

Exhibit A
City of Largo
I/I Abatement Program
Lift Station 2 Sub-basin 2 Service Area I/I Abatement
Preliminary Engineering Analysis
Summary of Task Descriptions
McKim & Creed, Inc.
September 20, 2018

The City of Largo's (City) goals are to reduce the total volume of wastewater received at the City's Wastewater Reclamation Facility (WWRF) during periods of significant wet weather. While the WWRF has capacity to treat the additional wastewater volumes generated during significant rainfall events, there are several lift station service areas which have had recorded Sanitary Sewer Overflows (SSOs) during wet weather events of lengthy duration. The Lift Station 2 (LS) service area is one of the wastewater collection systems that have experienced SSO's during these past events. As such, the City plans to implement improvements to the wastewater collection system in this service area to mitigate the problematic SSOs. McKim & Creed will implement a program that involves identification of storm water inflow and groundwater infiltration (I/I) sources, provides recommendations for I/I abatement projects, assists in I/I abatement, and documents I/I flow reduction. To accomplish this, the City has divided the LS basin into four (4) sub-basins. Sub-basin 1 is currently being undertaken with a projected completion date of November 2018. McKim & Creed will provide the City with consulting services for Lift Station 2, Sub-basin 2, comprised of the following tasks:

Scope of Services

- Task 1 – Project Management and Administration
- Task 2 – Storm Water Inflow Source Identification (Smoke/Dye Testing)
- Task 3 – Storm Water Inflow Abatement Design (Preparation of Bid Documents)
- Task 4 – Infiltration Source Identification (MFI Inspections/Night Flow Isolations/CCTV)
- Task 5 – Infiltration Abatement Design (Preparation of Bid Documents)

The scope of services is further defined and described in the following tasks:

Task 1 – Project Management and Administration

Task includes project management, kickoff meeting and administration that will be performed from project authorization through construction completion and close-out. Work associated with this task includes the following:

- a. Project Set-up
- b. Project kickoff meeting

- c. Monthly invoicing and status reports
- d. Master schedule management

Task 2 – Storm Water Inflow Source Identification

McKim & Creed will conduct comprehensive smoke testing of the Lift Station 2 Sub-basin 2 project area (see map; **Attachment A**) wastewater collection system gravity sewers. The testing will encompass approximately 55,204 linear feet of mainline gravity sewers and 1,138 service laterals. Based on the results of the smoke testing effort, dye testing/flooding will be performed on portions of the storm drainage system(s) that are identified as being connected to the wastewater collection system. The following identifies the tasks which will be completed during the smoke/dye testing initiative.

Smoke Testing:

1. Select area to be tested and develop working field maps of the area.
2. Field review the area selected and note on the map addresses of the work areas identified by the appropriate City blocks.
3. Distribute notice of smoke testing to homes, businesses, schools, etc. to be impacted by smoke testing efforts. In addition, Largo Fire & Rescue will be notified of any proposed smoke testing activities seventy two hours prior to initiation.
4. During the initial field review, identify all types of businesses, specifically any medical offices or facilities, hospitals, schools, retirement homes (communities) or any other establishment that may need special consideration and handling during the smoke test. Strict consideration and coordination with customers who have sensitive needs must be adhered to, some of whom will not be included on any smoke testing schedule as the nature of their business, such as hospitals, is far too delicate.
5. At least twenty four hours must expire from the issuance of smoke testing notices to allow all affected to prepare for the testing or call with special exceptions, such as persons with health problems living at home, etc.
6. On the day of the testing, the selected portion of the study area will be identified and all street names and related City block addresses will be given to the fire department/emergency personnel for the area where the testing will occur. **UNDER NO CIRCUMSTANCES WILL THE AREA SELECTED FOR THAT DAY'S TESTING BE MODIFIED TO INCLUDE ADDITIONAL WORK UNLESS THE FIRE DEPARTMENT/EMERGENCY PERSONNEL HAVE BEEN NOTIFIED FIRST.** The name and ID number of the fire department person contacted will be documented on the appropriate form. The fire department/emergency personnel will be provided the exact locations and specific time frames of where and when the tests will be performed.
7. Multi-day scheduling with one time reporting to the fire department/emergency personnel will not be permitted.

