

CITY OF DETROIT

Water and Sewerage Department



Water Main Replacement and Rehabilitation inclusive of Lead (Pb) Service Line Replacements in Neighborhoods at Various Locations throughout Detroit

Project A, WS -741: EVERGREEN-OUTER DRIVE, CRARY/St MARYS, AND CADILLAC COMMUNITY NEIGHBORHOODS OF DETROIT.

Project B, WS -742: GREENWICH, SAN BERNARDO, PEMBROKE, SHERWOOD FOREST, McDOWELL, OAK GROVE DISTRICT 2, HAWTHORNE PARK, AND CONANT GARDENS NEIGHBORHOODS OF DETROIT.

Planning Document

February 16, 2024

Mike Duggan
Mayor

Gary Brown
Director

Michael Einheuser
Chairperson
Board of Water
Commissioners



City of Detroit
Mike Duggan, Mayor

Detroit City Council

Mary Sheffield, President
James Tate, President Pro-Tem
Mary Waters
Coleman A. Young II
Angela Whitfield-Calloway
Scott Benson
Latisha Johnson
Gabriela Santiago-Romero
Fred Durhal III

Table of Contents

1.	EXECUTIVE SUMMARY	1
2.	PROJECT OVERVIEW	3
2.1.	PURPOSE	3
2.2.	INTRODUCTION	4
2.2.1	WS-741: WATER MAIN REPLACEMENT IN THE EVERGREEN-OUTER DRIVE, CRARY/St MARYS, AND CADILLAC COMMUNITY NEIGHBORHOOD OF DETROIT.	
2.2.2	WS-742: WATER MAIN REPLACEMENT IN GREENWICH, SAN BERNARDO, PEMBROKE, SHERWOOD FOREST, McDOWELL, OAK GROVE DISTRICT 2, HAWTHORNE PARK, AND CONANT GARDENS NEIGHBORHOODS OF DETROIT.	5
3.	PROJECT BACKGROUND	6
3.1.	SUMMARY OF PROJECT NEED	6
3.2.1	STUDY AND SERVICE AREA	22
3.2.2	LAND USE IN STUDY AREA	22
3.2.3	ECONOMIC CHARACTERISTICS	23
3.3.	POPULATION PROJECTION	24
3.4.	EXISTING FACILITIES	23
4.	ANALYSIS OF ALTERNATIVES.....	26
4.1.	IDENTIFICATION OF POTENTIAL ALTERNATIVES	26
4.1.1.	“NO ACTION” – Alternative 1	26
4.1.2	OPTIMUM PERFORMANCE OF EXISTING FACILITIES – Alternative 2	27
4.2	ANALYSIS OF PRINCIPAL ALTERNATIVES	27
4.2.1	DESCRIPTION OF PRINCIPAL ALTERNATIVES	28
4.2.3	ENVIRONMENTAL EVALUATION.....	34
4.2.4.	IMPLEMENTABILITY AND PUBLIC PARTICIPATION.....	34
4.2.5.	TECHNICAL AND OTHER CONSIDERATIONS	35
5.	SELECTED ALTERNATIVE	36
5.1	DESCRIPTION.....	36
5.1.1.	COSTS	36
5.1.2.	IMPLEMENTATION SCHEDULE	39
5.1.3.	USER COST	40
5.1.4.	ABILITY TO IMPLEMENT THE SELECTED ALTERNATIVE	41
5.1.5.	DISADVANTAGED COMMUNITY STATUS.....	41
5.1.6.	SURFACE WATER INTAKE PROTECTION PROGRAM	42
6.	EVALUATION OF ENVIRONMENTAL IMPACTS	42
6.1.	GENERAL	42
6.1.1.	BENEFICIAL AND ADVERSE	42
6.1.2	SHORT AND LONGTERM.....	43
6.1.3.	IRREVERSIBLE OR IRRETRIEVABLE	44

6.2.	ANALYSIS OF IMPACTS	43
6.2.1.	DIRECT IMPACTS	43
6.2.2.	INDIRECT IMPACTS	43
6.2.3.	CUMULATIVE IMPACTS	44
7.	MITIGATION	44
7.1.	GENERAL	44
7.2.	MITIGATION OF SHORT-TERM IMPACTS	44
7.3.	MITIGATION OF LONG-TERM IMPACTS	44
5		
6		
8.1.	PUBLIC HEARING	45
8.1.1.	PUBLIC HEARING ADVERTISEMENT AND NOTICE.....	45
8.1.2.	PUBLIC HEARING TRANSCRIPT.....	45
8.1.3.	PUBLIC HEARING COMMENTS RECEIVED AND ANSWERED.....	45
8.1.4.	ADOPTION OF THE PLANNING DOCUMENT	46

TABLES

Table 3-2.	LAND USE IN DETROIT	23
Table 3-3.	CITY-WIDE DISTRIBUTION SYSTEM PIPING SUMMARY	25
Table 3-4.	SUMMARY OF DETROIT WATER MAIN DISTRIBUTION PIPES.....	25
Table 4-1-1	COST COMPARISON OF WS-741: WATER MAIN REPLACEMENT and REHABILITATION in Select Locations In Detroit	32
Table 4-1-2	COST COMPARISON OF WS-742: WATER MAIN REPLACEMENT and REHABILITATION at Select Locations In Detroit	33
Table 5-1-A	WS-741 Cost Summary:	37
Table 5-1-B	WS-742 Cost Summary	37
Table 5-2	PROJECT MILESTONE SCHEDULES	39
Table 5-3-1	USER COST IMPACT FOR Water Main Replacements/Rehabilitation WS-741	39
Table 5-3-2	USER COST IMPACT FOR Water Main Replacements/Rehabilitation WS-742	40

FIGURES

Figure 3-1-A/B	PROJECT LOCATION MAPS WS-741 and WS-742	8 and 16
----------------	---	----------

APPENDICES

- A. ESTIMATED CONSTRUCTION COSTS
- B. DISADVANTAGED COMMUNITY STATUS DETERMINATION WORKSHEET;
SUBMITTAL FORM, BOARD RESOLUTIONS
- C. PUBLIC HEARING NOTICE, MAILING LIST FOR PUBLIC HEARING, PUBLIC HEARING
TRANSCRIPT, VISUAL AIDS
- D. Planning Document CORRESPONDENCE; USACE PERMIT; SHPO
SUBMITTAL; MNFI REVIEW; USFWS REVIEW

1. EXECUTIVE SUMMARY

The City of Detroit is submitting this Planning Document for two projects within the limits of Detroit which include replacement/rehabilitation of the vintage water main inclusive of Lead (Pb) water services replacement within selected locations of the Detroit distribution system in various neighborhoods of Detroit. Vintage cast iron water main of six through twelve inches in diameter will be replaced across multiple streets of Detroit with ductile iron pipe or rehabilitated in place through epoxy bonded fabric lining. The work also includes replacement of all fire hydrants, gate valves, and other appurtenances required of the work. The two-year projects will also include replacement of Lead service lines with new copper services from the water main to the customer meter. The frequent loss of pressure due to breaks in the aged piping network creates a potential public health risk as well as cause major inconvenience to residents and businesses.

This project is not only for Lead service line replacement though it includes Lead service line replacement as part of water main replacement. Detroit Water and Sewerage Department visually confirms Lead service lines with hydro-excavation and replaces them afterward upon visual confirmation. The City of Detroit is feeding from surface water resources and does not require any underground water systems.

The City of Detroit is a retail customer of the Great Lakes Water Authority (GLWA), for which GLWA provides potable water to the City of Detroit and neighboring southeastern Michigan communities throughout Wayne, Oakland, Macomb, St. Clair, Lapeer, Genesee, Washtenaw, and Monroe Counties. The 1,079 square mile water service area, which includes Detroit and 127 suburban communities, makes up approximately 40% of the state's population.

The water distribution system servicing the City of Detroit is comprised of approximately 2,700 miles of various size pipes ranging mainly from 6 to 16 inches. Most of these pipes were installed in the late 19th century and the first half of the 20th century. Due to the age of these pipes and the multi-seasonal stresses upon the network, water main breaks are a frequent occurrence, and they constitute a drain on Detroit Water and Sewerage Department (DWSD) resources necessary to address these breaks—often during inclement weather conditions. Water main breaks can also increase the potential public health risk from cross-connection contamination (bacteriological and/or chemical) resulting from reduced pressure or depressurized water mains during the repair. DWSD has developed a process for the identification of water system improvements needed in neighborhoods across the City of Detroit.

The water mains with the highest risk are prioritized and selected using information from the sixth update (Autumn 2022) of the risk & criticality model. The risk model leverages

assets and other data with the level of service (LOS) objectives to assign a risk value to each water main. The risk model provides a data-driven quantitative framework for water assets to ensure that risk assessments are defensible, consistent, and repeatable. Figure 1 illustrates how different risk criteria are accounted for in an asset's overall risk.

The approach to analyzing the consequences of failure for the water risk model uses a quadruple-bottom-line assessment approach employing four criticality indices:

- **Economic:** This index reflects the potential impact in terms of the direct and indirect capital cost of asset failure. For example, remediation costs can be greatly increased in a heavily traveled area, whereas traffic management costs are high. The scoring ranges for the economic risk model indices are typically proportional to the sum of the direct and indirect cost of repair.
- **Social:** This index reflects the potential impact on the public in the event of asset failure.
- **Operational:** This index reflects the potential impact on system operations in the event of asset failure. This index generally considers both organizational and system impacts in terms of whether there is sufficient redundancy in the system to circumvent the failed asset for an extended period. In addition, the operational criteria consider the urgency and complexity of the remediation of a failure.
- **Environmental:** Remediation costs can be greatly increased in environmentally sensitive areas. This index reflects the potential impact on the environment in the event of asset failure.

The current framework probability of failure comprises the following aspects:

- **Structural Failure:** Typically, structural failure is due to material degradation and the pipe's inability to resist applied loads.
- **Hydraulic Failure:** Hydraulic failure occurs due to a loss of capacity resulting from either a change in demand objectives or a loss of conveyance capacity (e.g., increased roughness or entrapped air blockage).
- **Water Quality Failure:** Water quality is negatively affected by the presence of Lead service connections and by long runs with low water turnover.

This Planning Document identifies the current condition of the existing pipes and presents alternatives for addressing the deteriorated conditions of these pipes. Evaluation of these alternatives was performed based on the Michigan Department of Environment, Great Lakes, and Energy (MI-EGLE) guidelines for preparing a Drinking Water State Revolving Fund (DWSRF) Planning Document. The recommendation presented in this Planning Document consists primarily of replacing the aged water mains with new ones based on the results of hydraulic modeling and water main break

history. Several of the water mains will be upsized where hydraulic capacity does not support a minimum of 20 psi under all flow conditions. In a limited number of streets, rehabilitating the existing main with a structural liner will be performed as opposed to replacement. Full Lead Service Line Replacements (FLSLR) are also included in the project. It is a benefit to public health and safety to replace the Lead service lines. DWSD policy, in accordance with the Michigan Lead and Copper Rule, is that all Lead water services, as encountered, shall be replaced with copper from the proposed water main to the individual customer meters as part of its capital project work. Additionally, DWSD contractors are required to perform an excavation at every service connection to visually verify if the service is Lead or copper.

