CITY OF DETROIT
Water and Sewerage Department

Water & Sewerage Department

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

Project A, WS -725: Midtown, Cultural Center, Medical Center, and Barton-McFarland Neighborhoods of Detroit

Project B, WS -TBD: Dexter – Linwood, Davison and Buffalo-Charles Neighborhoods of Detroit

Planning Document
April 03, 2023

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Table of Contents

TABLES

FIGURES

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 the Planning Document for two projects in the limits of Detroit. This project is including replacement of Vintage Water Main at various neighboorhoods of Detroit, which includes upgrading 6 inch water main to 8 inch and 10 inch water main to 12 inch. It is Detroit Water and Sewerage Department polices upgrading 6 inch water main to 8 inch and 10 inch water main to 12 inch, because 6 inch water main can not sufficiently supply fire flow according to Detroit Water and Sewerage Department hydraulic model and 10 inch water main are rarely available in the market. All work is in with the Public Right of Way. There is no upgrades/replacement within the existing treatment facility. This project is not only for lead service line replacement though it includes lead service line replacement as part of water mian replacement. Detroit Water and Sewerage Department visually confirms lead service lines with hydroexcavation and replaces it after upon visual confirmation. City of Detroit is feeding from surface water resources and dose 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 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 constant 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 fifth update (Autumn 2021) of the risk & criticality model. The risk model leverages asset and other data with 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 assets

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 to the public in the event of the asset failure.
- Operational: This index reflects the potential impact to system operations in the event of the 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 to 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 the public health and safety to replace the Lead (Pb) 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%	1. Pipe Size 2. Traffic Level/Road Class 3. Pipe Material 4. Pressure
	Operational 30%	1. Critical Customer 2. Pipe Size 3. Redundancy
	Social 25%	1. Census Tract Population Density 2. Employment 3. Traffic Level/Road Class 4. Critical Customer
	Environmental 15%	1. Pipe Size 2. Proximity to ESA
Probability	Condition 60%	1. Break Rate Model 2. Breaks per 1000ft 3. Cave-Ins 4. Service Line Density
	Hydraulics 30%	1. Hydrant AFF 2. Headloss Gradient
	Quality 10%	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 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, and 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 warrnt correction is in development by DWSD. DWSD dose not have any waterborne diseases out breaks. Water treatmentis conducted by GLWA. Watermain replacement greatly increases the water energy efficenies as DWSD watermain are old, which has multiple breaks due to which a lot of water is wasted from DWSD watermains.

2.2. INTRODUCTION

2.2.1 WS-725: WATER MAIN REPLACEMENT AND REHABILITATION AT MIDTOWN, CULTURAL CENTER, MEDICAL CENTER, AND BARTON-McFARLAND NEIGHBORHOODS OF DETROIT

DWSD has identified several project areas for pipe replacement and rehabilitation, in Midtown, Cultural Center, Medical Center, and Barton-McFarland Neighborhoods of Detroit Neighborhoods are in urgent need of addressing due to risk analysis, which accounts for water main breaks, Fire Service Flows, Lead service lines, etc. as well as the results of hydraulic modeling. DWSD proposes to develop contract number WS-725 with a Project scope that includes replacing and rehabilitating approximately 30,877 linear feet of vintage cast iron water main of pipe size 6 through 12 inches in diameter for an estimated total project cost of 12,536,081 M. See table 5-1-A below.

Water main replacement (WS-725) through the DWSRF loan program is expected to increase by no more than 1.02% the cost of water to a typical City of Detroit customer due to the impact of construction cost. 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-TBD: WATER MAIN REPLACEMENT AND REHABILITATION, DEXTER – LINWOOD, DAVISON AND BUFFALO-CHARLES NEIGHBORHOODS OF DETROIT

DWSD has identified several project areas for pipe replacement and rehabilitation, in Dexter – Linwood, Davison and Buffalo-Charles Neighborhoods of Detroit that are in urgent need of addressing due to risk analysis, which accounts for water main breaks, Fire Service Flows, Lead service lines, etc. as well as the results of hydraulic modeling DWSD proposed to develop a contract number WS-TBD with a Project scope that includes replacing and rehabilitating approximately 31,912 linear feet of vintage cast iron water main of pipe size 6 through 12 inches in diameter for an estimated total project cost of $13,265,188 See table 5-1-B below.

Water main replacement (WS-TBD) through the DWSRF loan program is expected to increase by no more than 1.08% the cost of water to a typical City of Detroit customer due to the impact of construction cost. 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-725 and WS-TBD were 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 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 to 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-725 and WS-TBD, approximately 933 lead services will be replaced which is included in the estimated total project cost of nearly $25,801,269M ($12,536,081 M and $13,265,188 M respectively).

3. PROJECT BACKGROUND

3.1. SUMMARY OF PROJECT NEED

Project A, WS-725: WATER MAIN REPLACEMENT AND REHABILITATION AT MIDTOWN, CULTURAL CENTER, MEDICAL CENTER, AND BARTON-McFARLAND 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 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, causing 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 pipe of copper or iron per building code.

DWSD has established an asset management program with a 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.

