Baltimore County Department of Public Works
On-Call Engineering Services for Pumping Stations
Project No. 2015-03

Task 003 – Jones Falls Sewershed Comprehensive Evaluation

January 29, 2020

In accordance with Baltimore County's request under the On-Call Engineering Services for Pumping Stations Agreement, Project No. 2015-03, Hazen and Sawyer is pleased to submit this Scope of Services and Fee Proposal for the Jones Falls Sewershed Comprehensive Evaluation. The proposed Scope of Services is in accordance with the executed agreement with Baltimore County dated February 23, 2016 and amended on May 24, 2019.

BACKGROUND

The County is requesting a comprehensive evaluation of the Jones Fall Sewershed to assess the near-term and long-term needs of the sanitary sewer system, including:

- Future capacity needs driven by development, re-development and/or future connection of unserved areas of the sewershed
- Strategies needed to further protect the environment from potential sanitary sewer overflows (SSOs)
- Best Management Practices for continued proactive operation and maintenance of the sanitary sewer system
- Strategies to address vulnerabilities and improve long-term sustainability and resiliency

The Jones Falls Sewershed includes approximately 1,124,000 linear feet (LF) of gravity sewers ranging from 6- to 42-inches in diameter and approximately 6,200 manholes or other sewer structures. Data and reporting from previous studies will be provided to Hazen as part of this comprehensive needs assessment. Hazen and Sawyer will complete an evaluation addressing the capacity, operations and maintenance (O&M), and structural needs of the sewer system and develop a comprehensive plan and strategies to address system deficiencies at year 2025, 20-year, and 50-year planning horizons and two additional planning horizons determined by the County. This work will be detailed in a comprehensive sewershed evaluation report that will provide a flexible roadmap enabling the County to develop informed, asset-based, risk-based, and prioritized Capital Improvement Plan (CIP) budgets for near-term and long-term system improvements and strategies.

GENERAL ASSUMPTIONS

For the purposes of this Task Order, the following assumptions are made:

- All available requested data and reports will be provided to the Consultant by the County in a timely manner.
- Flow and rainfall monitoring data collected by others after the notice to proceed for this task will be provided in electronic time series format to the Consultant by the County on a monthly basis for the duration of the monitoring period. Raw data will be supplied within one week of the end of the month and QA/QC'd final data will be supplied within four weeks of the end of the month.
- No lidar inspection will be performed.
- Recent CCTV and manhole inspection data is available for most of the Sewershed.
- Up to 50,000 LF of CCTV inspections are included based on an assumed average production rate of 450 linear feet (LF) per day for CCTV inspection and light cleaning.
- Up to 15,000 LF of heavy cleaning is included based on an assumed average production rate of 300 LF per day for heavy cleaning.
- Up to 20,000 LF of combination sonar/CCTV inspection is included based on an assumed average production rate of 1,000 LF per day for sonar/CCTV inspection.
- Up to 100 MACP Level 1 manhole inspections are included based on an assumed average production rate of 10 manholes per day.
- Up to 50 MACP Level 2 manhole inspections are included based on an assumed average production rate of 8 manholes per day.
- Up to 150 manhole surveys are included.
- The County is conducting a Performance Assessment, including I/I analysis, associated with the recent sewer improvements within the Sewershed. However, this assessment will not be completed for another eighteen (18) or more months. The County will provide data as it becomes available during this Task, but Hazen will proceed without this information. Hazen will develop an interim I/I analysis and update the I/I analysis after the performance assessment is complete. The modeling efforts described in Tasks 5 and 6 will utilize the interim I/I analysis results.
- Scope of Services does not include any design work. Conceptual locations of capacity improvements and strategies will be determined.
- Scope is limited to review of existing water quality data and reports. No water quality sampling, testing or fieldwork will be performed.
- For the future capacity assessment, the County will provide direction on targeted areas and timing for extending sewer service to properties with on-site septic systems. Planning level costs will be developed only for upgrades to the existing system as required to accommodate additional flows from properties with septic systems. Evaluation of sizing, location and costs of new infrastructure extensions to serve septic system areas is not included.

SCOPE OF SERVICES

The scope of services is divided into the following tasks:

- Task 1 – Project Administration
- Task 2 – Gather and Review Existing Data
- Task 3 – System Characterization and Data Gap Analysis
- Task 4 – Flow/Rainfall Monitoring Data Review and Interim I/I Analysis
- Task 5 – Hydraulic Model Refinement, Calibration and Verification
- Task 6 – Asset Management and Capital Improvement Program Development
- Task 7 – Sewershed Evaluation Reports
- Task 8 – Public Outreach

TASK 1 – PROJECT ADMINISTRATION

Task 1.1 – Project Management

The project team for this Task Order consists of the Consultant and its subconsultants, Savin Engineers, P.C., PEER Consultants, P.C., C.C. Johnson & Malhorta, P.C. (CCJM) and Mobile Dredging and Video Pipe (MDVP). The Consultant will coordinate the overall work of the project to include project management, subconsultant coordination and MBE/WBE participation management.

The Consultant will schedule, manage and coordinate the efforts of its subconsultants. The Consultant will be responsible for quality control of subconsultant's deliverables.

Deliverables:

- Monthly Invoices (one original invoice with copy of all backup paperwork; two copies of the invoice only)

Task 1.2 – Kick-off Meeting

Before the start of the project, a kick-off meeting will be scheduled to discuss the project goals, communication protocol, schedule, deliverables and existing data acquisition. Participants in this meeting are expected to include the Consultant project manager, the Consultant's technical expert, and the County's project manager. Consultant will submit an electronic format agenda in advance of the meeting, prepare the meeting minutes, and submit the minutes to all attendees in electronic format within five (5) business days after the meeting.

Deliverables:

- Draft and Final Meeting Agenda (PDF format)
- Draft and Final Meeting Minutes (PDF format)

Task 1.3 – Task Schedule and Progress Reports

Consultant will prepare a task-based schedule for the performance of the work under this Task Order. The baseline schedule will be submitted for approval and will outline the major tasks to be completed under this Task Order. The schedule will identify projected submittal dates for the Draft and Final Reports discussed in Task 7 of this proposal. The Consultant will assess the project progress and report on the progress on a monthly basis. Monthly progress reports will detail work activities completed during the reporting period, work activities planned for the next period, budget status, schedule status and an issue log. Consultant will update monthly, or as appropriate, the schedule for performing the services.

Deliverables:

- Draft and Final Baseline Schedule (PDF format)
- Monthly Updated Schedule (PDF format)
- Monthly Progress Reports with look-ahead (PDF format)

Task 1.4 – Additional Meetings

Additional meetings will be scheduled throughout the course of the project as needed, at the request of the County or the Consultant, to meet Task Order objectives. A total of eighteen (18) meetings, including the project kick-off, are assumed for this scope.

