

TASK AUTHORIZATION
SANITARY SEWER EVALUATION STUDY (SSES) AND REHABILITATION DESIGN
ASSISTANCE

This Authorization, when executed, shall become part of the On-Call Agreement for Professional Services between City of Greensboro (CITY), and CDM Smith Inc. (CONSULTANT), hereafter referred to as the Agreement, dated November 6, 2019.

- 1. The Basic Services of the CONSULTANT as described in the Agreement are supplemented as follows, to provide SSES and Rehabilitation Assistance in mostly the upper North and South Buffalo Drainage Basins, to be referred to as the PROJECT:**

BACKGROUND

The City of Greensboro (CITY) has focused their gravity sewer rehabilitation program to date on infiltration/inflow (I/I) reduction in the upper North Buffalo Drainage Basin. The I/I entering the sewer system must be kept under control to not exceed the downstream design limits of the North Buffalo equalization tank and pump station. It is also a “best practice” to continuously reduce I/I in some areas of the system as the pipes deteriorate over time and I/I increases over time with no I/I reduction efforts. The CITY has completed the rehabilitation of several North Buffalo mini-basins to date and documented substantial I/I reduction in those basins. The CITY intends to continue sanitary sewer evaluation surveys (SSES) and rehabilitation in priority subbasins of the North Buffalo Drainage Basin, South Buffalo Drainage Basin, and selected pump station service areas. The CITY intends to choose priority areas based on historical flow data, pump station run times, age & material of pipes, work orders, and SSOs. To choose the next area for rehabilitation to reduce I/I, flow monitors must be installed at the mini-basin level. Flow monitoring analysis is best performed in the winter and early spring when groundwater levels are highest. The CITY therefore intends to install flow meters in February/March of 2020 (under separate contract). Following the analysis of the flow monitoring data, mini-basins with the highest I/I will be evaluated and identified for rehabilitation.

The footages to perform flow monitoring and SSES are based on allocated budget for this work and the assumed rehabilitation footage is estimated to address approximately 0.6 percent of the overall sewer system each year. This authorization assumes data from 18 flow monitors and 5 pump stations will be analyzed in Task 2 to determine SSES locations and approximately 150,000 LF of sewer will be evaluated for rehabilitation in Tasks 3-4. The SSES data will be collected by the CITY.

The following footage of sewer by source is assumed to be identified for evaluation:

- Approximately 70,000 LF of sewer from Priority 2 sub-basins identified during 2018 SSES flow monitoring evaluation or sewer with high I/I identified from flow monitoring evaluation and prioritization in Task 2.
- Approximately 80,000 LF of sewer identified from priority pump station basins

This scope of services consists of the following major tasks:

- Task 1 – 2018 SSES Additional Services
- Task 2 – Flow Monitoring Analysis
- Task 3 – Sewershed SSES Data Analysis
- Task 4 – Design Assistance and Bidding Documents

SCOPE OF SERVICES

Task 1 – 2018 SSES Additional Services

This task includes the additional SSES and design services for the 2018 SSES and rehabilitation design in the North Buffalo sanitary sewer system as follows:

Task 1.A – Sewershed SSES Data Analysis

CONSULTANT will perform additional 3,000 feet of smoke testing review, Closed Circuit Television (CCTV) review, evaluation, and rehabilitation design.

Task 1.B – Design Assistance

CONSULTANT will assist with preparation of an additional bid package for the remaining six (6) sewersheds excluded from the bid package previously prepared for the Sewer Rehabilitation Contract 2019-05 package (originally bid in June 2019). CONSULTANT will provide a measurement and payment section, bid form, quantities, rehabilitation maps and tables, and planning level cost estimates based upon CITY's annual services contract, as appropriate. The CITY will compile the bid package with existing front end and technical specifications, advertise the bid, and distribute bid packages to bidders. Following the bid, CONSULTANT will provide a hard drive of the CCTV inspection videos and an excel table identifying the location of each video file by sewer reach ID to the CITY for their distribution to the Contractor.

Bidding services and construction administration services for this package are not included in this scope of services. The CITY would need to authorize this additional scope by separate amendment.

CONSULTANT will not provide a memorandum of the rehabilitation recommendations. Rehabilitation recommendations, quantities, and maps will be documented in the bid package only.

