MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY

INTEROFFICE COMMUNICATION

TO: File

FROM: Cindy Clendenon
Senior Project Manager
Revolving Loan Section

DATE: June 1, 2015

SUBJECT: Drinking Water Revolving Fund Project Nos. 7412-01, 7413-01 and 7414-01
City Of Detroit Water and Sewerage Department
Water Main Replacement Projects
Green Project Reserve Cost Determination

The purpose of this memo is to document the eligible Green Project Reserve (GPR) amount for the above-referenced projects. The City of Detroit Water and Sewerage Department submitted the attached GPR Qualification Template for Water Main Replacement with its May 1, 2015 DWRF Final Project Plan, plus four pages of supporting calculations.

The entirety of each project qualifies for GPR under the U.S. Environmental Protection Agency (EPA) water efficiency category (business case). The type of GPR is based on revised GPR guidance posted to our website May 2015 (see Page 3, Business Case required for watermain replacement to reduce water loss and prevent watermain breaks), and also EPA's GPR Business Case Examples (Example #1 Pipe Replacement).

The DEQ Southeast Michigan District Office engineer approved the technical rationale for GPR eligibility, as documented in the attached memorandum.

Because the entirety of each project meets the GPR criterion, no additional calculations are needed to apportion the construction and non-construction costs among GPR and non-GPR. Based on DWRF project planning estimates, the eligible GPR amounts are as follows.

7412-01 = $9,375,000 (FY 2016)
7413-01 = $6,500,000 (FY 2016)
7414-01 = $15,125,000 (FY 2017)

The amount of additional subsidy for each project, probably in the form of principal forgiveness, will be established in the Final Intended Use Plan for the respective Fiscal Year.

Attachments

Drinking Water Revolving Fund
Green Project Reserve Qualification Template

7412-01
7413-01

Applicant: Detroit Water and Sewerage Department (DWSD) Project No: TBD 7414-01
Project Name: Water Main Replacement

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: Pages Section 5.1.5.

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.

Meter Replacements with Conventional Meters

1. Over the last five years, water lost or unaccounted for in the system has averaged _____gallons per year and is_____percent of the water produced each year.

2. Identify the source of this information (i.e. water audit, water conservation study, production and billing records):_____

3. Identify the portion of the water loss that is likely due to inaccurate meters:_____

4. The expected reduction in water loss by installing replacement traditional water meters in all or a portion of the system is_____gallons per year, reducing the water loss percentage to_____.

5. It takes_____kilowatt hours (kWh) of electricity to produce and distribute 1,000 gallons of water. At a cost of $_____per kWh, the estimated annual electrical cost for the water loss due to inaccurate meters based on the five-year average is $_____.

6. Based on the average cost per year for the loss and the estimated cost of_____for replacing the meters, the project will pay for itself in_____months/years.

7. Attached all relevant data and calculations that were used to provide answers to these questions.

Water Main Replacement

1. Over the last ten years, 171 water main breaks have occurred on the water mains that are proposed for replacement, an average of 1 to 2 breaks/mile/year.

2. Identify the length, diameter, age and type of pipe to be replaced: Refer to Table 3-1 and Section 3.4 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 975 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 C). 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 30 M 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 the 1930s-1950s and repair work has identified these mains as being in a significant deteriorated condition. This 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 ductile iron and they will be wrapped with a protective layer of Polywrap.

7. Total projects costs for the water main replacement component of the project are $ 31,000,000.

8. Identify the source of data used for these calculations: Various DWSD reports such as the 2004 and 2014 Water Master Plans.

Submitted by:

Name

Date

Title

3. WATER EFFICIENT – water Loss Reduction, etc.

- Install water meters in previously unmetered areas (if rate structure is based on metered use)
- Replace existing broken/malfunctioning water meters or upgrade existing meters with automatic meter reading (AMR) systems (such as advanced metering infrastructure and smart meters) and meters with built in leak detection
- Retrofit existing meters to add AMR capability or leak detection equipment (not replacing the meter itself)
- Conducting water utility audits, leak detection studies, and water use efficient baseline studies, which are reasonably expected to result in a capital project or in a reduction in demand to alleviate the need for additional capital investment
- Developing water conservation plans/programs reasonably expected to result in a water conservation capital project or in a reduction in demand to alleviate the need for additional capital investment
- Recycling and water reuse projects that replace potable sources with non-potable sources
- Retrofit or replace existing landscape irrigation systems with more efficient systems (for example with moisture and rain sensing controllers)
- Automatic flushing systems (portable or permanent)

