**SECTION 0000**

**SEWER AND MANHOLE SMOKE TESTING**

**PART 1 GENERAL**

* 1. SUMMARY
1. It is the intent of this specification to provide for the smoke testing materials and procedures to be used in the investigation of the sanitary sewer facilities as shown on the project maps.
2. The nature of the smoke testing inspections shall be to confirm system connectivity, identify gravity sewer system defects and to provide a permanent record of the defects including type, location, and severity. Inspections shall be performed by introducing non-toxic smoke into the sanitary sewer pipes using a high capacity blower, observing smoke exiting vent stacks and defect locations, and documenting the noted defects.
	1. SCOPE OF WORK
3. Necessary Equipment - The Contractor shall inspect the gravity sanitary sewer system using high capacity blowers, non-toxic smoke, sub-meter GPS equipment (if required), safety equipment suitable for the for the field conditions, and a digital camera for documentation.
4. Standard Forms - All inspections shall be recorded on standard smoke testing forms provided by the Engineer or the Contractor. If the forms used are generated or otherwise provided by the Contractor, said forms shall be approved by the Engineer before smoke testing begins.
5. Schedule of Work Hours – The Contractor may work during the hours of 7:00 AM to 7:00 PM Monday through Friday. If there is a need for after-hours work or weekend work, prior consent shall be obtained from the Engineer before such work shall commence.
6. Traffic Control – The Contractor shall be solely responsible for providing any traffic control that is needed. All costs for traffic control shall be incidental to the project, unless otherwise specified in the contract documents as a separate pay item.

1.03 RELATED SECTIONS

**INSERT RELATED SECTIONS HERE OR DELETE**

* 1. REFERENCES
1. The National Association of Sewer Service Companies (NASSCO) prepared *Sewer and Manhole – Smoke Testing.*
	1. SUBMITTALS
2. Safety Plan – Prior to the award of this contract, the Contractor shall provide a safety plan and identify designated safety supervisory personnel to the Engineer. The plan shall include confined space entry provisions and training, listing of personal protective equipment to be used in the project, a traffic control plan (if applicable), and a road way safety plan.
3. Work Schedules - A work schedule shall be submitted for review and approval by the Engineer. No field testing or notification may proceed until the schedule has been approved by the Engineer. The Contractor shall provide a one week look-ahead schedule and coordinate with the Owner or Engineer the exact locations of smoke testing for the upcoming week.
4. Permits - Work permits from applicable local, State, and Federal agencies (if any) shall be submitted to the Engineer for review at the Engineer’s request.
5. Documents - Notification of smoke testing documents shall be submitted to the Engineer for review and approval prior to smoke testing.
6. Production – The Contractor shall make known to the Engineer its method of smoke production.
7. Work Samples - A sample of previously completed smoke testing, including inspection documentation reports and photographs, is required before smoke testing begins.
	1. QUALITY ASSURANCE
8. Crew Size – The crew shall be sized to operate the smoke generating machine(s) and provide full coverage of the area to visually locate smoke discharged from defects. A crew shall consist of a minimum of two (2) persons.
9. Training - The Contractor’s employees performing the smoke testing under the provisions of these specifications shall be properly trained and thoroughly experienced in the use of the equipment and procedures.
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**PART 2 PRODUCTS AND EQUIPMENT**

2.01 SMOKE BLOWERS

1. Type - The Contractor shall provide a portable blower designed and built specifically for the use of smoke testing. The blower shall be self-contained and powered by a minimum three (3) horsepower (HP) gasoline engine. Said blower shall be capable of producing a minimum of two thousand (2,000) cubic feet of air per minute (CFM).
2. Connections - The base of the blower shall have appropriate adapters and seals to make a good connection to the manhole without excessive loss of air and smoke.

2.02 SMOKE PRODUCTION

1. Bombs - Smoke bombs shall produce a chemical reaction generating white to gray smoke, leaving no residue, and shall be non-toxic and non-explosive. Each bomb shall be capable of producing an adequate volume of smoke when used alone or in combination with a number of bombs for the duration of the test.
2. Fluid - Smoke fluid shall produce smoke when exposed to the heat of the exhaust system of the motor for the blower. The smoke generated shall be white to gray smoke, leaving no residue, and shall be non-toxic and non-explosive.

2.03 OTHER EQUIPMENT

1. Ancillary Equipment - In addition to the blower, the Contractor shall provide all other equipment, tools, and incidentals required to perform smoke testing including but not limited to sewer line stoppers, sand bags, cameras, confined space entry equipment, etc.

**PART 3 EXECUTION**

3.01 NOTIFICATIONS

1. Engineer Notification - The Contractor shall notify the Engineer a minimum of forty-eight hours prior to the startup of smoke testing work or re-startup following delays due to weather.
2. Initial Notifications - With the first notification, the Owner shall notify affected residents that smoke testing shall occur no more than two weeks prior and not less than week prior to the date of the testing. A press release shall be the form for this notification.
3. Notification of Other Agencies - The Contractor shall notify the local police and/or fire departments prior to the start of the work.
4. Daily Notifications - In the area of daily testing, the Contractor shall notify:
	1. Emergency services by phone providing the area to be tested during that day of work.
	2. Residences and/or businesses in the area to be tested one day in advance of the testing. This shall be done by hand delivery of a notification letter, door knob hangtags or other acceptable methods to each residence and/or business.
	3. Homes of Special Concerns (if any) on the day of testing to be sure that all persons that may be sensitive to smoke shall be out of the home prior to testing.
5. Confined Space Entry - The Contractor shall minimize the physical entry of personnel into the sanitary sewer facilities. If required, manhole entry shall be in accordance with Federal, State and local regulations for confined space entry and other regulations that may apply.