Task 1.C – CCTV Review and Evaluation

The CITY requested that CONSULTANT provide additional assistance in review of CCTV/Sonar inspections in the South Buffalo area, CCTV review and recommendations for the Lands End Sewer, and CCTV review of inspection video from CITY's operations and recommendations.

CONSULTANT will provide limited support, RPR daily report setup, and coordination for the RPR support provided by CONSULTANT's subconsultant (CriTek). The Lump Sum amount for this task includes up to 20 hours for RPR coordination services and construction administration assistance by the CONSULTANT, which includes the preparation and coordination of work completed to date.

Task 2– Flow Monitoring Analysis

Task 2.A – South Buffalo and Pump Station Historic Flow Data Review

CONSULTANT will review the historic (2015) South Buffalo Basin flow data and pump station flow data, provided by the CITY, and evaluate peaking factors and R values for up to 3 rainfall events. These will be compared to previous evaluation of North Buffalo flow monitors. CONSULTANT will review GIS age and material information and work order and SSO information provided by the CITY for the potential priority sub-basins. This analysis will identify the next priority areas of the service area that should be monitored on a mini-basin level and thus the basis for determining flow monitoring locations for Task 2.B.

CONSULTANT will meet with the CITY to discuss the prioritization and selection of sub-basins identified as having high I/I.

Task 2.B – Flow Monitoring Data Collection Plan

CONSULTANT will develop a mini-basin flow monitoring plan to collect pertinent flow and rainfall data for the CITY's chosen sub-basins. CONSULTANT will make recommendations regarding flow monitor and rain gage locations, sub-basin size, and duration of flow monitoring. The scope of work includes identification of up to 18 temporary flow monitor locations and up to 6 rain gauges locations. It is anticipated that fourteen sub-basins will be identified for mini-basin

flow monitoring based upon the Task 2A analysis of pump station data, the 2015 South Buffalo basin flow data, and the prior analysis of 2015 North Buffalo basin flow data. Four of the monitor locations will be used for post rehabilitation I/I reduction analysis to measure the amount of I/I reduced through the prior phase of this program in the North Buffalo basin. The four monitors will include measuring two of the rehabilitated areas and two control areas.

Flow-monitoring field data collection including mobilization, installation, and maintenance of flow monitors and rain gauges will be performed by the CITY's contractor and is not included in this scope of work. The flow monitoring provided by the CITY's contractor shall:

- Measure the depth and velocity of wastewater flows at preset, synchronized time intervals of 15 minutes.
- Pressure sensors shall be installed with the capability of measuring depth of surcharging at the monitoring locations.
- Concurrent data shall be recorded from 6 temporary rain gages. The rain gage equipment shall be capable of measuring rainfall depth in increments of 0.01 inches at preset synchronized time intervals of 15 minutes.
- Flow and rainfall shall be provided to the CONSULTANT in digital spreadsheet-compatible format. Data shall include date, time, depth, and average velocity, and flow at not more than 15-minute increments. Site installation logs shall also be provided to CONSULTANT for each monitoring site.
- Raw flow and rain data shall be provided to the CONSULTANT after the start date of the flow monitoring period and bi-weekly thereafter.

Task 2.C – Flow Data Review and Analysis

CONSULTANT will review the raw data from the temporary meters at the start date of the flow monitoring period to make sure that the flow monitor site hydraulics are conducive to collection of quality data and that the equipment is functioning properly. During the flow monitoring period, CONSULTANT will also review data bi-weekly thereafter to monitor any potential change in conditions.

CONSULTANT will perform hydrograph decomposition to determine the rainfall dependent inflow and infiltration (RDI/I) contributions for up to three monitored storm events. Flow hydrographs recorded during a storm event will be decomposed into their wet weather and base flow components by subtracting the typical base flow hydrograph. R values (defined as the fraction of rainfall over a sewershed that enters the sanitary sewer as RDI/I), peaking factors, and RDI/I per linear foot of sewer will be evaluated. This analysis will reveal the relative RDI/I contributions of various portions of the service area.

This task includes prioritization of the mini-basins based on the flow monitoring data analysis which will be used as a basis for determining the mini-basins for SSES and rehabilitation in Task 3.

