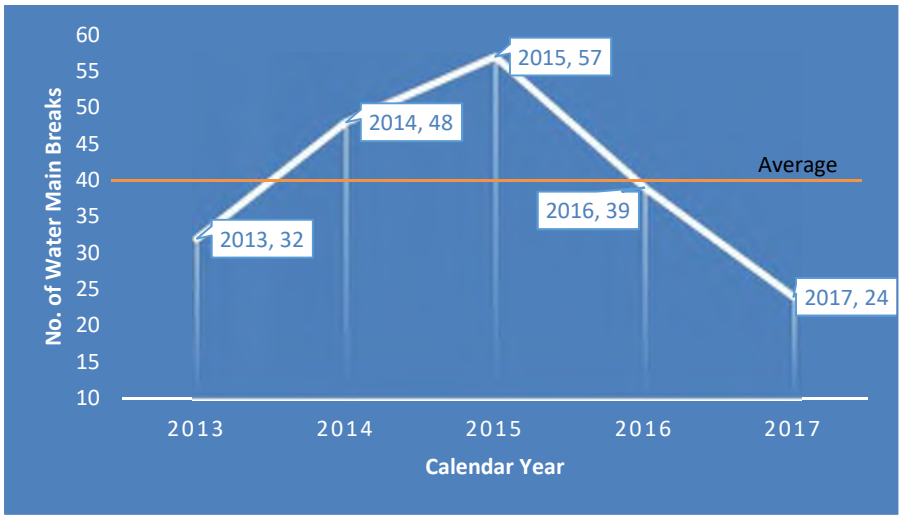


Figure 5. Historical, Annual Water Main Breaks

National Primary Drinking Water Regulations are limits set for substances that to pose a threat to health when present in drinking water at certain levels. Secondary Drinking Water Regulations are non-enforceable federal guidelines regarding taste, odor, color and certain other non-aesthetic effects of drinking water. These contaminants normally do not have any adverse health effects. The City is currently meeting both criteria and has had a longstanding history of receiving the award for 'Best Tasting Water in the State' voted by the Michigan Section of the American Water Works Association.

5.0 ASSETS CRITICAL TO SUSTAIN PERFORMANCE

The third question considered by the AMP is, “Which assets are critical to sustained performance?”. An understanding of how assets fail, the likelihood of failure and the consequence of failure must be documented. Documentation for evaluating these failures has been previously noted. The Business Risk Exposure or criticality ultimately being evaluated centers on the failure of an asset and the impact to the entire system. Failure is defined as the inability of any asset to perform at its expected level of service.

When analyzing the assets owned by the City, it was determined that all assets related to the water distribution infrastructure are equally critical in providing the desired level of service. Assets that have been identified as needing a capital improvement were selected based on the formal Business Risk Exposure framework, as identified within this report, as well as an informal approach, based on city personnel’s judgement and experience. It is believed that a formal and informal critical selection process is needed for budgeting cost effective solutions that ensure long-term funding strategies while meeting the defined level of service. These solutions are presented in the next section, 6.0 Capital Improvement Plan.

6.0 CAPITAL IMPROVEMENT PLAN

A Capital Improvement Plan (CIP) has been created to identify capital projects, providing a schedule and financing options, and arranging the capital needs to match the anticipated budget of the enterprise fund Scheduled projects to occur within 20 years are shown in Table 1. Displayed within Table 2 is a comparison of the five year projected project cost and the budgeted capital improvement money. The twenty year CIP will be updated annually with the City’s budget for a better representation of the system’s needs. The inclusion of the needs for capital improvement will better help the City budget and plan for foreseeable projects.