Figure 1 Water Risk Model Overview

	Category	Criteria / Information Used
Consequence	Economic 30%	<ol style="list-style-type: none"> 1. Pipe Size 2. Traffic Level/Road Class 3. Pipe Material 4. Pressure
	Operational 30%	<ol style="list-style-type: none"> 1. Critical Customer 2. Pipe Size 3. Redundancy
	Social 25%	<ol style="list-style-type: none"> 1. Census Tract Population Density 2. Employment 3. Traffic Level/Road Class 4. Critical Customer
	Environmental 15%	<ol style="list-style-type: none"> 1. Pipe Size 2. Proximity to ESA
Probability	Condition 60%	<ol style="list-style-type: none"> 1. Break Rate Model 2. Breaks per 1000ft 3. Cave-Ins 4. Service Line Density
	Hydraulics 30%	<ol style="list-style-type: none"> 1. Hydrant AFF 2. Headloss Gradient
	Quality 10%	<ol style="list-style-type: none"> 1. Lead Service Line Density 2. Water Age

2. PROJECT OVERVIEW

2.1. PURPOSE

This document has been prepared in accordance with the planning guidelines adopted by MI-EGLE for the Drinking Water State Revolving Fund (DWSRF) low-interest loan program. It is the intent of the DWSD to seek low-interest loan assistance under the DWSRF program for the recommended work.

The purpose of this document is to describe the capital improvement project for water main replacement/rehabilitation, which DWSD is proposing to undertake with DWSRF assistance to provide a reliable water supply to its customers. This Planning Document provides information on the status of the current potable water system, a description of why the project is needed, an evaluation of alternatives, a description of the recommended alternative, and an assessment of environmental impacts. The Planning Document also serves as the basis for public review and comment on the proposed work in accordance with the public participation requirements of the DWSRF program. A reliability study/master plan that substantiates water supply needs and outlines deficiencies that warrant correction is in development by DWSD. DWSD does not have any waterborne disease outbreaks. Water treatment work is conducted by GLWA. Watermain replacement greatly increases the water energy efficiencies as DWSD water mains are old and have multiple breaks due to which water is wasted from DWSD water mains.

2.2.INTRODUCTION

2.2.1 WS-741: WATER MAIN REPLACEMENT IN THE EVERGREEN-OUTER DRIVE, CRARY/St MARYS, AND CADILLAC COMMUNITY NEIGHBORHOODS OF DETROIT.

DWSD has identified several project areas for pipe replacement and rehabilitation in Water Main Replacement for Evergreen-Outer Drive, Crary/St Marys, and Cadillac Community neighborhoods of Detroit that are in urgent need of work. Risk analysis accounts for water main breaks, Fire Service Flows, Lead service lines, etc. as well as the results of hydraulic modeling to pinpoint the mains in need of replacement. DWSD proposes to develop contract number WS-741 with a Project scope that includes replacing and rehabilitating approximately 28,700 linear feet of vintage cast iron water main of pipe size 6 and 8 inches in diameter for an estimated total project cost of \$19,446,414. See table 5-1-A below.

Water main replacement (WS-741) through the DWSRF loan program is expected to increase by no more than 1.59% the cost of water to a typical City of Detroit customer due to the impact of construction costs. However, the impact may be less since it would be influenced by other factors such as the reduction in operating costs (chemicals, energy, etc.), reduced maintenance/repairs, and reduced water loss. Therefore, the actual rate determination would be based on factors that encompass the delivery of comprehensive services by DWSD to its customers. It should be recognized that the debt for distribution water main replacement work within the City of Detroit will be paid by Detroit customers only, not the entire GLWA

service area.

The increase in rate as calculated above is based on repayment of the DWSRF loan over a 20-year period. As a disadvantaged community, the City of Detroit can request a 30-year or 40-year financing period. DWSD will request a 30-year financing period.

2.2.2 WS-742: WATER MAIN REPLACEMENT IN GREENWICH, SAN BERNARDO, PEMBROKE, SHERWOOD FOREST, McDOWELL, OAK GROVE DISTRICT 2, HAWTHORNE PARK, AND CONANT GARDENS NEIGHBORHOODS OF DETROIT.

DWSD has identified several project areas for pipe replacement and rehabilitation, in Greenwich, San Bernardo, Pembroke, Sherwood Forest, McDowell, Oak Grove District 2, Hawthorne Park and Conant Gardens of Detroit neighborhoods that are in urgent need of work. Risk analysis accounts for water main breaks, Fire Service Flows, Lead service lines, etc. as well as the results of hydraulic modeling to pinpoint the mains in need of replacement. DWSD proposes to develop a contract number WS-742 with a Project scope that includes replacing and rehabilitating approximately 30,300 linear feet of vintage cast iron water main of pipe size 6 through 12 inches in diameter for an estimated total project cost of \$19,348,401. See table 5-1-B below.

Water main replacement (WS-742) through the DWSRF loan program is expected to increase by no more than 1.59% the cost of water to a typical City of Detroit customer due to the impact of construction costs. However, the impact may be less since it would be influenced by other factors such as the reduction in operating costs (chemicals, energy, etc.), reduced maintenance/repairs, and reduced water loss. Therefore, the actual rate determination would be based on factors that encompass the delivery of comprehensive services by DWSD to its customers. It should be recognized that the debt for distribution water main replacement work within the City of Detroit will be paid by Detroit customers only, not the entire service area.

The increase in rate as calculated above is based on repayment of the DWSRF loan over a 20-year period. As a disadvantaged community, the City of Detroit can request a 30-year or 40-year financing period. DWSD will select a 30-year financing period.

Under the CIP, planning work to renew and rehabilitate the water infrastructure for WS-741 and WS-42 was conducted and the following approach was typically used: 1) assessing the condition of the infrastructure by direct field assessment/inspection; 2) assessing the performance of the infrastructure, using hydraulic modeling and other analytical tools; 3) comparing condition and performance to the level of service benchmarks/goals; 4) identifying capital improvement requirements and prioritizing

them based on agreed-upon parameters and 5) developing a value-based CIP to identify prioritized needs. Work includes either rehabilitation or replacement of buried water infrastructure.

The City of Detroit has an estimated 80,000+ lead water services active within the municipal water system. Given the potential negative health impacts on water system customers, DWSD has been undertaking efforts to replace these services. Per EPA and MI-EGLE requirements, Lead services are replaced from the water main all the way to the customer meter within their property (residence, commercial space, other). While the Lead services are expected to be within the older portions of Detroit, realistically, they can be in any neighborhood. Across WS-741 and WS-742, approximately 1205 lead services will be replaced which is included in the estimated total project cost of \$38,794,815 (\$\$19,446,414 and \$19,348,401respectively).

3. PROJECT BACKGROUND

3.1. SUMMARY OF PROJECT NEED

Project A, WS-741: WATER MAIN REPLACEMENT IN EVERGREEN-OUTER DRIVE, CRARY/St MARYS, AND CADILLAC COMMUNITY NEIGHBORHOOD OF DETROIT.

Most of the water distribution system serving the City of Detroit was installed in the late 19th century or early 20th century. These water mains are unlined pit cast iron or spun cast iron pipe and have outlived their useful life of fifty years based on the recorded number of water main breaks and field experience with the system. As the pipes start to exceed this life expectancy, problems arise such as frequent breakage, loss of pipe wall thickness, exfiltration of treated water through leaks, cracks, and corroded joints, hydraulic obstructions due to tuberculation on the interior pipe surfaces, increased pumping costs due to reduced hydraulic capacity, and in severe leaking cases, ponding of water on roadways or significant deterioration of the subsurface which can cause sinkholes in the most severe cases.

Reduced or complete loss of pressure during these main breaks and subsequent repair can pose an increased risk to public health from potential chemical or bacteriological contamination by cross-connection. Loss of pressure in a public water supply is to be avoided whenever possible and maintaining minimum system pressure is imposed upon public water systems through the requirements of the Michigan Safe Drinking Water Act (PA 399, as amended).

The project will implement Full Lead Service Line Replacement (FLSLR) for Lead service lines 2 inches in diameter and smaller from the public water main to the meter.

Lead service lines 1.5-inches and 2-inches are replaced with in-kind diameters in copper; 1-inch and less are replaced with 1-inch copper. Service lines that are larger than two inches in diameter are rigid metal pipes of copper or iron per building code.

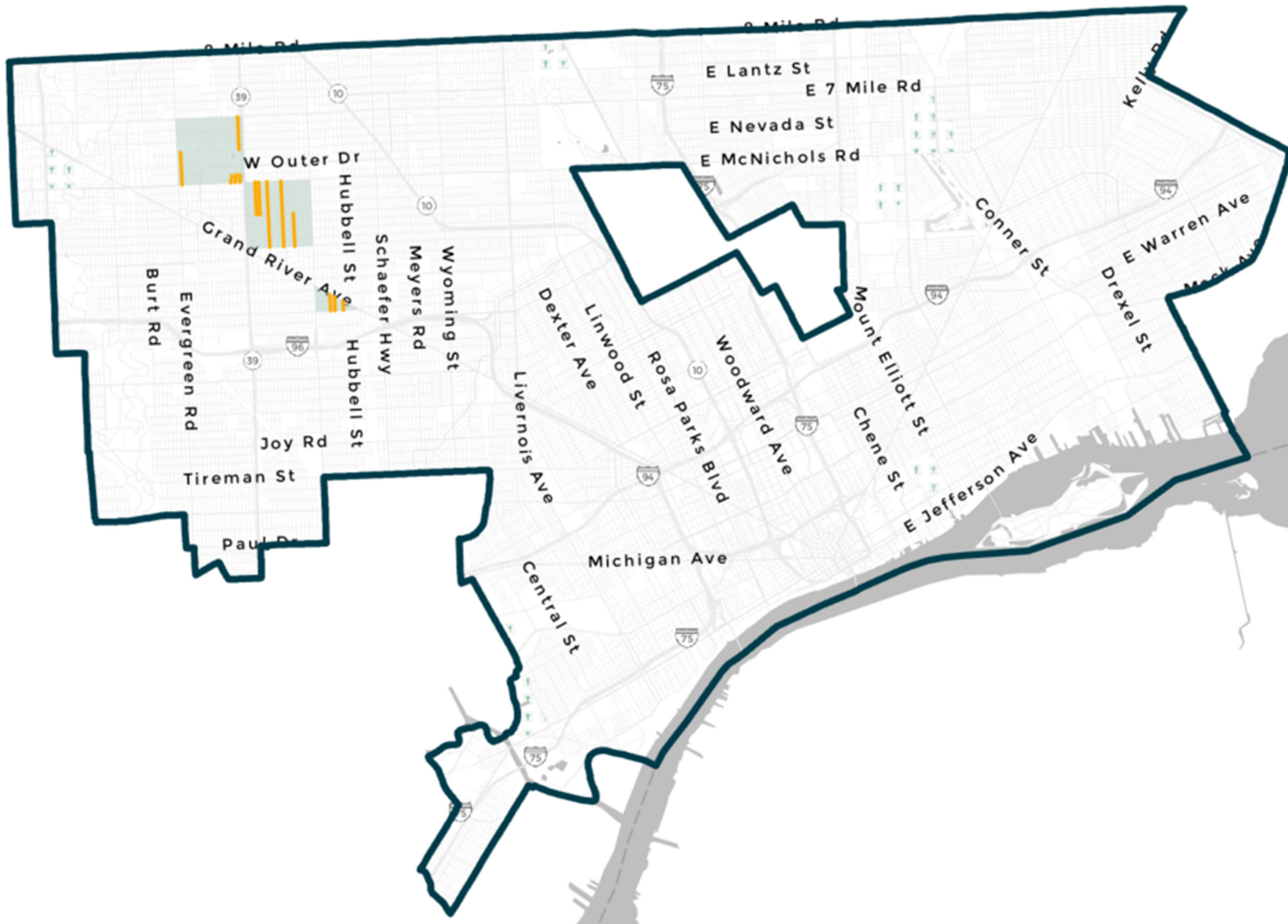
DWSD has established an asset management program with the goal to replace the aged water distribution system, which is approximately 2,700 miles of water main of various sizes (six to sixteen inches) over a 70-year period. This asset management replacement program started more than ten years ago. This goal would enable the distribution system to be replaced on a cycle consistent with the life expectancy of the pipe.

