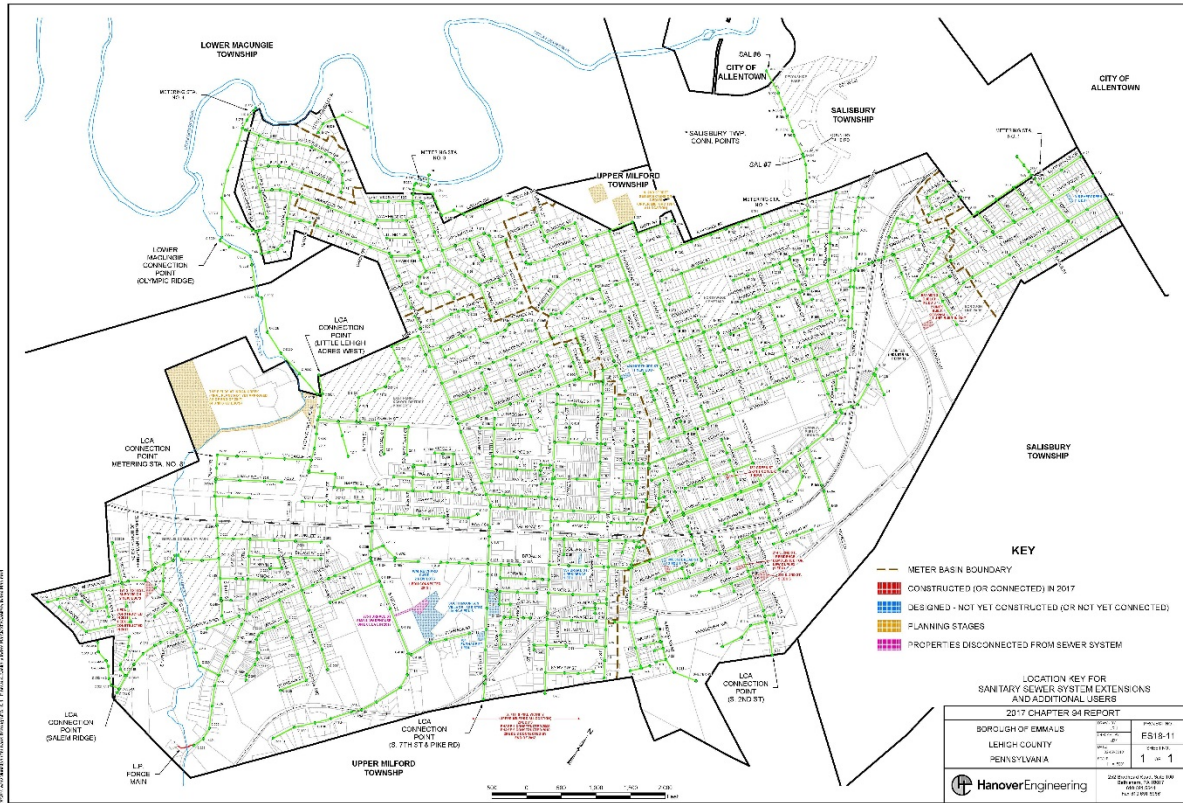


Borough of Emmaus Sanitary Sewer Operations and Maintenance Plan



It is the goal and policy of the Borough of Emmaus to continuously operate and maintain its sanitary sewer system in a manner that is efficient, effective, safe, environmentally friendly, and in the best interest of the community and region in which it serves. The Operations and Maintenance (O&M) plan of the Borough of Emmaus is designed to reduce and eliminate pollution into the system, inflow, and infiltration of unwanted sources.

Maintenance

The Borough’s maintenance plan is based on three types of maintenance: corrective maintenance, preventative maintenance, and predictive maintenance.

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 occurrences. 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.

Relying primarily on corrective maintenance as our method of operating and maintaining the system will never enable the Borough to focus on preventive and predictive maintenance since most of our resources would be directed at corrective maintenance activities and it is difficult to free up these resources to begin developing preventive maintenance programs.

To the extent possible, the Borough's intention is to limit corrective maintenance, as the goal of the Borough is to provide preventative and predictive maintenance on the system. However, in emergency instances, corrective maintenance is needed. All instances are documented, recorded, and reviewed by professional staff to examine the root cause as well as future prevention from a reoccurrence.