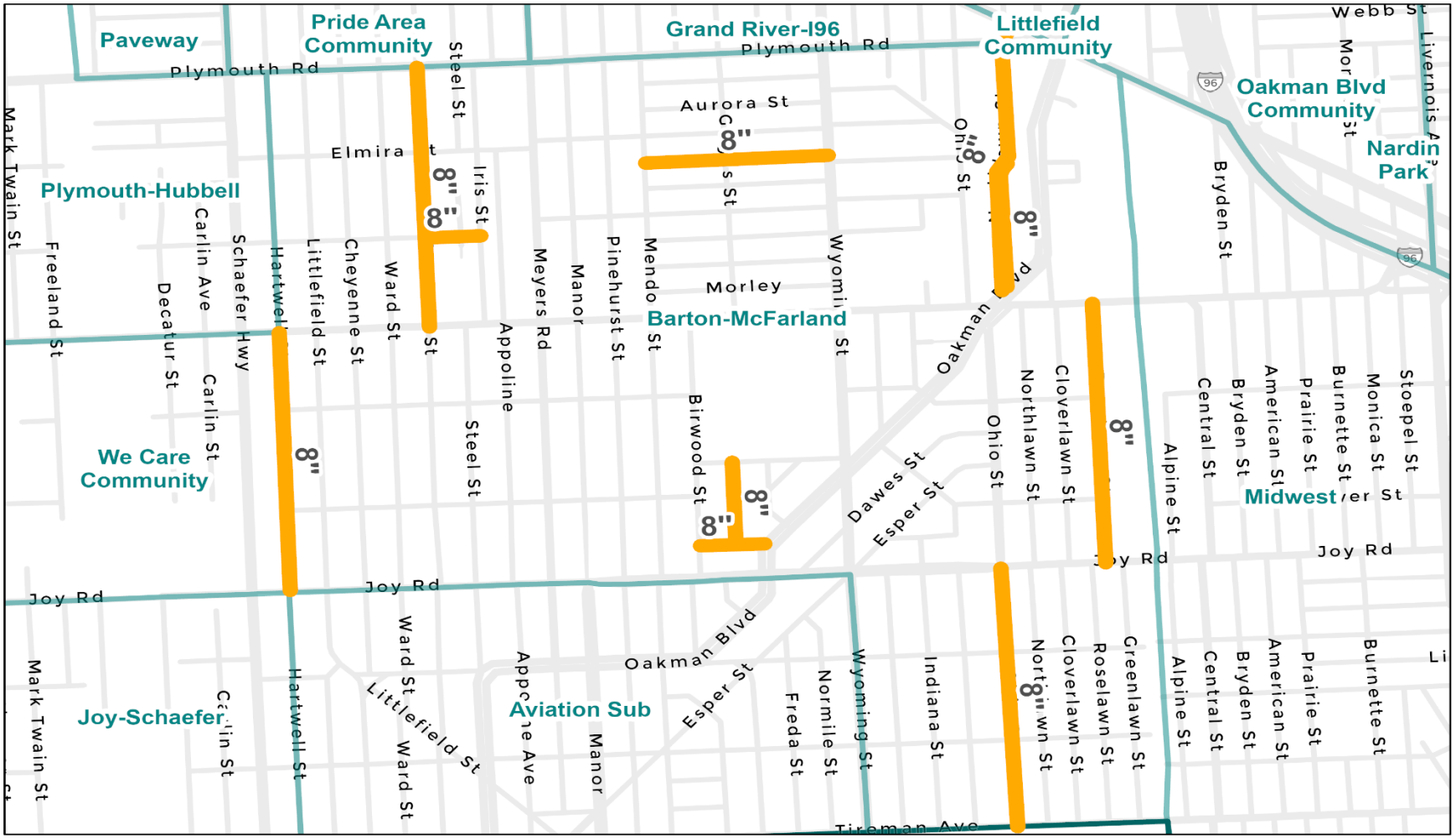
Historically, DWSD has tracked water maintenance activity and carefully logged the frequency of breaks and leaks in the system. DWSD now manages the water replacement program through the risk and criticality model which is updated annually with new condition assessment data. The projects identified are 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. Also, six-inch pipe is no longer a recommended minimum size for water main supply, thus 6-inch pipe will be replaced with eight-inch (except in those cases of a fire hydrant supply connection).

Several overview maps are included to identify project locations for WS-725 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 are 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 pipe of copper or iron per building code.

Figure 3-1-A PROJECT LOCATION MAPS for Project A, WS-725

Detroit Core City - Council District 5 - Watermains on 2nd, 4th, 5th, Alexandrine, Canfield, Cass, Henry, John R, Selden, Willis,



Detroit Westside - Council District 7 - Watermains on Beechdale, Griggs, Hartwell, Kramer, Northlawn, Ohio, Orangelawn, Roselawn, Sorrento

Table 3-1-A DETAILED LIST OF WATER MAIN REPLACEMENT IN NEIGHBORHOOD WEST of LIVERNOIS UNDER WS-725

Neighborhood	Description	Length of Existing Pipe (Ft.) per Pipe Diameter (inch)							
		4"	6"	8"	10"	12"	Section Map	Pipe Material	Intervention Suggested
Barton-McFarland	Sorrento Ave, Plymouth Road to W Chicago		2730			35	14M	CI	HDD
Barton-McFarland	Orangelawn St., Sorrento Ave to Iris St.		455				14M	CI	HDD
Barton-McFarland	Beechdale Ave., Mendota to Wyoming Ave.			1565			14M	CI	HDD
Barton-McFarland	NorthLawn St. (West Side), W Grand River to Oakman Blvd		2765				16M-16N	CI	HDD
Barton-McFarland	NorthLawn St. (East Side), Marquette RR to Oakman Blvd		1268				16M	CI	HDD
Barton-McFarland	Roselawn St., W Chicago to Joy Road		2532				16M	CI	HDD
Barton-McFarland	Ohio St., Joy Road to Tireman Ave.		2565				16L	CI	HDD
Barton-McFarland	Griggs Ave, Kramer St.to West Pointe Ave.		775				14M	CI	HDD
Barton-McFarland	Kramer St., Birwood Ave. to Oakman Blvd.			535			14M	CI	HDD