Historically, DWSD has tracked water maintenance activity and carefully logged the frequency of breaks and leaks in the system. DWSD now manages the water replacement program through the risk and criticality model which is updated annually with new condition assessment data. The projects identified are in areas of critical need based upon the risk and criticality analysis. For water main replacements, pipes of eight- and twelve-inch diameters will remain those sizes. Ten-inch pipe (not being a commercially produced pipe size) will be replaced with twelve-inches. Also, the six-inch pipe is no longer a recommended minimum size for the water main supply, thus 6-inch pipe will be replaced with an eight-inch (except in those cases of a fire hydrant supply connection).

Several overview maps are included to identify project locations for WS-741 in **Figures 3-1-A** and **Table 3-1-A**.

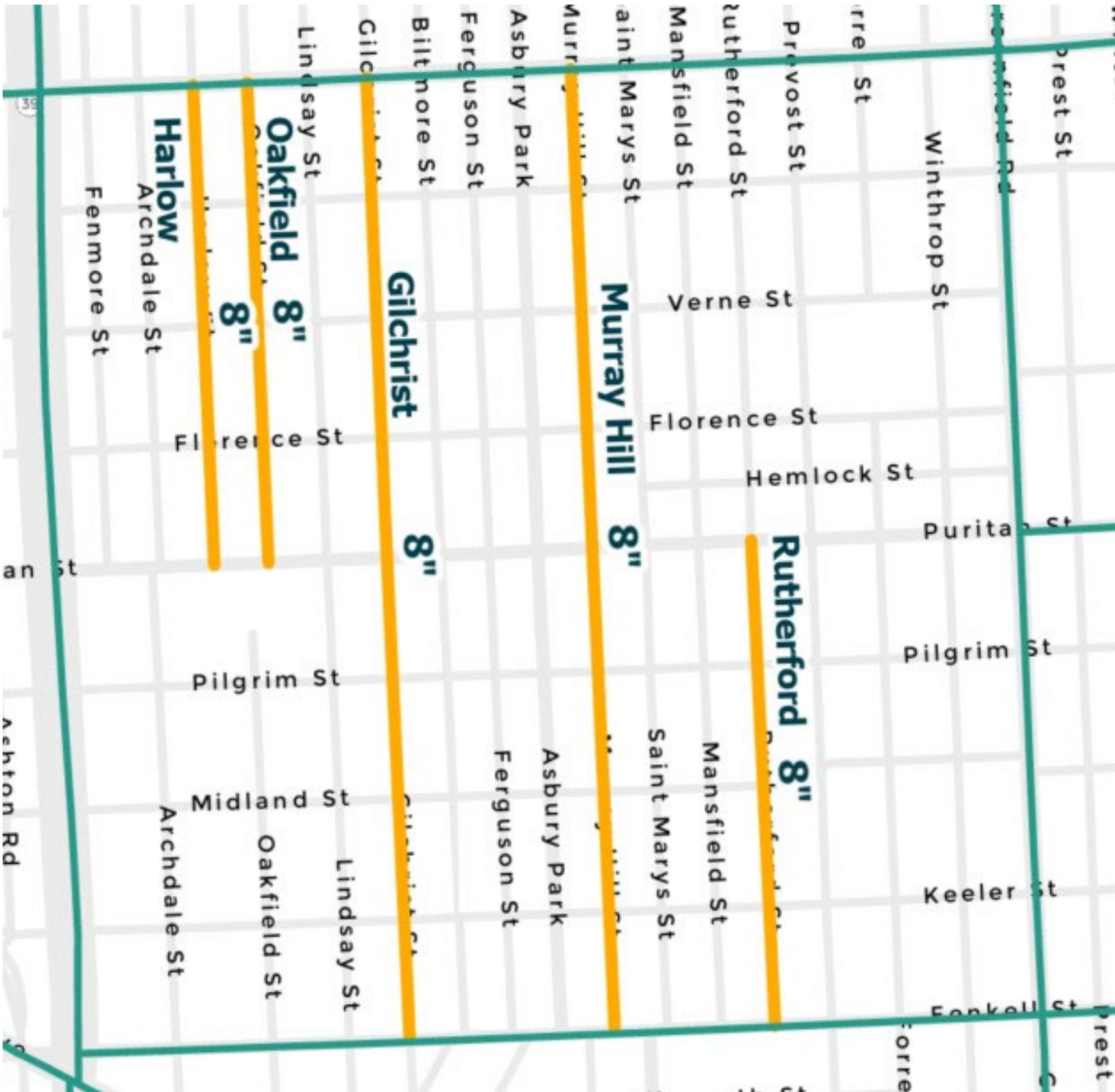
Lead service lines are a public health threat. The replacement of the Lead service lines on private and public property is DWSRF eligible. DWSD policy is that all Lead water services, as encountered, shall be replaced with copper from the water main to the individual customer meters as part of its capital project work. Additionally, DWSD contractors are required to perform an excavation at the curb box of every service connection to visually verify if the service is Lead or copper. The project will replace Lead service lines of two inches in diameter and smaller from the public water main to the meter, defined here as Full Lead Service Line Replacement (FLSLR). Lead service lines of 1.5-inches and 2-inches are replaced with in-kind diameters in copper; 1-inch and less are replaced with 1-inch copper. Service lines that are larger than two inches in diameter are rigid metal pipes of copper or iron per building code.

Figure 3-1-A PROJECT LOCATION MAPS for Project A, WS-741





Cadillac Community



Crary/St. Marys



Evergreen Outer Drive

Table 3-1-A DETAILED LIST OF WATER MAIN REPLACEMENT IN NEIGHBORHOODS OF DETROIT UNDER WS-741

Neighborhood	Description	Length of Existing Pipe (Ft.) per Pipe Diameter (inch)					Section Map	Pipe Material	Intervention Suggested
		4"	6"	8"	10"	12"			
Evergreen Outer Drive	Ashton Ave, McNichols Rd. to Dead-end		628				11Q	CI	DI
Evergreen Outer Drive	Rosemont Ave., McNichols Rd. to Dead-end			684			11Q		DI/Liner
Evergreen Outer Drive	Glastonbury Rd., McNichols Rd. to Dead-end		655				11Q	CI	DI
Evergreen Outer Drive	Ashton Ave., 7 Mile Rd. to Curtis St.		2819				11Q	CI	DI
Evergreen Outer Drive	Plainview Ave. 7 Mile Rd. to Curtis St.		2514				11Q	CI	DI
Crary/St Marys	Harlow St., Puritan St. to McNichols Rd.			2518			12P	CI	DI/Liner
Crary/St Marys	Oakfield St., Puritan St. to McNichols Rd.		2509				12P	CI	DI
Crary/St Marys	Gilchrist St., Fenkell St. to McNichols Rd.		5214				12P	CI	DI
Crary/St Marys	Murray Hill St., Fenkell St. to McNicholas Rd.		5168				12P	CI	DI

Crary/St Marys	Rutherford St., Fenkell St. to Puritan Rd.			3011			12P	CI	DI/Liner
Cadillac Community	Coyle St., Grand River Ave. to Schoolcraft St.		1264				130	CI	DI
Cadillac Community	Robson St., Grand River Ave. to Schoolcraft St.		1027				130	CI	DI
Cadillac Community	Lauder St., Grand River Ave. to Schoolcraft St.		650				130	CI	DI

Project B, WS-742: WATER MAIN REPLACEMENT IN GREENWICH, SAN BERNARDO, PEMBROKE, SHERWOOD FOREST, McDOWELL, OAK GROVE DISTRICT 2, HAWTHORNE PARK, AND CONANT GARDENS NEIGHBORHOODS OF DETROIT.

Most of the water distribution system serving the City of Detroit was installed in the late 19th century or early 20th century. These water mains are unlined pit cast iron or spun cast iron pipe and have outlived their useful life of 50 years based on the recorded number of water main breaks and field experience with the system. As the pipes start to exceed this life expectancy, problems arise such as frequent breakage, loss of pipe wall thickness, exfiltration of treated water through leaks, cracks, and corroded joints, hydraulic obstructions due to tuberculation on the interior pipe surfaces, increased pumping costs due to reduced hydraulic capacity, and in severe leaking cases, ponding of water on roadways.

Reduced or complete loss of pressure during these main breaks and subsequent repair can pose an increased risk to public health from potential chemical or bacteriological contamination by cross-connection. Loss of pressure in a public water supply is to be avoided whenever possible and maintaining minimum system pressure is imposed upon public water systems through the requirements of the Michigan Safe Drinking Water Act (PA 399, as amended).

The project will replace Lead service lines of two inches in diameter and smaller from the public water main to the meter, as part of these projects, Full Lead Service Line Replacement (FLSLR). Lead service lines 1.5-inches and 2-inches are replaced with in-kind diameters in copper; 1-inch and less are replaced with 1-inch copper. Service lines that are larger than two inches in diameter are rigid metal pipes of copper or iron per building code.

DWSD has established an asset management program with the goal to replace the aged water distribution system, which is approximately 2,700 miles of water main of various sizes (six to sixteen inches) over a 70-year period. This asset management replacement program started more than ten years ago. This goal would enable the distribution system to be replaced on a cycle consistent with the life expectancy of the pipe.

