CITY OF DETROIT
Water and Sewerage Department

Water Main Replacement for WS-713

Draft Project Plan
June 2020

Mike Duggan
Mayor

Gary Brown
Director

Michael Einheuser
Chairperson
Board of Water Commissioners

City of Detroit

Mike Duggan, Mayor

Detroit City Council

Brenda Jones, President
Mary Sheffield, President Pro Tem
Janeé Ayers
James Tate
Roy McCalister, Jr.
Scott Benson
André L. Spivey
Raquel Castañeda-López
Gabe Leland

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1. EXECUTIVE SUMMARY

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 multiseasonal stresses upon the network, water main breaks are a constant occurrence and they constitute a drain on the Detroit Water and Sewerage Department's (DWSD) resources necessary to address these breaks, often times 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 identified one project area for pipe replacement or rehabilitation, WS-713 known as Jefferson Chalmers (referred to throughout this report as Jefferson Chalmers), that is in critical need of addressing the repeated water main breaks. DWSD has also retained the services of a consulting engineering firm to provide Capital Improvement Program Management. A centerpiece of the CIP is the development of a Capital Improvement Program Management Organization (CIPMO), which coordinates and executes capital project planning and implementation across multiple agencies responsible for infrastructure and community development

Identification of capital improvements for two pilot areas was previously undertaken to establish the process by which capital planning and project implementation will occur across the City, including the Jefferson Chalmers neighborhood. Under the CIP, planning work to renew and rehabilitate the water infrastructure for Jefferson Chalmers was recently conducted, and the following approaches were 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. This project is being performed under DWSD's CS-1812 and includes one contract for water distribution network rehabilitation and replacement. Work includes either rehabilitation or replacement of buried water infrastructure identified as a result of CIPMO's condition assessment work performed in Jefferson Chalmers.

Full lead service line replacements are also included in the water main replacement project. It is a benefit to the public health and safety to replace the lead service lines. DWSD's policy is that all lead (Pb) 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 Pb or copper.

This Project Plan 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 (MEGLE) guidelines for preparing a Drinking Water Revolving Fund (DWRF) Project Plan. The recommendation presented in this Project Plan consists of primarily replacing the aged water mains with new ones, upsizing where fire flow is inadequate, and in a limited number of streets, rehabilitating the existing main with a structural liner. The Jefferson Chalmers project consists of the following:

- Jefferson Chalmers (Jefferson ChalmersWS-713): Replacing approximately 36,975 feet of pipes (size 6, 8, and 12 inches in diameter) for an estimated total project cost of $20.8M.

The impact of financing the water main replacement through the DWRF loan program is expected to increase by no more than 1.13% the cost of water to a typical City of Detroit customer due to the impact of construction cost. However, the actual rate determination will be based on factors that encompass the delivery of comprehensive services by DWSD to its customers. The increase is based on repayment of the DWRF loan over a 20-year period. As a disadvantaged community, the City of Detroit can request a 30-year financing period.

2. INTRODUCTION AND PURPOSE

This document has been prepared in accordance with the planning guidelines adopted by the MEGLE for the Drinking Water Revolving Fund (DWRF) low interest loan program. It is the intent of the DWSD to seek low interest loan assistance under the DWRF 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 DWRF assistance to provide reliable water supply to its customers. This Project Plan provides information on the status of the current water main 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 Project Plan also serves as the basis for public review and comment on the proposed work in accordance with the public participation requirements of the DWRF program.

3. PROJECT BACKGROUND

3.1. SUMMARY OF PROJECT NEED

Most of the water distribution system serving the City of Detroit was installed in the later 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 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, flooding problems.

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).

Lead service lines are a public health threat. The replacement of the lead service lines on private and public property are DWRF eligible. DWSD's policy is that all lead (Pb) 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 Pb or copper. The project will replace lead service lines of two inches in diameter and smaller from the public water main to the meter, or full 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. These service lines are not eligible for DWRF resources and shall be replaced to the stop box.

DWSD has established an asset management program with a goal to replace their aged water distribution system, which is approximately 2,700 miles of water main of various sizes (6”-16”), over a 70 year period. This asset management replacement program started more than 10 years ago. This goal would enable the distribution system to be replaced on a cycle consistent with the life expectancy of the pipe. Currently, DWSD prioritizes its water main replacement program based on a consideration of the following factors:

1. Frequency of breaks/leaks in the system.
2. Occupancy of the area under consideration with a dense resident occupancy considered as a high priority.
3. Reduced hydraulic capacity due to low coefficients of friction (C factors) as a

result of tuberculation on the interior pipe surface.

4. Inadequate fire protection availability due to reduced hydraulic capacity.
5. Increased pumping cost as a result of frictional increases.
6. Age and structural condition of the water main.

Historically, DWSD has tracked water maintenance activity and carefully logged the frequency of breakage in various sectors of the system. Breakage/leaks of 5 or more per 1,000 feet of water main as measured from valve to valve are considered to be threshold for evaluating possible pipe replacement, in conjunction with the above criteria.

The project identified in this project plan has target areas, which have been recently identified as areas in critical need. The water mains identified for replacement as part of this Project Plan had, on average, the following number of breaks per 1,000 linear feet of main over the mains' lifetime.

- Jefferson Chalmers (WS-713) – 2 breaks per 1,000 linear feet

An overview map showing the water main locations for WS 713 are depicted in **Figure 3-1** and a more detailed map of the individual streets are presented in **Figure 3-2**. A detailed street listing for Jefferson Chalmers is provided in **Table 3-1.**