Barton-McFarland	Hartwell Ave., W Chicago to Joy Road		2185				14M	CI	HDD
Medical Center	E Willis St., Brush Street to John R St.		598				20K	CI	HDD
Medical Center	E. Alexandrine St., John R St. to E. Alexandrine St. Alley		245				20K	CI	HDD
Midtown	2nd Ave, W Canfield St. to Selden St.			45		1387	20K	CI	HDD
Midtown	Cass Ave., Selden Street to Forest Ave.		2480				20K-20l	CI	HDD
Midtown	Selden Street, Woodward Ave. To Cass Ave.			805			20K	CI	HDD
Midtown	4th Ave., Selden Street to Calumet Street		1260				19J	CI	HDD
Midtown	Cass Ave., Martin Luther King Jr. Blvd. to I-75			240	2754		20K	CI	HDD
Midtown	5th Ave., Henry Street to Temple Street.			1260			19J	CI	HDD
Midtown	Henry Street, 5th Street to 4th Street			440			19J	CI	HDD
Midtown	Henry St., Cass Ave. to Clifford Street			160			20K	CI	HDD

Cultural Center	John R Street, Kirby Street E to Ferry Street E		493				20L	CI	HDD
Midtown	Henry from GV that is West of Second to Tee at Cass			780			20 K		HDD
Midtown	Second from GV North of Henry to The GV at Service drive-I-75					448	20 K		HDD
Midtown	Extending Wm replacement along Cass from End of scope in proposal to GV East and West along service drive					82	20 K		HDD
	Subtotals:		20,351	5,830	2,754	1,952			
	Design total:		30,887			LFT			

Project B, WS-TBD: WATER MAIN REPLACEMENT AND REHABILITATION, DEXTER – LINWOOD, DAVISON AND BUFFALO-CHARLES 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 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 pipe of copper or iron per building code.

DWSD has established an asset management program with a 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.

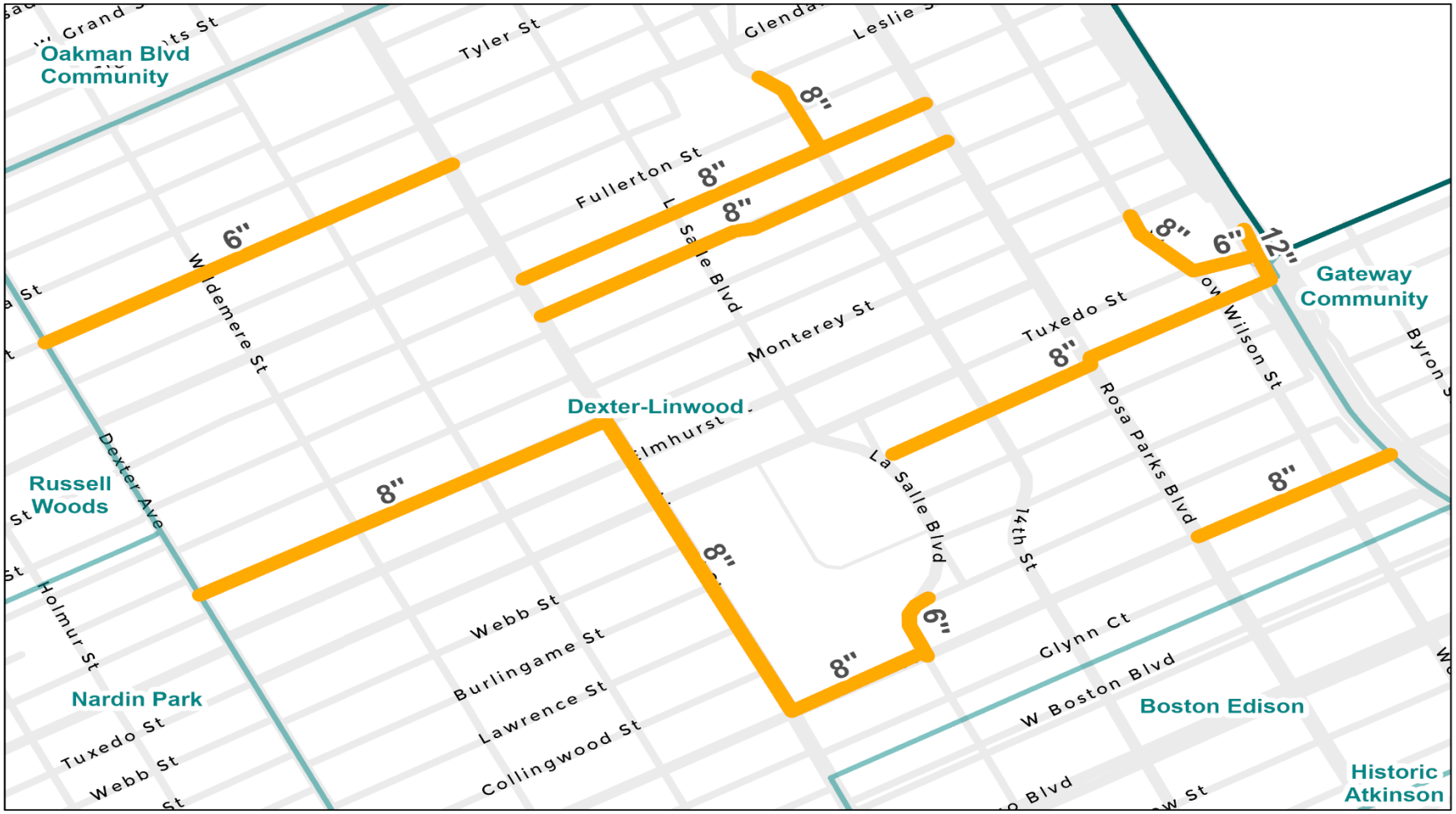
Historically, DWSD has tracked water maintenance activity and carefully logged the frequency of breaks and leaks in the system. DWSD now manages the water replacement program through the risk and criticality model which is updated annually with new condition assessment data. The projects identified are 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. Also, six-inch pipe is no longer a recommended minimum size for water main

supply, thus 6-inch pipe will be replaced with eight-inch (except in those cases of a fire hydrant supply connection).