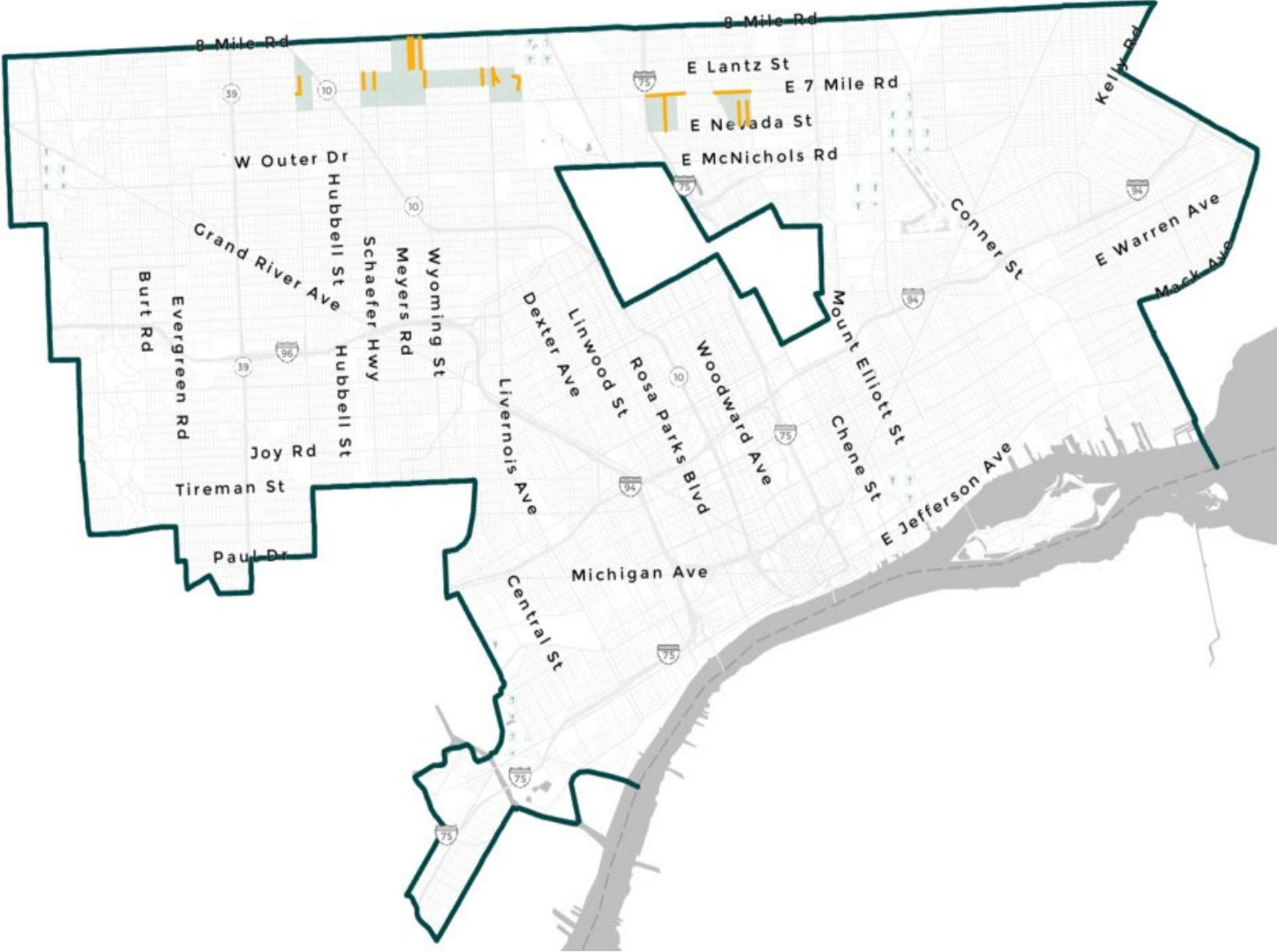
Historically, DWSD has tracked water maintenance activity and carefully logged the frequency of breaks and leaks in the system. DWSD now manages the water replacement program through the risk and criticality model which is updated annually with new condition assessment data. The projects identified are in areas of critical need based upon the risk and criticality analysis. For water main replacements, pipes of eight- and twelve-inch diameters will remain those sizes. Ten-inch pipe (not being a

commercially produced pipe size) will be replaced with twelve-inch pipe. Also, the six-inch pipe is no longer a recommended minimum size for the water main supply, thus 6-inch pipe will be replaced with an eight-inch (except in those cases of a fire hydrant supply connection).

Several overview maps are included to identify project locations for WS-742 in **Figure 3-1-B** and **Table 3-1-B**.

Lead service lines are a public health threat. The replacement of the Lead service lines on private and public property is DWSRF eligible. DWSD policy is that all Lead water services, as encountered, shall be replaced with copper from the water main to the individual customer meters as part of its capital project work. Additionally, DWSD contractors are required to perform an excavation at the curb box of every service connection to visually verify if the service is Lead or copper. The project will replace Lead service lines of two inches in diameter and smaller from the public water main to the meter, defined here as Full Lead Service Line Replacement (FLSLR). Lead service lines of 1.5-inches and 2-inches are replaced with in-kind diameters in copper; 1-inch and less are replaced with 1-inch copper. Service lines that are larger than two inches in diameter are rigid metal pipes of copper or iron per building code.

Figure 3-1-B PROJECT LOCATION MAPS for Project B, WS-742





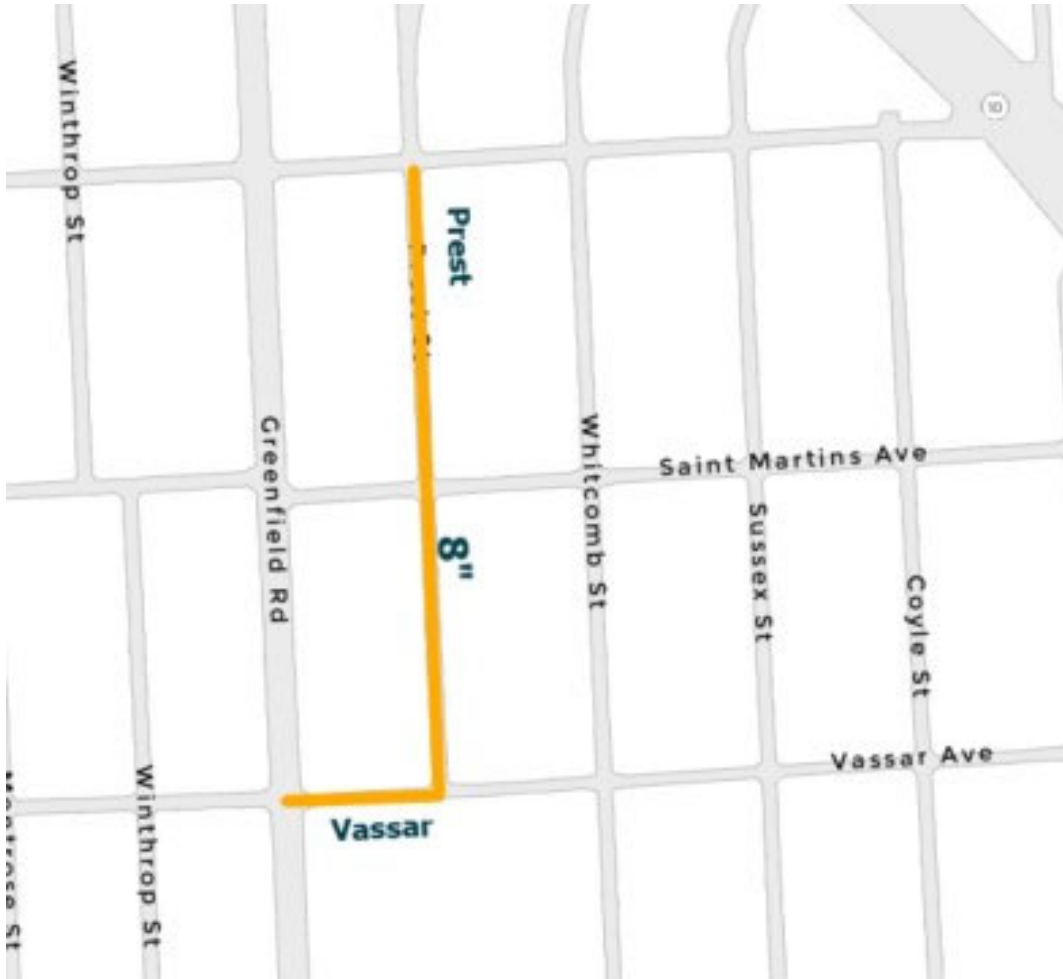
Hawthorne and Conant Gardens



Oak Grove District 2 and Sherwood Forest



Greenwich, Pembroke, and McDowell



San Bernardo

Table 3-1-B DETAILED LIST OF WATER MAIN REPLACEMENT IN NEIGHBORHOODS OF DETROIT UNDER WS-742

Neighborhood	Description	Length of Existing Pipe (Ft.) per Pipe Diameter (inch)							
		4"	6"	8"	10"	12"	Section Map	Pipe Material	Intervention Suggested
Greenwich	Hartwell Avenue, Ave. Pembroke Ave. to Vassar Ave.		1320				14R	CI	DI
Greenwich	Cheyenne St., Pembroke Ave. to Vassar Ave.		1266				14R	CI	DI
San Bernando	Prest St., Vassar Ave. to Pembroke Ave.		1250				13R	CI	DI
San Bernando	Vassar Ave., Greenfield Rd. to Prest St.			450			13R	CI	DI/Liner
Pembroke/ McDowell	Washburn St., 8-Mile Rd. to Pembroke Ave.		2537				14R	CI	DI
Pembroke/ McDowell	Griggs, 8-Mile Rd. to Pembroke Ave		2500				14R	CI	DI
Pembroke/ McDowell	Birwood, 8-Mile Rd. to Pembroke Ave			2473			14R	CI	DI/Liner
Sherwood Forest	Parkside St., Cambridge Ave. to Renfrew Rd.		1548	235			18R	CI	DI

Sherwood Forest	Warrington Drive, Chesterfield Rd. to Pembroke Ave.		1293				18R	CI	DI
Sherwood Forest	Canterbury, Chesterfield Rd. to St. Martins Ave.			851			18R	CI	DI/Liner
McDowell	Wyoming St., Outer Drive W to Pembroke Ave.					1198	16R-14R	CI	DI
Oak Grove District 2	Santa Rosa Drive, Outer Drive W to Pembroke Ave.			1242			16R	CI	DI/Liner
Hawthorne Park	Hull St., Nevada St. to 7 - Mile Rd.		2697				20Q	CI	DI
Hawthorne Park/ Northeast Central District	7-Mile Rd., Dequinder St. to Walter P Chrysler Frwy.		2996				20Q- 20R	CI	DI
Conant Gardens	Binder St., Nevada St. to Robinwood St.		1767				21Q	CI	DI
Conant Gardens	Norwood St., Nevada St. to Robinwood St.		1811				21Q	CI	DI
Conant Gardens	7-Mile Rd. E., Ryan Road to Brinker St.		2839				21Q	CI	DI

3.2 STUDY AREA CHARACTERISTICS

3.2.1 STUDY AND SERVICE AREA

The general study area for this Planning Document is the portion of the DWSD service area within the corporate limits of the City of Detroit. The study area encompasses approximately 88,876 acres with a population of approximately 632,589 people according to the 2020 Census, plus considerable commercial and industrial activity. The population served by the WS-741 project is 13,495 (Estimated from Detroitmi.gov/webapp/census-data-map). The population served by the WS-742 project is 12,403 (Estimated from Detroitmi.gov/webapp/census-data-map). Cultural and Historic Resources will be supplied by the design consultant. Air quality, wetlands, Great Lakes Shorelands, Coastal Zones, Coastal Management Areas, Floodplains, Natural or Wild and Scenic Rivers, Major surface waters, and agricultural Resources are not affected by this project. The topography is mostly flat. The geology and soil type of the City of Detroit is a combination of natural sand, silt, and glacial tills. The design consultant will review the MNSI and US Fish & Wildlife databases/references for the affected flora and fauna to obtain the respective environmental clearances ahead of the pipeline installation work.