Figure 3-1 PROJECT LOCATION MAP - WATER MAIN REPLACEMENT WS-713

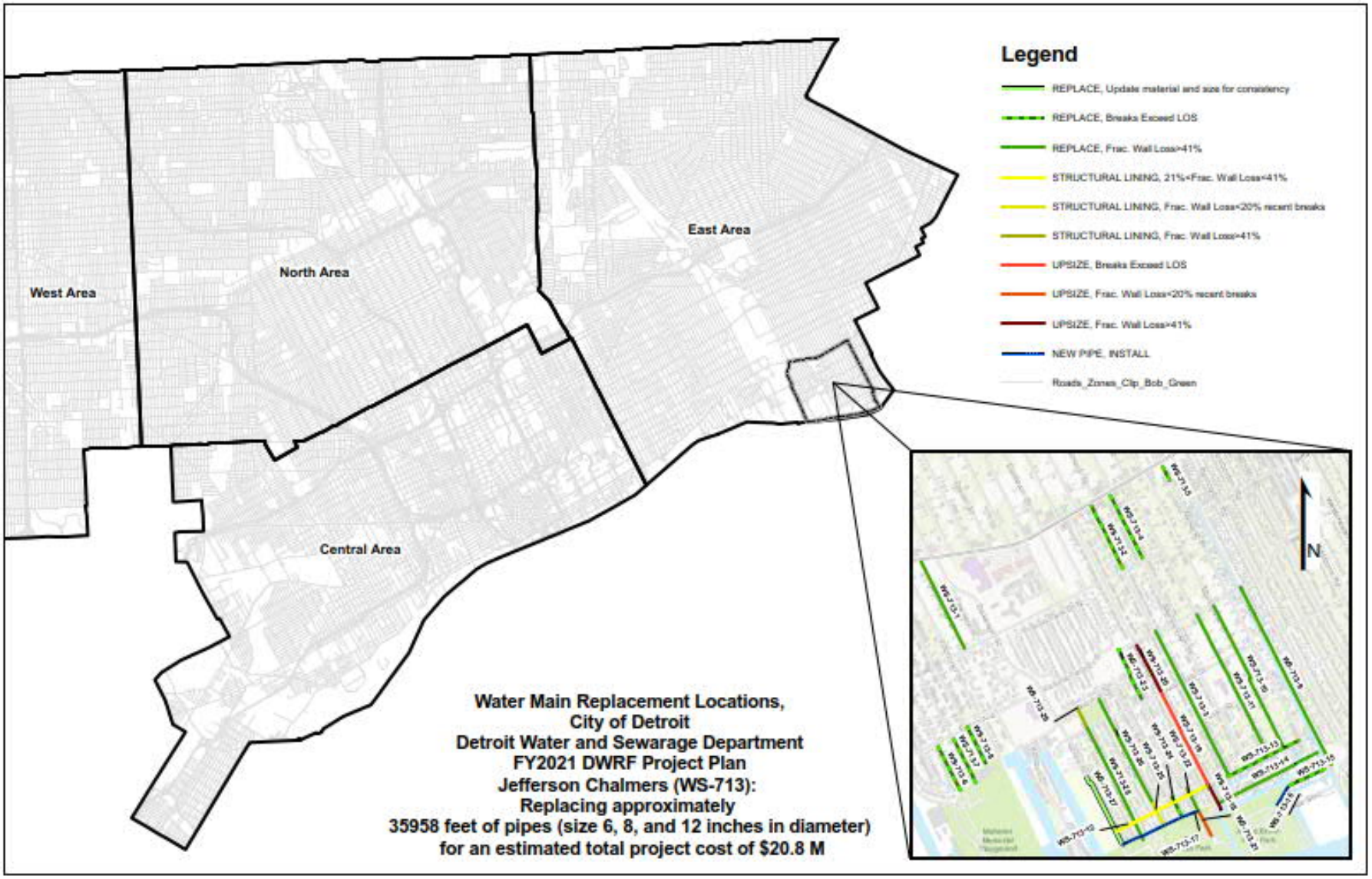

Figure 3 2 DETAILED OVERVIEW MAP - WATER MAIN REPLACEMENT WS-713

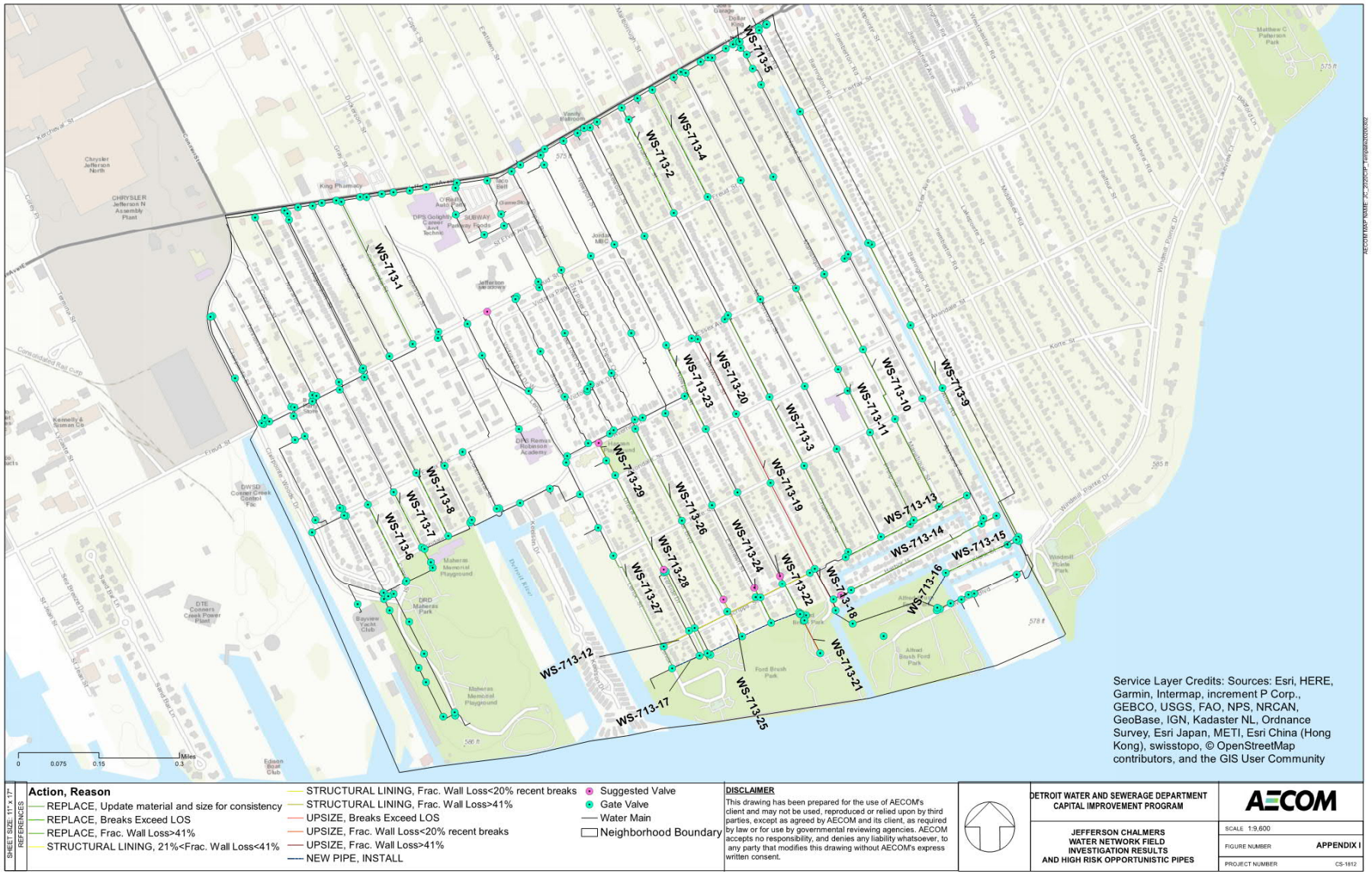

Table 3-1 DETAILED LIST OF WS-713 WATER MAIN REPLACEMENT

GIS_ID	Location	Detailed Location	Action	Reason	Length (ft.)	Dia. (in.)	Material	Year Installed
WS-713-3	Chalmers	Essex to Scripps	REPLACE	Frac. Wall Loss>41%	2607	8	Cast Iron	1916
WS-713-14	Harbor Island	between Lakewood and dead end (before Alter)	REPLACE	Frac. Wall Loss>41%	1704	6	Cast Iron	1915
WS-713-18	Lakewood	Riverside Blvd to Scripps	UPSIZE	Frac. Wall Loss>41%	473	8	Cast Iron	1915
WS-713-21	Newport	dead end to Park	UPSIZE	Frac. Wall Loss<20% recent breaks	455	6	Cast Iron	1915
WS-713-26	Piper	Scripps to Averhill	REPLACE	Frac. Wall Loss>41%	1894	8	Cast Iron	1915
WS-713-1	Continental	between Freud and Jefferson	REPLACE	Frac. Wall Loss>41%	1568	8	Cast Iron	1915
WS-713-25	Piper	dead end to Scripps	STRUCTURAL LINING	Frac. Wall Loss<20% recent breaks	409	8	Cast Iron	1915
WS-713-2	Chalmers	between Freud and Jefferson	REPLACE	Breaks Exceed LOS	1155	3	Cast Iron	1915
WS-713-4	Marlborough	between Freud and Jefferson	REPLACE	Breaks Exceed LOS	1182	8	Cast Iron	1915
WS-713-6	Conner	Essex to Gate Valve at Park	REPLACE	Breaks Exceed LOS	839	6	Cast Iron	1920
WS-713-7	Navahoe	Essex to Avondale	REPLACE	Breaks Exceed LOS	835	4	Cast Iron	1915
WS-713-8	Algonquin	Essex to Avondale	REPLACE	Breaks Exceed LOS	708	8	Cast Iron	1920
WS-713-5	Ashland	Jefferson to Fox River	REPLACE	Breaks Exceed LOS	295	3	Cast Iron	1915
WS-713-9	Alter	Essex to Klenke	REPLACE	Frac. Wall Loss>41%	3261	8	Cast Iron	1915
WS-713-10	Manistique	Essex to Scripps	REPLACE	Frac. Wall Loss>41%	2585	8	Cast Iron	1915
WS-713-11	Philip	Essex to Scripps	REPLACE	Frac. Wall Loss>41%	2556	4	Cast Iron	1915

GIS_ID	Location	Detailed Location	Action	Reason	Length (ft.)	Dia. (in.)	Material	Year Installed
WS-713-13	Scripps	between Ashland and Chalmers	REPLACE	Breaks Exceed LOS	1398	8	Cast Iron	1915
WS-713-15	Klenk St.	Alter to dead end	REPLACE	Breaks Exceed LOS	655	8	Cast Iron	1915
WS-713-19	Lakewood	Scripps to Avondale	UPSIZE	Breaks Exceed LOS	1705	8	Cast Iron	1915
WS-713-20	Lakewood	Essex to Avondale	UPSIZE	Frac. Wall Loss>41%	826	8	Cast Iron	1915
WS-713-22	Newport	dead end to Scripps	REPLACE	Frac. Wall Loss>41%	430	8	Cast Iron	1915
WS-713-23	Newport	between Avondale and Essex	REPLACE	Breaks Exceed LOS	929	8	Cast Iron	1914
WS-713-24	Eastlawn	dead end to Scripps	REPLACE	Breaks Exceed LOS	397	8	Cast Iron	1915
WS-713-27	Lenox	between Korte and Brush Park	REPLACE, UPSIZE	Update material and size for consistency.	1283	4	Cast Iron	1915
WS-713-29	Drexel	Averhill to Avondale South side	STRUCTURAL LINING	Frac. Wall Loss>41%	358	3	Cast Iron	1915
WS-713-28	Drexel/Riverside Dr	Avondale South side to past Scripps	REPLACE	Frac. Wall Loss>41%	2037	3	Cast Iron	1915
WS-713-12	Scripps	between Lakewood and Lenox	STRUCTURAL LINING	21%<Frac. Wall Loss<41%	1686	8	Cast Iron	1915
WS-713-16	Klenk St.	Dead end across channel to Riverside Blvd	NEW PIPE	Install	374	8	Cast Iron	1915
WS-713-17	Ford Brush Park	Lenox to Newport, park boundary	NEW PIPE	Install	1354	6	Cast Iron	1915

3.2. STUDY AREA CHARACTERISTICS

3.2.1. DELINEATION OF STUDY AREA

The general study area for this Project Plan is the portion of DWSD's service area within the corporate limits of the City of Detroit. The study area encompasses approximately 88,876 acres with a population of approximately 713,777 people according to the 2010 Census, plus considerable commercial and industrial activity.

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 and there is, therefore, little opportunity for land use changes to occur except through redevelopment.

Table 3-2 LAND USE IN DETROIT

Land Use	Acreage	Percentage (%)
Residential	54,392	61%
Commercial	13,492	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 $29, 481 on the U.S. Census website along with an estimated persons in poverty at 36.4%[1]. Income levels in Detroit tend to be significantly below those levels reported in neighboring areas in Wayne, Oakland, and Macomb Counties.