Emergency Response

In instances where corrective maintenance is required, and it is an emergency situation, the Borough is equipped with professional staff to handle such situations. During off-duty hours, an on-call employee is available 24/7 to take calls from emergency services or the Lehigh County Dispatch. The on-call employee, or Public Works Manager assesses the situation and calls out staff as needed according to the situation. Staffing is expected to be available to respond 24 hours per day, 7 days per week, 365 days per year.

Preventative Maintenance

Maintenance classified as preventive 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).

The major elements of a good preventive and predictive maintenance program include the following:

- Planning and scheduling.
- System mapping/GIS.
- Computerized maintenance program.
- Records management.
- Assets inventory and management.
- Spare parts management.
- Cost and budget control.
- Emergency repair procedures.
- Training program.

Some benefits of taking a preventive maintenance approach are:

- Maintenance can be planned and scheduled.
- Work backlog can be identified.
- Adequate resources necessary to support the maintenance program can be budgeted.
- Capital Improvement Program (CIP) items can be identified and budgeted for.
- Human and material resources can be used effectively.

Specific Preventative Maintenance efforts of the Borough Include, but are not limited to:

- Flush, cut roots, and camera – 1,000 lf / day of sewer main
 - April 1st – September 30th each year
 - Approximately 10 miles of sewer main per year
 - All of Borough over 5 years, rotating
 - Continuous maintenance effort
- Finish Sewer Meter # 1 area – by end of 2018
 - Camera and plan for corrective work in 2019, including any grouting, lining, and replacement projects
- Sewer Meter # 4 area to begin at end of 2021 and go through end of 2021
 - Three-year project
 - Will plan work as we go. All work identified while conducting inspection work in current year will be planned for the following year.
 - Need to purchase equipment to do some of the bigger mains
- Sewer Meter # 2 area – start 2021 – 3 years
 - Same process as other Sewer Meter areas.
- Sewer Meter # 3 area – 2024 camera work
 - Same process as other Sewer Meter areas.
 - Corrective action 2025
- Place portable flow meters in suspect areas not in the current camera work zone to assist with identifying specific areas that need immediate or near-immediate maintenance or corrective action.
- Inspect and repair / replace manholes every year – in line with camera work
- Continue to apply for and utilize grants for I & I efforts, including Growing Greener Grants, Small Water & Sewer Grants, and other applicable grant programs to assist in funding.
- Install manhole cups in every manhole

- Cost approximately \$45 each, 1,000 needed + area around it → \$300 per manhole for material
- Low-lying areas first
- Can do up to 10 per day
- Currently budget \$30,000 per year for manholes
- Budget to dictate repairs
- Lateral inspections when a home or business is sold, and dictated by ordinance
 - The installation of additional plumbing facilities that produce a major increase, in the judgment of the Borough, in Sewage flow from the house, building, property, or other structure served.
 - A change of use of the house, building, property or other structure served from residential to business, commercial, or other non-residential, or from non-residential / non-restaurant to restaurant or industrial uses such as carwashes, cleaners and laundries.
 - Prior to the close of escrow upon a sale or other transfer of the house, building, property or other structure served or, if there is no escrow, prior to recording of a deed or other document transferring title to the house, building, property or other structure served. A transfer of ownership between family members does not require testing if reassessment of the value of the property by the County of Lehigh is not required. A formal written waiver for the above requirement can be obtained by the Borough of Emmaus Public Works Inspector if the owner can provide official documentation that a proper inspection was conducted and approved by the Borough within the previous two (2) years of the property transfer or within ten (10) years of the last total replacement.
 - Upon repair or replacement of a portion of the Building Sewer or Sewer Lateral.
 - Upon a determination of the Borough that the cleaning, testing, repair, or replacement is required for the protection of the public health, safety, and welfare.
 - In a probate or other testamentary proceeding or in the event of a transfer to the terms of a revocable living trust, joint tenancy termination or other similar instrument, within 180 days after the sale, transfer, or conveyance of the house, building, property or other structure connected to the Borough's sewer system. A formal written waiver for the above requirement can be obtained by the Borough of Emmaus Zoning Officer if the owner can provide official documentation that a proper inspection was conducted and approved by the Borough within the previous two (2) years of the property transfer.
- Routine maintenance / cleaning of master meters and areas around master meters
- Training – storm water certification. One employee recently obtained their storm water certification. Additional employees will pursue the certification. Training and education programs will continue and shall be budgeted for accordingly. Additional training and certification programs are offered and required both in-house and outsourced.