Table 1. Twenty Year Capital Improvement Plan

Fiscal Year	Projects	Project Cost	Total Project Costs
2018-19	Replace Chart Recorder with Digital Readout	$ 5,000	$302,700
	Replace Cells in Madison Water Tower	$ 5,000	
	Replace Raw Water Flow Meter	$ 7,700	
	Replace Valve Actuator for High Service Pump No. 2	$ 6,000	
	Install Level Indicator for 1929 Basin	$ 3,000	
	Repair Lake Station Pump No. 1	$ 30,000 [1]	
	Repair Streaming Monitor in Laboratory	$ 3,000	
	Replace/Rebuild Raw Water Pumps (3)	$ 90,000 [1]	
	Replace Troughs for 1929 Filters	$ 54,000	
	Replace Valve in Sludge Drying Bed No. 2	$ 16,000 [1]	
	Replace Plant Main Water Meter	$ 60,000 [1]	
	Replace Plant Main Water Line	$ 15,000	
	Replace Two CL2 Indicators for Flash Mixers	$ 8,000	
2019-20	Replace Equalization Decant Valves and Actuators	$ 20,000 [1]	$414,250
	Investigate Derailing of Equalization Tank No. 1 Decant	$ 7,500 [1]	
	Purchase and Install Flygt Dewatering Pump for Equalization Basin	$ 28,000	
	Replace Media for all 8 Filters	$ 40,000 [1]	
	Repair Air Manifold Assembly under Filters	$ 8,750	
	Replace Venturi Flow Meter in 1959 High Service PS	$ 60,000 [1]	
	Install WTP Generator	$ 250,000	
2020-21	Replace Clearwell to High Service PS Valve	$ 16,000 [1]	$853,550
	Replace Valve in Sludge Drying Bed No. 2	$ 16,000 [1]	
	Replace Filter No. 3 Washwater Valve	$ 16,000 [1]	
	Replace Drain Valve for Filter No. 6	$ 16,000 [1]	
	Upgrade Compressed Air System for all Filters	$ 10,000 [1]	
	Replace Water Supply Line for Agitators	$ 15,000 [1]	
	Rebuild Filter No. 8 Agitators	$ 10,000 [1]	
	Rebuild Washwater Pump for Office and Pump Bldg	$ 30,000 [1]	
	Replace Sampling Station Sink	$ 10,000	
	Replace Control Panel and Flow Meter for Washwater PS	$ 85,000 [1]	
	Replacement Asphalt Pavement for Entire Facility	$ 270,000 [1]	
	Replace Cabinet and Guts for Switchgear	$ 162,000	
	Replace Electrical in Chemical Room	$ 5,000	
	Replace Electrical in 59 Basin	$ 10,000	
	Replace Flocculator, B1, in 59 Basin	$ 31,050	
	Replace Critical Fire Hydrants	$ 60,000 [1]	
	Replace Filter Gallery Dehumidifier	$ 9,000 [1]	
	Replace all Gas Furnaces in WTP (6)	$ 42,000 [1]	
	Replace Windows in Office and Pump Bldg (11)	$ 10,000 [1]	
	Replace Riding Mower	$ 7,500 [1]	
	Purchase Confined Space Equipment	$ 21,000	
	Replace Main Air Line in Pipe Gallery	$ 2,000	
2021-22	Replace Critical Gate Valves	$ 316,500 [1]	$996,500
	Repalce Water Main on W Breitmeyer from Breitmeyer to Robertson	$ 275,000 [1]	
	Loop Ellwood and Roseview Watermain	$ 120,000 [1]	
	Replace Water Main on Alter from N Rose to Dead End	$ 285,000 [1]	
2022-23	Replace Ozonator (1 of 2)	$ 1,000,000	$1,107,400
	Repair N2 Boost Compressor System for Ozone Tanks	$ 50,000 [1]	
	Repair O3 Residual Indicators for Ozone Tanks	$ 7,400	
	Replace Ozone Analyzers	$ 50,000 [1]	