[1] https://www.census.gov/quickfacts/fact/table/detroitcitymichigan/IPE120216#viewtop

3.3. POPULATION DATA

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 July 1, 2017 estimated population on the U.S. Census website is 673,104[3]. The estimated 2020 population is not available on this web-site. The report also indicates a forecasted decline in the overall population in the DWSD service area in the suburban communities.

3.4. EXISTING FACILITIES

The Detroit Water Distribution System are defined as pipes that are 16 inches and smaller in diameter with the majority of piping in diameters of 6-inch and 8-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. There is also steel transmission and distribution piping in the system in sizes 12 inches and larger, installed starting approximately in the 1920s when the city recognized that it was experiencing failures of the older cast iron pipes. Some of the older transmission mains in the system are of steel construction, whereas newer large diameter transmission mains are pre-stressed concrete cylinder pipes. Additionally, there is some asbestos cement pipe in the system. DWSD's use 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 6 inch and 8 inch pipes have low coefficients of friction (C factors) citywide, thereby increasing the energy required to maintain adequate pressure and transport capacity.

Table 3-3 CITY-WIDE DISTRIBUTION SYSTEM PIPING SUMMARY

Pipe Diameter	Linear Footage	% of System
6”	5,481,018	39%
8”	6,047,000	42%
10”	257,222	2%
12”	1,665,873	12%
16”	748,742	5%
20” and 24”	9,117	<1%

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 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 life 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 current DWSD standard calls for the use of Class 56 ductile iron pipe, which has been in use since the 1970s. Moving forward the CIPMO team has evaluated DWSDs current pipe class standard for the application and pressure duty required of the pipe replacements. Trench construction is generally proposing the use of ductile iron pipe with a polyethylene wrap on the exterior. For trenchless installation, such as pipe-bursting of existing cast iron pipe, and horizontal directional drilling, pipe replacement will be with HDPE. These trenchless construction technique 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.

4. ANALYSIS OF ALTERNATIVES

In accordance with the MEGLE guidelines for preparing a DWRF Project Plan, the potential alternatives to be analyzed include a No Action Alternative, Optimum Performance of Existing Facilities Alternative and a Regional Alternative. Other feasible alternatives referred to as "Principal Alternatives" are also analyzed.

4.1. IDENTIFICATION OF POTENTIAL ALTERNATIVES

4.1.1. NO ACTION

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 roughness. Therefore, a "No Action" alternative is not considered viable and is not pursued further.

4.1.2. OPTIMUM PERFORMANCE OF EXISTING FACILITIES

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, 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 water distribution system. DWSD's 20-Year Infrastructure Plan was based in part on the Detroit Future City (DFC) Strategic Framework, which is a highly detailed long-term guide for decision making by all of the stakeholders in the City. It articulates a vision for Detroit's future and recommends specific action items for reaching that future by addressing economic growth, land use, City systems (including DWSD's systems), neighborhoods, land and building assets and civic capacity. 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 DWSDs buried infrastructure. Through collaboration with DWSD and other city departments, the CIPMO team has

developed a specific 5 year CIP, targeting specific areas of Detroit for condition assessment of buried water and sewer infrastructure and development of rehabilitation or replacement strategies. The CIPMO team has completed condition assessments on areas (neighborhoods) of the city, for which Jefferson Chalmers is one of them.