This task also includes post rehabilitation analysis for 2 flow monitors and 2 control areas including a linear regression analysis with the pre-rehabilitation data.

Maps and tables of the analysis results will be created and presented at a meeting with the CITY. A memorandum will be delivered as part of Task 2.D.

Task 2.D – Technical Memorandum

CONSULTANT will prepare a brief technical memorandum (TM) to document the results of the flow monitoring analysis and recommendations SSES and rehabilitation work in the priority basins. A draft and a final version of the TM will be prepared.

Task 2.E – Identification of Temporary Flow Monitors for Model Calibration

CONSULTANT will work with CITY staff to review prior Master Plan Flow Monitoring Plan, consider new permanent monitors, and develop a temporary flow monitoring plan and budget for the anticipated temporary flow monitoring. A GIS map of proposed temporary flow monitor locations and a planning level budget for flow monitoring and data analysis for comparison to the CITY's current CIP budget will be delivered as part of Task 2.E.

Task 3 - Sewershed SSES Data Analysis

This task includes a kickoff meeting, preparation of CCTV and smoke testing location maps, and review and analysis of CCTV video and smoke testing inspection results. During the kickoff meeting, project goals, deliverables, schedule and data collection coordination will be discussed. This task includes field visual reconnaissance of the study area to observe surface conditions that could impact costs of open-excavation pipe replacement or excavation of insertion pits for slip lining or pipe bursting. This task also includes visual inspection of up to 5 aerial crossings to determine if there are signs of exterior deterioration of the piping or piers.

CCTV inspection data collection and smoke testing data collection will be performed by the CITY's contractor and is not included in this scope of work. To assist the CITY, CONSULTANT will prepare sewershed level maps for the CCTV and smoke testing subcontractor. It is assumed that the CITY will be responsible for subcontractor coordination and QA/QC of the CCTV inspections. This scope also assumes that the CCTV deliverables will be a NASSCO Pipeline Assessment and Certification Program (PACP) compliant database with PACP inspection results, photographs, digital CCTV videos, and inspection logs. It is assumed the CITY will provide a single compiled PACP compliant database for the CCTV inspections from the CCTV contractor on a monthly basis.

The City shall provide the smoke testing results to the CONSULTANT including a geodatabase containing the defect identification and location, defect results summary table, defect reports including pictures of smoke locations, and sewershed level map showing the smoke defect locations.

This task includes review and analysis of up to 150,000 LF of CCTV video and smoke testing inspection results. (This assumes 80,000 LF identified from the pump station areas and 70,000 LF identified from either the 2018 SSES flow monitoring North Buffalo - Priority 2 areas or South Buffalo mini-basins due to I/I concerns will be CCTV'd). During this review, defect tabulations on the CCTV videos and logs will be verified for accuracy and interpretations will be made related to necessary repairs according to the final design criteria. The final design criteria will be developed jointly with the CITY. Defects requiring point repairs shall be identified, including structurally defective pipes, defective lateral connections (hammer taps), root intrusion, offset joints, sags in pipes or joints, and major inflow sources such as stormwater connections. The most cost-effective rehabilitation approach will be determined based on the CCTV inspection. In addition to the rehabilitation technique, a list of major sags observed, stationing of required point repairs, and number of service laterals will be provided in rehabilitation summary tables in Task 4.

Task 4 – Design Assistance and Bidding Documents

CONSULTANT will prepare GIS based maps of the proposed rehabilitation methods and summary tables of rehabilitation method and site-specific notes for each sewershed. This task includes up to four (4) meetings to review the draft rehabilitation recommendation tables and maps for groups of 2 to 3 sewersheds per meeting with the CITY. CONSULTANT will update the sewershed maps and summary tables based upon comments from the review meetings.

CONSULTANT will assist with preparation of up to two (2) bid packages for the sewer rehabilitation identified in Task 3. CONSULTANT will provide a measurement and payment section, bid form, quantities, and a planning level cost estimate based upon CITY's annual services contract unit costs.

A draft of the specification sections listed above and bid form will be forwarded to the CITY for review, and a meeting will be held to discuss comments. The final technical specification sections prepared will incorporate comments on the draft sections. The CITY will complete and compile most of the technical specification sections and compile the bid package with CITY front end documents, advertise the bid, and distribute bid packages to bidders.

