
Operations & Maintenance Manual

Section 2

Operation & Maintenance

2.1 Types of Maintenance

The overall goal of this manual is to provide a schedule of activities associated with the operation and maintenance of the collection and conveyance system. These activities, in conjunction with a long-term rehabilitation strategy, will allow the system to be restored and maintained in an efficient working condition, reducing the affects of infiltration and inflow.

2.1.1 Corrective Maintenance

Maintenance classified as corrective, including emergency maintenance, is reactive. Only when the equipment or system fails is maintenance performed. Reliance on reactive maintenance will always result in poor system performance, especially as the system ages. A corrective maintenance approach is characterized by:

- The inability to plan and schedule work.
- The inability to budget adequately.
- Poor use of resources.
- A high incidence of equipment and system failures.

Emergency maintenance involves two types of emergencies: normal emergencies and extraordinary situations. Normal emergencies can happen on a daily basis whether it is a pipe break or a blockage in a sewer. An effective maintenance program can reduce normal emergencies. Extraordinary emergencies, such as high-intensity rainstorms, hurricanes, floods and earthquakes, will always be unpredictable; however, the effects of extraordinary emergencies on the system's performance can be minimized by implementation of a planned maintenance program and development of a comprehensive emergency response plan.

2.1.2 Preventative Maintenance

Maintenance classified as preventative is proactive and is defined by a programmed, systematic approach to maintenance activities. This type of maintenance will always result in improved system performance except in the case where major chronic problems are the result of design and/or construction flaws that cannot be completely corrected by O&M activities. Proactive maintenance is performed on a periodic (preventive) basis or an as needed (predictive) basis. Preventive maintenance can be scheduled on the basis of specific criteria such as known problem areas, (for example a siphon that often gets clogged, a low point that is often first to overflow in a storm event or even an area prone to blockages), equipment operating time since the last maintenance was performed or passage of a certain amount of time (calendar period).

2.1.3 Predictive Maintenance

The third type of maintenance is predictive. Predictive maintenance, which is also proactive, is a method of establishing baseline performance data, monitoring performance criteria over a period of time and observing changes in performance so that failure can be predicted and maintenance can be performed on a planned, scheduled basis. System performance is frequently a reliable indicator of how the system is operated and maintained. Agencies that historically relied primarily on corrective maintenance as their method of operating and maintaining the system are never able to focus on preventive and predictive maintenance, since most of their resources are directed at corrective maintenance activities and it is difficult to free up these resources to begin developing preventive maintenance programs.

2.2 Sewer Cleaning

The majority of sewer line cleaning is conducted prior to closed-circuit television (CCTV) work. Cleaning should also be performed on an as needed basis to help alleviate problems in other areas of the system.

2.3 Pump Stations & Metering Stations

The Township's sanitary sewer system utilizes three pump stations. The Gardenview Place (Shirn's) Pump Station is a variable frequency drive duplex grinder pump station that conveys the sewage from the West Cottage Sewer shed, Loyalsock Township, and the Shirn's Sewer shed. Sewage flows from this pump station are discharged to the Gardenview Sewer shed at manhole GV-088 located behind the Shirn's Car Dealership. The English Farm Lane pump station is a duplex demand grinder pump station that conveys sewage from the northwest portion of the Fox Hollow Sewer shed through a 2.5" PVC force main to manhole FH-012 located in front of 1525 Fox Hollow Road, which then flows by gravity to the Fox Hollow main pump station located at 1321 Fox Hollow Road. The Fox Hollow Road pump station is a duplex demand grinder pump station that conveys flow from the remainder of the Fox Hollow Sewer shed through a 4" ductile iron force main to manhole GR-095 located at the intersection of Helminiak Street and High Pines Road.

2.3.1 Operation

Standard Operating Procedures (SOPs) and Standard Maintenance Procedures (SMPs) should be utilized for each pump station. An adequate number of trained personnel should be available to maintain all pump stations. Trained personnel should include all individuals within the Sewer Department and additional personnel from the Maintenance Department, as deemed necessary.