2024-25	Replace Ozonator (1 of 2)	$ 1,000,000 [1]	$1,060,000
	Replace Ozone Building Gas Detector	$ 15,000 [1]	
	Equalization Basin 1 Structural Study	$ 5,000 [1]	
	Transmission Line Inspection	$ 40,000 [1]	
2024-25	Replace Water Main on Riverview from Michigan to Michigan	$ 285,000 [1]	$929,400
	Madison Water Tower Structure & Paint Inspection	$ 10,000 [1]	
	Replace Ozone Deck Gas Detector	$ 15,000 [1]	
	Equalization Basin 2 Structural Study	$ 5,000 [1]	
	Install SCADA System	$ 55,000 [1]	
	Replace Water Main on Balmoral from Esplanade to SCL	$ 330,000 [1]	
	Bolt Replacement in Lower Pump Room	$ 16,000 [1]	
	Valve Operational Audit	$ 10,000 [1]	
	Sludge Disposal Clean Up	$ 30,000 [1]	
	Clearwell Structural Inspection & Documentation	$ 40,000 [1]	
	Effluent Corrosion Control	$ 10,000 [1]	
	Replace Plant Braces & Supports	$ 16,000 [1]	
	Replace O3 Residual Indicators	$ 7,400 [1]	
	Paint 1929 Section Ceilings	$ 5,000 [1]	
	Replace Mezzanine & Lab Floors	$ 5,000 [1]	
	Paint 1959 Section Walls	$ 5,000 [1]	
	Madison Water Tower Elevation SCADA Updates	$ 5,000 [1]	
	Transmission Line Repairs	$ 80,000 [1]	
2025-26	Paint & Repair Madison Water Tower	$ 1,000,000 [1]	$1,206,000
	Replace Critical Fire Hydrants	$ 80,000 [1]	
	Replace Critical Valves	$ 80,000 [1]	
	Sludge Disposal Clean Up	$ 30,000 [1]	
	Bolt Replacement in Lower Pump Room	$ 16,000 [1]	
2026-27	Replace Critical Fire Hydrants	$ 80,000.0 [1]	$1,206,000
	Replace Critical Valves	$ 80,000 [1]	
	Sludge Disposal Clean Up	$ 30,000 [1]	
	Bolt Replacement in Lower Pump Room	$ 16,000 [1]	
	Replace 4" Water Main in Distribution System	$ 1,000,000 [1]	
2027-28	Replace Critical Fire Hydrants	$ 80,000.0 [1]	$1,016,000
	Replace Critical Valves	$ 80,000 [1]	
	Bolt Replacement in Lower Pump Room	$ 16,000 [1]	
	Replace 8" Water Main in Distribution System	$ 500,000 [1]	
	Sludge Disposal Clean Up	$ 30,000 [1]	
	Build Brick Wall on Back of 59 Basin	$ 100,000	
	Update Filter Backwash System to SCADA	$ 170,000	
	Transmission Line Repairs	$ 40,000 [1]	
2028-29	Madison Water Tower Structure & Paint Inspection	$ 10,000 [1]	$1,015,000
	Replace 8" Water Main in Distribution System	$ 500,000 [1]	
	Sludge Disposal Clean Up	$ 30,000 [1]	
	Replace Water Main on Chippewa from Hampton to Balmoral	$ 475,000 [1]	
2029-30	Replace 8" Water Main in Distribution System	$ 600,000 [1]	$715,000
	Madison Water Tower Elevation SCADA Updates	$ 5,000 [1]	
	Sludge Disposal Clean Up	$ 30,000 [1]	
	Repair Lake Station Pump No. 1	$ 30,000 [1]	
	Replace High Service Pump No. 1 Pump & Motor	$ 50,000	