The following meetings with Baltimore County are anticipated:

- Task 1 – One (1) project kickoff meeting (see Task 1.2 above)
- Task 3 – One (1) data review/mapping meeting to discuss focus areas
- Task 3 – One (1) meeting to discuss data gap analysis and fieldwork recommendations
- Task 5 – One (1) meeting with the County's planning group
- Task 5 – Five (5) meetings with developers and large institutions to discuss future development projections
- Task 5 – One (1) meeting with the County's Groundwater Management Section to discuss septic systems
- Task 5 – One (1) meeting to review model update recommendations
- Task 5 – One (1) meeting to review capacity assessment results and define level of service
- Task 6 – One (1) meeting to develop initial scoring approach for risk assessment
- Task 6 – One (1) meeting to review the initial results of the risk assessment and adjust scoring criteria as needed
- Task 6 – One (1) meeting to review cleaning/CCTV needs for O&M funding assessment

- Task 6 – One (1) meeting to review the capital improvement program recommendations
- Task 7 – One (1) meeting to review the County's comments on Draft Report
- Task 7 – One (1) meeting to review the Power BI dashboard

Consultant will submit an electronic format agenda in advance of each meeting, prepare the meeting minutes, and submit the minutes to all attendees in electronic format within five (5) business days after the meeting.

Deliverables:

- Draft and Final Meeting Agendas for each meeting (PDF format)
- Draft and Final Meeting Minutes for each meeting (PDF format)

Task 1.5 – QA/QC

Quality assurance/quality control procedures will be employed to maintain quality of all deliverables. These procedures include the use of quality control reviews of engineering assumptions and calculations, quality assurance audits of the workflow processes, and other measures necessary to provide a deliverable of a quality meeting industry standards. A quality control review will be conducted on each submittal prior to delivery to the County. These reviews apply to all modeling databases, technical memoranda, or reports generated for this Task Order. Members of in-house staff not associated with the Task Order will be selected to perform these reviews.

TASK 2 – GATHER AND REVIEW EXISTING DATA

Consultant will gather and review existing data for the Jones Falls Sewershed. All data will be provided by Baltimore County for the Consultant's review. A formal data request will be submitted prior to the kick-off meeting. The Consultant anticipates the following data, at a minimum, will be requested and reviewed for completeness and fitness for the project's purpose:

- Jones Falls Model Development and Calibration Report
- Jones Falls Long Term Capacity/Peak Flow Management Evaluation (LTC/PFME) Report
- Jones Falls Sewershed Repair, Replacement and Rehabilitation (SRRR) Plan
- Historical sanitary sewer overflow (SSO) data including cause if available in electronic format by asset ID or property address
- Historical basement backup data where capacity or blockage is the cause in electronic format by property address
- Historical work order data including cleaning, repairs and complaint calls in electronic format by asset ID or property address
- Historical smoke and dye testing results in electronic format
- Frequent preventative maintenance cleaning areas and other known trouble spots
- Current Baltimore County GIS data including sewer assets, road centerline, pavement, railroads, sub-basin delineations, parcels, buildings, critical facilities, zoning, land

use/planning, hydrology features, soil types, and flow meter and rain gauge locations (current and previous)

- Available land use plans, including the Baltimore County Master Plan 2020
- Current population characteristics
- Population and employment projections, including the latest Baltimore Metropolitan Council of Government (BMCOG) projections
- Flow projections, as gathered by the County, from large institutions and developments within the sewershed (i.e., GBMC, Sheppard Pratt, St. Joseph Medical Center, Towson University, Towson Row, etc.). Hazen will support this data collection effort as described under Task 5.2.
- Most recent copy of the InfoWorks model files
- As-built drawings of the sewer collection system, pump stations and force mains
- Available records on work done as part of the implementation of the SRRR Plan including record drawings, corrective action tracking spreadsheet or other electronic format data
- Drawings for collection system improvements that are in design or construction or are installed but not currently in the GIS
- List of planned improvements, including any local relief sewers required for future planned development
- Record drawings for any previous collection system improvements in the Sewershed, including sewer rehabilitation
- Available flow and rainfall monitoring data from previous and current monitoring efforts, including data for areas of the system where corrective actions were completed (post-construction monitoring). Flow meter installation and maintenance records will also be provided.
- Report on performance assessment of rehabilitation projects which will be completed following the current flow monitoring program (report to be prepared by others)
- Most recent CCTV inspection data including videos and PACP-compliant databases
- Most recent manhole inspection data including photos and MACP-compliant databases
- Water meter consumption data for the last twelve (12) months in electronic format by month. Geocoded locations preferred.
- Level sensor data
- Pump station SCADA data
- Pump station information including pump curves, wet well set points, and record drawings
- Records of on-site septic systems located within the Sewershed from the Groundwater Management section. GIS features preferable if available but electronic address records are also acceptable.
- Data on condition of existing septic systems within the Sewershed as well as any water quality monitoring data in the vicinity of pertinent septic systems
- Records of new tap connections and/or subdivision plans for new development and re-development areas since the last comprehensive flow monitoring period in 2008, as available in electronic format
- Available historical water quality data and reports, including the NPDES Annual Report, prepared by Baltimore County's Department of Environmental Protection and

Sustainability or other entities. Consultant will review water quality data in conjunction with rainfall data, SSO data, and GIS mapping of on-site septic system locations and identify any correlations between the datasets.

Deliverables:

- Formal data request in an email prior to kick-off meeting
- List of data provided by Baltimore County
- List of data discrepancies or major data gaps after data review

TASK 3 – SYSTEM CHARACTERIZATION AND DATA GAP ANALYSIS

The objective of this task is to understand and map the locations of existing problems such as known O&M issues, SSOs, and pipe failures to identify focus areas and additional flow, level and rainfall monitoring needs. Through the data gap analysis, the Consultant will understand the extent and relative confidence in asset attribute data to be incorporated into the model. The result is a prioritized field data collection plan.

Consultant will map the data collected under Task 2 (to the extent the data can be geolocated) and identify data gaps/needs for the hydraulic modeling and areas of focus for further evaluation. All field work performed under this task will be provided to the County in a format to import into the County's Computerized Maintenance Management System (CMMS) software, which the County is planning to roll out in January 2020. Consultant will work with the County to confirm data standards necessary to facilitate import into the CMMS and GIS.

Task 3.1 – Map Existing Data and Identify Problem Areas

Consultant will map the existing data using ArcGIS Pro including:

- SSOs
- Basement backups
- Frequent cleaning areas
- Work orders, differentiating between pre- and post-rehabilitation work orders in areas where comprehensive rehabilitation has been completed
- Pipeline Assessment Certification Program (PACP) inspection data
- Manhole Assessment Certification Program (MACP) inspection data
- Rehabilitation data (previous projects, projects in planning/design/construction)
- Capacity improvement projects (in planning/design/construction)
- Flow meter, level sensor and rain gauge locations and meter basin boundaries and characteristics
- Rehabilitation and replacement recommendations from the SRRR Plan, including the installation dates of these improvements (construction work is nearing completion)
- Capacity deficiencies identified from previous modeling/study efforts
- New taps since the last model was developed

- On-site septic system locations

Consultant will review the mapped data to identify the following areas of focus:

- Problem areas for O&M issues
- Areas with known or suspected capacity constraints
- Areas with structural condition concerns

Special attention will be paid to dates. County will provide dates when improvements were made within the Sewershed, so that the data can be analyzed by way of pre- and post-repair. The County has indicated that repair and rehabilitation work from the SRRR Plan (largely structural repairs) and some isolated relief sewer work within the Sewershed is nearly complete.