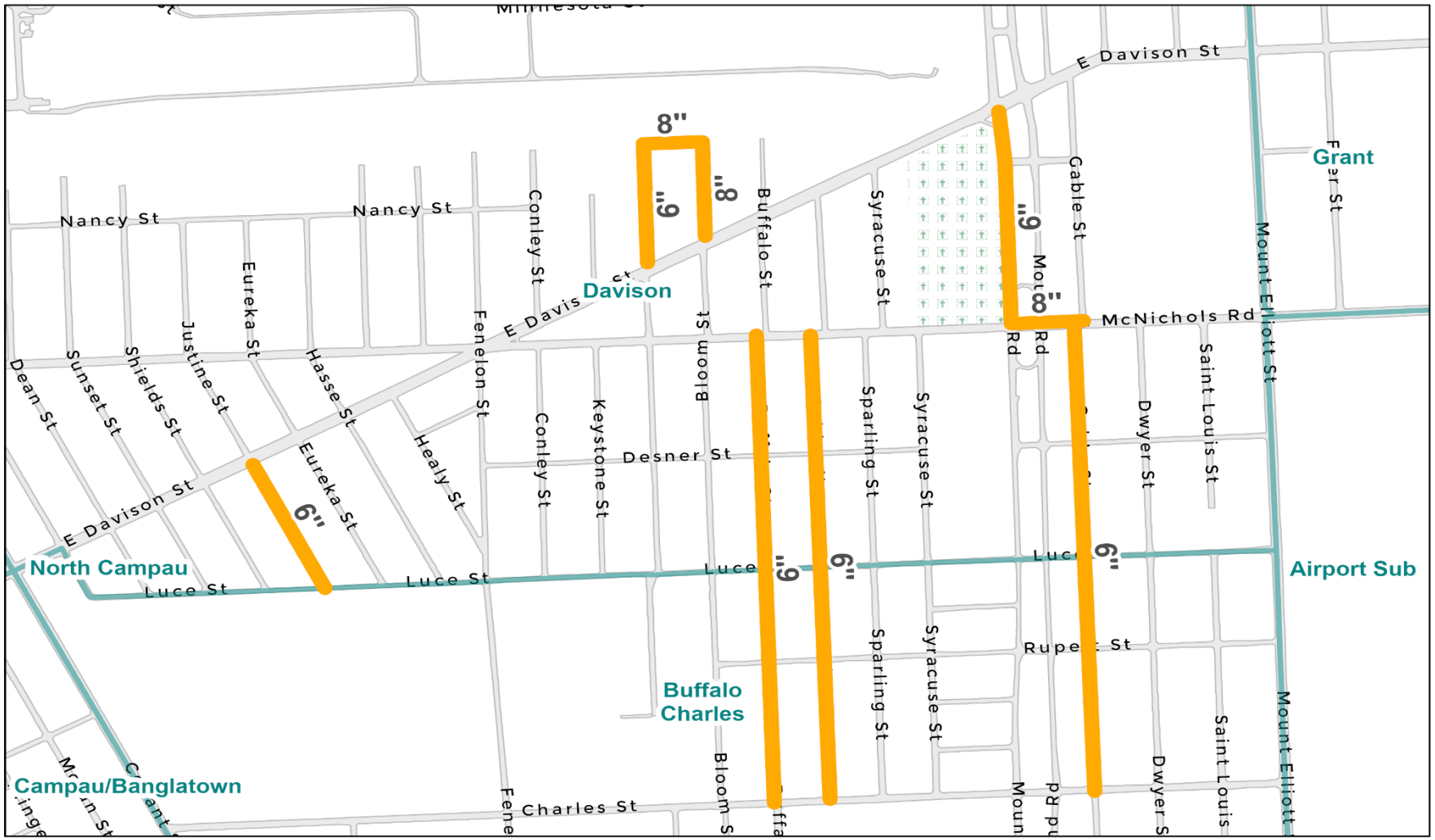
Several overview maps are included to identify project locations for WS-TBD in Figure 3-1-B and Table 3-1-B.

Lead service lines are a public health threat. The replacement of the Lead service lines on private and public property are 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 pipe of copper or iron per building code.

Figure 3-1-B PROJECT LOCATION MAPS for Project B, WS-TBD Dexter Davison



Detroit Westside - Council District 5 - Watermains on 14th, Calvert, Glendale, Highland, John C Lodge, La Salle, Linwood, Monterey, Sturtevant, Tuxedo, Webb, and Woodrow Wilson.



Detroit Eastside - Council District 3 - Watermains on Bloom, Buffalo, Caldwell, Gable, Justine, McNichols, Moenart, Mound, and Phyllis.