2030-31	Replace 8" Water Main in Distribution System	$ 600,000 [1]	$762,000
	Sludge Disposal Clean Up	$ 30,000 [1]	
	Replace Drain Valve for Filter No. 6	$ 16,000 [1]	
	Replace High Service Pump No. 2 Pump & Motor	$ 50,000	
	Install Security System with Cameras & Alarms	$ 50,000	
	Replace Filter No. 3 Washwater Valve	$ 16,000 [1]	
2031-32	Madison Water Tower Structure & Paint Inspection	$ 20,000 [1]	$1,055,000
	Valve Operational Audit	$ 10,000 [1]	
	Replace Water Main on Hampton from Mulberry to Hampton	$ 350,000 [1]	
	Replace High Service Pump No. 3 Pump & Motor on Variable Speed Drive	$ 75,000	
	Build New Meter Pit at Selfridge with Bypass	$ 600,000 [1]	
2032-33	Replace Critical Fire Hydrants	$ 80,000 [1]	$810,000
	Replace Critical Valves	$ 80,000 [1]	
	Replace Water Main on Crest from Mulberry to Balmoral	$ 500,000 [1]	
	Replace High Service Pump No. 4 Pump & Motor on Variable Speed Drive	$ 75,000	
	Replace Washwater Pump	$ 50,000	
	Remove High Service Pumps No. 5 & 6	$ 25,000	
2033-34	Replace Critical Fire Hydrants	$ 80,000 [1]	$1,010,000
	Replace Critical Valves	$ 80,000 [1]	
	Replace Water Main on Riverside from 2nd to Avon	$ 850,000 [1]	
2034-35	Madison Water Tower Structure & Paint Inspection	$ 10,000 [1]	$1,134,000
	Replace Critical Fire Hydrants	$ 80,000 [1]	
	Replace Critical Valves	$ 80,000 [1]	
	Sludge Disposal Clean Up	$ 30,000 [1]	
	Replace Ozone Deck Gas Detector	$ 15,000 [1]	
	Replace Troughs for 1929 Filters	$ 54,000 [1]	
	Replace Low Lift No. 1 Pump & Motor	$ 50,000 [1]	
	Replace All Chemical Feed Pumps	$ 50,000 [1]	
	Install New Cathodic Protection System for Madison Tower	$ 200,000 [1]	
	Rebuild 29 Filters With Complete Change Out of Media	$ 550,000 [1]	
	Effluent Corrosion Control	$ 10,000 [1]	
	Madison Water Tower Elevation SCADA Updates	$ 5,000 [1]	
2035-36	Paint 1929 Section Ceilings	$ 5,000 [1]	$1,091,000
	Sludge Disposal Clean Up	$ 30,000 [1]	
	Bolt Replacement in Lower Pump Room	$ 16,000 [1]	
	Replace Low Lift No. 2 Pump & Motor	$ 50,000	
	Replace Doors & Windows at Treatment Plant	$ 75,000	
	Tuck & Point Bricks on Main Building	$ 350,000	
	Rebuild 59 Filters With Complete Change Out of Media	$ 550,000	
	Replace Ozone Deck Gas Detector	$ 15,000 [1]	
2036-37	Replace Riding Mower	$ 7,500 [1]	$877,500
	Transmission Line Repairs	$ 80,000 [1]	
	Replace Venturi Flow Meter in 1959 High Service PS	$ 60,000 [1]	
	Paint all Hydrants with Protective Coatings	$ 30,000	
	Replace Low Lift No. 3 Pump & Motor	$ 50,000	
	Inspect & Line Water Intake Pipe	$ 300,000	
	Replace All Chemical Storage Tanks & Piping	$ 350,000	
2037-38	Madison Water Tower Structure & Paint Inspection	$ 10,000 [1]	$1,039,000
	Clearwell Structural Inspection & Documentation	$ 40,000 [1]	
	Replacement Asphalt Pavement for Entire Facility	$ 270,000 [1]	
	Replace/Rebuild Raw Water Pumps (3)	$ 90,000 [1]	
	Replace Level Indicator for 1929 Basin	$ 3,000	
	Paint All Plant Pipibng With Rust Proof Coating	$ 100,000	
	Replace 59 Basin Transfer Pumps & Drives	$ 75,000	
	Line (2) 24" Transmission Mains From Plant to City	$ 400,000	
	Replace Filter Gallery Dehumidifier	$ 9,000 [1]	
	Replace all Gas Furnaces in WTP (6)	$ 42,000 [1]	
20 Year Total			**$18,600,300**

Notes: [1]Indicates estimated cost. Actual quote not obtained.