3.2.2 LAND USE IN STUDY AREA

As shown in **Table 3.2**, the existing land use within the City of Detroit is comprised predominantly of residential, commercial, and industrial uses. Most of the land in the area is developed already, therefore, there is little opportunity for land use changes to occur except through redevelopment.

Table 3-2. LAND USE IN DETROIT

Land Use	Acreage	Percentage (%)
Residential	54,39	61%
Commercial	13,49	15%
Industrial	7,020	8%
Recreation/Open	9,497	11%
Other	4,475	5%

3.2.3 ECONOMIC CHARACTERISTICS

Detroit has classically had an unemployment rate considerably above regional and national averages. High unemployment rates have been a chronic problem in a ring surrounding the central business district. Compared to regional averages, Detroit has a relatively low percentage of its population employed in professional occupations and has a higher-than-average incidence of unskilled workers. Prime employment categories include civil service, banking, real estate, and insurance. The median household income was listed as \$32,498 on the U.S. Census website along with an estimated person in poverty at 33.2%¹. Income levels in Detroit tend to be significantly below those levels reported in neighboring areas in Wayne, Oakland, and Macomb Counties.

3.3. POPULATION PROJECTION

The population projections presented in the 2015 Water Master Plan Update report prepared by CDM/Smith for DWSD indicate a forecasted decline in population for the City of Detroit. The City of Detroit's population is expected to decrease from 713,777 (2010 Census) to 613,709 by the year 2035. The 2020 estimated population on the U.S. Census website is 639,111¹. The SEMCOG July 2020 Projected Population is 642,508. DWSD is projecting flat demand for water for the next five years.

3.4. EXISTING FACILITIES

The Detroit Water Distribution System is defined as pipes that are sixteen inches and smaller in diameter with most of the piping in diameters of six-inch and eight-inch. Most of the system is quite old. Many pipes are over 100 years old, and the average age of pipes in the entire city is approximately 85 years.

Most of the water mains in the Detroit Water Distribution System are comprised of older unlined pit cast and centrifugally spun cast iron pipe. The newer ductile iron pipe has been installed in the city ever since it became commonly available (generally after 1970), but ductile iron piping represents a very small percentage of the total length of pipe in the system. Additionally, there is some asbestos cement pipe in the system. DWSD installation of asbestos cement pipe ended in the mid-1980s.

Table 3.3 summarizes the distribution of various pipe sizes in the system. It is noted that many of the six-inch and eight-inch pipes have low coefficients of friction (C factors) citywide, thereby increasing the energy required to maintain adequate pressure, and transport capacity.

¹ <https://data.census.gov/cedsci/profile?g=1600000US2622000> Census Data 2020

Table 3-3. CITY-WIDE DISTRIBUTION SYSTEM PIPING SUMMARY

Pipe Diameter	Linear Footage	Percent of System
6"	5,481,018	38.4%
8"	6,047,000	42.4%
10"	257,222	1.8%
12"	1,665,873	11.7%
16"	748,742	5.25%
24" through 42"	68,640	0.05%

**Approx 0.4 % of the water main in the Detroit system are GLWA transmission pipes of 24-inches and larger.

Table 3-4 shows the existing water main data by type and installation year and shows the distribution of various pipe types within the system.

Table 3-4. SUMMARY OF DETROIT WATER MAIN DISTRIBUTION PIPES

Type	Installation Period	% of System
Unlined cast iron pipes – Pit cast	Until 1923	40%
Unlined cast iron pipes – Class 150	1923-1940	38%
Unlined cast iron pipes – Class 250	After 1940	10%
Lined ductile iron	After 1970	7%
Asbestos cement	After 1980	5%

According to a 1977 report prepared by DWSD, cast iron pipes purchased and installed prior to 1923 were manufactured by the pit-cast process, which gave long trouble-free service. From 1923 to 1940, cast iron pipes (Class 150) made by a centrifugal process (spun cast) were purchased and installed in the Detroit system. DWSD has since experienced serious trouble with spun cast pipes, and a lifespan of 35 to 40 years was suggested for this class of pipes based on the same report. Starting from 1940, DWSD began using Class 250 spun cast pipe for additional wall thickness for combating corrosion. DWSD officially adopted the standard use of Class 250 pipe in 1945. AECOM has previously evaluated the current pipe class standard for the application and pressure duty required of the pipe replacements. Trench construction is generally proposing the use of Class 52 and 54 ductile iron pipes encased with a polyethylene wrap. For trenchless installation, such as pipe-bursting of existing cast iron pipe and horizontal directional drilling, pipe replacement will be with High-Density Polyethylene (HDPE) pipe of type DR11 C906. These trenchless construction techniques are used around the country in urban areas and are a means to save time and construction cost and minimize disruption to the right-of-way, protect other existing utilities, and save money for the ratepayers in Detroit.

The City of Detroit has an estimated 80,000+ Lead water services active within the municipal water system. Given the potential negative health impacts to water system customers, DWSD has been undertaking efforts in the replacement of these services. Per EPA and MI-EGLE requirements, Lead services are replaced from the water main all the way to the customer meter within their property (residence, commercial space, other). Lead replacements are integrated into water main replacement capital work.

4. ANALYSIS OF ALTERNATIVES

In accordance with the MI-EGLE guidelines for preparing a DWSRF Planning Document, the potential alternatives to be analyzed include a No Action Alternative, Optimum Performance of Existing Facilities Alternative, and a Regional Alternative.

4.1. IDENTIFICATION OF POTENTIAL ALTERNATIVES

Project A, WS-741 WATER MAIN REPLACEMENT IN EVERGREEN-OUTER DRIVE, CRARY/St MARYS, AND CADILLAC COMMUNITY NEIGHBORHOOD OF DETROIT.

Project B, WS-742: WATER MAIN REPLACEMENT IN GREENWICH, SAN BERNARDO, PEMBROKE, SHERWOOD FOREST, McDOWELL, OAK GROVE DISTRICT 2, HAWTHORNE PARK, AND CONANT GARDENS NEIGHBORHOODS OF DETROIT.

4.1.1. “NO ACTION” – Alternative 1

As indicated in Section 3.1, the project is needed due to the aging water mains. The water mains included in this project have exceeded their useful life as evidenced by the frequent breaks that occur leading to disruption of water supply, potential increased risk to public health, and potential flooding issues for the residents, commercial, and industrial customers. A “No Action” alternative would simply worsen the conditions by leading to an increase in water main breaks, more frequent disruption to customer service and potential increased public health risk, and potential for loss of other utilities including sewers, gas, and roads; all the while, putting additional stress on an already resource challenged DWSD. Furthermore, the “No Action” alternative leaves unaddressed the higher energy loss associated with the pipe interior roughness. Therefore, a “No Action” alternative is not considered viable and is not pursued further.

4.1.2 OPTIMUM PERFORMANCE OF EXISTING FACILITIES – Alternative 2

DWSD is currently operating the water distribution system within the constraints of an aging system. The aging system contains Lead service lines. It is a benefit to public health and safety to remove or rehabilitate the existing water mains and to remove and replace existing Lead service lines. Water main breaks are handled through the assigned DWSD staff and supplemented with contracted services as conditions may require. In 2014, DWSD embarked on a 20-Year Infrastructure Plan to address upgrading, maintaining, or replacing the water mains depending on the severity of the problem. A water main leakage detection program is ongoing. The program used to be outsourced, but currently, DWSD is self-performing leak detection efforts. The leak survey completed in 2014 was based on several studies conducted to evaluate the water leaks qualitatively and quantitatively in the city water distribution system. DWSD has developed a Capital Improvement Plan Management Organization (CIPMO) for the purpose of targeting assets for condition assessment and accelerating the replacement of DWSD infrastructure. Through collaboration with DWSD and other City departments, the CIPMO team has developed a specific five-year CIP, targeting specific areas of Detroit for condition assessment of buried water and sewer infrastructure and development of rehabilitation or replacement strategies.

4.1.3 REGIONAL ALTERNATIVE – Alternative 3

Under the Bifurcation Agreement, GLWA operates the water treatment plants, pump stations, and transmission mains that provide potable water to the City of Detroit and 127 additional municipal water supplies as a regional water system. The service area identified for water main replacement resides entirely within the City of Detroit.

The City of Detroit and all the surrounding communities adjacent to the subject area, are serviced by GLWA. Therefore, a Regional Alternative in the context of this Planning Document is not applicable.

4.2 ANALYSIS OF PRINCIPAL ALTERNATIVES

Project A, WS-741 WATER MAIN REPLACEMENT IN EVERGREEN-OUTER DRIVE, CRARY/St MARYS, AND CADILLAC COMMUNITY NEIGHBORHOOD OF DETROIT

Project B, WS-742: WATER MAIN REPLACEMENT IN GREENWICH, SAN BERNARDO, PEMBROKE, SHERWOOD FOREST, McDOWELL, OAK GROVE DISTRICT 2, HAWTHORNE PARK, AND CONANT GARDENS NEIGHBORHOODS OF DETROIT.

4.2.1

DESCRIPTION OF PRINCIPAL ALTERNATIVES

There are only two options for addressing the problems associated with aged water mains. DWSD can either do nothing and continue to repair the old pipes (Alternative 1) or replace or rehabilitate the old pipes with new ones (Alternative 2). As a part of Alternative 2, rehabilitation of a limited number of feet of water main will be incorporated.

A. Alternative 1 – Repair of Existing Water Mains

Water main repair is conducted throughout the system, particularly in those areas where problems have not escalated to the point which would warrant replacement as described in Section 3.1. Nevertheless, water main repairs are time consuming, costly, constitute a drain on DWSD resources needed to carry out the repairs, and pose a potential increase in public health risk. In addition, repairs often trigger additional breakage and/or leaks in the vicinity because of disturbances to the section of pipe being repaired. Water main repairs require shutting off potable water service to multiple customers while the source of the leak is confirmed, repaired, and returned to service. Repair activities cannot be pre-scheduled, and field crews must respond on an “as needed” basis, often during the winter months when cold weather and freeze-thaw conditions trigger pipe breaks.