4.1.3. REGIONAL ALTERNATIVE

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

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

4.2. ANALYSIS OF PRINCIPAL ALTERNATIVES

4.2.1. DESCRIPTION OF PRINCIPAL ALTERNATIVES

There are only two options for addressing the problems associated with aged water mains. DWSD can either 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 as a result 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, which may in some cases

result in an increase of pipe size, depending on the changes in customer base, including commercial, business and residential demographics. Looping of the water main by eliminating dead ends is also included in new replacement contracts. Full lead service line replacement (FLSLR) will be included in the scheduled replacement of aged water main pipes. It is a benefit to the public health and safety to replace the lead service lines. DWSD's policy is that all Lead (Pb) 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 every service connection to visually verify if the service is Pb 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, defined as full lead service line replacement (FLSLR). Lead service lines 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. The cast iron pipes included in this project have surpassed their anticipated service life. Many of the piping replacements call for replacement of existing 6-inch diameter water mains with 8-inch diameter water mains, and similarly existing 10-inch diameter water mains will be replaced with 12-inch diameter water mains as a standard course of practice. The installation of 8-inch water main for replacement has become a minimum recommended size in a distribution system for communities who intend to provide fire flow protection. The upsizing of 10-inch to 12-inch water mains results from 10-inch water main no longer being a standard, mass produced piping size.

4.2.2. COST EFFECTIVENESS ANALYSIS

A monetary evaluation of the feasible alternatives was prepared using MEGLE guidelines for DWRF Project Plans, including the present worth formulas and discount interest rate of 0.200%. 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 on the basis of 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.

The present worth of salvage value was then computed by multiplying the salvage at the end of the 20 years by the conversion factor 0.9608 based on the following formula:

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

Where:

PW = Present Worth (Salvage)

F = Future Value (Salvage)

i = Discount Interest Rate (0.200%)

n = Number of Years (20)

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

Interest during the construction period was computed using the formula:

$$I = i \times 0.5 \times P \times C$$

Where:

I = Interest Value

i = Discount Interest Rate (0.200%)

P = Period of Construction in Years (assumed to be one year)

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 19.5861 using the following formula:

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

Where:

PW = Present Worth (O&M)

A = Annual O&M Cost

i = Discount Interest Rate (0.200%)

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 0.200% 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 0.0511:

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

Where:

A = Equivalent Annual Cost

PW = Present Worth

i = Discount Interest Rate (0.200%)

n = Number of Years (20)

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

The cost analysis for Alternatives 1 and 2 for Jefferson Chalmers is presented in **Table 4-1**. 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 COST COMPARISON OF WATER MAIN REPLACEMENT - JEFFERSON CHALMERS

AVERAGE EQUIVALENT ANNUAL COST DETERMINATION

Cost Effective Analysis and Present Worth Determinatior

Project: **DWSD Project 1**
System: **Water Main Replacement**

			Alternative 1 NO ACTION		Alternative 2 36,975 LINEAR FEET OF WATER MAIN REPLACEMENT	
Planning Period:	2020-2040	20 Years				
Construction Duration:		2 Year				
Inflation Rate (CPI):		2.000%				
Discount Rate:		0.200%				
Capital Costs (One Time Expenditures):		Salvage Value Factor		Present Worth Factor		Present Worth Factor
50 Yr. Structures		0.6000	$ -		$ 15,799,724	
20 Yr. Process Equipment		0.0000	$ -		$ -	
10 Yr. Process Equipment		0.0000	$ -	0.9998	$ -	0.9998
15 Yr. Auxiliary Equipment		0.6667	$ -	0.9997	$ -	0.9997
10 Yr. Auxiliary Equipment		0.0000	$ -	0.9998	$ -	0.9998
Subtotal			$ -		$ 15,799,724	
Contingency		10%	$ -		$ 1,579,972	
Engineering, Legal, Admin., "Green" Provisions		20%	$ -		$ 3,475,939	
Total			$ -		$ 20,855,636	
		CPI Factor				
10 Replacement Cost at Yr.		1.2190	$ -		$ -	
15 Replacement Cost at Yr.		1.3459	$ -		$ -	
20 Salvage Value at Yr.			$ -	0.9608	$ 9,479,834	0.9608
OM&R Costs (Recurring Equal Expenditures)			2020 / 2040		2020 / 2040	
Repair & Maintenance			$ 1,479,000 / $ 1,539,298		$ - / $ -	
Total O&M Costs			$ 1,479,000 / $ 1,539,298		$ - / $ -	
Fixed O&M Costs			$ 1,479,000 / $ 1,479,000		$ - / $ -	
Total Variable O&M Costs			$ - / $ 60,298		$ - / $ -	
Yearly Increase			$ 3,015		$ -	
Present worth (PW) of constant annual O&M cost:				19.5861		19.5861
PW of variable annual O&M cost (annual increase):				184.7667		184.7667
Capital Recovery Factor				0.0511		0.0511
Assumptions			CALCULATIONS - PRESENT WORTH		CALCULATIONS - PRESENT WORTH	
1) Based on an average of five breaks per year			1. Initial Cost	$ -	1. Initial Cost	$ 20,855,636
2) Annual O&M cost does not include cost of restoration and cost of contracted services if needed			2a. Constant O&M	$ 28,967,827	2a. Constant O&M	$ -
			2b. Variable O&M	$ 557,050	2b. Variable O&M	$ -
			3. Replacement Cost	$ -	3. Replacement Cost	$ -
			4. Salvage Value (minus)	$ -	4. Salvage Value (minus)	$ 9,108,488
			5. Interest During Construction	$ -	5. Interest During Construction	$ 41,711
			6. Total Present Worth	**$ 29,524,877**	**6. Total Present Worth**	**$ 11,788,859**
EQUIVALENT ANNUAL COST				**$ 1,507,441**		**$ 601,900**

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As shown in **Table 4-1**, the Equivalent Annual Cost of Alternative 2 (Water Main Replacement) is less than the Equivalent Annual Cost of Alternative 1 (Pipe Repairs). Therefore, Alternative 2, Replacement, is more cost effective for each case.