Deliverables:

- Maps of the existing data and preliminary areas of focus and suggested additional monitoring locations will be presented at a progress meeting with Baltimore County and provided to the County in electronic PDF and hard copy format.

Task 3.2 – Gap Analysis and Additional Field Data Collection Recommendations

Consultant will conduct a gap analysis to identify missing values, errors, and inconsistencies in asset attributes that will impact the model. Gap analysis will be performed using the data management tools available in InfoWorks CS and GIS. Automated inference tools within InfoWorks CS and GIS will be utilized to identify questionable data such as:

- Reverse grade slopes
- Missing attribute data
- Larger diameter pipes upstream of smaller diameter pipes
- Orphan pipes or manholes
- Incorrect spatial data (e.g., a manhole location inconsistent with nearby assets)
- Incorrect elevation data (e.g. manhole rim elevations conflicting with adjacent terrain)

This will include detailed analysis of data sources for pipes in the model including GIS, record drawings, and CCTV inspections. Consultant will apply engineering judgment to determine locations where assumptions and interpolations will suffice for model calibration. Manhole surveys will be performed as needed under Task 3.3.

Consultant will also utilize the mapped data to identify the following:

- Assets without inspection data
- Assets in problem areas that do not have recent inspection data
- Any locations where additional flow or level monitoring is needed for model calibration or model expansion, or to further investigate problem areas (see Task 4.1)
- Areas where acoustic inspections or other investigations should be performed to ascertain potential blockages that could inform the model calibration and capacity assessments

- Exposed assets adjacent to or crossing streams where external asset condition should be verified

Consultant will recommend additional field work to address critical data gaps. The base scope assumes:

- Up to 100 manhole surveys to be completed by subconsultant CCJM
- Up to 50,000 LF of CCTV inspections to be completed by subconsultant Savin Engineers
- Up to 100 Level 1 and 50 Level 2 manhole inspections to be completed by subconsultant Savin Engineers
- Up to 15 additional flow meters (including for areas of model expansion) – flow monitoring to be performed by others under a separate task. The County has two (2) contractors that can install these flow meters once final locations are selected.
- Up to 20 level monitors – level monitoring to be performed by others under a separate task. The County has two (2) contractors that can install these level monitors once final locations are selected.
- Up to 200 acoustic inspections to be completed by subconsultant MDVP
- Up to 15,000 LF of creek walks and exposed asset assessments to be completed by Consultant

Consultant will develop Survey 123 Forms for various field data collection efforts. These forms will be tailored to collect necessary data by asset type.

The additional fieldwork to be performed by the Consultant is described in Tasks 3.3 through 3.7.

Deliverables:

- Maps of the additional fieldwork recommendations will be presented at a progress meeting with Baltimore County and provided to the County in electronic PDF and hard copy format.
- GIS or other electronic format data identifying specific assets to be included in the additional field investigation.

Task 3.3 – Manhole Surveys

The base scope assumes up to one hundred (100) manhole surveys will be conducted. Visual observations will be made concerning the pipe connectivity and system configuration, and rim-to-invert depth measurements will be taken for all incoming and outgoing pipes. The Consultant will also collect horizontal and vertical location data (x and y location points and rim elevation) for each manhole. No confined-space entry will be performed. Where unmapped sewer lines and manholes are found or other corrections to the existing GIS maps are needed based on field conditions, map corrections will be made and submitted to the County in ArcGIS shapefile format or in any specified format meeting the County requirements for GIS changes.

Deliverables

- Field survey data in electronic format or in County specified format
- GIS shapefile for map corrections

Task 3.4 – CCTV Inspections

Consultant will conduct closed-circuit television (CCTV) inspections in accordance with the National Association of Sewer Service Companies (NASSCO) PACP standards. The base scope assumes up to 50,000 linear feet (LF) of gravity sewer mains ranging from 8 to 42 inches in diameter will be inspected. No confined space entry will be performed. Traffic control by a subconsultant to Savin Engineers is assumed for up to seven (7) days.

CCTV Inspection Requirements

- CCTV inspection will proceed after a single light cleaning pass or prior to cleaning as long as the camera can make it through the pipe. After the CCTV inspection, if the pipe is not a minimum of 95 percent clear, up to two (2) additional light cleaning passes will be performed in accordance with NASSCO (National Association of Sewer Service Companies) standards.
- Heavy cleaning (consisting of more than three passes with the hydraulic cleaner, root cutting and/or grease cutting) is included in this scope for up to 15,000 LF of gravity sewer mains ranging from 8 to 30 inches in diameter.
- All inspection records will be provided in a PACP-compliant database with inspection fields populated.
- Inspection videos will be recorded in MPEG1 format and will follow the naming convention established by the County.
- New manholes will be reported to the County.

Reverse Inspection Setups

- If the upstream and downstream manholes are inaccessible due to private property, a CCTV inspection/reverse inspection will be attempted from the nearest upstream or downstream manholes located in the public right-of-way.

Deliverables

- PACP-compliant CCTV inspection database, logs, photos and videos
- GIS shapefiles of pipe defects (point features) and pipe ratings (pipe features)
- Identification of debris levels to be input into the hydraulic model

Task 3.5 – Manhole Inspections

Consultant will conduct manhole inspections in accordance with NASSCO MACP standards. The base scope assumes up to 100 MACP Level 1 and up to 50 MACP Level 2 manhole inspections will be performed. No confined space entry will be performed for Level 1

inspections. Consultant will work with the County to identify which optional fields to include in the Level 1 inspections, if any.

Manhole Inspection Requirements

- All inspection records will be provided in an MACP-compliant database with inspection fields populated.
- The inspections will include electronic images of the surface, casting and chimney, barrel and invert.
- Defects will be identified, and active infiltration quantified in accordance with the NASSCO MACP standards for Level 2 inspections.
- New and/or buried manholes will be reported to the County.
- Consultant is not responsible for frame or cover replacement or for raising manhole cover to grade.
- Consultant will notify the County of all manholes with signs of surcharge identified during the field inspection work.

Could Not Locate / Could Not Access (CNL/CNA) Manholes

- Consultant will perform due diligence when attempting to locate manholes. A list of CNL/CNA manholes will be provided to the County after due diligence has been performed without success.
- Consultant will make a minimum of two separate inspection attempts at different times before designating a manhole as CNA due to private property, parked car or heavy traffic.