Following each bid, CONSULTANT will provide a hard drive of the CCTV inspection videos and an excel table identifying the location of each video file on the hard drive by sewer reach ID to the CITY for their distribution to the Contractor(s). CONSULTANT will attend the two (2) pre-bid meetings and two (2) pre-construction meetings for the bid packages.

Bidding services (beyond the meetings defined above) and construction administration services for this package are not included in this scope of services. The CITY would need to authorize this additional scope by separate amendment.

Project Management, Quality Management, and Contract Administration services are included within the Tasks.

2. CITY'S RESPONSIBILITIES

The responsibilities of CITY as described in the Agreement are as follows:

- Provide the CONSULTANT with QA/QC'd PACP coded CCTV data including a NASSCO Pipeline Assessment and Certification Program (PACP) compliant database. CCTV inspections shall be labeled with corresponding pipe and manhole IDs in the CITY's GIS system. Provide CONSULTANT any changes in pipe layout or orientation identified as the result of the CCTV inspection. Provide CONSULTANT a list of pipes with incomplete or reverse inspections.
- Provide the CONSULTANT with smoke testing results data. Results should include a final compiled geodatabase of smoke testing results showing the defect type and location. Smoke testing reports shall be labeled with corresponding pipe or manhole IDs in the City's GIS system as well as the address of where the defect was observed.
- Provide the CONSULTANT with all applicable GIS data.
- Provide historical flow monitoring data as necessary.
- Arrange for access to sites as necessary.
- Aid in selection of flow monitor and rain gage sites.
- Timely review and input of deliverables.
- Prepare front end and technical specifications except for those listed to be prepared by CONSULTANT, compile the bid packages with front end and technical specifications, advertise the bid, and distribute bid packages to bidders.
- Bear all costs incident to compliance with the requirements of the CITY's Responsibilities.

3. TIME PERIOD FOR PERFORMANCE

The estimated time periods for the performance of basic services as set forth in this Agreement are supplemented as follows:

- Work described in this Task Authorization will begin within two weeks of execution of this Task Authorization and receiving a formal Notice to Proceed (NTP).
- CONSULTANT estimates completion of Tasks 2.A and 2.B no later than 6 weeks after project start and data is received from the CITY. CONSULTANT estimates completion of Task 2.C within 8 weeks of receipt of the final QAQC'd flow data. The draft TM in Task 2.D will be delivered within 4 weeks of completion of Task 2.C. The final TM will be completed within 2 weeks of receiving one set of consolidated comments from the CITY on the draft TM. A detailed project schedule will be prepared within 30 calendar days after receipt of NTP.
- Each meeting to review the results of Task 3 Sewershed SSES Data Analysis will be held within 16 weeks of receipt of the complete CCTV and smoke testing data for the sewershed(s) being reviewed. The draft technical specifications will be delivered within 8 weeks of the final meeting to review results of Task 3. The final specifications will be delivered within 3 weeks of receiving comments from the CITY on the draft specifications.

4. COMPENSATION AND PAYMENT

The method of payment for services rendered by the CONSULTANT shall be as set forth below:

For the Basic Services Task 1, 2, 3, and 4 performed under Section 1, the CITY agrees to pay the CONSULTANT a lump sum amount of **\$425,000**. The amounts presented in Table 4-1 are estimated values for reference only and CONSULTANT will not be held to upper limits by task.

Partial payments shall be made by the CITY on a monthly basis in proportion to the percentage of work completed.

The CONSULTANT intends to subcontract to CriTek Engineering Group, P.C., an MBE engineering firm, to provide CCTV review and other engineering services for a not-to-exceed amount of \$77,170 under Tasks 3 and 4.

The CONSULTANT intends to subcontract to Stewart Engineering, an MBE engineering firm, to provide GIS and mapping services for a not-to-exceed amount of \$14,400 under Tasks 2, 3 and 4.

Table 4-1: Payment Amounts by Task

Task – Description	Value
1 – 2018 SSES Additional Services	\$22,700
2 – Flow Monitoring and Analysis	\$119,300
3 – Sewershed SSES Data Analysis	\$148,000
4 – Design Assistance and Bidding Documents	\$135,000
TOTAL NOT TO EXCEED TASK AUTHORIZATION	\$425,000