Table 2. Five Year Capital Improvement Costs vs. Anticipated Budget

Fiscal Year	Anticipated Capital Budget[1]	Planned Project Costs	Difference
2018-19	$ 313,604	$ 302,700	$ 10,904
2019-20	$ 412,242	$ 414,250	$ (2,008)
2020-21	$ 877,456	$ 853,550	$ 23,906
2021-22	$ 1,003,274	$ 996,500	$ 6,774
2022-23	$ 1,139,576	$ 1,107,400	$ 32,176
Total	**$ 3,746,152**	**$ 3,674,400**	**$ 71,752**

Notes: [1]Anticipated Capital Budget is tabulated from the existing rate structure, adopted June 5, 2017.

7.0 CONCLUSION

After analyzing the first four core questions set forth by the Michigan Department of Environmental Quality Guidance for developing an AMP; the fifth core question, “What is the best long-term funding strategy?” is considered.

In order to sustainably manage the drinking water infrastructure, the City must have the financial resources and capacity to operate, maintain, repair and replace assets as needed. The contents of this report and the user charge rate study, Appendix E, shall be analyzed on an annual basis to ensure the needs of the system are being met as well as the desired level of service is being provided. The City of Mount Clemens has a complex set of assets that provide essential water services to approximately 5,950 customers in eastern Macomb County. With constant analyzing and updating of this asset management plan the City will ensure the sustainable long-term operation, maintenance, replacement and expansion of its assets.

Appendix I

Preliminary Construction Cost Estimates

ANDERSON, ECKSTEIN & WESTRICK, INC.
CIVIL ENGINEERS - SURVEYORS - ARCHITECTS
Shelby Township - Roseville - Livonia
586.726.1234 | www.aewinc.com

PROJECT NAME: Jones St. & Esplanade St.
Water Main Replacement
Lead Service Replacements

OWNER: City of Mount Clemens

PREPARED BY: Jacob Fenech

PRELIMINARY ENGINEER'S ESTIMATE

DATE: 4/6/2026

AEW PROJECT NO.: 0220-0243
DWSRF Project Plan

CHECKED BY: Ashley Carpenter
DATE: 4/8/2026

WORK ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
Jones Street Water Main Replacement				
1. Mobilization, Max	1	LSUM	$90,100.00	$90,100.00
2. HMA Surface, Rem	3,450	Syd	$20.00	$69,000.00
3. Pavt, Rem	3,100	Syd	$20.00	$62,000.00
4. Curb & Gutter, Rem	2,000	Ft	$25.00	$50,000.00
5. Water Main, Rem	1,600	Ft	$60.00	$96,000.00
6. Hydrant, Rem	4	Ea	$1,000.00	$4,000.00
7. Gate Valve, 6 inch, Rem	5	Ea	$1,250.00	$6,250.00
8. Gate Well, Rem	4	Ea	$1,000.00	$4,000.00
9. Sanitary Manhole Cover, Adj, Case 1	8	Ea	$800.00	$6,400.00
10. Dr Structure Cover, Adj, Case 1	11	Ea	$800.00	$8,800.00
11. Water Main, DI, 8 inch, Tr Det G	1,600	Ft	$220.00	$352,000.00
12. Water Main Connection, 8 inch	3	Ea	$10,000.00	$30,000.00
13. Gate Valve, 8 inch	5	Ea	$4,000.00	$20,000.00
14. Gate Well, 60 inch dia	5	Ea	$4,000.00	$20,000.00
15. Gate Well, Cover	5	Ea	$800.00	$4,000.00
16. Water Serv	5	Ea	$3,000.00	$15,000.00
17. Water Serv, Long	5	Ea	$5,000.00	$25,000.00
18. Water Serv, Special	30	Ea	$10,000.00	$300,000.00
19. Fire Hydrant Assembly	4	Ea	$7,500.00	$30,000.00
20. Aggregate Base, 8 inch	3,000	Syd	$30.00	$90,000.00
21. HMA, 5EML	500	Ton	$150.00	$75,000.00
22. HMA, 4EML	500	Ton	$150.00	$75,000.00
23. Driveway, Nonreinf Conc, 6 inch	1,300	Syd	$80.00	$104,000.00
24. Conc Pavt with Intergral Curb, Nonreinf, 8 inch	1,800	Syd	$80.00	$144,000.00
25. Curb & Gutter, Conc, Match Existing	2,000	Ft	$65.00	$130,000.00
26. Maintenance Aggregate, 21AA	10	Ton	$35.00	$350.00
27. Site Restoration and Cleanup	1	LS	$25,000.00	$25,000.00
28. Erosion Control, Inlet Filter	22	Ea	$200.00	$4,400.00
29. Erosion Control, Silt Fence	3,200	Ft	$10.00	$32,000.00
30. Traffic Control & Maintenance	1	LS	$20,000.00	$20,000.00
			Jones Street Water Main Subtotal	**$1,892,000.00**