Deliverables

Consultant will prepare and submit the following to the County:

- MACP-compliant manhole inspection database and photos in electronic format
- GIS shapefiles of manhole defects and manhole ratings

Task 3.6 – Acoustic Inspection

Consultant will conduct up to 200 acoustic inspections of sewer mains ranging from 8 to 12 inches in diameter using InfoSense's SL-RAT technology to inform potential for blockage. Acoustic inspections will be performed in O&M problem areas as identified in Task 3.1. It is assumed that 140 inspections will be on-road and 60 inspections will be off-road. Traffic control is limited to signs and cones (no flagmen or arrow boards). No flow control will be provided, and no confined space entry will be performed.

In areas where acoustic inspection scores pipes below seven (7), a follow-up PACP-compliant CCTV inspection will be conducted to ascertain the nature of the blockage/debris and to provide a record that some level of blockage was found. Recommendations for follow-up cleaning will be provided.

Cleaning and subsequent CCTV inspection of the cleaned pipe are not included in the scope. Post-cleaning CCTV inspection data, provided by the County, will be reviewed to confirm results.

Deliverables

Consultant will prepare and submit the following to the County:

- Electronic results of acoustic survey scores in Excel and/or GIS format
- PACP-compliant CCTV inspection database, logs, photos and videos of any CCTV inspections performed
- GIS files of pipe defects (point features) and pipe ratings (pipe features)

Task 3.7 – Creek Walks/Exposed Asset Assessments

Consultant will perform creek walks and exposed asset assessments for up to 15,000 LF of sewer mains located adjacent to or crossing streams. Consultant will visually assess the exterior condition of exposed sewers and manholes. The general condition of the streambanks in these areas will be recorded. Survey 123 forms will be developed and implemented as part of this effort.

Deliverables

- Survey 123 export of field data including photos and other data
- PDF field reports for each asset

Task 3.8 – Sonar/CCTV Inspections

Consultant will conduct up to 20,000 LF of sonar/CCTV inspections of sewer mains ranging from 30 to 42 inches in diameter. Sonar/CCTV inspections will be performed in O&M problem areas as identified in Task 3.1. No flow control will be provided, and no confined space entry will be performed.

Deliverables

Consultant will prepare and submit the following to the County:

- Electronic results of the sonar inspections
- PACP-compliant CCTV inspection database, logs, photos and videos
- Identification of debris levels to be input into the hydraulic model
- GIS files of pipe defects (point features) and pipe ratings (pipe features)

Task 3.9 – Summarize Field Data

Consultant will summarize field data collected under Tasks 3.3 through 3.7 and will utilize the data as needed to refine and calibrate the collection system model. Consultant will develop

rehabilitation and other "next-action" recommendations as necessary based on the inspection data. Field data results and recommendations will be incorporated into the Asset Management Program Development in Task 6.

TASK 4 – FLOW/RAINFALL MONITORING DATA REVIEW AND INTERIM I/I ANALYSIS

The objective of this task is to review and analyze the flow and rainfall monitoring data collected under a separate task order to support the model calibration and determine infiltration/inflow reduction strategies and priorities.

Task 4.1 – Flow, Level and Rainfall Monitoring Data Review

Consultant will review temporary flow and rainfall monitoring locations (installed/maintained by others) and provide feedback on the adequacy of the locations for hydraulic modeling purposes (and to support model expansion, and characterization of the system with respect to any observed SSO/O&M issues that would affect system performance). Consultant will identify future needs for flow monitoring. Since the data is collected, screened and processed by others, a QA/QC review of the flow monitoring data set will be conducted by the Consultant to assess its sufficiency for use in model calibration and verification as well as interim I/I analyses. It is assumed that up to twelve (12) months of data from up to forty-five (45) flow meter sites will be reviewed and analyzed. Data from up to fifteen (15) additional flow meter sites installed based on the Consultant's recommendations will be reviewed and analyzed for up to twelve (12) months. Consultant will review and analyze rain gauge and radar rainfall data for the flow monitoring time period. Consultant will review and analyze level sensor data for up to twenty (20) locations. Review and analysis will include flow meter volume balances as applicable.

Task 4.2 – Flow Disaggregation and Rainfall Derived Infiltration/Inflow (RDII) Evaluation

Consultant will disaggregate data from the flow meters into:

- Base sanitary flow (weekday, weekend)
- Base groundwater infiltration (GWI) including normalized GWI such as GPD/ft/in
- Seasonal RDII metrics (e.g., RTK) for each meter basin including volumes and R-values representing fast, medium and slow response.

Consultant will summarize RDII characteristics for each meter basin in tabular format and thematically map using GIS.

Deliverables:

- Tables and maps of RDII characteristics (PDF format)

TASK 5 – HYDRAULIC MODEL REFINEMENT AND CALIBRATION

The objectives of this task are to refine and calibrate the existing model so that it can be used as a tool to assess current capacity for certain levels of service, to identify future capacity constraints from new growth and redevelopment, and to develop and size improvement strategies to address capacity issues.

Task 5.1 – Existing Model Review

Consultant will review the existing model for fitness for purpose by:

- Reviewing model extents and making recommendations for refinements/expansion based on previous tasks. For the purposes of this proposal, it is assumed that the model will be expanded to include all 8-inch sewers. Refinements/expansion will be completed under Task 5.6.
- Performing wet and dry weather existing model verification with new flow and rainfall data
- Reviewing pump station and force main representations and output relative to available data
- Comparing current GIS and corrective action records to model input
- Reviewing model subcatchment representation

Deliverables:

- Summary of recommended additional field data collection in GIS or other electronic format as well as an overview of model adjustments needed as a result of the verification exercise.

Task 5.2 – Develop Future Condition Models

Consultant will develop future flow projections for near term (2025), 20-year and 50-year planning horizons and up to two (2) additional planning horizons in the event that project phasing improvement strategies might be implemented. The 50-year planning analysis will include an assessment of build-out conditions, with the assumption that any available land within the County's service boundaries for the Sewershed is developed in accordance with its current zoning. County will define the available, developable land within the Sewershed. The development of future condition models for these planning horizons will include the following:

- Review of available land use plans
- Attending one (1) meeting with applicable planning groups/agencies within Baltimore County to discuss projected future development and development timing
- Attending up to five (5) meetings with large institutions and commercial developments to discuss projected future development and development timing (e.g., GBMC, St. Joseph Medical Center, Sheppard Pratt, Towson University, Towson Row)

- Review of water consumption data in combination with dry weather flow meter data to assess unit dry weather flow variability throughout the sanitary sewer system. The assessment will involve looking at unit dry weather flows based on development type, development age, industry type, commercial type, etc. and will be used to "truth check" flow data estimates.
- Review of population and employment projections

The Consultant will develop design flow determination strategies and parameters such as unit dry weather flows for various land uses. Consultant will develop future wet weather design flow determination strategies and parameters as applicable. Infill development (i.e., re-development or new development in developed areas) will be handled differently than greenfield development (i.e., development in undeveloped areas). Future RDII strategies and parameters will be developed for new development where new pipes will be built while RDII strategies and parameters from the calibrated model will be used for infill areas. Consultant will delineate future "pipelines" to represent the connection of future flows to the existing pipe network as necessary to properly represent timing of flows. In some cases, future subcatchments will be connected directly to the nearest existing pipe.