8. The City's Project Representative will be notified on a daily basis with the same information.
9. Should the fire department/emergency personnel respond to the target area during the actual smoke testing, all testing will cease immediately and the Smoke Testing Team's field supervisor in charge will communicate with the fire unit responding to answer any questions that the fire department officer may have.
10. All testing activity will cease when any property owner or occupant complains of smoke entering their establishment or home. Smoke Testing Team's field personnel will then attempt to isolate where the smoke is entering the establishment or home and make the occupant aware of what the problem may be. All defective plumbing found inside should be documented appropriately for future reference. The occupant will be advised to have the defect repaired by a licensed plumber.
11. During the smoke testing, Smoke Testing Team field personnel will scout the area for smoke escaping from ground sources, roof vents, storm drain structures, etc. All sources of Infiltration/Inflow will be photographed, measured, drawn, and documented accordingly with addresses, data, and sketches. The smoke test form will identify which sewer reach is being tested by its component identification in the City's GIS database.

It is understood that City staff members may accompany McKim & Creed field staff during the smoke testing to gain a better understanding of how to quantify potential inflow volumes from the smoke defects recorded and how to compare the smoke testing defect results to the previously recorded flow data. McKim & Creed will develop a 'Smoke Testing Results' spreadsheet that identifies each pipe section tested and the results of the test, whether positive or negative. A separate spreadsheet; 'Smoke Testing Defects', will be prepared that identifies all defects encountered during the smoke testing activity. This spreadsheet will contain a column which identifies the surface area associated with each defect, the associated inflow volume based on a one inch rainfall event at the defect and if there is a need to conduct dye water testing/flooding. If a dye test (dye trace or dye flood) is necessary, a service order number will be prepared for the work effort using the City's CMMS system and a description provided of what personnel and equipment will be needed.

Dyed Water Tracing:

It is assumed that 10 dye water traces will be required to confirm where private storm water inflow sources are entering the wastewater collection system. Private sector dye water tracing will be conducted by introducing a small quantity of liquid dye concentrate into suspect sources such as downspouts, area drains, patio drains, window well drains, and driveway drains, and then introducing a sufficient volume of clean water to locate the source's discharge point. During each tracing, sanitary sewers, storm drains, and curb lines located downstream of the sources shall be monitored for signs of dyed water. The quantity of dye concentrate and water used will vary depending on pipe size and the quantity of flow and debris in each line section. A report will be

prepared for each location where dye water tracing has been performed. The report will identify where the dye water was introduced and its' susceptibility for entering the wastewater collection system. Photos will be taken of where the dye water is introduced and where it is recorded discharging into the downstream wastewater collection system manhole.

Dyed Water Flooding:

It is assumed that three (3) dye water floods will be required to identify potential cross connections between the sanitary sewer system and storm drainage sewer system. The Dye Water Flooding results will be documented for each location where the storm drainage system is flooded. Each Dye Water Flood Report will identify the section of wastewater gravity piping being tested, the location(s) where the storm water system piping was isolated and flooded, photographs of each setup and CCTV inspection results identifying the location(s) where dye water was identified entering the wastewater collection system. The following information will also be documented.

- Evidence of dyed water in manholes downstream from the ponding area, stream crossing, or other suspected sources where the dyed water is placed;
- Time of travel from contributing source to manhole sampled, and the concentration of the dyed water;

The Field Inspection Procedures for Dyed Water Flooding are as follows:

1. A mixture of water and any approved dye coloring substance will be introduced to the identified source. Dye Water Team inspectors will be stationed immediately downstream on the local sanitary and storm sewer lines. Observations, whether positive or negative, should be documented appropriately. Whenever possible the dyed water point of exit will be documented either by a handheld digital recorder or by HD closed circuit television inspection equipment.
2. Prior to any testing, the appropriate City staff shall be notified of the specific location of testing and what adjacent waterways may be affected when the dye water is released into the storm drainage system.

Fire hydrants used to supply the water source needed will be opened slowly and closed in the same manner. A flow restrictive device shall be used on the hydrant to prevent discoloration problems. A flow restrictive device and flow meter will be rented through Pinellas County. Should the water be running cloudy or dirty after use, the fire hydrant shall be left open at a slow pace until the water clears. If long term draining is required, the Dye Water Team shall notify the City and Largo Fire and Rescue.