ANDERSON, ECKSTEIN & WESTRICK, INC.
CIVIL ENGINEERS - SURVEYORS - ARCHITECTS
Shelby Township - Roseville - Livonia
586.726.1234 | www.aewinc.com

PROJECT NAME: Jones St. & Esplanade St. Water Main Replacement Lead Service Replacements

OWNER: City of Mount Clemens

PREPARED BY: Jacob Fenech

PRELIMINARY ENGINEER'S ESTIMATE

DATE: 4/6/2026

AEW PROJECT NO.: 0220-0243

CHECKED BY: Ashley Carpenter

DWSRF Project Plan

DATE: 4/8/2026

WORK ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
Esplanade Street Dual Water Main Replacement				
1. Mobilization, Max	1	LS	$59,900.00	$59,900.00
2. HMA Surface, Rem	3,550	Syd	$20.00	$71,000.00
3. Pavt, Rem	250	Syd	$20.00	$5,000.00
4. Curb & Gutter, Rem	1,400	Ft	$25.00	$35,000.00
5. Water Main, Rem	1,550	Ft	$60.00	$93,000.00
6. Hydrant, Rem	1	Ea	$1,000.00	$1,000.00
7. Gate Valve, 6 inch, Rem	5	Ea	$1,250.00	$6,250.00
8. Gate Well, Rem	5	Ea	$1,000.00	$5,000.00
9. Sanitary Manhole Cover, Adj, Case 1	3	Ea	$800.00	$2,400.00
10. Dr Structure Adj. Case 1	21	Ea	$800.00	$16,800.00
11. Water Main, DI, 8 inch, Tr Det G	1,550	Ft	$220.00	$341,000.00
12. Water Main Connection 8 inch	4	Ea	$10,000.00	$40,000.00
13. Gate Valve, 8 inch	4	Ea	$4,000.00	$16,000.00
14. Gate Well, 60 inch dia	4	Ea	$4,000.00	$16,000.00
15. Gate Well, Cover	4	Ea	$800.00	$3,200.00
16. Water Serv	5	Ea	$3,000.00	$15,000.00
17. Water Serv, Long	5	Ea	$5,000.00	$25,000.00
18. Water Serv, Special	16	Ea	$10,000.00	$160,000.00
19. Fire Hydrant Assembly	2	Ea	$7,500.00	$15,000.00
20. Aggregate Base, 8 inch	1,800	Syd	$30.00	$54,000.00
21. HMA, 5EML	400	Ton	$150.00	$60,000.00
22. HMA, 4EML	400	Ton	$150.00	$60,000.00
23. Driveway, Nonreinf Conc, 6 inch	250	Syd	$80.00	$20,000.00
24. Curb & Gutter, Conc, Match Existing	1,400	Ft	$65.00	$91,000.00
25. Maintenance Aggregate, 21AA	20	Ton	$35.00	$700.00
26. Site Restoration and Cleanup	1	LS	$15,000.00	$15,000.00
27. Erosion Control, Inlet Filter	21	Ea	$200.00	$4,200.00
28. Erosion Control, Silt Fence	1,600	Ft	$10.00	$16,000.00
29. Traffic Control & Maintenance	1	LS	$10,000.00	$10,000.00
			Esplanade Water Main Subtotal	**$1,257,000.00**