B. Alternative 2 – Water Main Replacement

Replacement of aged water main pipes is based on the replacement criteria discussed in Section 3.1. The replacement pipe is sized to meet the service area needs, including commercial, business, and residential demographics. In all cases, 6-inch diameter water mains are being replaced with an 8-inch minimum diameter water main to facilitate maintaining pressures under all flow conditions. Full Lead Service Line Replacement (FLSLR) will be included in the scheduled replacement of aged water mains. It is a benefit to the public health and safety to replace the Lead service lines. DWSD policy is that all Lead water services, as encountered, shall be replaced with copper from the water main to the individual customer meter as part of its capital project work. Additionally, DWSD contractors are required to perform a hydro-excavation at every service connection to visually verify if the service is Lead or copper. The project will replace Lead service lines of two (2) inches in diameter and smaller from the public water main to the meter, herein defined as FLSLR. Lead service lines of 1.5 inches and 2

inches are replaced with in-kind diameters in copper; Lead services of 1 inch and less are replaced with 1-inch copper. Replacement of aged water mains also provides for the use of ductile iron or HDPE piping. Finally, some pipes are rehabilitated in place using a specialty lining process.

The cast iron pipes included in this project have surpassed their anticipated service life. The piping replacements call for a minimum eight-inch diameter water main, the minimum recommended size in a distribution system for communities who intend to provide fire flow protection, which is also supported by Recommended Standards for Water Works.

4.2.2. COST EFFECTIVENESS ANALYSIS

A monetary evaluation of the feasible alternatives was prepared using MI-EGLE guidelines for the DWSRF Planning Document, including the present worth formulas and discount interest rate of (2.0%). Under this analysis, the useful life is assumed to be 50 years for pipelines. The salvage value of pipes at the end of the 20-year planning period was computed based on a straight-line depreciation over the useful life of the item. Therefore, the salvage value of the pipes at the end of the 20-year planning period is estimated to be 60% of the initial cost. $(30/50) = 0.6$

The present worth of salvage value was then computed by multiplying the salvage at the end of the 20 years by the conversion factor 0.6730 based on the following formula:
 $1/(1+(2.0)/100)^{20}=0.6730$

$$PW = F * 1/(1 + i)^n$$

Where:

PW = Present Worth (Salvage)

F = Future Value (Salvage)

i = Discount Interest Rate (2.0%)

n = Number of Years (20)

$$1/(1 + i)^n = \text{Conversion Factor}$$

Interest during the construction period was computed using the formula:

$$(2.0)/100 * 0.5 * 2 * 19,446,414 = \$388,928.28 \text{ for Project A, WS-741 and,}$$
$$(2.0)/100 * 0.5 * 2 * 19,348,401 = \$386,968.02 \text{ for Project B, WS-742}$$

$$I = i * 0.5 * P * C$$

Where:

I = Interest Value

i = Discount Interest Rate (2.0%)

P = Period of Construction in Years (assumed to be two years)

C = Capital Cost of the Project

The annual Operation and Maintenance (O&M) expenses associated with each alternative were estimated, and then converted into a Present Worth value by multiplying the annual cost by a conversion factor of 16.3514 using the following formula: $[(1+(2.0)/100)^{20}-1] / 2.0/100(1+(2.0)/100)^{20}= 16.3514$

$$PW = A * [((1 + i)^n - 1)/i(1 + i)^n]$$

Where:

PW = Present Worth (O&M)

A = Annual O&M Cost

i = Discount Interest Rate (2.0%)

n = Number of Years (20)

$$[((1 + i)^n - 1)/i(1 + i)^n] = \text{Conversion Factor}$$

For each alternative, the total Present Worth was computed from the estimated cost (including construction, engineering, and administrative costs), salvage value, interest during construction, and/or O&M costs. This equates to the amount which would be needed at the start of the project to cover construction costs and operating expenses over the 20-year planning period if interest were to accrue at the discount rate (2.0%) annually.

The Present Worth of each alternative was then converted to an Equivalent Annual Cost, which is the amount that would be paid uniformly over a 20-year period based on the Present Worth value. This amount was obtained by the using the following formula and capital recovery factor of 0.0612:

$$=[(2.0)/100(1+(2.0)/100)^{20}/((1+(2.0)/100)^{20} - 1)]= 0.0612$$

$$A = PW * [(i(1 + i)^n)/((1 + i)^n - 1)]$$

Where:

A = Equivalent Annual Cost

PW = Present Worth

i = Discount Interest Rate (2.0%) n = Number of Years (20)

$[(i(1 + i)^n)/((1 + i)^n - 1)] = \text{Capital Recovery Factor}$

The cost analysis for Alternatives 1 and 2 is presented in **Tables 4-1-1 and 4-1-2**. Capital costs are based on a unit cost basis for the purpose of this analysis to show the estimated expenses for a typical 1,000-foot pipe length. The annual O&M cost is based on DWSD historical data in past reports.

Table 4-1-1 COST COMPARISON OF Project A, WS-741: WATER MAIN REPLACEMENT IN EVERGREEN-OUTER DRIVE, CRARY/St MARYS, AND CADILLAC COMMUNITY NEIGHBORHOODS OF DETROIT.

Cost Effective Analysis and Present Worth Determination						
Project:	DWSD Project WS-741					
System:	Water Main Replacement, Various Locations in Detroit					
Planning Period:	2024-2044	20	Years	Alternative 1	Alternative 2	
Construction Duration:		2	Year	NO ACTION	28,661 LINEAR FEET OF	
Inflation Rate (CPI):		2.000%			WATER MAIN REPLACEMENT	
Discount Rate:		2.000%				
Capital Costs (One Time Expenditures):		Salvage Value Factor		Present Worth Factor	Present Worth Factor	
50 Yr. Structures		0.6000	\$ -		\$ 19,446,414	
20 Yr. Process Equipment		0.0000	\$ -		\$ -	
10 Yr. Process Equipment		0.0000	\$ -	0.9980	\$ -	
15 Yr. Auxiliary Equipment		0.6667	\$ -	0.9970	\$ -	
10 Yr. Auxiliary Equipment		0.0000	\$ -	0.9980	\$ -	
Subtotal			\$ -		\$ 19,446,414	
Contingency		10%	\$ -		\$ 1,944,641	
Engineering, Legal, Admin., Provisions		20%	\$ -		\$ 4,278,211	
Total			\$ -		\$ 25,669,266	
		CPI Factor				
10 Replacement Cost at Yr.		1.2190	\$ -		\$ -	
15 Replacement Cost at Yr.		1.3459	\$ -		\$ -	
20 Salvage Value at Yr.			\$ -	0.6730	\$ 11,667,848	
OM&R Costs (Recurring Equal Expenditures)			2025	2045	2025	2045
Repair & Maintenance			\$ 1,146,440	\$ 1,703,550	\$ -	\$ -
Total O&M Costs			\$ 1,146,440	\$ 1,703,550	\$ -	\$ -
Fixed O&M Costs			\$ 1,146,440	\$ 1,146,440	\$ -	\$ -
Total Variable O&M Costs			\$ -	\$ 557,110	\$ -	\$ -
Yearly Increase			\$ 27,855		\$ -	
Present worth (PW) of constant annual O&M cost:				16.3514		16.3514
PW of variable annual O&M cost (annual increase):				144.6003		144.6003
Capital Recovery Factor				0.0612		0.0612
Assumptions			CALCULATIONS - PRESENT WORTH		CALCULATIONS - PRESENT WORTH	
Increased future O&M to account for further deterioration to piping materials resulting in increased power and repair costs			1. Initial Cost	\$ -	1. Initial Cost	\$ 25,669,266
			2a. Constant O&M	\$ 18,745,937	2a. Constant O&M	\$ -
			2b. Variable O&M	\$ 4,027,911	2b. Variable O&M	\$ -
			3. Replacement Cost	\$ -	3. Replacement Cost	\$ -
			4. Salvage Value (minus)	\$ -	4. Salvage Value (minus)	\$ 7,852,127
			5. Interest During Construction	\$ -	5. Interest During Construction	\$ 513,385
			6. Total Present Worth	\$ 22,773,848	6. Total Present Worth	\$ 18,330,525
EQUIVALENT ANNUAL COST				\$ 1,392,774		\$ 1,121,035

Table 4-1-2 COST COMPARISON OF Project B, WS-742: WATER MAIN REPLACEMENT IN GREENWICH, SAN BERNARDO, PEMBROKE, SHERWOOD FOREST, McDOWELL, OAK GROVE DISTRICT 2, HAWTHORNE PARK, AND CONANT GARDENS NEIGHBORHOODS OF DETROIT.

Cost Effective Analysis and Present Worth Determination						
Project:	DWSD Project WS-742					
System:	Water Main Replacement, Various Locations in Detroit					
Planning Period:	2024-2044	20	Years	Alternative 1	Alternative 2	
Construction Duration:		2	Year	NO ACTION	30,900 LINEAR FEET OF	
Inflation Rate (CPI):	2.000%				WATER MAIN REPLACEMENT	
Discount Rate:	2.000%					
Capital Costs (One Time Expenditures):		Salvage Value Factor		Present Worth Factor		Present Worth Factor
50 Yr. Structures		0.6000	\$ -		\$ 19,348,426	
20 Yr. Process Equipment		0.0000	\$ -		\$ -	
10 Yr. Process Equipment		0.0000	\$ -	0.9980		0.9980
15 Yr. Auxiliary Equipment		0.6667	\$ -	0.9970		0.9970
10 Yr. Auxiliary Equipment		0.0000	\$ -	0.9980		0.9980
Subtotal			\$ -		\$ 19,348,426	
Contingency	10%		\$ -		\$ 1,934,843	
Engineering, Legal, Admin., Provisions	20%		\$ -		\$ 4,256,654	
Total			\$ -		\$ 25,539,922	
		CPI Factor				
10 Replacement Cost at Yr.		1.2190	\$ -		\$ -	
15 Replacement Cost at Yr.		1.3459	\$ -		\$ -	
20 Salvage Value at Yr.			\$ -	0.6730	\$ 11,609,056	0.6730
OM&R Costs (Recurring Equal Expenditures)			2025	2045	2025	2045
Repair & Maintenance			\$ 1,236,000	\$ 1,836,631	\$ -	\$ -
Total O&M Costs			\$ 1,236,000	\$ 1,836,631	\$ -	\$ -
Fixed O&M Costs			\$ 1,236,000	\$ 1,236,000	\$ -	\$ -
Total Variable O&M Costs			\$ -	\$ 600,631	\$ -	\$ -
Yearly Increase			\$ 30,032		\$ -	
Present worth (PW) of constant annual O&M cost:				16.3514		16.3514
PW of variable annual O&M cost (annual increase):				144.6003		144.6003
Capital Recovery Factor				0.0612		0.0612
Assumptions	CALCULATIONS - PRESENT WORTH			CALCULATIONS - PRESENT WORTH		
Increased future O&M to account for further deterioration to piping materials resulting in increased power and repair costs	1. Initial Cost		\$ -		1. Initial Cost	\$ 25,539,922
	2a. Constant O&M		\$ 20,210,372		2a. Constant O&M	\$ -
	2b. Variable O&M		\$ 4,342,572		2b. Variable O&M	\$ -
	3. Replacement Cost		\$ -		3. Replacement Cost	\$ -
	4. Salvage Value (minus)		\$ -		4. Salvage Value (minus)	\$ 7,812,562
	5. Interest During Construction		\$ -		5. Interest During Construction	\$ 510,798
	6. Total Present Worth		\$ 24,552,944		6. Total Present Worth	\$ 18,238,159
EQUIVALENT ANNUAL COST			\$ 1,501,577			\$ 1,115,386

As shown in Tables 4-1-1 and 4-1-2 for WS-741 and WS-742 the equivalent annual cost of option 2 (water main replacement) is significantly less than the Equivalent Annual Cost of ongoing repairs. Therefore, Alternative 2, Replacement of the water mains is the most cost efficient.