Task 3 – Storm Water Inflow Abatement Design

Upon completion of the dye testing/flooding a Technical Memorandum will be developed to recommend effective forms of abatement for each inflow source discovered. In some cases the necessary abatement activity will include the use of City staff, or third party contracting. The Technical Memorandum will include the individual Dye Test Reports as well as verbiage describing the necessary work which must be completed to eliminate the storm water inflow source(s) and projected costs for completing the work. In addition an 11x17 map which identifies the sanitary and storm water features affected by the proposed I/I remediation effort will be provided. General notes will be added to the map which identifies the proposed I/I abatement scope, but no physical survey, or utility location, will be completed. The diagrams, sketches and notes will be sufficient for use by City maintenance crews to address the inflow abatement. If detailed design is required for corrections beyond the City crew's capability, we would negotiate additional compensation for these designs.

Task 4– Infiltration Source Identification

This task includes activities needed to identify locations within the Lift Station 2 Sub-basin 2 project area (see map; Attachment A) which are contributing the highest levels of groundwater infiltration. The activities will include conducting manhole inspections and performance of night flow isolations and CCTV inspections. These will be conducted during a fall month in 2018. The following describes the activities to be conducted as part of the infiltration source identification task.

Manhole Inspections:

The manhole inspections will document the existence of a storm water inflow abatement insert/dish, identify previously completed manhole repairs/rehabilitation, establish the existence of active groundwater infiltration, determine the structural condition of the manhole, based on visual observation, and document any Operations and Maintenance (O&M) related defects (roots/grease/sediment buildup). The following identifies the approach to be utilized for completing the inspections.

- Conduct First Pass (Level 1) Inspection – Document manhole location, piping connectivity, piping depths, piping materials, piping size, frame/cover dimensions, existence of inflow insert/dish and drop connections, manhole construction materials utilized, manhole dimensions, condition of connecting mainline gravity sewers, and establish general O&M and structural grades using NASSCO MACP guidelines.
- Conduct Second Pass (Level 2) Inspection – Conduct digital side scan inspection of all structures

- Develop Rehabilitation Recommendations – Use the results of the digital side scanning to develop manhole rehabilitation recommendations for each defective structure.

Level 1 Manhole Inventory/Inspection: Each manhole located in the Lift Station 2 Sub-basin 2 project area (see map; Attachment A) will be inventoried and visually inspected. The inventory will include collection of x, y location data utilizing non-survey grade GPS equipment, such as a Trimble R-1 RTK-GPS. Manhole inventory will include up to 225 manholes. Manhole lids will be opened to confirm pipe connectivity, pipe size, and material as shown on the existing GIS. Rim elevation data (z) will not be collected, as the intention of the inspections is based on providing enough adequate data to develop repair and/or rehabilitation recommendations and not for hydraulic model construction use.

Manhole evaluation findings will be summarized on individual manhole evaluation forms that meet the criteria established by NASSCO MACP data collection attribution protocol. The following data will be recorded on the Manhole Evaluation Forms (and in electronic format) for each manhole evaluated.

- Identify each manhole by component number
- Manhole cover and frame type
- Identification of covered or un-located manholes
- Number and size of holes, if any, in a manhole cover, whether cover is subject to ponding or runoff and if a manhole insert has been installed
- Size of ponding/runoff area
- Drawing of invert and direction of flow
- Verified manhole depths and diameters
- Construction materials utilized and condition of cover, rings, walls, steps, aprons, troughs/channels and pipelines incoming and outgoing
- Quantification of visible sources of extraneous flow (inflow & infiltration)
- Identification of special problems and conditions, such as overflows, bypasses, etc.
- Description of leaks and locations
- Evaluation of type and depth of debris in manhole
- Location of manhole: street, driveway, right-of-way/easement
- The x,y location of evaluated manholes will be collected utilizing non-survey grade GPS equipment, such as a Trimble R-1-GPS
- Any manhole found broken, cracked, missing covers, or surcharged, will be reported to the City immediately for remediation action.
- When new structures are found the City will be notified to ensure that the proper identification numbers are added to the new features.

Incoming and outgoing gravity sewer lines connected to the manhole will be investigated, and the following information shall be recorded.

- Size, type, and depth of pipe
- Root growth in pipe
- Type of deposition in pipe and recommended cleaning method
- Visible infiltration sources
- Structural condition of pipe
- Special problems and conditions in pipe

Gravity line investigations will be conducted utilizing either pole mounted camera equipment or manned entry.