Consultant will develop thematic mapping of development conditions for near term (2025), 20-year and 50-year planning horizons and up to two (2) additional planning horizons. These future flow projections will be utilized in the future capacity assessment to be performed under Task 5.8.

Deliverables:

- Maps showing projected future development locations including new development and potential redevelopment by parcel for 2025, 20-year, and 50-year planning horizons and up to two (2) additional planning horizons (PDF format)
- Future populations and flow projections tied to parcels
- Any future "pipelines" to represent flows from future development areas if necessary, to properly represent timing of flows

Task 5.3 – Assessment of Septic System Elimination

The Consultant will identify and map all parcels within the Sewershed that are currently served by septic systems based on geolocated electronic data provided by the County. The Consultant will attend one (1) meeting with the County's Groundwater Management Section to identify areas within the Sewershed where septic system elimination may be desired in the future. Future design flow determination strategies including flow projections will be developed for up to 1,100 septic systems to be connected to the public sewer. The future flow projections for this septic system elimination will be included in the future condition models developed under Task 5.2. Planning level cost estimates will be developed for the strategies to construct upgrades to existing sewer system infrastructure to accommodate the septic system elimination. These sewer system improvements will be included in the Capital Improvement Program to be developed under Task 6.6.

Deliverables:

- Maps of the parcels with septic systems and potential septic elimination areas (PDF format)
- Future design flow determination strategies including flow projections for the septic system elimination
- Planning level cost estimates for the upgrades to the existing sewer system infrastructure required for the septic system elimination

Task 5.4 – Phase 2 Field Investigations

Consultant will recommend and perform (upon authorization by the County) additional field investigations based on the more detailed model review including:

- Collecting manhole survey data for the expanded model or where additional conflicts are found between existing data sources. Up to fifty (50) additional manhole surveys will be performed. No confined space entry will be performed.
- Conducting pump station flow testing for four (4) pump stations to obtain accurate capacity representations in the model as well as wet well settings.
- Identification of debris levels will be completed using CCTV inspection and sonar inspection data as described in Tasks 3.4 and 3.8

Deliverables:

- Manhole survey data in electronic format or in County specified format
- Pump station drawdown testing results including comparison of actual operating conditions to original pump curves

Task 5.5 – Model Update Recommendations

Consultant will develop detailed recommendations for existing model updates including:

- Existing model representation of physical system including manhole survey results, new construction/rehabilitation/replacement, and debris as identified during the CCTV and sonar inspections described in Tasks 3.4 and 3.8
- New development
- Subcatchment delineations
- Dry weather flow representation
- RDII hydrology
- Model expansion
- Sensitivity analysis

Deliverables:

None. Work from this task will be documented in the Model Update and Calibration Report.

Task 5.6 – Update Physical Model Representation and Subcatchment Delineation

Consultant will update the current physical model based on the results of the gap analysis, GIS review, manhole surveys, CCTV/sonar inspections, pump station testing, recent development, modified subcatchment delineations, and recent system improvements.

Expansion of model networks will be initially done by importing County-provided GIS data for modeled sewer pipes and manholes into the InfoWorks framework, reviewing record drawings of applicable pump stations and force mains, and performing a QA/QC analysis on pipe/manhole connectivity and alignment. Data gaps will be populated using a combination of record drawings, field inspection data, and other data collected in prior tasks. Interpolation and extrapolation of inverts and/or rim elevations will be performed when no other reliable data sources exist. Subcatchment data for sewer service areas that are available in GIS will be used as a starting point for delineation of flow inputs in the model network. The larger subcatchments will be subdivided as required to achieve appropriate modeling resolution. Pump station operational information will be defined in the model for explicitly-modeled pumps and station piping, and configuration of diversion structures and SSO structures will also be defined.

Deliverables:

None. Work from this task will be documented in the Model Update and Calibration Report.

Task 5.7 – Model Calibration/Verification

The model will be configured to accurately represent both dry weather flow conditions as well as wet weather performance of the collection system. Dry weather flows will be developed based on a combination of flow metering data, water consumption data, and population data as appropriate. Wet weather flows will be developed using standard hydrologic parameters that represent the rainfall-dependent infiltration and inflow response of sewer systems. These parameters will be calibrated and verified as described below. Groundwater influences and/or tidal influences will be represented as observed through monitoring data.

Based on 2019-2020 flow and rainfall monitoring data, field testing, available water consumption data and other information, Consultant will perform dry and wet weather calibration for the model. Consultant will utilize the flow and rainfall monitoring data received from the County to perform dry and wet weather calibrations and verifications of the hydraulic models. Representative storm events of varying intensities and depths will be selected from the radar rainfall data set to be used for calibration and verification. A maximum of ten (10) wet weather events will be used for calibration and the remainder of the continuous monitoring period (up to 18 months of total data) for verification of the model. The calibration approach is to use a combination of fixed runoff and groundwater infiltration (GWI) model.

A sensitivity analysis including up to five (5) model parameters for one (1) storm event (from the monitoring period) at up to ten (10) monitoring locations will be performed to assess the relative impact of model parameter values on flow predictions. Graphs of the predicted storm flow hydrograph using the calibrated parameter value, a high value and low value will be prepared for

each instance.

The model will be calibrated by adjusting hydrologic and hydraulic parameters with the target to achieve the calibration/verification goals listed below. Model calibration accuracy and quality will be judged by industry guidelines, such as delineated in the Wastewater Planning User's Group Code of Practice for the Hydraulic Modelling of Sewer Systems (Nov. 2002). These guidelines establish the following calibration/verification goals for two out of three wet weather events:

- Dry weather peak flows within +10% and -10%
- Dry weather flow volumes within +10% and -10%
- Wet weather peak flows within +25% and -15%
- Wet weather flow volumes within +20% and -10%
- Wet weather peak depths within +1.6 feet and -0.3 feet
- Timing and shape of hydrographs are similar

Consultant will summarize the calibration/verification results by meter including calibration/verification statistics as well as summaries of calibration challenges, especially if the calibration/verification goals could not be met with reasonable effort.