Table 3-1-B DETAILED LIST OF WATER MAIN REPLACEMENT IN NEIGHBORHOOD OF DETROIT UNDER WS-TBD

Neighborhood	Description	Length of Existing Pipe (Ft.) per Pipe Diameter (inch)							
		4"	6"	8"	10"	12"	Section Map	Pipe Material	Intervention Suggested
Davison	Justine St., E Davison St. to Luce St		820				22P	CI	HDD
Buffalo Charles	Gable St., Charles St. to E McNichols Rd		2555				23P	CI	HDD
Dexter-Linwood	Glendale Ave., Dexter Ave. to Linwood St.		2696				18M	CI	HDD
Dexter-Linwood	Monterey St., Dexter Ave to Linwood St.		2690				18M	CI	HDD
Dexter-Linwood	Sturtevant St., Linwood St. to 12th St/Rosa Parks		2730				19N	CI	HDD
Dexter-Linwood	14th Street, Sturtevant St. to Leslie Street	608					19N	CI	HDD
Dexter-Linwood	Highland St., Linwood St. to 12th St/Rosa Parks		704	2026			19N	CI	HDD
Dexter-Linwood	Linwood St., Monterey St. to Calvert Ave.			2600			18M	CI	HDD
Dexter-Linwood	Webb St., La Salle Blvd. to John C Lodge Freeway		1444	1116			19M	CI	HDD

Dexter-Linwood	John C Lodge Service, Webb St. to Tuxedo St.					300	19N	CI	HDD
Dexter-Linwood	Woodrow Wilson St., Elmhurst St. to Tuxedo St.		510				19N	CI	HDD
Dexter-Linwood	Calvert Ave., 12th St/Rosa Parks to John C Lodge Freeway		1200				19M	CI	HDD
Dexter-Linwood	Moenart St., Phyllis St. to E Davison St.		664				22Q	CI	HDD
Davison	Bloom St., Phyllis St. to E Davison St.			532			22Q	CI	HDD
Davison	Phyllis St., Moenart St. to Bloom St.			310			22Q	CI	HDD
Buffalo Charles	Caldwell St., E McNichols Rd to Charles St.		2600				22P	CI	HDD
Buffalo Charles	Buffalo St., E McNichols Rd to Charles St.		2610				22P	CI	HDD
Dexter-Linwood	Calvert Ave., Linwood St. to La Salle Blvd.		920				19M	CI	HDD
Dexter-Linwood	Tuxedo St., John C Lodge Service to Woodrow Wilson St.			360			19N	CI	HDD
Dexter-Linwood	La Salle Blvd, Calvert Ave. to Collingwood Street			327			19M	CI	HDD

Davison	McNichols Road, Gable Street to Mound Road			270			23Q	CI	HDD
Davison	Mound Rd, E Davison St. to E McNichols Rd		1320				22Q	CI	HDD
	Subtotals:	608	23,463	7541		300			
	Design total:	31,912				LFT			

3.2 STUDY AREA CHARACTERISTICS

3.2.1 STUDY AND SERVICE AREA

The general study area for this Planning Document is the portion of 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 WS-725 project is 21,188 (Estimated from Detroitmi.gov/webapp/census-data-map). The population served by Dexter and Davison project is 10,891 (Estimated from Detroitmi.gov/webapp/census-data-map). Cultural and Historic Resourses will be supplied by design consultant. Air quality, wetlands, Great Lakes Shorelands, Coastal Zones, Costal Management Area, Floodplains, Natural or Wild and Scenic Rivers, Major surface waters, agricultural Resources are not affected by this project. Topograghy is mostly flat. Geology and soil type of the City of Detroit is combination of natural sand, silt and glacial tills. Fauna and Flora Michigan Natural Features Inventory MNSI and US Fish Wild Life clearance will be supplied by design consultant.

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, 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 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 persons 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 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 639,111[1]. The SEMCOG July 2020 Projected Population is 642,508. DWSD is projecting flat demand of 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 the majority of 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 pipe in the Detroit Water Distribution System is comprised of older unlined pit cast and centrifugally spun cast iron pipe. 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 much 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	% of System
6"	5,481,01	39%
8"	6,047,0	42%
10"	257,222	2%
12"	1,665,87	12%
16"	748,742	5%

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. The Department experienced serious trouble with spun cast pipes, and a lifespan of 35 to 40 years was suggested to 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. The 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 pipe 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 is a means to save time and construction cost, and minimize disruption to the right-of-way, other existing utilities, and the rate payers 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-725: WATER MAIN REPLACEMENT AND REHABILITATION AT MIDTOWN, CULTURAL CENTER, MEDICAL CENTER, AND BARTON-MCFARLAND NEIGHBORHOODS OF DETROIT

Project B, WS-TBD: WATER MAIN REPLACEMENT AND REHABILITATION DEXTER – LINWOOD, DAVISON AND BUFFALO-CHARLES 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 the public health and safety to remove and replace the 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 qualitatively and quantitatively evaluate the water leaks in the City water distribution system. As mentioned in Section 1 of this plan, DWSD has engaged 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-725: WATER MAIN REPLACEMENT AND REHABILITATION AT MIDTOWN, CULTURAL CENTER, MEDICAL CENTER, AND BARTON-McFARLAND NEIGHBORHOODS OF DETROIT

Project B, WS-TBD: WATER MAIN REPLACEMENT AND REHABILITATION DEXTER – LINWOOD, DAVISON AND BUFFALO-CHARLES 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 hydroexcavation 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 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. (20/50)=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)

$1/(1 + i)^n$ = Conversion Factor

Interest during the construction period was computed using the formula: (2.0)/100*0.5*2*16,547,627=$330,953 Project A, WS-725 and, (2.0)/100*0.5*2*17,510,048=$350,201 Project B, WS-TBD

$I = i * 0.5 * P * C$

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)

$[((1 + i)^n - 1)/i(1 + i)^n]$ = 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 which 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)