Description of Pump Stations

2.3.1. A Gardenview Place

(Shirm's) Pump Station is a variable frequency drive duplex grinder pump station equipped with two 15 HP 1170 rpm C-face 3 phase Baldor/1200 GPM Vaughan pedestal chopper pumps model # VDP6U8S-104 that are set up on a lead/lag cycle and are metered by an inline Rosemount mag meter and also an Endress Hauser Ecograph T data logger that are then sent to a SCADA system for monitoring and alarming. The levels within the wet well are controlled by a Dwyer instruments model SBLT205-040 submersible level transducer and are backed up by a float system. This station is also equipped with a 65 KW/ 3 phase Generac generator for power failure

2.3.1. B Fox Hollow

The Fox Hollow Road pump station is a duplex demand grinder pump station equipped with two Vaughan 35HP 220GPM model S3V-073 submersible chopper pumps that conveys flow from the entire Fox Hollow Sewer shed through a 4" ductile iron force main to manhole GR-095 located at the intersection of Helminiak Street and High Pines Road. Flow at this station is metered through an Endress Hauser Proline Promag 53 mag meter and also an Endress Hauser Ecograph T data logger that are then sent to a SCADA system for monitoring and alarming. The levels within the wet well are controlled by a pressure systems series 700 submersible level transducer and is backed up by a float system. This station is also equipped with a 75 KW/ 3 phase Generac generator for power failure.

2.3.1. C English Farm Lane

The English Farm Lane pump station is a duplex demand grinder pump station equipped with two 7.5HP, 35gpm KSB submersible chopper pumps that conveys sewage from the northwest portion of the Fox Hollow Sewer shed through a 2.5" PVC force main to manhole FH-012 located in front of 1525 Fox Hollow Road, which then flows by gravity to the Fox Hollow main pump station located at 1321 Fox Hollow Road. Flow at this station is metered through an Endress & Hauser Proline Promag 53 mag meter and is then sent to a scada system for monitoring and alarming. The levels within the wet well are controlled by a pressure systems series 700 submersible level transducer and is backed up by a float system. This station is also equipped with a 17 KW/ single phase Generac generator and cutler hammer sxv9000 variable frequency drives to create the third phase to operate the pumps.

2.3.2 Solids Handling

All pump stations are equipped with chopper pumps to liquefy solids to be sent to WSA West WWTP.

2.3.3 Emergency Response Procedures

In the event that a pump station failure has occurred, an alarm is triggered through the Township maintained telemetry program. A pager sends an alpha numeric page, as well as, a text message to the Sewer Department Supervisor, as well as all Sewer Department employees, via text message. Seniority, as well as experience, is used in determining personnel that may be responding and is done so by the Sewer Department Supervisor on a case by case basis.

A minimum of two people are required for supervision of the pumps at all times during these situations.

2.3.4 Alarms and Monitoring

Emergency operating procedures should be defined for each pump station and the proper alarms should be set to notify personnel in the event of pump station failures and/or overflows.

2.3.5 Inspection

The three pump stations that convey sewage to WSA's West WWTP, should be inspected on a daily basis. Daily activities should include, at a minimum, check of properly functioning telemetry, visual check to ensure flow meters are working properly, visual check of wet well water levels, pump operating levels, fuel and fluids for the backup generators. All site visits to the pump stations are required to be recorded in the log books and initialed by the inspector.

2.3.6 Preventative & Routine Maintenance

The pumps and equipment in the Station should be serviced and maintained in accordance with the manufacturing company's maintenance requirements.

2.3.7 Force Mains

The Township's sanitary sewer system consists of two force mains, one which is routed from the English Farm Lane pump station to manhole FH-012 in front of 1525 Fox Hollow Road. The second goes from the Fox Hollow main pump station to manhole GR-095 at the Helminiak Street / High Pines Road intersection. The force mains should be tested for fatigue and blockage on a specified schedule. Testing of the force mains should be conducted approximately once every ten years.

In addition to testing the force mains, an emergency operating procedure for operation of the system in the event that the force main service is interrupted should be prepared.

2.3.8 Metering stations

Currently Old Lycoming Township operates six sampling stations located throughout Lycoming and Old Lycoming Townships, these sampling stations are equipped with ISCO model 3710/3730 refrigerated samplers. The flow is monitored by control electronics model PDS-360 Ultrasonic Open-Channel Flowmeter and Endress Hauser Ecograph T data logger.

2.4 Sampling

WSA requires the collection of 14 samples per quarter. The samples should be 24-hour composite samples. Each sample should be returned to WSA. WSA will analyze the samples for the following parameters:

- COD
- CBOD₅
- SCBOD₅
- TSS
- Ammonia
- Total Organic Nitrogen
- Nitrate/Nitrite as N
- Total Nitrogen
- Total Phosphorus

2.5 Sanitary Sewer System Evaluation

One of the most valuable activities that the Township can perform to maintain the sanitary sewer system in good repair and provide uninterrupted service, is the implementation of a sanitary sewer system inspection and investigation program, which is a form of preventative maintenance. Through the inspection and investigation program, those responsible for the sanitary sewer system operations have comprehensive information about the state of their sanitary sewer system. The findings of the various inspections and investigations provides important information to the Township Authority, who are responsible for making decisions about deficiencies in the sanitary sewer system.

