FEMA Fiscal Year 2020 Hazard Mitigation Assistance Gant – Building Resilient Infrastructure and Communities

City of Cambridge MD Sewer System Hardening for Resilience to Hazards

Scope of Work

1.0 Overview

Sea level is projected to rise by more than two feet by 2050 in Dorchester County and the City of Cambridge is already experiencing more frequent and persistent nuisance flooding, and major storms that are impacting our public infrastructure such as municipal storm and sanitary sewer systems. Because of the age and location of the existing sewer system infrastructure and rising sea levels, the current system does not function as required and the problem is exacerbated by flooding and environmental degradation.

The scope of work for this project includes elevating pump stations, and upgrading the gravity sewer line to harden the system and make it resilient to all hazards.

2.0 Project Area

Our project area will be the limits of the City Sewer System within the 100-year floodplain which is along the Choptank River and extends from Cambridge Creek to Dorchester County. This area is subject to constant nuisance flooding due to high tides and has endured many major storms including Hurricanes Hazel and Isabel with flooding of homes and extensive damage to our public infrastructure. This area is primarily within the City's historic district and is a key area of the City's Comprehensive Plan.

Project Area Along Choptank River Within 100 Year Floodplain

View at Long Wharf toward City Marina

View Hambrooks & Belvedere toward Choptank

3.0 Mitigation Strategy to Achieve a Resilient Storm water and Sanitary Sewer System

The City of Cambridge is in the process of developing a risk based Flood Mitigation strategy that aligns with the evolution of risks due to sea level rise over time. We have a three phased approach to address projections for sea level rise and major storms contained in the 2017 Dorchester County Flood Mitigation Plan. Those projections include the potential of a 2.1-foot sea level rise by 2050 combined with a Category 1 storm surge of 7 ft, and the potential for a 5.7 ft sea level rise by 2100.

The city storm and sanitary storm sewer system is a critical public asset and this project is aimed at making the systems resilient to all hazards within that strategic framework. We are proposing a three phased approach to the Hardening of the City of Cambridge MD Sewer System to make it Resilient to all Hazards.

During Phase I, which we are seeking funding for under this grant application, we will, at a minimum, harden our sewer system to withstand current flood risk levels within the 100-year flood plain. We will also assess the risk to the system based on sea level rise projections for 2050, and to the degree practicable, implement hardening measures to address the added risk. The system upgrades will include floodproofing. However additional protection measures may be required to protect the system against up 5.7 ft of sea level rise by 2100. The lessons learned during Phase I will provide important data for the development of flood protection measure for long term risk to sea level rise. It will also provide more time to validate assumptions with regards to future risk due to climate change.

Hardening measure will include structural enhancements including increasing the elevation of lift/pump stations, and upgrading the gravity sewer that is inadequate to handle the flow required. Hardening measures will also include operational measures that may prevent intrusion of flood water into the system, and measures to protect assets and operations, measures to ensure system reliability such as back- up power,

This project will be managed by a team that includes knowledgeable SMEs and individuals representing the City, County, and State. A contractor will be engaged to design and construct the improvements to the system.

4.0 Technical Approach

The City's sewer collection system consists of approximately 48 miles of gravity sewer lines, 15 pumping stations, and approximately 5 miles of force main. The gravity sewer lines range in size from 6-inches to 36-inches with the majority of the lines being 8-inch (approximately 58%). There are about 6 miles of sewer lines and three pumping stations within the City's "West End" area, that were installed in 1912 or earlier, much of which is within the 100-year floodplain.\

The City has assessed what assets are most vulnerable, and evaluated mitigation measures that can harden the system to all hazards. The results will be used to develop requests for proposals for the design and construction of improvements to harden the sewer system to all hazards.

4.1 Vulnerable Assets

The City has identified the key assets that are vulnerable to flooding and they include both the pumping stations and the gravity sewer line. It is estimated that inflow in infiltration (I&I) accounts for as much as 50% of the total volume of flow to the pumping stations within the project area. Flooding due to frequent high tides and heavy rainfall result in waste water volumes that easily exceed the capacity of the sanitary system. The City spends upward of $250,000 per year to maintain the system, and has spent $20,000 per year to manually remove excess sewage build up at pumping stations.

4.2 Mitigation Measures

The City has identified mitigation measures that can protect the key vulnerable assets. We have evaluated mitigation measures for both the pump stations and sewer pipeline.

- **Lift/Pump stations** - the pump stations in the 100-flood plain which are designed to move raw sewage from lower to higher elevations where it then moves by gravity conveyance. These stations are located at the lowest points in the sewer systems and are therefore prone to flooding. Lift stations are also vulnerable to power outages. When lift stations lose power and do not have adequate emergency power, sewage can back up and flood streets or run off into tidal waters. This presents a serious threat to public health and the environment.

- **Gravity Sewer System** – The City has approximately 6000 ft. of sewer lines and 32 manholes in the project area. We know from our records during flooding events that there is a significant amount of inflow and infiltration to the system that is resulting in exceeding its

capacity. Because of the age of the sewer system, and the routine flooding of the system due to high tides, the system is already not functioning as required. With sea level anticipated to rise up to 2 ft. by 2050 and up to 5.7 ft by 2100 the only remedy available is to upgrade the system to harden it to withstand flooding due to high tides, major storms and sea level rise.

4.3 Design and Construction

The City will use the results of its analysis to procure contractor support for the design and construction of an upgraded sewer system, and the elevation of the 3 pump stations within the 100-year flood plain. We will complete this project within 3 years.

Elevation of Pump Stations -The pump stations require the most maintenance due to flooding which has resulted in sewage backup in the system and power outages. These pump stations are already over taxed due to high tides and major storms and will not survive an increase in flooding due to a projected 2 to 5 ft of sea level rise. It makes the most sense to elevated them with new pumps that will make the system resilient to all hazards.

Sewer Line Capacity Enhancement - The sewer line will be required to be upgraded given the age of our sewer infrastructure within the 100 floodplain and the anticipated increase in hydraulic head of another 2 to 5 ft. of water due to sea level rise, plus the risk of major storm surges.

Capacity enhancement can be achieved by installing parallel relief lines, replacing existing lines with larger ones, expanding the capacity of existing pump stations, or building new ones. Parallel relief lines are often used when the existing line cannot be placed out of service, or when it is more cost-effective to install a parallel relief line than to replace the existing one. However, installation of parallel relief lines may require additional rights-of-way. Another option would be to install a thin liner in the existing sewer line if the liner has a reduced roughness to increase flow capacity. Our project cost estimate is based on the assumption that the sewer line would need to be upgraded. That would be the highest cost, but we believe it to be the most effective solution.