	Estimated Construction Subtotal	**$3,149,000.00**
	Contingency (10%)	$315,000.00
	Estimated Construction Total	**$3,464,000.00**
Watermain Project Related Fees		
Project Planning Efforts (Project Plan, Bond Counsel, Legal Fees)		$100,000.00
Design Engineering	4.67%	$170,000.00
Construction Engineering (Inspection, Administration, Material Testing)	15%	$520,000.00
	Project Related Fees Total	**$790,000.00**
	Watermain Grand Total	**$4,260,000.00**

ANDERSON, ECKSTEIN & WESTRICK, INC.
CIVIL ENGINEERS - SURVEYORS - ARCHITECTS
Shelby Township - Roseville - Livonia
586.726.1234 | www.aewinc.com

PROJECT NAME: Jones St. & Esplanade St. Water Main Replacement Lead Service Replacements

OWNER: City of Mount Clemens

PREPARED BY: Jacob Fenech

PRELIMINARY ENGINEER'S ESTIMATE

DATE: 4/6/2026

AEW PROJECT NO.: 0220-0243

CHECKED BY: Ashley Carpenter

DWSRF Project Plan

DATE: 4/8/2026

WORK ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
Lead Service Replacement Project				
1. Mobilization, Max	1	LSUM	$110,000.00	$110,000.00
2. Traffic Control, Minor	1	LSUM	$15,000.00	$15,000.00
3. Traffic Control, Major	1	LSUM	$20,000.00	$20,000.00
4. Sidewalk, Rem	1,080	Syd	$15.00	$16,200.00
5. Pavt, Rem	2,160	Syd	$20.00	$43,200.00
6. Driveway, Rem	360	Syd	$18.00	$6,480.00
7. Curb and Gutter, Rem	2,000	Ft	$25.00	$50,000.00
8. Aggregate Base, 4 inch	1,080	Syd	$20.00	$21,600.00
9. Aggregate Base, 8 inch	2,520	Syd	$30.00	$75,600.00
10. Pavt Repr, Nonreinf Conc, 8 inch	1,020	Syd	$120.00	$122,400.00
11. HMA, 4EML	175	Ton	$150.00	$26,250.00
12. HMA, 5EML	175	Ton	$150.00	$26,250.00
13. Sidewalk, Conc, 4 inch	8,748	Sft	$9.00	$78,732.00
14. Sidewalk, Conc, 6 inch	972	Sft	$10.00	$9,720.00
15. Brick Pavers, Rem, Salv, Replace	100	Sft	$50.00	$5,000.00
16. Driveway, Nonrein Conc, 6 inch	360	Syd	$80.00	$28,800.00
17. Curb and Gutter, Conc, Match Existing	2,000	Sft	$65.00	$130,000.00
18. Water Serv, Curb Stop to Meter	180	Ea	$4,500.00	$810,000.00
19. Water Serv, Short, Main to Curb Stop	90	Ea	$3,000.00	$270,000.00
20. Water Serv, Long, Main to Curb Stop	90	Ea	$4,000.00	$360,000.00
21. Water Serv, Investigate	20	Ea	$800.00	$16,000.00
22. Site Restoration and Cleanup	1	LSUM	$75,000.00	$75,000.00
			Estimated Construction Subtotal	**$2,316,232.00**
			Contingency (10%)	**$232,000.00**
			Estimated Construction Total	**$2,548,232.00**