The Township's Sanitary Sewer System Inspection Program consists of visual and structural inspections. Visual inspections of the pump station and grease interceptors are conducted to determine their ability to operate properly. Structural inspections of manholes and pipelines are conducted to determine their structural condition.

The responsibility for inspections and investigations of the sanitary sewer lines is with the Township's Sewer Department. The objective for frequent inspections and investigations of the Township' Sanitary Sewer System is to:

1. Ensure that the sanitary sewer system is in good working condition.
2. Identify existing or potential problems in the sanitary sewer system.
3. Pinpoint the location of problems.
4. Evaluate the seriousness of problems.
5. Provide accurate and meaningful information regarding problems so that they may be corrected.
6. Correct problems within the sewer department's scope of work.

Frequent inspections to ensure the proper functioning of the sanitary sewer system are also an effective way of establishing good public relations with the citizens of the Township. Hence, it is important that the Township Sewer Department continuously monitor the condition of the sanitary sewer system.

Detailed structural inspections are used to determine the structural conditions of the sanitary sewer system's pipe and manholes. Closed-circuit television (CCTV) inspection is used to internally inspect the condition of pipes. Manhole inspections are visual inspections used to determine the condition of manholes. Using this combination of inspection techniques, the structural conditions of the sanitary sewer system can be evaluated. Any serious problems can be identified, without excavation, so that the proper corrective action can be taken.

A sequential program for the CCTV and manhole inspections will be instituted to complete inspections of approximately 16 percent of the sanitary sewer system each year. For the sequential CCTV inspection program, the Township has been divided into six sections. A map of the sections is included in Appendix A. Table 2.1 provides a "boundary description" of each of the sections. The CCTV inspection will be conducted by the Sewer Department and will utilize Pipeline Assessment and Certification Program (PACP) codes developed by the National Association of Sewer Service Companies (NASSCO) for summarizing the findings of the CCTV inspection. The manhole inspections and smoke testing will also be conducted by the Sewer Department at the time of mainline inspections.

Table 2.1 Boundary Description

Section No.	SEWERSHED	NORTHERN BORDER	SOUTHERN BORDER	EASTERN BORDER	WESTERN BORDER
1	Indian Hills	Bottle Run Stream	Bottle Run Rd	Route 15	Ravine Dr
2	Gardenview	Bottle Run Stream	Township line	Lycoming Creek	Princeton Ave
3	Shirms	Township line	Shim's PS	Lycoming Creek	Lycoming Creek Rd
4	Grimesville	Bottle Run Road	Round Hill Rd	Spring Run Rd	Grimesville Rd
5	W. Cottage	Beech Street	West Cottage Ave	Lycoming Creek	Route 15
6	Fox Hollow	Hemlock Rd	Fox Hollow Rd	Grimesville Rd	Fox Hollow Rd

2.5.1 Flow Monitoring

Flow monitoring provides a cost-effective method for understanding system-wide flow behavior and quantifying infiltration and inflow (I&I) under a wide range of conditions. Accurate sewage flow monitoring is a critical component of the investigation activities. In addition to properly characterizing the system, accurate flow monitoring is required to adequately assess the success of future improvements. A monitoring plan was developed to address this issue as part of the development of the Work Plan for the I & I Investigation in 2008. The Sewage Flow Monitoring Plan included flow metering of the sewage flows conveyed to the WSA's West WWTP, as well as, multiple established metering locations throughout the Township and included at every sewer shed outfall.

The Old Lycoming Township sanitary sewer system outfall is monitored by a flow meter at the Flexer Court metering station. The layout of the collection system allows it to be separated into sewer sheds. Each sewer shed has a designated metering point:

- Indian Hills: Manhole GV-001 on Mahaffey Lane just under the Route 15 overpass.
- Gardenview: Flexer Court Meter Station.
- Shirm's: Shirm's Pump Station.
- Grimesville Road: Manhole GR-087 located at the intersection of Round Hill Road and Overhill Road.
- West Cottage: West Cottage Meter Station.
- Fox Hollow: Fox Hollow Pump Station.

2.5.2 Rainfall Monitoring

In order to estimate the portion of the wet weather flow that is attributed to infiltration and the portion attributed to inflow, the correlation of wet weather flows with rainfall amount and intensity is required. Old Lycoming Township operates its own rain gauge located on the roof of the Old Lycoming Township Building, 1951 Green Avenue, Williamsport, PA 17701.

The flow and rainfall data from all monitoring equipment should be recorded on 15 minute intervals, downloaded monthly and stored within the Sewer Department server and provided to the engineer for analysis. This analysis provides an effective way of monitoring the efficiency of the system; as well as, a summary of any bypasses. As rehabilitation of the system is complete, the flow monitoring data will also be a means of measuring the reduction of I & I into the Township's system.