4.2.3 ENVIRONMENTAL EVALUATION

The environmental impact of the pipe repair alternative is more severe when compared to the water main replacement alternative. Under the repair alternative, the environmental impact and disruption of service is experienced multiple times annually and will increase over the 20-year analysis period. The environmental impact of the water main replacement is related mostly to the one-time construction phase and is discussed in more detail in Section 6.0. Leakage from aged pipes results in wasted treated water and increased energy use by equipment required to treat the raw water and pump the finished water into the distribution system. Water leaking from aged pipes is referred to as non-revenue water since it is wasted and lost to the environment after having gone through the expense of treatment and pumping processes. The wasted water has an impact on the GLWA cost of treating and pumping potable water. That cost is borne by all GLWA customers including DWSD customers. Leakage (including water lost through leaking joints, as well as breaks and main flushing) based on past DWSD studies has been found to be significant, and above average when compared to other major cities nationwide. The lost water from leaks and broken water mains also has an impact on the regional wastewater treatment facilities because the wastewater collection system serves the City of Detroit. Therefore, additional energy used at interceptor lift stations and the raw and intermediate sewerage lift pumps at the Water Resource Recovery Facility to pump this additional flow from the water main leakage has a negative environmental impact. This leakage would also contribute to combined sewer overflows during severe weather events in the City.

4.2.4. IMPLEMENTABILITY AND PUBLIC PARTICIPATION

Both alternatives described in Section 4.2.1 can be implemented. The pipe repair alternative would be implemented primarily by the DWSD maintenance staff with occasional support from contracted services under emergency conditions when break occurrence is extensive, whereas the pipe replacement alternative would require DWSD to procure a contractor to implement the work through a contract agreement. As previously discussed, there is a benefit to the public health to replacing the Lead service lines during a water main replacement project. Public participation was ensured through a public notice to allow residents ample time to

review the Planning Document and become familiar with the proposed project. A 10-day minimum advanced public notice of a hearing and a public hearing was made to provide time for the residents to provide input and express their concerns regarding the Planning Document and the selected alternative.

4.2.5. TECHNICAL AND OTHER CONSIDERATIONS

Pipe replacement (Alternative 2) is substantially less burdensome from a staffing and resource management perspective since new pipes constructed of modern materials require minimal maintenance over long periods of time. By contrast, repairing old pipes (Alternative 1) is very resource intensive and very difficult to plan. Furthermore, the work must be conducted on an emergency basis, often during extremely inclement weather. Pipe breaks adversely impact residents as they experience an interruption in their service, and they are exposed to a potential increase in public health risk due to the potential for contamination through backflow or back-pressure from a cross-connection. Many breaks occur during winter due to shifting soils from freeze/thaw cycles and result in roadways, sidewalks, and other areas encumbered with ice that can be very destructive to roads and vehicles and constitute a safety hazard. In addition, new pipes provide greater fire protection due to improved hydraulic capacity, since the old pipes often exhibit tuberculation on their interior surfaces. This tuberculation increases friction between the flowing water and the interior pipe wall, causing increased pressure loss and decreased flow.

5. SELECTED ALTERNATIVE

Alternative 2 is the alternative recommended for implementation based on both monetary and non-monetary evaluation. This alternative encompasses the installation of new water mains to replace aged pipes subject to excessive breaks. The work will include excavation of the existing mains and installation of new pipes. All pipes whether replaced by open excavation, Horizontal Directional Drilling and Pipe Bursting or lined will be subjected to pressure testing and disinfection, and then right-of-way restoration will be performed. The replacement or rehabilitation of the existing mains will include the replacement of Lead service lines as encountered during the water main replacement work. It is a benefit to the public health and safety to remove the Lead service lines. As previously mentioned, DWSD policy is that all Lead water services shall be replaced with copper from the water main to the individual customer meter as part of capital project work. Additionally, DWSD contractors are required to perform a hydro-excavation at every service connection to visually verify if the service is Lead or copper. The project will replace Lead service lines of two inches in diameter and smaller from the public water main to the meter (FLSLR). Lead service lines 1.5-inches and 2-inches are replaced with in-kind diameters in copper; 1-inch and less are replaced with 1-inch copper. Any disturbed areas adjacent to the pipes will be revegetated and restored to pre-project conditions.

5.1 DESCRIPTION

Project A, WS-741 and Project B, WS-742

The specific streets where the new water mains for WS-741 will be installed are listed in **Table 3-1-A**, along with the pipe diameters, lengths, and general location within the project. For WS-742, the streets and pipe breakdowns are shown in **Table 3-1-B**. Figures 3-1-A and 3-1-B are the map sets showing the piping work.

5.1.1. COSTS

Project A, WS-7141 and Project B, WS-742

The estimated cost for the proposed water main project consists of construction costs plus costs to cover engineering (design and construction) and administrative tasks. The estimated total cost for the Water Main Replacement for all the listed Neighborhoods in Detroit is provided in **Appendix A-2**.

Cost is summarized below in **Tables 5-1-A and 5-1-B.**

Table 5-1-A Project A, WS-741: WATER MAIN REPLACEMENT IN EVERGREEN-OUTER DRIVE, CRARY/St MARYS, AND CADILLAC COMMUNITY NEIGHBORHOODS OF DETROIT.

Planning Period:	2025-2045	20 Years	PROJECT A WS-741 28661 LINEAR FEET OF WATER MAIN REPLACEMENT
Construction Duration:		2 Years	
Inflation Rate (CPI):		2.000%	
Discount Rate:		2.000%	
Capital Costs (One-Time Expenditures):			
50 Yr. Structures			\$19,446,414
Contingency		10%	\$ 1,944,641
Engr, Legal, Admin., "Green" Provisions		20%	\$ 4,278,211
Total			\$ 25,669,266

Table 5-1-B Project B, WS-742: WATER MAIN REPLACEMENT IN GREENWICH, SAN BERNARDO, PEMBROKE, SHERWOOD FOREST, McDOWELL, OAK GROVE DISTRICT 2, HAWTHORNE PARK, AND CONANT GARDENS NEIGHBORHOODS OF DETROIT.

Planning Period:	2024-2044	20 Years	PROJECT B WS-742 30,273 LINEAR FEET OF WATER MAIN REPLACEMENT
Construction Duration:		2 Years	
Inflation Rate (CPI):		2.000%	
Discount Rate:		2.000%	
Capital Costs (One Time Expenditures):			
50 Yr. Structures			\$19,348,426
Contingency		10%	\$1,934,842.6
Engr, Legal, Admin., "Green" Provisions		20%	\$4,256,653.6
Total			\$25,539,922

The estimated cost for the full water main replacements is included in **Appendix A**

5.1.2. IMPLEMENTATION SCHEDULE

The recommended Water Main Replacement project is scheduled to be completed in accordance with the following schedule.

Table 5-2 PROJECT MILESTONE SCHEDULES

Project Activity	Project WS-741	Project WS-742
Advertise for Public Hearing	[DATE]	[DATE]
Public Hearing on Draft Planning Document	March 20, 2024	March 20, 2024
Complete and Submit Final Planning Document	June 1, 2024	June 1, 2024
Complete Plans and Specifications	September 2024	October, 2024
Advertise for Bids	January, 2025	January, 2025
Receive Bids	February, 2025	February, 2025
Award Construction Contract	March 2025	March 2025
Start of Construction	April 2025	April 2025
Complete Construction	April 2027	April 2027

5.1.3. USER COST

The water main replacement recommended in this Planning Document is targeted for low interest loan assistance through the DWSRF program. The availability of loan funds is dependent on annual appropriations and the placement of the project on the Priority List prepared annually by MI-EGLE.

Repayment of the DWSRF loan through annual debt retirement payments will impact the residential customer rates resulting in increased user costs. This impact to customer rates is generally determined by dividing the additional expenses among the users in the service area as summarized in **Table 5-3-1 and 5-3-2**. The annualized cost of the project was calculated using the capital recovery factor 0.0516 and the following formula:

$$A = PW * [(i(1 + i)^n)/((1 + i)^n - 1)]$$

Where:

A = Equivalent Annual Cost

PW = Present Worth of the project cost

i = Interest Rate through DWSRF Loan (2.0%)

n = Number of Years (20)

Table 5-3-1 USER COST IMPACT FOR PROJECT A, WS-741

Item	Water Main Replacement
Total Cost of Project	\$25,669,266.40
Annualized Cost of Project (Assuming DWSRF interest rate of 2.0% over 20 years)	\$1,121,035
Number of User Accounts (households) in the City of Detroit	240,000
Average Water Consumption per Household (industry average)	7,333 gallons/month (approximately 980 ft ³ /month)
Current DWSD Water Supply Rate for 0.6 m CF usage	\$25.04 per 1,000 ft ³
Current Monthly DWSD Water Supply Rate per Household	\$24.54
Current Annual DWSD Water Supply Rate per Household	\$294.47
Increase in Cost per Household (Year 1)	\$4.68
Proposed Annual DWSD Water Supply Rate per Household (Year 1)	\$299.12
Proposed Percent Increase in Cost per Household per Year	1.59%

Table 5-3-2, USER COST IMPACT FOR PROJECT B, WS-742

Item	Water Main Replacement
Total Cost of Project	\$25,539,922
Annualized Cost of Project (Assuming DWSRF interest rate of 2.0% over 20 years)	\$1,115,386
Number of User Accounts (households) in the City of Detroit	240,000
Average Water Consumption per Household (industry average)	7,333 gallons/month (approximately 980 ft ³ /month)
Current DWSD Water Supply Rate for 0.6 m CF usage	\$25.04 per 1,000 ft ³
Current Monthly DWSD Water Supply Rate per Household	\$24.54
Current Annual DWSD Water Supply Rate per Household	\$294.47
Increase in Cost per Household (Year 1)	\$4.68
Proposed Annual DWSD Water Supply Rate per Household (Year 1)	\$299.12
Proposed Percent Increase in Cost per Household per Year	1.59%

The theoretical impact of financing the WS-741 and WS-742 water main replacement through the DWSRF loan program is expected to increase by no more than 1.59% due to WS-741 and 1.59% due to WS-742 the cost of water to a typical user. This anticipated increase is due to the impact of construction costs. However, the impact would be less since it would be influenced by other factors such as the reduction in operating costs (chemicals, energy, etc.), less water loss through breaks, and reduced maintenance/repairs. Therefore, the actual rate determination would be based on factors that encompass the delivery of comprehensive services by DWSD to its customers. It should be recognized that the debt for distribution water main replacement work within the City of Detroit will be paid by Detroit customers only, not the entire service area.