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

The cost analysis for Alternatives 1 and 2 is presented in Table 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-725: WATER MAIN REPLACEMENT AND REHABILITATION AT MIDTOWN, CULTURAL CENTER, MEDICAL CENTER, AND BARTON-McFARLAND NEIGHBORHOODS OF DETROIT

AVERAGE EQUIVALENT ANNUAL COST DETERMINATION
PROJECT-A, WS-725

Project:		DWSD Project B											
System:		Water Main Replacement, Various Locations in Detroit East of Livernois Avenue											
Planning Period:	2024-2044	20	Years		Alternative 1				Alternative 2			
Construction Duration:		2	Year		NO ACTION				30,887	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		$ -				$ 12,536,081			
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				$ -				$ 12,536,081			
	Contingency		10%		$ -				$ 1,253,608			
	Engineering, Legal, Admin., "Green" Provisions		20%		$ -				$ 2,757,938			
	Total				$ -				$ 16,547,627			
			CPI Factor									
10	Replacement Cost at Yr.		1.2190		$ -				$ -			
15	Replacement Cost at Yr.		1.3459		$ -				$ -			
20	Salvage Value at Yr.				$ -		0.6730		$ 7,521,649			0.6730
OM&R Costs (Recurring Equal Expenditures)					2024	2044			2024	2044		
	Repair & Maintenance				$ 1,235,480	$ 1,835,858			$ -	$ -		
	Total O&M Costs				$ 1,235,480	$ 1,835,858			$ -	$ -		
	Fixed O&M Costs				$ 1,235,480	$ 1,235,480			$ -	$ -		
	Total Variable O&M Costs				$ -	$ 600,378			$ -	$ -		
	Yearly Increase				$ 30,019				$ -			
	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				
1) Based on an average of five breaks per year				1. Initial Cost			$ -	1. Initial Cost			$	16,547,627
2) Annual O&M cost does not include cost of restoration and cost of contracted services if needed				2a. Constant O&M			$ 20,201,869	2a. Constant O&M			$	-
				2b. Variable O&M			$ 4,340,745	2b. Variable O&M			$	-
				3. Replacement Cost			$ -	3. Replacement Cost			$	-
				4. Salvage Value		(minus)	$ -	4. Salvage Value		(minus)	$	5,061,854
				5. Interest During Construction			$ -	5. Interest During Construction			$	330,953
				6. Total Present Worth			$ 24,542,614	**6. Total Present Worth**			$	11,816,726
EQUIVALENT ANNUAL COST							**$ 1,500,946**					**$ 722,672**

3/30/2023

Table 4-1-2 COST COMPARISON OF Project B, WS-TBD: WATER MAIN REPLACEMENT AND REHABILITATION DEXTER – LINWOOD, DAVISON AND BUFFALO-CHARLES NEIGHBORHOODS OF DETROIT

AVERAGE EQUIVALENT ANNUAL COST DETERMINATION
PROJECT-B, WS-7XX(Dexter-Davison)

Project:		DWSD Project B											
System:		Water Main Replacement, Various Locations in Detroit											
Planning Period:	2024-2044	20	Years		Alternative 1				Alternative 2			
Construction Duration:		2	Year		NO ACTION				31,912	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		$ -				$ 13,265,188			
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				$ -				$ 13,265,188			
	Contingency		10%		$ -				$ 1,326,519			
	Engineering, Legal, Admin., "Green" Provisions		20%		$ -				$ 2,918,341			
	Total				$ -				$ 17,510,048			
			CPI Factor									
10	Replacement Cost at Yr.		1.2190		$ -				$ -			
15	Replacement Cost at Yr.		1.3459		$ -				$ -			
20	Salvage Value at Yr.				$ -		0.6730		$ 7,959,113			0.6730
OM&R Costs (Recurring Equal Expenditures)					2024	2044			2024	2044		
	Repair & Maintenance				$ 1,276,480	$ 1,896,782			$ -	$ -		
	Total O&M Costs				$ 1,276,480	$ 1,896,782			$ -	$ -		
	Fixed O&M Costs				$ 1,276,480	$ 1,276,480			$ -	$ -		
	Total Variable O&M Costs				$ -	$ 620,302			$ -	$ -		
	Yearly Increase				$ 31,015				$ -			
	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			
1) Based on an average of five breaks per year					1. Initial Cost		$ -		1. Initial Cost			$ 17,510,048
2) Annual O&M cost does not include cost of restoration and cost of contracted services if needed					2a. Constant O&M		$ 20,872,278		2a. Constant O&M			$ -
					2b. Variable O&M		$ 4,484,795		2b. Variable O&M			$ -
					3. Replacement Cost		$ -		3. Replacement Cost			$ -
					4. Salvage Value	(minus)	$ -		4. Salvage Value	(minus)		$ 5,356,255
					5. Interest During Construction		$ -		5. Interest During Construction			$ 350,201
					6. Total Present Worth		$ 25,357,072		6. Total Present Worth			$ 12,503,994
EQUIVALENT ANNUAL COST							**$ 1,550,755**					**$ 764,703**

3/30/2023

As shown in Tables 4-1-1 and 4-1-2 for WS-725 and WS-TBD 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. This lost water from leaks and broken water mains also has an impact on the regional wastewater treatment facilities because the wastewater collection system serving 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 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 replace the Lead service lines during a water main replacement

project. The public participation ensured through a public notice to allow local 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 local 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 pipe (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 hydroexcavation 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 preproject conditions.