3.02 WORK SCHEDULES

1. Work Per Schedule - Upon reward of the contract, the Contractor shall proceed under the work schedule submitted and approved by the Engineer.
2. Work in Commercial Areas - Work times in commercial areas shall be scheduled prior to the opening of the majority of the businesses in that area, if practicable.
3. Conditions Not Suitable for Testing - The Contractor shall not perform smoke testing on days or in conditions that, in the opinion of the Engineer, shall hinder the results of the test. Conditions that may hinder the effectiveness of the testing and receipt of proper results may include heavy winds or heavy rains.

3.03 PERFORMANCE OF THE TEST(S)

1. Regulations and Laws - The Contractor and its personnel shall be aware of and shall follow all Federal, State, and Local safety laws and regulations.
2. Footages for Testing - Unless otherwise approved by the Engineer, the sections of sewer subject to testing shall not exceed nine hundred feet (900’).
3. Locating Defects - The walk through for locating defects shall not begin until smoke is highly visible with a smoke plume emanating from the plumbing vents of houses at the end of the setup location. A colored locate flag and/or spray paint shall be placed at the location of the defect. The points of exfiltration, as identified above, shall be referenced and dimensioned to permanent landmarks, or house and/or lot numbers. If the contract specifies and/or allows for GPS location of defects, the Contractor may use coordinates in lieu of dimensions to permanent landmarks. The coordinates of the defect shall be within one (1) meter of the defect and be recorded before continuing. The coordinates (if any) shall be included in the final reports provided to the Engineer. Walkers shall traverse not only the sidewalk but areas between all homes and back yards looking for illegal connections including patio, pool, and roof drains connections.
4. Plugs and Flow Barriers - It is the intent of this specification that the smoke testing be accomplished without the need for bypass pumping. The Contractor shall provide temporary plugs, sandbags, or flow barriers as required to contain an adequate volume of smoke within the section of sewer being tested, or to limit the extent of sewer subjected to pressurized smoke. The Contractor shall monitor the resulting surcharged sewer at the manhole upstream of the section of sewer being tested, and prevent overflow conditions from occurring by removing the flow barriers.
5. Field Notes and Maps - All smoke testing information shall be accurately and neatly recorded on field worksheets or portable electronic devices.
6. Sources of Exfiltration - For each sewer main tested, the Contractor shall prepare a field log identifying each point of smoke exfiltration.
7. Digital Photographs - A photograph of all leaks using a digital camera shall be included in the field log. All photographs shall be clearly cross-referenced to the typed and/or computer generated log indicating the location of the leak. The digital photo shall be in Joint Photographic Experts Group (JPEG) format and delivered in a minimum 640 x 480 pixels.
8. Manhole Numbers - The smoke testing report shall reference the alphanumeric manhole numbers shown on the Project Maps (if available).

**PART 4 DELIVERBLES AND PAYMENTS**

* 1. MEASUREMENT
1. Distance Measurement - Measurement of the actual number of linear feet smoke tested shall be made from the center of the manhole to the center of the manhole. The Contractor shall measure with a walking wheel, tape, or other approved device or method.
	1. ACCEPTANCE
2. Review - Inspection reports shall be reviewed for quality control. A minimum of five percent (5%) of the submitted reports shall be randomly reviewed by the Engineer.
	1. DELIVERABLES
3. Electronic File Storage - As part of the final submittal on this project, the Contractor shall submit all digital photographs on DVDs or external hard drives (as dictated by the size and quantity of the files submitted). If a hard drive is submitted, it shall become the property of the Owner.
4. Electronic Copies of Field Notes - The Contractor shall return to the Engineer copies of all field forms and sketches made during smoke testing in a portable document format (PDF).
5. Written Reports – As part of the final submittal on this project, the Contractor shall provide two (2) copies of a bound, written report in an approved format. This report shall contain at minimum the following items:
	1. Date and time of the test;
	2. Address or other location information for the defect;
	3. GPS coordinates of the defect (if applicable and required);
	4. To/From Manhole numbers for each segment inspected;
	5. Name of the drainage or sub-basin area;
	6. Pipe diameter of the line smoke tested;
	7. Length of the segment smoke tested; and
	8. Photo number and/or name of each defect.
	9. PAYMENTS
6. Pay Estimates - Pay estimates shall be submitted on a regularly scheduled basis to the Engineer by the Contractor.
7. Approval of Quantities - The Engineer shall review the quantities submitted by the Contractor, and shall immediately inform the Contractor of its certification or disallowing of any quantities submitted for payment. If the quantities of work in question by the Engineer can’t be immediately resolved to the satisfaction of both parties, the pay estimate shall move forward without those quantities included. Said denied quantities may be resolved and submitted on the next pay estimate, or may be added to a punch list (if any) at the end of the project, whichever is acceptable to both parties.

**END OF SECTION**

**RECOMMENDED PAYMENT SCHEDULE**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Item Number** | **Description** | **Est. Qty.** | **Unit** | **Unit****Price $** | **Total Price $** |
|  |  |  |  |  |  |
|  | **GENERAL ITEMS** |  |  |  |  |
|  | Mobilization | 1 | Lump Sum |  |  |
|  | Traffic Control | 1 | Lump Sum |  |  |
|  | **SMOKETESTING** |  |  |  |  |
|  | Smoke Testing  | 000 | Linear Feet |  |  |
|  | **TOTAL BID** |  |  |  | **00,000.00** |