Deliverables:

- Model Update and Calibration Report summarizing Tasks 5.1 through 5.7.
- InfoWorks ICM files for the revised current conditions model, 2025 model, 2040 model, 2070 model and up to two (2) additional planning horizon models

Task 5.8 – Baseline/Future Capacity Assessment

Consultant will use the calibrated and verified model to evaluate the sewer system's response to simulations of up to five (5) precipitation frequency events and also an extended period simulation using historical rainfall data under baseline (2020) and future conditions (2025, 2040, 2070 and up to two other planning horizons). Assessment of the existing precipitation frequency events will include the following:

- 2-year (24-hour),
- 10-year (24-hour),
- 20-year (24-hour),
- 2-year (6-hour),
- 10-year (6-hour) and
- Extended period simulation (EPS)

A sensitivity analysis will be performed on the precipitation frequency events. Changing rainfall patterns model science will be used to estimate the standard return frequency of the precipitation frequency events at a 50-year planning horizon. Comparison of the current precipitation frequency and the 2070 estimated precipitation frequency will be presented in tabular format. For a single return period and duration (i.e., 10-year, 6-hour precipitation frequency), Consultant

shall simulate the existing system's response to the IDF values for the current and projected future precipitation frequency events.

An extended period simulation will be performed following review of up to ten (10) years of rainfall data. The extended period simulation will be conducted using a "typical" year of rainfall.

The simulations will be performed for six scenarios, baseline 2020 (based on the time period for which monitoring data is collected) and future (growth scenario based on future flow projections, 2025, 2040, 2070 and up to two (2) other planning horizons). Future flow projections will be as developed under Task 5.2.

The ability of the wastewater collection system to convey baseline and future flows during both dry and wet weather (using the existing precipitation frequency events and the EPS) will be evaluated, including the systems' capability to convey buildout flows (50-year planning horizon). Locations of model-predicted SSOs, surcharging and capacity deficiencies will be identified. Predicted volumes of model-predicted SSOs at each location will be provided for each storm event. Pump station performance will also be evaluated. Tables and GIS maps depicting the performance of the collection system for each simulation (model-predicted SSOs, model-predicted surcharging, pipeline capacity deficiencies, pump station capacity deficiencies) will be developed. Results of the capacity assessment will be presented in a workshop with the County.

A sensitivity analysis of storm duration on predicted SSOs will be performed for up to two (2) of the precipitation frequency events (listed above) under the baseline scenario. Two (2) additional durations will be tested, one of which will be longer in duration than the storms listed above, and one of which will be shorter. A summary table of SSOs by precipitation frequency event will be developed.

Consultant will coordinate with the City of Baltimore and provide capacity assessment results at the City/County system boundaries to the City. Consultant will utilize the City's latest InfoWorks model as a boundary condition in this study.

Deliverables:

- Slides from Capacity Assessment workshop
- GIS files showing capacity results for each simulation
- Thematic maps in PDF format showing capacity assessment results for each precipitation frequency event and development condition (locations of SSOs and sewers that are surcharged, including extent of surcharge and type of surcharge; i.e., backwater induced or capacity related)
- Tables showing the length of sewers surcharged by diameter ranges
- Return period analysis: summary and comparison of surcharged and flooded manholes under various conditions
- Capacity Assessment Report, including an evaluation of the system's capability to convey flow

Task 5.9 – Define Levels of Service (LOS) Strategies

Consultant will work with the County to establish strategies for the level of service (LOS) definition and the planning objectives/strategies for the collection system. The LOS strategy is the triggers for improvements (unmet LOS for a selected precipitation frequency event) as well as the design targets for improvements (LOS achieved for a selected precipitation frequency event) in terms of a precipitation frequency and level threshold (overflow, extent of surcharge). The selection of the strategy for level of service will be determined in conjunction with the capacity assessment results. The Consultant will prepare for and lead a LOS workshop with the County to develop consensus moving forward for these strategies.

Deliverables:

- Slides and exhibits from LOS workshop (to be combined with the Capacity Assessment workshop)

TASK 6 – ASSET MANAGEMENT AND CAPITAL IMPROVEMENT PROGRAM DEVELOPMENT

The objective of this task is to develop risk scoring for all pipes within the sewershed by analyzing the structural, O&M and capacity assessment data and to create a prioritized capital improvement framework that addresses structural, O&M and capacity issues and strategies for modernizing the collection system.

Task 6.1 – Analysis of Existing Data for Asset Management Program

Consultant will review the data gathered under Tasks 2 through 5 for the following purposes:

- Establish pipe cohorts based on available data and experience
- Identify deterioration curves, end of useful life and remaining useful life for each cohort (using industry standards, supplemented by available age and line break/failure data)
- Identify collection system capacity-related deficiencies based on the simulations performed under Task 5
- Assess physical condition and capacity of each pipe segment using available data

PACP scoring of the pipes will not be performed as part of this task.

Task 6.2 – Risk Assessment

Consultant will develop consequence of failure (CoF), likelihood of failure (LoF) and overall risk scores (business risk exposure or BRE) for each pipe segment based on the data analyzed in Task 6.1. Additional field investigations will not be performed for this task. The development of the scoring criteria and BRE scoring will include a workshop with the County to develop

consensus on the initial scoring approach, as well as a second meeting to review the initial results and to make any necessary adjustments to the scoring framework:

- Consequence of Failure (CoF) Scoring – Develop CoF criteria, weighting and scoring for all sewer (gravity and force mains) pipes. Utilize GIS model-builder to develop CoF scores for each pipe asset based on accepted criteria. Apply the criteria to each pipe segment within GIS.

- Likelihood of Failure (LoF) Scoring - Develop (LoF) criteria, weighting and scoring for all sewer (gravity and force mains) pipes. Utilize GIS model-builder to develop LoF scores for each pipe asset based on accepted criteria. Apply the criteria to each pipe segment within GIS. The LoF scoring will incorporate available condition data and will include structural failure as well as capacity and blockage (O&M) failure risks.

- Business Risk Exposure (BRE) Scores – Develop a combined BRE score as a combination of the CoF and LoF. Assign BRE scores for each pipe segment. In addition, the Consultant will develop a risk matrix that indicates risk regions that will incorporate strategies depending on the combination of CoF and LoF. Every pipe asset will be assigned a corrective action option and priority for consideration and evaluation.

Task 6.3 – Develop Capacity Improvement Strategies

Consultant will develop and evaluate strategies for achieving the selected level of service at year 2025, 20-year and 50-year planning horizons and up to two other planning horizons, including preliminary construction cost estimates. Strategies may include an option to pump flows from the Jones Falls Sewershed elsewhere within the sanitary sewer system either permanently or during wet weather events only. The capacity impacts on another Sewershed when receiving flow from the Jones Fall Sewershed will be determined based on the existing hydraulic modeling and capacity assessments which have been developed for those Sewersheds.

The number of SSOs predicted to be reduced by implementation of strategies will be provided. The percentage of predicted SSO volume captured by implementing strategies will be provided.