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. 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 GLWA's cost of treating and pumping potable water. That cost is borne by all of GLWA's customers including DWSD's 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 waste water collection system serving the City of Detroit is a combined sewer. 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 would be ensured through a public notice to allow local residents ample time to review the Project Plan and become familiar with the proposed project. A 30-day minimum advanced public notice of a hearing, and a public hearing would be held to provide time for the local residents to provide input and express their concerns regarding the Project Plan 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 residential 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 and/or excessive wall loss determined through the condition assessment testing and for a limited amount of linear footage rehabilitation with a structural lining. The work will include excavation of the existing mains, installation of new pipes, pressure testing, backfill, disinfection and right-of-way restoration. The excavation of the existing mains will include the removal of lead service lines as encountered during the water main replacemement work. It is a benefit to the public health and safety to remove the lead service lines. As previously mentioned, DWSD's policy is that all Lead (Pb) water services, shall be replaced with copper from the water main to the individual customer meters as part of capital project work. Additionally, DWSD contractors are required to perform an excavation at every service connection to visually verify if the service is Pb 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 and 1-inch and less are replaced with 1-inch copper. Any disturbed areas adjacent to the pipes will be re-vegetated and restored to pre-project conditions. “Green” infrastructure components such as bio-swales and permeable pavers will be incorporated where feasible. DWSD will coordinate this work with the City’s Department of Public Works. These “Green” infrastructure components are not part of the DWRF Green Project Reserve (GPR) project eligibility determination criteria, which are discussed in Section 5.1.5. The removed cast iron pipe will be collected for recycling into new product uses. This collection will be done through DWSD’s existing recycling program.

5.1. DESCRIPTION

The specific streets where the new water mains will be installed are listed in **Table 3-1**, along with the pipe diameters, lengths and general location within the project shown in **Figure 3-2**.

5.1.1. COSTS

The estimated cost for the proposed water main project consists of: construction costs plus costs to cover engineering (design and construction); administrative tasks; and a provision to add “green” features to the project. The construction cost estimate for the water main replacement project is included in **Appendix A** for reference. The estimated total cost for Jefferson Chalmersthe Jefferson Chalmers project is provided in **Tables 4-1,** and summarized in **Tables 5-1, respectively**.

Table 5-1 JEFFERSON CHALMERS (WS-713) WATER MAIN REPLACEMENT COST ESTIMATE

Planning Period:	2020-2040	20	Years	**JEFFERSON CHALMERS**
Construction Duration:		2	Years	**36,975 LINEAR FEET OF WATER MAIN REPLACEMENT**
Inflation Rate (CPI):		2	%	
Discount Rate:		0.2	%	
Capital Costs (One Time Expenditures):				
50 Yr. Structures				$15,799,724
Contingency			10%	$1,579,972
Engineering, Legal, Admin., "Green" Provisions			20%	$3,475,939
Total				**$20,855,636**

5.1.2.

5.1.3. 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-713**
Advertise for Public Hearing	March 13, 2020
Public Hearing on Draft Project Plan	April 15, 2020
Complete and Submit Final Project	May 15, 2020
Complete Plans and Specifications[2]	April 30, 2020
Advertise for Bids	January 21, 2021
Receive Bids	February 18, 2021
Award Construction Contract	April 27, 2021
Start of Construction	May 17, 2021
Complete Construction	May 16, 2023

5.1.4. USER COST

The water main replacement recommended in this Project Plan is targeted for low interest loan assistance through the DWRF program. The availability of loan funds is dependent on annual appropriations and the placement of the project on the Priority List prepared annually by MEGLE.

Repayment of the DWRF loan through annual debt retirement payments will impact the

[2] *Plans and Specifications will include requirements for American Iron and Steel and compliance with Davis Bacon Act*

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**. The annualized cost of the project was calculated using the capital recovery factor 0.0511 and the following formula:

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

Where:

A = Equivalent Annual Cost

PW = Present Worth

i = Interest Rate through DWRF Loan (2.0%) n = Number of Years (20)

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

Table 5-3 USER COST IMPACT FOR WS-713 PROJECT

Item	Water Main Replacement
Total Cost of Project	$20,855,636
Annualized Cost of Project (Assuming DWRF interest rate 2.0% over 20 years)	$601,900
Number of User Accounts (households) in City of Detroit	179,833
Average Water Consumption per Household (industry average)	7,333 gallons/month (approximately 980 ft^3/month)
Current DWSD Water Supply Rate	$25.20 per 1,000 ft^3
Current Monthly DWSD Water Supply Rate per Household	$24.70
Current Annual DWSD Water Supply Rate per Household	$296.35
Increase in Cost per Household (Year 1)	$3.35
Proposed Annual DWSD Water Supply Rate per Household (Year 1)	$299.70
Proposed Percent Increase in Cost per Household per Year	1.13%

The theoretical impact of financing the water main replacement through the DWRF loan program is expected toincrease by no more than 1.13% 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 DWRF 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.

5.1.5. 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, DWSD had entered into contracts with its suburban customers, which establish 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.

5.1.6. GREEN PROJECT RESERVE FUNDING

DWSD intends to pursue Green Project Reserve (GPR) Funding for the water main replacement project contained in this Project Plan. A GPR Qualification Form and supporting calculations are included in **Appendix B** for reference. If MEGLE determines that the water main replacement project qualifies under the GPR criteria and if GPR funds are available, the project may be able to receive an additional subsidy (probably in the form of principal forgiveness). The amount of additional subsidy is not yet known and will be determined by MEGLE at a later date. If provided, the additional subsidy will reduce the loan repayment amount and will therefore reduce the cost impact on users.

The distribution system piping in the City of Detroit contains approximately 2,700 miles of water main ranging in diameter from 6 inches to 16 inches and experiences up to 1,600 breaks annually (frequently in the winter season). While DWSD has maintained a water main replacement program for many years, a considerable amount of water main still in service is cast iron, was constructed over the time period from the late 1800s to 1940s and experiences a considerable number of water main breaks on an annual basis. Additionally, these older mains exhibit tuberculation on the interior pipe wall, which reduces the carrying capacity of the pipe, along with increasing the energy required to move water through the pipe while maintaining acceptable delivery pressure at the required flow rate. Further, these water mains have remained in service beyond their expected useful life and experience considerable leakage, resulting in lost (non-revenue) water requiring additional energy to treat and transport excess water.

The burden to the environment from these deteriorated water mains in the form of carbon loading and fossil fuel depletion can be correlated as follows:

- Increased energy usage from fossil fuel power plants as a result of increased headloss due to deteriorated interior pipe walls;
- Increased energy usage from fossil fuel power plants for excess production which is not utilized for the benefit of society and is wasted as non-revenue water;
- Increased energy usage from fossil fuel power plants for additional pumping at waste water lift stations associated with the water Infiltration and Inflow (I&I) into

combined sewers; and,

- Increased fossil fuel usage by the repair vehicles and equipment needed to perform the repairs and maintenance on these deteriorated water mains.

While the replacement of all old, undersized and deteriorated water main in the City would pose an insurmountable task, both physically and financially, a select number of mains have been targeted based on their maintenance history and unreliability. This Project Plan details the replacement/rehabilitation of water mains in selected streets in the Jefferson Chalmers neighborhood (WS-713), based upon completed condition assessments.

Observations of the pipe interior (from recent repairs of main breaks) supports the existence of a severe amount of tuberculation on the interior wall, which as stated earlier decreases the pipes carrying capacity and increases energy usage to deliver service at an acceptable pressure and flow. The distribution system serving the City of Detroit is very large; the size, nature, and circumstances causing water main failures can and do vary greatly.