5.1 DESCRIPTION

Project A, WS-725 and Project B, WS-TBD

The specific streets where the new water mains for WS-725 will be installed are listed in Table 3-1-A, along with the pipe diameters, lengths and general location within the project. For WS-TBD, 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-725 and Project B, WS-TBD

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-725: WATER MAIN REPLACEMENT AND REHABILITATION AT MIDTOWN, CULTURAL CENTER, MEDICAL CENTER, AND BARTON-McFARLAND NEIGHBORHOODS OF DETROIT

			PROJECT A WS-725
Planning Period:	2024-2044	20 Years	30,877 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			$ 12,536,081
Contingency		10%	$ 1,253,608
Engineering, Legal, Admin., "Green" Provisions		20%	$ 2,757,938
Total			$ 16,547,627

Table 5-1-B Project B, WS-TBD: WATER MAIN REPLACEMENT AND REHABILITATION DEXTER – LINWOOD, DAVISON AND BUFFALO-CHARLES NEIGHBORHOODS OF DETROIT

			PROJECT B WS-TBD
Planning Period:	2024-2044	20 Years	31,912 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			$ 13,265,188
Contingency		10%	$ 1,326,519
Engineering, Legal, Admin., "Green" Provisions		20%	$ 2,918,341
Total			$17,510,048

The estimated cost for the full water main replacements are 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-725	Project WS-TBD
Advertise for Public Hearing	April 5 , 2023	April 5 , 2023
Public Hearing on Draft Planning Document	April 19, 2023	April 19, 2023
Complete and Submit Final Planning Document	June 1, 2023	June 1, 2023
Complete Plans and Specifications	September, 2023	December, 2023
Advertise for Bids	January, 2024	January, 2024
Receive Bids	Febuary, 2024	Febuary, 2024
Award Construction Contract	March, 2024	March, 2024
Start of Construction	April, 2024	April, 2024
Complete Construction	April, 2026	April, 2026

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

i = Interest Rate through DWSRF Loan (2.0%)

n = Number of Years (20)

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

Table 5-3-1 USER COST IMPACT FOR PROJECT A, WS-725

Item	Water Main Replacement
Total Cost of Project	$16,547,627
Annualized Cost of Project (assuming DWRF interest rate of 2.0% over 20 years)	$722,672
Number of User Accounts (households) in 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 mCF 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)	$3.01
Proposed Annual DWSD Water Supply Rate per Household (Year 1)	$297.48
Proposed Percent Increase in Cost per Household per Year	1.02%

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

Item	Water Main Replacement
Total Cost of Project	$17,510,048
Annualized Cost of Project (assuming DWRF interest rate of 2.0% over 20 years)	$764,703
Number of User Accounts (households) in 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 mCF 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)	$3.19
Proposed Annual DWSD Water Supply Rate per Household (Year 1)	$297.66
Proposed Percent Increase in Cost per Household per Year	1.08%

The theoretical impact of financing the WS-725 and WS-TBD water main replacement through the DWSRF loan program is expected to increase by no more than 1.02% due to WS-725 and 1.08% due to WS-TBD the cost of water to a typical user. This anticipated increase is due to the impact of construction cost. 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.

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; *[1] 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 located 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 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 in 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 addressed 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 10 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 March 30, 2023) 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 April 19, 2023. The hearing included a presentation on the project, as well as an opportunity for public comment and questions. The official hearing transcript and a copy of the visual aids (handout) used during the presentation is 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 April 19, 2023, and the GLWA Board of Directors at their regular meeting conducted on June 24, 2023, 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 are 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

		Engineer's Cost Estimate for WS-725 Water main replacement/Rehabilitation in the Neighborhood of Detroit				
Bid Item	**Description**	**Quantity**	**Unit**	**Average Unit Rate from WS-720**	**Amount**	Remarks
	Section-1					
1	Mobilization/Demobilization	1	LS		$ 596,003.87	
	Section-2					
2	Restoration and Final clean up, Residential street, Within the Pavement	1,885	LFT.	$ 201.52	$ 379,845.15	
3	Restoration and Final clean up, Residential street, Outside the Pavement	5,366	LFT.	$ 87.64	$ 470,299.91	
4	ADA Ramp, w/ Curb	650	SYD	$ 163.00	$ 105,950.00	Approximate qty.
5	Tree, Remove, 6 inch to 18 inch Diameter	7	EA	$ 2,796.00	$ 19,572.00	Approximate qty.
6	Tree, Install	7	EA	$ 1,207.00	$ 8,449.00	Approximate qty.
	Section-3					
7	Fire Hydrant Assembly, Remove	67	EA	$ 585.34	$ 39,031.12	
8	Fire Hydrant Assembly, Install, W/Restoration	83	EA	$ 7,739.09	$ 639,423.83	
9	Gate Valve and Well, Removal	47	EA	$ 1,142.49	$ 53,617.28	
10	Gate Valve in Box	58	EA	$ 3,714.35	$ 214,931.88	
11	Gate Valve	14	EA	$ 3,507.76	$ 50,177.96	
12	Gate Well	25	EA	$ 7,321.82	$ 180,392.01	
13	Water Main, Abandon, Pump with Flowable Fill	13,899	LFT	$ 9.06	$ 125,905.75	
14	Water Main, Open Cut, Ductile Iron	7,104	LFT	$ 177.38	$ 1,260,102.68	
15	Water Main, Direction Drill, HDPE	13,899	LFT	$ 132.03	$ 1,835,162.67	
16	Pipe Bursting	6,177	LFT	$ 136.76	$ 844,820.73	
17	Water main Lining	3,706	LFT	$ 157.43	$ 583,520.29	
18	Water Main, Temporary	16,988	LFT	$ 21.36	$ 362,779.06	
19	Water Service, Replace Lead Service to Copper Service, on Public Side, W/ Restoration	458	EA	$ 2,591.93	$ 1,188,366.41	
20	Water Service, Replace Lead Service to Copper Service, on Private side, W/ Restoration	458	EA	$ 2,603.77	$ 1,193,797.20	
21	Water Service, Replace Copper Service, up to two-inches (2") diameter,Short/ Long on Public Side, W/ Restoration	154	EA	$ 4,447.19	$ 685,453.02	
22	Water Service, Remove and Replace Curb Box	613	EA	$ 551.07	$ 337,597.86	
23	Water Service, Remove and Replace Curb Stop	613	EA	$ 674.68	$ 413,324.05	
24	Water Service, Hydro-Vac	613	EA	$ 642.93	$ 393,868.18	
25	Electrical Grounding System	546	EA	$ 492.40	$ 268,816.80	
26	Pitcher Style Filters and Refill Filter Cartridges	613	EA	$ 168.89	$ 103,466.68	
27	Water Main, Hydrostatic Pressure Test	30,887	LFT	$ 2.78	$ 85,855.45	
28	Water Main, Chlorination and Flushing	30,887	LFT	$ 2.45	$ 75,550.38	
			Subtotal		11,920,077	
			Moblization +Subtotal		12,516,081	
	Section-4					
29	Contaminated Material Allowance	1	LS	$ 20,000.00	$ 20,000.00	
30	Provisional Allowance	1	LS	$ 1,000,000.00	$ 1,000,000.00	
	TOTAL ESTIMATED CONSTRUCTION COST:				**$13,536,081.23**	