The results of the 'Level 1' inventory/inspection efforts will be used to grade each manhole for both structural and O&M condition using MACP guidelines. The MACP rating system utilizes the following methodology.

- **Grade 5** – Manholes needing immediate repairs due to I/I, structural deficiencies, roots, corrosion, etc. (failure imminent)
- **Grade 4** – Manholes with significant defects that will reach Priority 5 status if repair/rehabilitation isn't performed in near future
- **Grade 3** – Manholes with noticeable defects but do not require immediate attention
- **Grade 2** – Manholes in fair condition without significant deficiencies
- **Grade 1** – Manholes in good condition

Level 2 Digital Side Scan Inspection: When completing the Level 2 inspections, McKim & Creed will utilize a digital side scanning camera to capture 360 degree imagery of the manholes.

The inspection will be completed in a manner that minimizes movement of the camera head and the descent of the camera will be limited to a maximum of 1-inch per second. Prior to beginning the descent of the camera head, sufficient time will be maintained at manhole rim level in order to properly record the condition of the manhole's frame and connection to manhole corbel. Collected inspection video will be reviewed in the field to ensure that a quality inspection has been achieved.

McKim & Creed will review the collected digital side scanning video and develop rehabilitation recommendations for each structure inspected. The repair/rehabilitation recommendation action will address the following conditions:

1. Remove Steps
2. Stop Active Infiltration
3. Patch Voids and all Frame Connections with non-shrink grout
4. Remove Loose Coating Materials
5. Resurface Corbel/Walls with Cementitious Mortar
6. Rebuild/Repair Bench/Trough and Seal Pipe Connections
7. Coat Corbel/Cone, Walls, Bench and Trough with an Approved Epoxy Coating System
8. Adjust Frame and Cover Height
9. Reset Frame and Cover
10. Remove Roots
11. Provide Inflow Abatement Insert
12. Remove Debris
13. Perform Structural Repair(s)
14. Replace Frame and Cover
15. Prep Manhole Frame & Corbel and Apply Polyurea Coating to Connection

McKim & Creed will prepare a Technical Memorandum that identifies the proposed repair, or rehabilitation, of each deficient structure. The Technical Memorandum will include mapping that identifies the location of each structure, the proposed repair/rehabilitation methodology to be utilized for each structure and the projected cost for completing the work.

Night Flow Isolations: Upon completion of the manhole inspection effort, McKim & Creed will begin the night flow isolation activities on all gravity piping within the Lift Station 2 Sub-basin 2 project area (see map; Attachment A) . The following verbiage describes the scope of services for conducting the night flow isolation initiative.

Flow isolation measurements shall be accomplished using secondary velocity measurement devices and manual depth measurements for large diameter piping, and portable pre-calibrated weirs for small diameter piping. Night flow isolations shall be performed on all gravity sewers experiencing active groundwater infiltration and the pipe sections with the highest levels of infiltration will be recommended for CCTV inspection to adequately document each groundwater infiltration source. Night flow isolations shall be conducted on a sewer reach by sewer reach between the hours of 11:00 PM and 5:00 AM. Upstream flow shall be isolated and consideration given to piping sections whose infiltration rates could be subjected to varying tidal conditions. If restriction of upstream flows may cause backups, upstream flow subtraction shall be utilized for flow isolation. A minimum of three (3) flow measurements shall be taken during each flow isolation, at five minute increments, to assure that no irregular flow

other than groundwater exists. Photographs shall be taken to record the measurements gained from each five minute reading. If flow measurement is negatively affected by standing water caused by system surcharge then no reading shall be taken until the 'tailwater' condition has been eliminated. Spreadsheets will be prepared in a manner that identifies the results of the flow isolations including five minute readings, apparent infiltration volumes, after the subtraction of infiltration rates from connecting manholes and susceptibility of tidal influence. The spreadsheets will be included in a Technical Memorandum which describes the overall results of the night flow isolation initiative and identifies the gravity piping sections which require CCTV inspection to identify the source(s) of active infiltration.