Business Case Required

- Water meter replacement with traditional water meters
- Water main replacement or rehabilitation to reduce water loss and prevent water main breaks
- Projects that result from a water efficiency related assessment, such as water audits, leak detection studies, conservation plans, etc. (that are not categorical)
- Storage tank replacement/rehabilitation to reduce water loss (also can be considered energy savings, if removing pump/pumping station, etc.)
- New water efficient landscape irrigation system (where there currently is not one)
- Pressure reducing valves (PRV)
- Internal plant water reuse or recycle
- Distribution system leak detection equipment (portable or permanent)

Ineligible Projects

- Covering open finished water reservoirs (federally mandated, so not considered "above and beyond")

4. ENVIRONMENTALLY INNOVATIVE

Definition: Within the context of the DWRF program, "environmentally innovative projects" would include those that are consistent with the underlying project eligibilities of the DWRF program, and that demonstrate new and/or innovative approaches to delivering service, and/or managing water resources in a more sustainable way, including projects that achieve public health protection and environmental protection objectives at the least life-cycle costs.

Categorical Projects

- Total/integrated water resources management planning likely to result in a capital project
  - Plans to improve water quantity and quality associated with water system technical, financial, and managerial capacity
  - Eligible source water protection planning

AS emailed to West Unit 5-14-2015

Pipe Replacement

Water Efficiency

Summary

- Replacement of 24,000 feet of pre-1930s lead-jointed cast iron (CI) distribution pipe with new 8-inch to 16-inch ductile iron (DI) pipe to eliminate the loss of 115 million gallons of water per year (MGY), equal to 10% of total production and 52% of total system water loss.
- SRF loan amount = $2,500,000
- Water saving (green) portion of loan = 100%
- Annual water savings = 115 million gallons (MG)

Background

- The water distribution system has approximately 80 miles of CI and DI distribution pipe ranging from 6 to 16 inches in diameter. The water system is 100% metered and includes a master meter (or production meter) at the source water supply (after treatment).
- As part of a water loss management plan,[1] the water utility calibrates all water meters every 5 years and conducts a leak detection survey every 2 years. Over the past 5 years the utility performed a physical condition assessment of 1% of the distribution pipes. The pipes were selected for assessment based on historic leak detection survey data.
    - Based on the assessment of 1% of the pipe, the utility concluded that the pre-1930s distribution pipe is in the poorest condition, has incurred the most leaks, and is most critical to replace.
- Pre-1930s pipe accounts for 17% (13.6 miles) of the 80 miles of distribution pipe. This project will replace 24,000 feet of pipe (4.5 miles or approximately 33% of the pre-1930s pipe) with 8-inch to 16-inch DI pipe.
    - The remaining 83% of the distribution system includes DI pipe installed between 1950 and 2000. Because this pipe has been found to be in better condition, there is no alternative pipe replacement project that would yield the same (or better) water efficiency gains.
- In 2010, the water treatment plant processed an average of 3 million gallons per day (MGD) or 1,095 MGY. Based on the water balance, the system had an authorized water consumption of 875 MGY. The total system water loss of 220 MGY is the difference between the water produced and the authorized consumption.
- The system water loss is comprised of the following:
    - Apparent losses of 0.05% based on water meter accuracy = 5.48 MGY (assume no losses due to unauthorized consumption or theft)
    - Real losses = 214.52 MGY
        - Transmission and distribution main leaks = 210 MGY
        - Storage tanks/overflows = 2.52 MGY
        - Service connection leaks = 2 MGY[2]
- The real losses correlate to 74.78 gallons/connection/day.[3]

Results

- 175 pipeline repairs were made during the last year. The highest frequency of repairs was in the pre-1930s pipes and equally distributed among all sizes.[4] In addition to the leak repair records, the leak detection survey, and condition assessment assisted with determining which sections of distribution mains are most prone to leaks and are the highest priority for replacement.[5]
- The utility concluded there is minimal water loss in pipes installed after the 1930s and estimates the 210 MGY of water loss through the distribution pipe is primarily from the pre-1930s pipe.