If DWSRF loans are not available, DWSD will need to finance the cost of the water main replacement as part of its Capital Improvement Program (CIP) through revenue bonds.

5.1.4. ABILITY TO IMPLEMENT THE SELECTED ALTERNATIVE

DWSD is a City-owned utility with broad statutory authority. Prior to GLWA assuming responsibility for operating and maintaining the regional water supply through the Bifurcation Agreement, DWSD had entered into contracts with its suburban customers, which established the terms and conditions for providing water and overseeing the operation and maintenance of the regional system. The Department has substantial experience in the financing of capital improvements under a variety of programs. It has a proven track record for using system revenues to retire its debt on new facilities.

In accordance with the Bifurcation agreement between DWSD and GLWA, the Great Lakes Water Authority (GLWA) will be the loan applicant on behalf of the City of Detroit Water and Sewerage Department (DWSD), the loan recipient.

5.1.5. DISADVANTAGED COMMUNITY STATUS

The DWSRF program includes provisions for qualifying the applicant community as a disadvantaged community. The benefits for communities with a population of 10,000 or more that qualify for the disadvantaged community status consist of:

- Award of 30 additional priority points.
- Possible extension of the loan term to 30 years or the useful life of the components funded, whichever is earlier. The estimated useful life of the new water mains is 50 years. DWSD is aware that the DWSRF program offers 20, 30, and 40-year loan terms and will evaluate which term is the most appropriate for DWSD and its customers. DWSD has indicated they will select a 30-year loan term.

MI-EGLE requires submittal of a Disadvantaged Community Status Determination

Worksheet to determine if the community qualifies for this status. A completed worksheet is included in **Appendix B**.

Reference; <https://www.census.gov/quickfacts/fact/table/detroitcitymichigan/IPE120216#viewtop> Under Criterion 1, Detroit qualifies for Disadvantaged Community Status based on approximately 37.9% of families in Detroit below the poverty level.

5.1.6. SURFACE WATER INTAKE PROTECTION PROGRAM

Protection of surface water intakes for the system is the responsibility of GLWA as a part of the bifurcation agreement. Prior to that agreement, three (3) grants were received to develop plans for a Surface Water Intake Protection program. These grants are for the three raw water intakes now maintained by GLWA. Two intakes are in the Detroit River at Fighting Island and Belle Isle; the third intake is located in Lake Huron adjacent to Burtchville Township, located north of the City of Port Huron. The plans were prepared as part of the 2015 Water Master Plan Update. The applicable box in the Planning Document Submittal Form will be checked for State approval of the Surface Water Intake Protection Program.

6. EVALUATION OF ENVIRONMENTAL IMPACTS

6.1. GENERAL

The anticipated environmental impacts resulting from implementing the recommendations of this Planning Document include beneficial and adverse; short and long-term; and irreversible and irretrievable. The following is a brief discussion of the anticipated environmental impacts of the selected alternative.

6.1.1. BENEFICIAL AND ADVERSE

The proposed project will significantly improve DWSD capability to provide reliable, high quality potable water (at the required service volume and pressure) to its residents in the City of Detroit. The project will also generate construction-related jobs, and local contractors would have an opportunity to bid on the contracts.

Noise and dust will be generated during construction of the proposed Projects. The contractors will be required to implement efforts to minimize noise, dust, and related temporary construction byproducts. Some street congestion and disruption of vehicular movement may occur for short periods of time, and areas targeted for water main replacement will require a short (2-4 hour) service interruption for the switchover from the old pipes to the new ones. Residents will need to flush their lines after the switchover is made. Spoils from open trenches will be subject to erosion; the contractors will thereby be required to implement a Soil Erosion and Sedimentation Control (SESC) Program as described and regulated under Michigan's Part 91, Soil Erosion and Sedimentation Control, of the Natural Resources and Environmental Protection Act (NREPA). Wayne County considers

DWSD an Authorized Public Agency regarding SESC. Underground utility services (water, electric, gas, etc.) may be interrupted occasionally for short periods of time. The aesthetics of the area will be temporarily affected until restoration is complete. Resources will be lost in the production of materials used in construction, and fossil fuels will also be utilized during construction activities. All construction will be within the existing City of Detroit Road right-of-way (ROW). Replacement of Lead water service lines will occur on private property as permitted by a written agreement with the resident.

6.1.2. SHORT AND LONG-TERM

The short-term adverse impacts associated with construction activities will be minimal and will be mitigated in comparison to the resulting long-term beneficial impacts. Short-term adverse impacts include traffic disruption, dust, noise, and site aesthetics. No adverse long-term impacts are anticipated. Additionally, there will be no change to the visible landscape at the completion of this project.

6.1.3. IRREVERSIBLE OR IRRETRIEVABLE

The impact of the proposed project on irreversible and irretrievable commitment of resources includes materials utilized during construction and fossil fuels utilized to implement project construction.

6.2. ANALYSIS OF IMPACTS

6.2.1. DIRECT IMPACTS

Construction of the proposed project is not expected to have an adverse effect on historical, archaeological, geographic, or cultural areas, as the construction activities will occur within extensively urbanized areas which have previously been disturbed by prior development and existing road rights-of-way. Additionally, there will be no change to the visible landscape at the completion of this project.

The proposed project will not detrimentally affect the water quality of the area, air quality, wetlands, endangered species, wild and scenic rivers, or unique agricultural lands.

6.2.2. INDIRECT IMPACTS

It is not anticipated that DWSD's proposed projects will alter the ongoing pattern of growth and development in the study area. Growth patterns in the service area are

subject to local use and zoning plans, thus providing further opportunity to minimize indirect impacts.

6.2.3. CUMULATIVE IMPACTS

Improved customer satisfaction and reliable service delivery of potable water to customers are the primary cumulative beneficial impacts anticipated from the construction of the proposed water mains.

7. MITIGATION

7.1. GENERAL

Where adverse impacts cannot be avoided, mitigation methods will be implemented. Mitigation measures for the project such as soil erosion control will be utilized as necessary and in accordance with applicable laws. Details will be further specified in the construction contract documents used for the projects.

7.2. MITIGATION OF SHORT-TERM IMPACTS

Short-term impacts due to construction activities such as noise, dust, and street congestion cannot be avoided. However, efforts will be made to minimize the adverse impacts by use of thorough design and well-planned construction sequencing. To the extent possible, water mains will be in rights-of-way to minimize adverse impacts on private property and routings will be selected to avoid major street and ornamental vegetation whenever possible. Established tree removals in the public right-of-way will also be avoided where possible. Where tree removals cannot be avoided, replacement saplings will be planted as a part of the restoration after construction. Access to properties will be maintained throughout the construction period for the water main replacement work. Site restoration will minimize the adverse impacts of construction, and adherence to the Soil Erosion and Sedimentation Act will minimize the impacts due to disturbance of the soil structure. Specific techniques will be illustrated in the construction contract documents.

Open trenches will be protected to minimize the hazards to citizens. Construction will not normally take place in residential areas at night or on weekends to minimize disruption of normal living patterns.

7.3. MITIGATION OF LONG-TERM IMPACTS

Careful restoration of street pavement, sidewalks, and driveways will be required to ensure that they perform satisfactorily in the future. The aesthetic impacts of construction will be mitigated by site restoration.

7.4. MITIGATION OF INDIRECT IMPACTS

In general, it is not anticipated that mitigation measures to address indirect impacts will be necessary for the recommended improvements adopted in this Planning Document. The proposed project is not located in undeveloped areas, nor is it to promote growth in areas not currently served by DWSD. In addition, the local land use plan and zoning ordinance further regulate and control development. For these reasons, indirect impacts are not likely to be a concern for this project.

8. PUBLIC PARTICIPATION

8.1. PUBLIC HEARING

8.1.1. PUBLIC HEARING ADVERTISEMENT AND NOTICE

A Public Hearing Notice was published ten days in advance of the hearing date to alert parties interested in this Planning Document and request input prior to its adoption (see **Appendix C**). This direct mail notice (mailed and emailed on **DATE**) included an invitation to comment. The public hearing was scheduled for a regular DWSD Board of Water Commissioners meeting at the Fifth Floor Board Room of 735 Randolph, Detroit on April 19, 2023.

8.1.2. PUBLIC HEARING TRANSCRIPT

A formal public hearing on the draft Planning Document was held before the DWSD Board of Water Commissioners on March 20, 2024. The hearing included a presentation on the project, as well as an opportunity for public comment and questions. **The summary of the public hearing and a copy of the visual aids (handout, slideshow) used during the presentation are included in Appendix C.**

8.1.3 PUBLIC HEARING COMMENTS RECEIVED AND ANSWERED

There were no comments or responses from the public resulting from the public hearing.

8.1.4. ADOPTION OF THE PLANNING DOCUMENT

The Planning Document was approved by the DWSD Board of Water Commissioners at the public hearing on **DATE**, and the GLWA Board of Directors at their regular meeting conducted on **DATE**, and resolutions were adopted, ultimately authorizing GLWA to proceed with official filing of the Planning Document for purposes of securing low interest loan assistance under the DWSRF Program. Executed copies of the DWSD Board of Water Commissioners and the GLWA Board of Directors Resolutions approving the Planning Document are included in **Appendix B** of this document. Miscellaneous correspondence applicable to the Planning Document, is also included in **Appendix D** of this document.

APPENDIX A-1 and A-2

*Table A-1 and A-2 Cost Estimate for Full Lead Service Line Replacement
Water Main Replacement at select locations in Detroit Neighborhoods*

APPENDIX B

*SUBMITTAL FORM, DISADVANTAGED COMMUNITY STATUS
DETERMINATION WORKSHEET, BOARD RESOLUTIONS*

APPENDIX C

PUBLIC HEARING NOTICE, MAILING LIST FOR PUBLIC HEARING, PUBLIC HEARING SUMMARY, VISUAL AIDS

APPENDIX D

*PLANNING DOCUMENT CORRESPONDENCE; USACE PERMIT; SHPO
SUBMITTAL; MNFI REVIEW; USFWS REVIEW*