		Engineer's Cost Estimate for WS-7XX Water main replacement/Rehabilitation in the Neighborhood of Detroit				
Bid Item	**Description**	**Quantity**	**Unit**	**Average Unit Rate from WS-720**	**Amount**	Remarks
			Section-1			
1	Mobilization/Demobilization	1	LS		$ 630,723.22	
			Section-2			
2	Restoration and Final clean up, Residential street, Within the Pavement	1,885	LFT.	$ 201.52	$ 379,865.20	
3	Restoration and Final clean up, Residential street, Outside the Pavement	5,366	LFT.	$ 87.64	$ 470,276.24	
4	ADA Ramp, w/ Curb	650	SYD	$ 163.00	$ 105,950.00	Approximate qty.
5	Tree, Remove, 6 inch to 18 inch Diameter	7	EA	$ 2,796.00	$ 19,572.00	Approximate qty.
6	Tree, Install	7	EA	$ 1,207.00	$ 8,449.00	Approximate qty.
			Section-3			
7	Fire Hydrant Assembly, Remove	69	EA	$ 585.34	$ 40,388.46	
8	Fire Hydrant Assembly, Install, W/Restoration	86	EA	$ 7,739.09	$ 665,561.74	
9	Gate Valve and Well, Removal	49	EA	$ 1,142.49	$ 55,982.01	
10	Gate Valve in Box	60	EA	$ 3,714.35	$ 222,266.70	
11	Gate Valve	15	EA	$ 3,507.76	$ 51,634.23	
12	Gate Well	26	EA	$ 7,321.82	$ 187,438.59	
13	Water Main, Abandon, Pump with Flowable Fill	14,916	LFT	$ 9.06	$ 135,143.31	
14	Water Main, Open Cut, Ductile Iron	8,291	LFT	$ 177.38	$ 1,470,636.29	
15	Water Main, Direction Drill, HDPE	14,916	LFT	$ 132.03	$ 1,969,422.85	
16	Pipe Bursting	7,105	LFT	$ 136.76	$ 971,718.09	
17	Water main Lining	3,374	LFT	$ 157.43	$ 531,245.85	
18	Water Main, Temporary	18,771	LFT	$ 21.36	$ 400,939.16	
19	Water Service, Replace Lead Service to Copper Service, on Public Side, W/ Restoration	475	EA	$ 2,591.93	$ 1,231,189.46	
20	Water Service, Replace Lead Service to Copper Service, on Private side, W/ Restoration	475	EA	$ 2,603.77	$ 1,236,478.30	
21	Water Service, Replace Copper Service, up to two-inches (2") diameter,Short/ Long on Public Side, W/ Restoration	160	EA	$ 4,447.19	$ 711,550.40	
22	Water Service, Remove and Replace Curb Box	635	EA	$ 551.07	$ 349,934.28	
23	Water Service, Remove and Replace Curb Stop	635	EA	$ 674.68	$ 428,427.71	
24	Water Service, Hydro-Vac	635	EA	$ 642.93	$ 408,266.18	
25	Electrical Grounding System	566	EA	$ 492.40	$ 278,698.40	
26	Pitcher Style Filters and Refill Filter Cartridges	635	EA	$ 168.89	$ 107,246.63	
27	Water Main, Hydrostatic Pressure Test	33,687	LFT	$ 2.78	$ 93,649.97	
28	Water Main, Chlorination and Flushing	33,687	LFT	$ 2.45	$ 82,533.25	
		Subtotal			$ 12,614,464.32	
		Moblization +Subtotal			$ 13,245,187.53	
			Section-4			
29	Contaminated Material Allowance	1	LS	$ 20,000.00	$ 20,000.00	
30	Provisional Allowance	1	LS	$ 1,000,000.00	$ 1,000,000.00	
TOTAL ESTIMATED CONSTRUCTION COST:					**$14,265,187.53**	

APPENDIX B

SUBMITTAL FORM, DISADVANTAGED COMMUNITY STATUS DETERMINATION WORKSHEET, BOARD RESOLUTIONS

APPENDIX C

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

APPENDIX D

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