1 Water Loss Management Plan for the Hypothetical Drinking Water System. February 2011.
2 Leak Detection and Condition Assessment for the Hypothetical Drinking Water System. Updated August 2010.
3 The system has 7,859 connections.
4 Water Loss Management Plan for the Hypothetical Drinking Water System. February 2011.
5 Leak Detection and Condition Assessment for the Hypothetical Drinking Water System. Updated August 2010.

PIPE REPLACEMENT, CONTINUED

- Based on the condition assessment, the 24,000 linear feet of pipe selected for replacement is estimated to account for approximately 115 MGY of lost water.[6]
- The estimated 115 MGY of water loss from the pre-1930s pipe is 52% of the overall water loss of the system: 115 / 220 = 52%.

Conclusions

- By replacing the 24,000 feet of pipe, the utility anticipates conserving 115 MGY (52% of overall water loss); therefore, reducing the volume of water withdrawn, treated, and pumped from the reservoir.
- The cost to pump and treat water is $1.53 per 1,000 gallons. Cost savings from reduced leaks are estimated at $175,950 (115,000 * $1.53). The simple payback period of the loan is 14.2 years.
- Additional benefits include reductions in unnecessary pumping and operation and maintenance expenditures, and eliminating potential health hazards associated with waterborne pathogens entering the water distribution system.
- The energy savings of avoiding pumping the 115 MGY in water lost from the reservoir to the service connection, an elevation difference of 200 feet, is 103,600 kilowatt-hours (kWh) per year. The carbon emissions avoided from reducing this electricity consumption are equivalent to 74.4 metric tons of carbon dioxide.[7] (Note that the energy savings and carbon reduction calculations are not required for water efficiency business cases.)

6 Leak Detection and Condition Assessment for the Hypothetical Drinking Water System. Updated August 2010.
7 USEPA Greenhouse Gas Equivalencies Calculator, retrieved January 2011: http://www.epa.gov/cleanenergy/energy-resources/calculator.html.

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INTEROFFICE COMMUNICATION

TO: Cynthia Clendenon
Revolving Loan Section
Office of Drinking Water and Municipal Assistance

FROM: Stephanie Johnson
Office of Drinking Water and Municipal Assistance
Southeast Michigan District Office

DATE: May 18, 2015

SUBJECT: City of Detroit Water and Sewerage Department
Qualification for Green Project Reserve Funding

The purpose of this memo is to document the basis for determining that the City of Detroit Water and Sewerage Division (DWSD) Drinking Water Revolving Fund (DWRF) Project qualifies for the green project reserve funding. This project is replacing 62,000 feet of 8-inch, 2,000 feet of 12-inch, 5,200 feet of 16-inch, and 5,300 feet of 24-inch unlined cast iron mains that are on average 85 years old. The following information was used to make this determination.

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 that 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. Three target areas in the west and north sides of the City have been recently identified as areas in critical need. There are 20 street locations within these target areas that are experiencing excessive breaks. Many of these mains are corroded and contain deposition that has significantly reduced the carrying capacity while at the same time, increasing the friction losses and energy necessary to deliver water through them. The City has estimated that the energy savings they will realize from this project is 30 MKwH per year, which is in addition to the improved flows and pressure that will result.

Over the last 10 years, DWSD experienced 171 main breaks in that portion of the system to be replaced, for an average of nearly 1-2 breaks per mile per year. The City also estimates that each break results in an average water loss of 2.6 million gallons for a total of 975 million gallons per year in the piping to be replaced.

System losses in excess of 15% are generally considered unacceptable in the waterworks industry. Although DWSD is only planning to replace a small portion of their water mains with this project, they are replacing 85 year old, antiquated piping that is likely experiencing the highest percentage of leaks. Therefore, it is expected that the replacement of these targeted mains will decrease the City's lost water to a much greater extent than the percentage of the City's total pipe inventory they represent, further enhancing the City's water conservation and efficiency

The new mains will also have an improved C factor as compared to the existing cast iron pipes. Therefore, the City estimates there will be a significant energy savings from pumping water through the new mains versus the old ones.

Based on the information provided by the City and their consultant, this project does qualify for the green project reserve funding. The water main replacements will improve water conservation/efficiency by reducing water losses experienced from frequent breaks and on-going leaks as well as provide for reduced energy use.