Based on the 2015 Water Master Plan, it is estimated that the average water main break for the pipe size ranges included in this project plan results in a maximum water loss of 2.6 million gallons of water per break based on an average of three days for repair work per break. Therefore, the total lost water from these pipes included in this Project Plan based on an annual average of lesss than one break per 1,000 feet of pipe over the most recent twelve year period is approximately 11 million gallons annually (based on water loss of 600 gpm per break for a maximum duration of three days). Based on a cost of production of $176 per million gallons as listed in the 2015 Water Master Plan Update, the estimated annual cost of lost water from these mains is approximately $6,139. In addition to the cost of lost water, there are also maintenance costs to be considered for the repair of these mains. On average for the size ranges of the pipes included in this Project Plan, the labor, equipment, repair materials, supervision, restoration and administrative cost is estimated to be $9,200 per break.

In addition to the direct costs associated with the lost water and repair activities, and the increased burden on the environment from additional carbon loading and depletion of fossil fuels for the lost water production, distribution and water main repair activities, there are other non-economic considerations which will benefit by replacement of these mains. A reduction in the frequency of risk for the health and safety of work crews performing the maintenance will be realized, along with a reduction of interruption of service and the risk to the general public through the potential for contamination by cross-connection or bacterial intrusion due to depressurized water mains.

In conclusion, by replacing the water mains identified in this Project Plan, there is a potential for DWSD to conserve up to 11 million gallons of water per year through the elimination of breaks and leaks. The annual savings in cost from reduced water production and maintenance

activities is estimated to be $130,000 based on less than 1 break per 1,000 feet of pipe. In addition to the reduction in direct costs previously mentioned, the indirect, non-economic benefits to the environment are reduced carbon loading and fossil fuel depletion through a reduction in energy requirements, and a reduction in opportunity for risk to workers and the general public consuming the product.

5.1.7. DISADVANTAGED COMMUNITY STATUS

The DWRF 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 quality 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 DWRF program offers both 20 and 30 year loan terms and will evaluate which term is the most appropriate for DWSD and its customers.

MEGLE 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 C**

5.1.8. SURFACE WATER INTAKE PROTECTION PROGRAM

DWSD received three (3) grants to develop plans for a Surface Water Intake Protection program. These grants are for the three DWSD raw water intakes 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 Project Plan 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 Project Plan 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's 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 project. The contractor(s) 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. Spoil from open trenches will be subject to erosion; the contractor(s) 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 with regard to SESC. Underground utility service 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 road right-of-way (ROW). The work will be done in the City of Detroit ROW, Wayne County ROW, and/or Michigan Department of Transportation (MDOT) ROW. Replacement of service lines will occur on private property as permitted by an agreement.

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 compoletion 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 compoletion 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 project 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 located 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. 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 specified in the construction contract documents.

Open trenches will be protected to minimize the hazards to citizens and construction will not normally take place in residential areas at night or on weekends in order 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 Project Plan. The proposed projects are 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 will be published to alert parties interested in this Project Plan and request input prior to its adoption (see **Appendix D**). In addition, a direct mail notification will be sent to the potentially interested parties included on a mailing list provided by GLWA (see **Appendix D**. This direct mail notice will include an invitation to comment.

PUBLIC HEARING TRANSCRIPT

A formal public hearing on the draft Project Plan will be held before the GLWA Board of Directors. The hearing will include 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 will be included in **Appendix D** along with the attendance list.

8.1.2. PUBLIC HEARING COMMENTS RECEIVED AND ANSWERED

Will be updated based on comments from the public during the Public Hearing.

8.1.3. ADOPTION OF THE PROJECT PLAN

(Will be updated based on Public Hearing.) The Project Plan is expected to be approved by the GLWA Board of Directors, which will adopt a Resolution at its regular monthly board workshop meeting, authorizing GLWA to proceed with official filing of the Project Plan for purposes of securing low interest loan assistance under the SRF Program. An executed copy of the Board of Directors' Resolution approval for the Project Plan will be included in **Appendix C** of this document. Miscellaneous correspondence applicable to the Project Plan is also included in **Appendix C**.