Project Related Fees			
Project Planning Efforts (Project Plan Updates, Public Hearing)			$5,000.00
Design Engineering (Permits, Maps, Specs, Meetings)		Hourly	$15,000.00
Construction Engineering (Inspection, Construction Admin, Material Testing)		15%	$383,000.00
		Project Fees	**$403,000.00**
		Lead Service Repalcement Grand Total	**$2,960,000.00**
		Total DWSRF Loan Request	**$7,200,000.00**

Appendix J

Present Worth Analysis of Selected Alternatives

PRESENT WORTH ANALYSIS

No.	Item	Water Main Replacement Lead Water Service Replacement	
1	Capital Cost	$	7,200,000.00
2	Salvage Value at 20 years	$	4,320,000.00
3	Present Worth of Salvage	$	2,636,366.40
4	Interest During Construction	$	90,000.00
5	Annual O&M Costs	$	-
6	Present Worth of O&M	$	-
7	Total Present Worth	$	4,653,633.60
8	Equivalent Annual Cost	$	298,516.63

Notes:

(1) From The Preliminary Cost Estimate.

(2) Salvage Value at the end of the 20 year planning period is computed on the basis of straight line depreciation.

(3) Present Worth of Salvage Value = 0.61027 x SalvageValue at the end of 20 years
(P/F, Discount Rate=2.5%, 20 years) = 0.61027

(4) Interest During Construction = 0.5 x P x I x C
P = Construction Period in Years = 1 year
I = Discount Rate = 2.5%
C = Total Capital Cost

(5) Total Present Worth = Total Capital Cost + Present Worth of O&M + Interest During Construction - Present Worth of Salvage

(6) Equivalent Annual Cost = 0.09439 x Total Present Worth
(A/P, Discount Rate = 2.5%, 20 years) = 0.064147

Appendix K

Public Meeting Advertisement and Summary

NOTICE OF PUBLIC MEETING
Drinking Water State Revolving Fund (DWSRF) Loan Program
Water Main and Lead Service Line Replacements

The City of Mount Clemens will hold a public meeting on the proposed Drinking Water State Revolving Fund (DWSRF) Water Main and Lead Service Line Replacement for the purpose of receiving comments from interested persons.

The meeting has been scheduled for Monday, April 20, 2026, at 5:30pm, in the City Commission chambers, located at Mount Clemens City Hall, 1 Crocker Boulevard, Mount Clemens, Michigan 48043.

The purpose of this project is to improve the reliability, safety, and long-tern performance of Mount Clemens drinking water system. The project will replace aging watermain infrastructure and remove lead service lines to reduce risks of breaks, maintain safe water quality, and support compliance with state and federal drinking water regulations.

Project construction will involve the replacement of two existing watermains and the removal and replacement of identified lead service lines serving residential properties. Construction activities will include excavation within the roadway and adjacent areas, installation of new watermains and service lines, system connections, testing, and surface restoration.

Temporary impacts may include construction-related noise, dust, traffic disruptions, lane closures, and short-term water service interruptions for affected residents and businesses. These impacts are expected to be localized and temporary, with access maintained to properties and full restoration of pavement and disturbed areas upon completion of construction.

The total estimated project cost is approximately $7.2 million, which is proposed to be financed through the Drinking Water State Revolving Fund (DWSRF) loan program.

Copies of the plan detailing the proposed project will be available for inspection on the City's Website at https://mountclemens.gov under the 'Upcoming Events' Section. Please follow the link on the calendar event titled "Notice of Public Project Planning Meeting – Drinking Water State Revolving Fund (DWSRF) Loan Program". The plan will be available beginning on Thursday, April 9, 2026.

Written comments received before the public meeting concludes on Monday, April 20, 2026, will receive a written response in the final project plan. Written comments should be sent to the City's consulting engineer preparing the final project plan. Direct written comments to Anderson, Eckstein and Westrick, ATTN: Jacob Fenech, Graduate Engineer, 51301 Schoenherr Road, Shelby Township, Michigan 48315 or by e-mail at jfenech@aewinc.com.

Appendix L

City Council Resolution to Adopt Project Planning Document