CCTV Inspections: Upon approval of the recommendations presented by the Night Flow Isolation Technical Memorandum, McKim & Creed will conduct CCTV inspections of approximately 16,942 linear feet of gravity sewers. Prior to any CCTV inspection, the piping will be cleaned. Cleaning shall include a maximum of three (3) passes of the cleaning head. The cleaning equipment will provide a minimum of twelve (12) gallons per minute of flow at 3,000 psi.

The CCTV inspection equipment will be designed for use in sewers and will have its own light source suitable for viewing entire pipe periphery. CCTV inspection software will be PACP compliant. Inspections shall be completed from manhole to manhole. The camera shall be moved through the line in either direction at a uniformly moderate rate by self-propelled mechanisms. Video images of defects will be captured and tied to their electronic log entry. Obstructions may be encountered during the course of the internal evaluation that prevents the travel of the camera. Should an obstruction not be passable, McKim & Creed will withdraw the equipment and re-enter it for internal evaluation from the opposite end of the sewer reach. Should additional obstructions be encountered after the redeployment of the equipment, and no means are available for passing the obstruction without additional cleaning, the City will be notified and images provided to identify why additional cleaning of the piping is required.

Defects, including building connection leaks, infiltration sources, pipe corrosion, broken pipe, crushed pipe, collapsed pipe, offset joints, etc., will be identified. Location of the observation will be by footage from the entrance manhole and clock position in relation to the pipe circumference. A summary of CCTV inspection results will be presented in a Technical Memorandum. The Technical Memorandum will identify deficiencies encountered, both structural and nonstructural, and shall rate defect severity in accordance with NASSCO PACP. The Technical Memorandum will also provide recommendations for necessary rehabilitation/replacement; including cost estimates, and include copies of the digital video and inspection reports.

Task 5 – Infiltration Abatement Design:

Upon approval from the City regarding the recommendations provided in the Technical Memorandum, McKim & Creed will prepare plans and specifications for the City to utilize for successful completion of the necessary manhole and gravity sewer rehabilitation using third party contractor(s), or contractors previously selected by the City. It is assumed that the majority of the proposed rehabilitation will include the use of trenchless type repair/rehabilitation systems and as such in-depth corridor surveys and SUE will not be required. Should point repairs or open-cut construction be required, McKim & Creed will negotiate scopes and fees for such repairs to include necessary SUE, surveying, design and permitting services.

STAFFING – KEY PROJECT TEAM MEMBERS

Principal-in-Charge	Street Lee, PE
Project Manager	Kris Samples, PE
Lead Engineer	Greg Anderson, PE
Smoke/Dye Testing Supervisor	Delvin Carter, PACP/MACP
Manhole Inspection Supervisor	Patrick Goode, PACP/MACP
Night Flow Isolation Supervisor	Tony Goode, PACP/MACP
CCTV Inspection Supervisor	Patrick Goode, PACP/MACP

SCHEDULE

This schedule is based on receiving notice-to-proceed (NTP) in October of 2018.

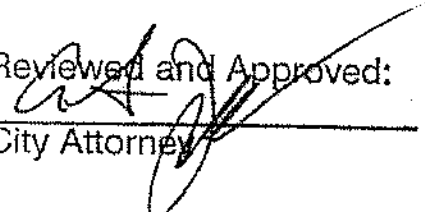
<u>Description</u>	<u>Time to Complete After Receiving NTP Authorization</u>
Project Kick-Off Meeting	2-Weeks
Manhole Inspections	1-Month
Night Flow Isolations & CCTV Inspections	2-Months
Infiltration Abatement Design	3-Months
Smoke Testing	4-Months
Dye Testing	5-Months
Flow Monitoring & I/I Analysis	7- Months
Inflow Abatement Design	9-Months

Exhibit B

FEE

The Work described herein will be performed on a Lump Sum basis. Monthly invoicing will be based on percent complete to date for each task. Scope of Work for the Tasks described herein will be performed for the Lump Sum Fee Amounts as shown in the table below.

TASK	TASK DESCRIPTION	TOTAL
LIFT STATION 2 SUB-BASIN 2 SERVICE AREA I/I ABATEMENT		
1	Project Management and Administration	\$10,000
2	Storm Water Inflow Source Identification	\$44,018
3	Storm Water Inflow Abatement Design	\$10,000
4	Infiltration Source Identification	\$118,480
5	Infiltration Abatement Design	\$17,000
	NOT TO EXCEED FEE	\$199,498

Reviewed and Approved:


 City Attorney