Task 6.4 – Asset Renewal, Capacity Upgrade, and O&M Funding Assessment

The LoF, CoF, and BRE scores will be utilized to develop a preliminary Asset Renewal, Capacity Upgrade, and O&M Funding assessment that will provide strategies for annual renewal and replacement (R&R), capacity upgrades, and operation and maintenance (O&M) spending needs over the five planning horizons (year 2025, 20-year, 50-year, and up to two other planning horizons) to maintain a desired overall level of service/risk using current dollars. The R&R and capacity upgrades funding assessment will include assumptions for replacement versus rehabilitation as well as unit price costing using available local bidding information combined with other available costing data. The O&M funding assessment will include forecasting of cleaning and CCTV inspection needs. Consultant will work with the County to determine internal or external resource assumptions. CCTV inspection and cleaning needs will include

forecasting of inspection and cleaning frequencies by pipe to the extent practicable and will include reactive and preventive cleaning lengths. Consultant will meet with the County to develop consensus on cleaning and CCTV inspection needs assumptions to be used in the forecasting. Consultant will develop a list of equipment and staff needed to achieve the goals internally.

Task 6.5 – Near-Term Pipeline Renewal and Replacement, Capacity, and O&M Strategies

The risk assessment scores from Task 6.2 will be used to identify pipe segments that will require near-term improvements (next ten years), as well as priority cleaning and CCTV inspection. A list of segments requiring near-term improvements will be developed based on risk assessment and capacity deficiencies. An updated list of near-term pipeline renewal projects will be provided to the County. Costs for these projects will be developed based on unit costs from recent pipeline bids/projects in the area. It is assumed the County will provide the bid tabs from recent pipeline renewal projects. For priority cleaning and CCTV inspection, the Consultant will develop pipe runs (for larger trunk sewers) and pipe clusters (for more systematic basin-wide assessments) to be assessed over the next five years.

Deliverables:

- Asset Management Program Development Report summarizing the results of Tasks 6.1 through 6.4, including funding assessment and list of renewal/modernization projects and costs

Task 6.6 – Prioritized Capital Improvement Framework

Consultant will develop a prioritized capital improvement framework (CIF) for each planning horizon (up to five total) based on the results of the asset management program development and considering possible strategies that could be implemented.

Consultant will develop a project prioritization strategy with County input and develop a CIF framework from the list of strategies to achieve the target LOS at each planning horizon.

Consultant will identify and evaluate strategies for modernizing the collection system including real-time controls, permanent sensor networks, interceptor maintenance programs, and predictive maintenance.

A Power BI dashboard (see Task 7.3) will be utilized to present long-term risk profiles under varying funding scenarios and will include consideration for remaining useful life (RUL) in terms of structural, O&M and capacity perspectives. Pipe renewal and replacement costs and capacity upgrade costs will be based on available costing information and the use of current costing tools. The dashboard will include items such as the remaining useful life of each pipe segment, the risk scores, renewal and replacement costs, capacity upgrade costs, long-term projected strategies and CIF, etc. In addition, potential maintenance key performance indicators (KPIs), including inspections and service test results, will be included.

Deliverables:

- Detailed list of infrastructure needs.
- Detailed list of strategies.
- CIF will be included in the Comprehensive Report and Power BI Dashboard described in Task 7.

TASK 7 – SEWERSHED EVALUATION REPORT

The objective of this task is to provide a deliverable that identifies a roadmap forward for providing reliable sewer service in accordance with the County's long-term objectives for the Jones Falls Sewershed.

Task 7.1 – Draft Jones Falls Sewershed Comprehensive Evaluation Report

Consultant will develop a Draft Jones Falls Sewershed Comprehensive Evaluation Report that will discuss the comprehensive evaluation, including the data review and mapping, data gap analysis, additional fieldwork, flow/rainfall monitoring analysis, I/I analysis, model review and calibration, capacity assessment and strategies including asset management and capital improvement program development. GIS maps will be utilized to illustrate results of the various evaluation steps, including:

- Existing data review: problem areas, SSOs, basement backups, work orders, constraints/issues relative to condition, capacity and water quality
- Data gap analysis: missing/erroneous data and additional data needs
- Additional fieldwork: locations and results of fieldwork
- Interim I/I analysis results
- Future condition models: projected development for each planning horizon
- Capacity assessment results: model-predicted overflows and surcharging under various precipitation frequency events and an extended period simulation for each planning horizon
- Capacity and Renewal & Replacement improvements: for risk level at each planning horizon and best available current RUL estimates
- Asset management development: risk scores, Renewal & Replacement, capacity, and O&M recommendations

Consultant will summarize and provide detailed lists of infrastructure needs and strategies to address capacity, structural and O&M deficiencies within the sewershed. A prioritized capital improvement program for year 2025, 20-year and 50-year planning horizons and up to two additional planning horizons based upon possible strategies implemented will be presented, including planning-level construction cost estimates and an implementation schedule.

The Draft Report will also discuss Best Management Practices (i.e., Interceptor Maintenance Program) for on-going proactive maintenance of the small diameter and large diameter sewer mains within the Sewershed.

Deliverables:

- Draft Report: 2 hard copies and 1 electronic PDF copy

Task 7.2 – Final Jones Falls Sewershed Comprehensive Evaluation Report

Consultant will prepare a formal Response to Comments table addressing the County's comments on the Draft Report. Consultant will incorporate the comments into a Final Jones Falls Comprehensive Sewershed Evaluation and Remedial Measures Report.

Deliverables:

- Response to Comments table (PDF format)
- Final Report: 2 hard copies and 1 electronic PDF copy
- All InfoWorks model files
- Power BI dashboard (see Task 7.3)

Task 7.3 – Power BI Dashboard

Power BI is a data analytics software that uses dashboard pages to visualize data and assist in communicating results to technical and non-technical stakeholders. Consultant will develop an interactive Power BI dashboard to illustrate the following project tasks: data review and mapping, I/I analysis, future flow projections, capacity assessment, asset management, and capital improvement program. The thematic maps produced for the comprehensive evaluation report (Task 7.1) will be utilized in the framework for the dashboard. Power BI will provide interactive maps, tables and graphs to summarize, compare and analyze the results of this sewershed evaluation. The dashboard will allow the County to view the relationships between the various improvement projects and understand how development "triggers" impact the improvements. The Power BI dashboard will be customized to communicate findings/recommendations between the various County groups or with external stakeholders. Up to fifteen (15) dashboard pages will be developed.

TASK 8 – PUBLIC OUTREACH

Task 8.1 – Community Meetings

Consultant will prepare presentations and handouts for meetings/workshops with the general public or community/environmental groups. Consultant will attend up to five (5) meetings/workshops.