APPENDIX A

ESTIMATED CONSTRUCTION COSTS

Table A- 1 Jefferson Chalmers(WS-713) Cost Estimate

Bid Item	Section	Description	Quantity	Unit	Engineer's Estimate	
					Unit Price	Extension
01	General	Mobilization/Demobilization	1	LS	$ 751,415.00	$ 751,415.00
02	General	Material Testing	1	LS	$ 219,240.00	$ 219,240.00
03	General	Traffic Control	1	LS	$ 149,870.86	$ 149,870.86
04	General	Pre-Construction Site Documentation	1	LS	$ 25,000.00	$ 25,000.00
05	General	Project Sign	2	EA	$ 5,337.09	$ 10,674.18
06	General	Closeout	1	LS	$ 27,510.65	$ 27,510.65
07	Restoration	Sidewalk, Rem	816	SYD	$ 21.10	$ 17,217.60
08	Restoration	Sidewalk, Conc, 4 inch	3,839	SYD	$ 45.51	$ 174,712.89
09	Restoration	Sidewalk, Conc, 6 inch	64	SYD	$ 60.17	$ 3,850.88
10	Restoration	ADA Ramp, w/ Curb	771	SYD	$ 271.71	$ 209,488.41
11	Restoration	Curb and Gutter, Rem	237	LFT	$ 14.38	$ 3,408.06
12	Restoration	Curb and Gutter, Conc	1,463	LFT	$ 60.69	$ 88,789.47
13	Restoration	Pavement, Rem	163	SYD	$ 39.61	$ 6,456.43
14	Restoration	Driveway, Conc, 6 inch	223	SYD	$ 61.75	$ 13,770.25
15	Restoration	Aggregate Base, No. 22A, 6 inch	3,428	SYD	$ 15.11	$ 51,797.08
16	Restoration	Concrete Base, 8 inch	3,276	SYD	$ 104.80	$ 343,324.80
17	Restoration	HMA Pavement, Rem, Milling, Greater than 2 inch Depth Up to 4 inch Depth	11,072	SYD	$ 4.40	$ 48,716.80
18	Restoration	HMA Pavement, 36A, 1.5 inch	14,289	SYD	$ 27.80	$ 397,234.20
19	Restoration	HMA Pavement, 13A, 2 inch	14,298	SYD	$ 31.09	$ 444,524.82
20	Restoration	Concrete Paving, 9 inch	156	SYD	$ 133.78	$ 20,869.68
21	Restoration	Brick Pavers, Remove and Replace	68	SYD	$ 52.83	$ 3,592.44
22	Restoration	Structure, Adjust Existing Casting to Grade	31	EA	$ 753.43	$ 23,356.33
23	Restoration	Mulched Seeding	4,316	SYD	$ 8.68	$ 37,462.88
24	Restoration	Sodding	100	SYD	$ 6.18	$ 618.00
25	Restoration	Tree, Rem, 6 inch to 18 inch Diameter	13	EA	$ 1,431.24	$ 18,606.12
26	Restoration	Tree, Rem, Greater than 18 inch Diameter	9	EA	$ 2,146.86	$ 19,321.74
27	Restoration	Tree, Install	22	EA	$ 1,445.10	$ 31,792.20
28	Restoration	Chain Link Fence, Remove and Replace, 4-foot	60	LFT	$ 61.96	$ 3,717.60
29	Restoration	Guardrail, Remove and Replace	20	LFT	$ 142.59	$ 2,851.80
30	Restoration	Wetland Restoration	567	SYD	$ 125.00	$ 70,875.00
31	Water	Fire Hydrant Assembly, Rem	73	EA	$ 1,155.74	$ 84,369.02
32	Water	Fire Hydrant Assembly, Install	108	EA	$ 8,009.62	$ 865,038.96
33	Water	Water Main, Abandon, Fill with Flowable Fill, 6 inch	4,142	LFT	$ 4.26	$ 17,644.92
34	Water	Water Main, Abandon, Fill with Flowable Fill, 8 inch	16,258	LFT	$ 5.11	$ 83,078.38
35	Water	Water Main, Abandon, Fill with Flowable Fill, 12 inch	100	LFT	$ 8.42	$ 842.00
36	Water	Gate Valve and Box, Rem, 6 inch	2	EA	$ 619.35	$ 1,238.70
37	Water	Gate Valve and Box, Rem, 8 inch	1	EA	$ 712.51	$ 712.51
38	Water	Gate Valve and Box, 8 inch	61	EA	$ 2,913.59	$ 177,728.99
39	Water	Gate Valve and Box, 12 inch	5	EA	$ 4,973.75	$ 24,868.75
40	Water	Gate Valve and Well, Abandon, Fill with Flowable Fill, 6 inch	3	EA	$ 811.25	$ 2,433.75
41	Water	Gate Valve and Well, Abandon, Fill with Flowable Fill, 8 inch	15	EA	$ 968.64	$ 14,529.60
42	Water	Gate Valve and Well, Abandon, Fill with Flowable Fill, 12 inch	2	EA	$ 1,073.31	$ 2,146.62
43	Water	Gate Valve and Well, Rem, 6 inch	5	EA	$ 1,178.96	$ 5,894.80
44	Water	Gate Valve and Well, Rem, 8 inch	43	EA	$ 1,237.91	$ 53,230.13
45	Water	Gate Valve and Well, Rem, 12 inch	2	EA	$ 1,361.70	$ 2,723.40
46	Water	Gate Valve and Well, 8 inch	19	EA	$ 4,923.83	$ 93,552.77
47	Water	Gate Valve and Well, 12 inch	2	EA	$ 7,060.82	$ 14,121.64
48	Water	Water Main, Open Cut, Ductile Iron, 8 inch	7,453	LFT	$ 200.42	$ 1,493,730.26
49	Water	Water Main, Open Cut, Ductile Iron, 12 inch	292	LFT	$ 384.62	$ 112,309.04
50	Water	Water Main, Pipe Bursting, HDPE, 6 inch to 8 inch	1,904	LFT	$ 97.78	$ 186,173.12
51	Water	Water Main, Pipe Bursting, HDPE, 8 inch to 8 inch	9,425	LFT	$ 96.87	$ 912,999.75
52	Water	Water Main, Pipe Bursting, HDPE, 8 inch to 12 inch	324	LFT	$ 133.94	$ 43,396.56
53	Water	Water Main, Direction Drill, HDPE, 8 inch	13,339	LFT	$ 123.55	$ 1,648,033.45
54	Water	Water Main, Direction Drill, HDPE, 12 inch	2,508	LFT	$ 162.63	$ 407,876.04
55	Water	Water Main, Direction Drill, HDPE, 8 inch, Harbor Island Street Canal Crossing	1	LS	$ 32,780.67	$ 32,780.67
56	Water	Water Main, Direction Drill, HDPE, 8 inch, Klenk Island Canal Crossing	1	LS	$ 68,344.60	$ 68,344.60
57	Water	Water Main, Jack and Bore, HDPE, 8 inch, Ashland Street Creek Crossing	1	LS	$ 175,845.77	$ 175,845.77
58	Water	Water Main, Lining, 8 inch	1,442	LFT	$ 153.60	$ 221,491.20
59	Water	Water Main, Connect to Existing	42	EA	$ 7,292.85	$ 306,299.70
60	Water	Water Main, Temporary	17,385	LFT	$ 45.79	$ 796,059.15
61	Water	Water Service, 1 inch, Short	433	EA	$ 2,591.39	$ 1,122,071.87

62	Water	Water Service, 1 inch, Long	352	EA	$ 3,168.91	$ 1,115,456.32
63	Water	Water Service, 1.5 inch, Short	5	EA	$ 2,887.65	$ 14,438.25
64	Water	Water Service, 1.5 inch, Long	3	EA	$ 3,682.54	$ 11,047.62
65	Water	Water Service, 2 inch, Short	1	EA	$ 3,136.76	$ 3,136.76
66	Water	Water Service, 2 inch, Long	1	EA	$ 4,097.73	$ 4,097.73
67	Water	Water Service, 4 inch	1	EA	$ 9,120.67	$ 9,120.67
68	Water	Water Service, Reconnect Existing Copper Service, 1 inch	35	EA	$ 2,183.50	$ 76,422.50
69	Water	Water Service, Reconnect Existing Copper Service, 1.5 inch	2	EA	$ 2,435.10	$ 4,870.20
70	Water	Water Service, Reconnect Existing Copper Service, 2 inch	1	EA	$ 2,751.17	$ 2,751.17
71	Water	Water Service, Reconnect Existing Service, 3 inch	4	EA	$ 3,988.14	$ 15,952.56
72	Water	Water Service, Remove and Replace Lead Service Line, 1 inch	17,434	LFT	$ 57.14	$ 996,178.76
73	Water	Water Service, Remove and Replace Lead Service Line, 1.5 inch	166	LFT	$ 67.20	$ 11,155.20
74	Water	Water Service, Remove and Replace Lead Service Line, 2 inch	25	LFT	$ 77.11	$ 1,927.75
75	Water	Water Service, Hydro-Vac	833	EA	$ 699.25	$ 582,475.25
76	Water	Electrical Grounding System	745	EA	$ 591.61	$ 440,749.45
77	Water	Pitcher Style Filters and Refill Filter Cartridges	914	EA	$ 77.51	$ 70,844.14
78	Water	Water Main, Hydrostatic Pressure Test	36,975	LFT	$ 1.96	$ 72,471.00
79	Water	Water Main, Chlorination and Flushing	36,975	LFT	$ 1.17	$ 43,260.75
80	Water	Water Main, Bacteriological Test	104	EA	$ 1,074.38	$ 111,735.52
81	Allow	Contaminated Material Allowance	1	LS	$ 20,000.00	$ 20,000.00
				TOTALS:	**$**	**15,799,724**

Statement of Estimated Costs

•AECOM has no control over the cost of labor and material, the general contractor's or any subcontractors method of determining prices, or competitive bidding and market conditions. This opinion of probable costs of construction is made on the basis of experience, qualifications, and best judgement of professional construction cost managers familiar with the construction industry. AECOM cannot and does not guarantee that proposals, bids, or actual construction costs will not vary from this or subsequent cost estimates.

•This Estimate does not include design revision costs in the event that the estimate is in excess of the established budget.

•AECOM's staff of professional cost managers has prepared this estimate in accordance with general accepted principles and practices. Our staff is available to discuss its contents with any interested party.