2.5.3 Manhole Inspection

As an integral part of the sanitary sewer system, manholes must be inspected for:

1. Obstructions and debris.
2. Proper grade or elevation of the manhole lid, with the optimum condition where the elevation of the manhole is "flush" with the surrounding elevation; not in a sump where storm water collects over the lid or raised above the street surface where it is damaged by snow removal equipment.
3. Defects that would compromise the structural integrity of the manhole or allow for groundwater to infiltrate into the sanitary sewer system.

The inspections shall consist of a visual evaluation of the condition of the manhole and the pipes connected to the manhole. Subsurface components of the manholes, the frame seal, walls, steps and inverts shall be inspected.

For manholes which appear to be located on privately owned property, prior to entering the property to inspect the manhole, the Sewer Department shall first attempt to receive permission from the property's owner. If no one is available to authorize entry on to the property to inspect the manhole, the Sewer Department shall direct their administrative staff to send a letter to the property owner explaining the purpose for the inspection, with a name and number for the resident to call, and make arrangements for the Sewer Department to inspect the manhole.

All completed manhole inspection forms shall be reviewed by the Sewer Department Supervisor prior to placing the inspection forms in a central file maintained by the department's administrative staff. Based on the review of the inspection forms, the Sewer Department supervisor shall identify all manholes with debris accumulations and promptly schedule the cleaning of every manhole with debris accumulations.

The Sewer Department is responsible for compiling a list of manholes, which were noted as having structural damage, and summarizing in a report submitted to the department Supervisor, the work that must be completed to repair the damaged manholes and recommendations for the completion of this work. It will then be the responsibility of the Sewer Department Supervisor to make a recommendation to the Township Authority to determine the approach that will be used for completing the work.

The Township's collection and conveyance system is comprised of 626 manholes. These manholes have also been divided into sewer shed inspection areas. Each of these sewer sheds includes approximately 100 manholes.

Pictures

Each manhole within the designated inspection area will be inspected. Prior to opening the manhole, the proper sewer shed and manhole ID number should be painted on the lid and have a picture taken. The frame and cover should be inspected for cracks, holes and overall condition. Upon opening the manhole, pictures should be taken of the different manhole components. Any evidence of infiltration should be noted, along with the condition of the bench and channel, steps, riser and any connections that enter the manhole. Picture sequence from top to bottom should be as follows:

- Sewer shed and manhole ID number should be painted on the lid.
- Picture to capture the manholes position and its surroundings
- Picture of the frame.
- Picture of the chimney.
- Picture of the cone.
- Picture of the barrel.
- Picture of the steps.
- Picture of the bench.
- Picture of the flow line and how the pipes are situated within the flow line.
- Any infiltration or maintenance issues observed.

Records

A manhole inspection report should be completed for each manhole via the Trimble Geo XT GPS unit. A copy of the manhole inspection form is provided in Appendix B. Pictures should be taken of the manhole. All measurements for the effluent, influent inverts and pipe diameters will also be recorded during this step. At the end of each particular survey, a GPS shot will be taken to obtain the coordinates for mapping and future locating purposes.

The manhole inspection data for each manhole will be kept until the manhole has been re-inspected as part of the rotating schedule. Once the new inspection has been completed, the new updated manhole inspection form will supersede the existing information.

Upon the completion of the inspection of the manhole, a summary of the manholes shall be provided to the Sewer Department Supervisor for review. Upon review by the Sewer Department Supervisor and the inspection personnel, the manholes that were inspected will be rated and prioritized for rehabilitation.

2.5.4 Closed-Circuit Television Inspection

Closed-circuit television (CCTV) inspection provides the most positive and reliable information on the internal condition of a buried pipe. Permanent records of the inspection, which can be used for future reference, are made by recording the inspection on videotape. CCTV inspection capability extends to pipes as small as six inches in diameter. Knowledge of the TV equipment and its capabilities are very important.

A CCTV unit consists of the following components:

1. Pan and tilt color camera.
2. Floodlights.
3. Camera carrying skids or robotic crawler.
4. Multi-conductor power and video cable.
5. TV picture monitor.
6. System power control center or module.
7. Portable power source, usually a portable generator or on board inverter.
8. Pulley assembly with two winch stands, if using skids.
9. Cable reel and footage meter.
10. Service truck containing the TV power control and picture monitor.
11. Mpeg video recording inspection software.

The Township's collection and conveyance system is comprised of approximately 22 miles of sewer lines. These lines have been divided into inspections areas. Each of these inspection areas is composed of approximately 16 percent of the overall system (approximately 19,360 linear feet). The interceptor has been separated into its own inspection area, as the inspection of this line will require additional time and manpower.