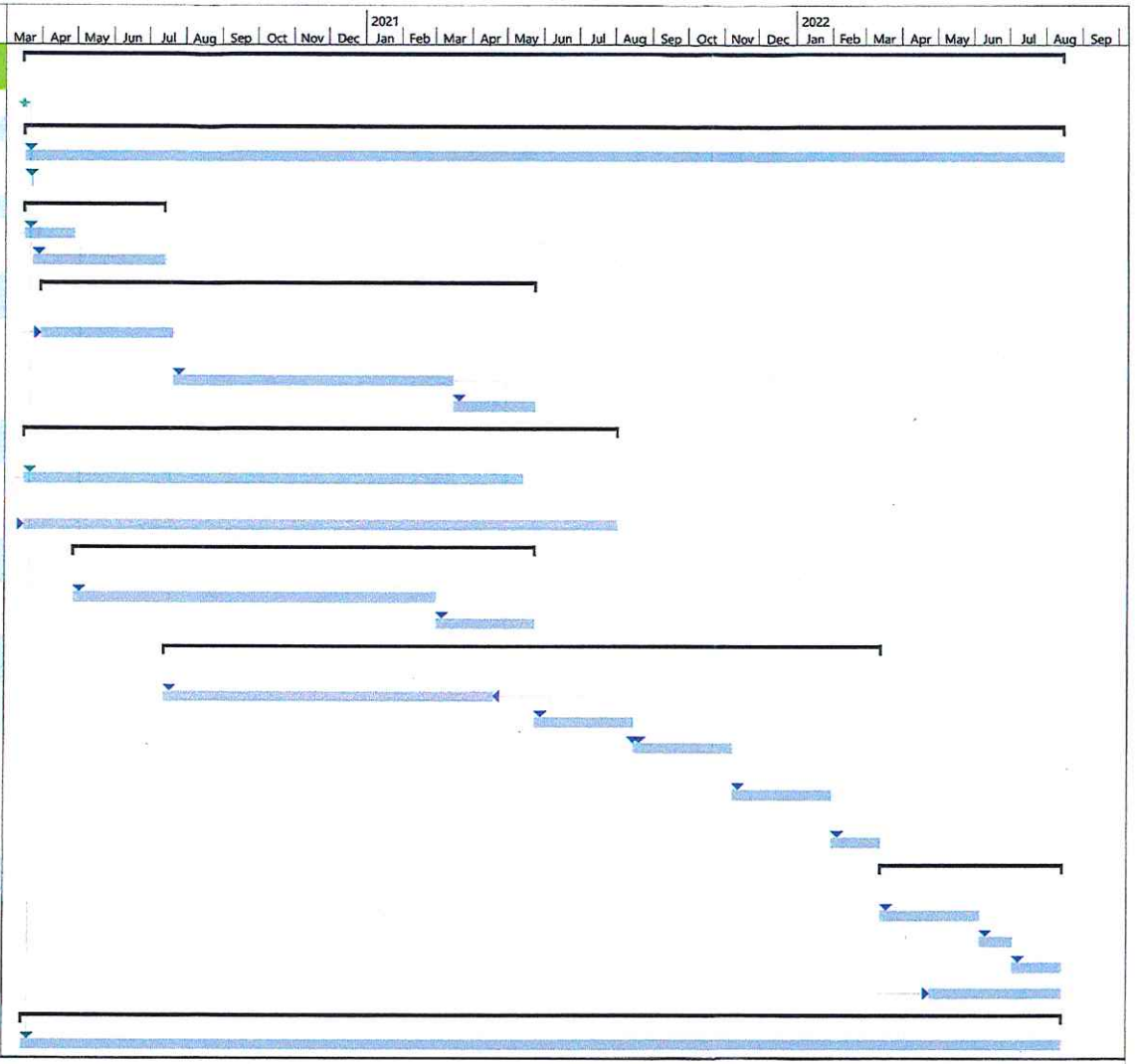
Deliverables:

- Exhibits and presentation materials for community meetings

PROJECT SCHEDULE

The Consultant is prepared to start this work immediately upon authorization/issuance of a purchase order. A proposed project milestone schedule is provided in Attachment A.

ID	Task Name	Duration	Start	Finish
1	**Jones Falls Sewershed Comprehensive Evaluation**	**631 days**	**Mon 3/16/20**	**Mon 8/15/22**
2	**NTP**	1 day	Mon 3/16/20	Mon 3/16/20
3	**Task 1 - Project Administration**	**630 days**	**Tue 3/17/20**	**Mon 8/15/22**
4	Project Management	630 days	Tue 3/17/20	Mon 8/15/22
5	Kick-off Meeting	1 day	Mon 3/23/20	Mon 3/23/20
6	**Task 2 - Gather/Review Existing Data**	**85 days**	**Tue 3/17/20**	**Mon 7/13/20**
7	Obtain Data from County	30 days	Tue 3/17/20	Mon 4/27/20
8	Review Data	80 days	Tue 3/24/20	Mon 7/13/20
9	**Task 3 - System Characterization and Data Gap Analysis**	**300 days**	**Tue 3/31/20**	**Mon 5/24/21**
10	Map Data/ID Problem Areas/Gap Analysis	80 days	Tue 3/31/20	Mon 7/20/20
11	Field Inspections	170 days	Tue 7/21/20	Mon 3/15/21
12	Summarize Field Data	50 days	Tue 3/16/21	Mon 5/24/21
13	**Task 4 - Flow Data Review and I/I Analysis**	**360 days**	**Tue 3/17/20**	**Mon 8/2/21**
14	Flow/Rainfall Monitoring (by others)	304 days	Tue 3/17/20	Fri 5/14/21
15	Flow Data Review and I/I Analysis	360 days	Tue 3/17/20	Mon 8/2/21
16	**Task 5 - Model Refinement/Calibration/Verification**	**280 days**	**Tue 4/28/20**	**Mon 5/24/21**
17	Model Update/Recalibration	220 days	Tue 4/28/20	Mon 3/1/21
18	Capacity Assessment	60 days	Tue 3/2/21	Mon 5/24/21
19	**Task 6 - Asset Management/CIP Development**	**435 days**	**Tue 7/14/20**	**Mon 3/14/22**
20	Risk Assessment	200 days	Tue 7/14/20	Mon 4/19/21
21	Capacity Alternatives	60 days	Tue 5/25/21	Mon 8/16/21
22	Asset Renewal/Capacity/O&M Funding Assessment	60 days	Tue 8/17/21	Mon 11/8/21
23	R&R, Capacity and O&M Recommendations	60 days	Tue 11/9/21	Mon 1/31/22
24	Prioritized CIF	30 days	Tue 2/1/22	Mon 3/14/22
25	**Task 7 - Sewershed Evaluation Reports**	**110 days**	**Tue 3/15/22**	**Mon 8/15/22**
26	Draft Report	60 days	Tue 3/15/22	Mon 6/6/22
27	County Review	20 days	Tue 6/7/22	Mon 7/4/22
28	Final Report	30 days	Tue 7/5/22	Mon 8/15/22
29	Power BI	80 days	Tue 4/26/22	Mon 8/15/22
30	**Task 8 - Public Outreach**	**630 days**	**Tue 3/17/20**	**Mon 8/15/22**
31	Community Meetings	630 days	Tue 3/17/20	Mon 8/15/22



Project: Jones Falls Sewershed Comprehensive Evaluation
Date: Tue 1/21/20

Task Milestone Summary