•The unit rates reflect current estimated bid costs in the area based on the Measurement and Payment specifications. Pricing reflects probable construction costs obtainable in the project locality on the date of this statement of probable costs. This estimate is a determination of fair market value for the construction of this project. Since AECOM has no control over the cost of labor, material, equipment, or over the contractor's method of determining prices, or over the competitive bidding or market conditions at the time of bid, the statement of probable construction cost is based on industry practice, professional experience and qualifications, and represents AECOM's best judgment as professional construction consultant familiar with the construction industry. However, AECOM cannot and does not guarantee that the proposals, bids, or the construction cost will not vary from opinions of probable cost prepared by them.

•This estimate assumes that the general construction contract will be administered as a competitively bid negotiated GMP with a selected construction manager *f* general contractor and prequalified subcontractors. Costs associated with a restrictive bidding market, including small business set−asides (minority, woman or veteran service disabled veteran owned) and sole−sourced contractors are not included, and can cause a significant increase to the overall cost of the project

APPENDIX B

GREEN PROJECT RESERVE QUALIFICATION FORM & SUPPORTING CALCULATIONS

DWRF Project Plan for Jefferson Chalmers Water Main Replacement/Rehabilitation Water Loss Calculations to Support the Green Project Reserve (GPR) Application

Information received from DWSD Central Services. Based on the 2015 Water Master Plan:

	Value	Unit
Total number of breaks	161	breaks
Total number of breaks in the last 12 years	53	breaks last 12 years
Average number of breaks per year for the 12 yr period	4	breaks per year
Approximate Project Plan Footage (amount of pipe evaluated as part of the project plan)	36,975	linear feet
Total number of breaks per 1,000 lft	4.35	breaks per 1,000 lft
Miles of proposed replacement	7.0	miles
Average breaks per mile	0.63	breaks per mile
Average duration of a main break until it is fixed	3	days
Minimum average flow rate of a break	500	gpm
Maximum average flow rate of a break	600	gpm
Maximum average flow rate of a break	864,000	gallons per day
Max water loss per break	2,592,000	gallons/break
	2.6	MG/Break
Estimated Water Loss	11	MG / Year
Cost of water production	$ 176.00	$/MG
Maximmum cost per break	$ 458	$/break
Breaks per 1000 linear feet per year for the project area.	0.36	breaks/1000 ft/year
Gallons Lost Annually	34,776,000	gallons/year
(assuming 0.13 breaks/1000 ft/year & 600 gpm/break & 3	34.78	MG/year
days to repair)	0.943430246	MG/1000 ft/year
The Water Production Cost due to breaks in the pipe evaluated as part of the project plan	$ 166	$/1000 ft/year
Approximate Water Production Cost due to breaks in the Project Plan Footage of pipe evaluated	$ 6,139	$ for the Project Plan Footage per year
Cost of energy per MG	$ 87	$/MG
Cost of energy per KwH	$ 0.08411	$/KwH
Energy per MG	1,034	KwH/MG
Energy per year associated with lost water	11,878	KwH/year
Cost of energy per year associated with breaks	$ 3,025.51	$ per year
Annual O&M cost per 1000 feet	$ 46,000	$
Annual O&M cost per break (assuming 5 breaks/1000ft)	$ 9,200	$/break
Estimated annual maintenance savings	$ 123,433	$
Estimated Total Annual Savings (including both water production savings and maintenance savings)	$ 129,573	$

Drinking Water Revolving Fund
Green Project Reserve Qualification Template

Applicant: Detroit Water and Sewerage Department (DWSD) Project No: Jefferson Chalmers
Project Name: Water Main Replacement/Rehabilitation

Identify by page number from the project plan, or attach excerpts, where water efficiency or energy efficiency improvement justification is provided or discussed to support the need for the recommended green project reserve component: Section 5.1.6.

Please ensure all requested information is provided to enable an assessment by the Michigan Department of Environmental Quality (DEQ) of whether the project or project component can qualify for funding from the green project reserve.

Water Main Replacement

1. Over the last **twelve** years, 53 water main breaks have occurred on the water mains that are proposed for replacement, an average of <1 breaks/mile/year.

2. Identify the length, diameter, age and type of pipe to be replaced: Refer to Table 3-1 in Section 3.1 in the Project Plan.

3. Each break is estimated to result in the average loss of 2.6 M gallons of water, calculated to total 11 M gallons/year of water lost for those water mains.

4. Present the data indicating how this is a significant source of water loss in the system and how the pipes proposed for replacement are likely to generate the greatest return in leak reduction. Refer to water loss calculations in the Project Plan (Appendix B). Refer to the cost effectiveness analysis in the Project Plan (Section 4.2.2) for monetary evaluation.

5. ~~The energy savings from pumping/delivering water through the new water mains versus the old ones is estimated at _____ KwH/year~~.
   AECOM is unable to calculate this value with available data. However, the energy associated with producing and pumping water that is lost through breaks is estimated at 11,878 KwH/year.

6. Describe the condition of the replaced mains with respect to friction/head loss etc. from tuberculation or other deterioration issues. As appropriate, identify if the soils are corrosive and contributing to the deterioration/breaks or leaks in the mains, and how the replacement mains are designed to address future corrosion: The water mains date back from 1914 through 1920 and previous repair history and a recent condition assessment has identified these mains as being in a significant deteriorated condition. This deteriorated condition is mainly due to the age of the pipes and the original material of construction (cast iron). New water mains will be of the more resistant materials: 1)ductile iron with poly wrapped exterior, 2) HDPE, or 3) structural lining within the existing pipe.

7. Total costs for the Jefferson Chalmers project for the water main replacement/rehabilitation component of the project is approximately $20,800,000.

8. Identify the source of data used for these calculations: 2015 Water Master Plan Update.

Submitted by:

Name Robert A. Green, PE — Date 3/12/2020

AECOM, Task Lead, Central Region Water
Title

APPENDIX C

SUBMITTAL FORM, SELF-CERTIFICATION FORM, DISADVANTAGED COMMUNITY STATUS DETERMINATION WORKSHEET (INCLUDED IN THIS DRAFT), BOARD RESOLUTIONS

Disadvantaged Community Status Determination Worksheet

The following data is required from each municipality in order to assess the disadvantaged community status. Please provide the necessary information and return to:

Robert Schneider Revolving Loan
Section
Office of Drinking Water and Municipal Assistance
P.O. Box 30241
Lansing, MI 48909-7741
Schneiderr@michigan.gov

If you have any questions please contact Robert Schneider at 517-388-6466 Please check

the box this determination is for:

☒ DWRF ☐ SRF

Under Criterion 1, Detroit qualifies for Disadvantaged Community Status based on approximately 36.4% of families in Detroit below the poverty level.[3]

1. Total amount of anticipated debt for the proposed project, if applicable.

_____

2. Annual payments on the existing debt for the system.

_____

3. Total operation, maintenance and replacement expenses for the system on an annual basis.

_____.

4. Number of "residential equivalent users" in the system.

_____

For determinations made using anticipated debt, a final determination will be made based upon the awarded loan amount.

(EQP 3530 REV 01/2015)

[3] https://www.census.gov/quickfacts/fact/table/detroitcitymichigan/IPE120216#viewtop

APPENDIX D

PUBLIC HEARING NOTICE, MAILING LIST FOR PUBLIC HEARING, PUBLIC HEARING TRANSCRIPT, VISUAL AIDS AND ATTENDANCE LISTS

APPENDIX E

PROJECT PLAN CORRESPONDENCE