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.

The goal of managing maintenance is to minimize investments of labor, materials, money, and equipment. In other words, we want to manage our human and material resources as effectively as possible, while delivering a high level of service to our customers.

The benefits of an effective operation and maintenance program are as follows:

- Ensuring the availability of facilities and equipment as intended.
- Maintaining the reliability of the equipment and facilities as designed. Our sewer systems are required to operate 24 hours per day, 7 days per week, and 365 days per year. Reliability is a critical component of the operation and maintenance program. If equipment and facilities are not reliable, then the ability of the system to perform as designed is impaired.
- Maintaining the value of the investment. Wastewater systems represent major capital investments for the Borough and are major capital assets of the community. If maintenance of the system is not managed, equipment and facilities will deteriorate through normal use and age. Maintaining the value of the capital asset is one of the Borough's major responsibilities. Accomplishing this goal requires ongoing investment to maintain existing facilities and equipment and extend the life of the system, and establishing a comprehensive O&M program.
- Obtaining full use of the system throughout its useful life.
- Collecting accurate information and data on which to base the operation and maintenance of the system and justify requests for the financial resources necessary to support it.
- Costs. Planned maintenance and repairs are much more cost effective both in the long and short term because the work can be done with the proper materials during normal working hours and under preferred working conditions. Repairing a pipe break in the middle of night during freezing rain with the wrong materials, while paying time and a half for labor can not only increase cost many-fold but produce a substandard repair and leave the consumer without service for an unnecessarily long time.

Routine Preventive Operation and Maintenance Activities

A good preventive maintenance program is one of the best ways to keep a system in good working order and prevent service interruptions and system failures which can result in overflows and/or backups. In addition to preventing service interruptions and system failures, a preventive maintenance program can protect the capital investment in the collection system.

Preventive maintenance activities should ensure that the Borough:

- Routinely inspects the collection system, including pump stations, and addresses defects or other problems.
- Investigates complaints and promptly corrects faulty conditions.
- Provides maintenance records, an adequate workforce and appropriate equipment in working order.
- Maintains and updates a schedule of planned activities.

Preventive maintenance activities typically address:

- Planned, systematic, and scheduled inspections to determine current conditions and plan for maintenance and repairs.
- Planned, systematic, and scheduled cleaning and repairs of the system based on past history.

- Proper sealing and/or maintenance of manholes.
- Regular repair of deteriorating sewer lines.
- Remediation of poor construction.
- Inspection and maintenance of pump stations and other appurtenances.
- A program to ensure that new sewers and connections are properly designed, inspected and constructed and new connections of inflow sources are prohibited.
- A program to oversee lateral and private collection system installations that tie in to public wastewater collection systems.
- A program to eliminate existing illegal inflow sources and a strategy for informing and educating the public about such sources.

Capital Improvement Program

Capital improvement programs often follow a capital improvement plan, which is a plan for expenditures taking into consideration the fundamental strategic goals for a utility system, including growth, expansion, renewal and replacement, regulatory compliance, and stakeholder service needs. Typically, CIP documents show the projected annual expenditures by project and category for at least five years. Increasingly, utilities are extending their CIP documents to 10 - 20 year time frames and including projected sources of revenue where available. Traditionally, CIPs have been updated on a regular cycle, such as once per year or every other year. The Borough of Emmaus has begun the practice of updating their CIP documents on a continuous basis and posting the current CIP on either intranet or Internet sites.

Current capital improvement programs include the replacement of master meters, purchase of equipment, replacement and repair of manholes, and continued I & I efforts.

Budgets

Although an adequate budget is not a guarantee of a well-run collection system, an inadequate budget will make this achievement difficult. Funding has significant impacts on staff and their ability to do their job. Funding can come from a variety of sources, including user fees or appropriations from the State or local government.

A key element of the operation budget program is the tracking of costs in order to have accurate records each time the annual operating budget is developed. Having an annual baseline provides documentation for future budget considerations and provides justification for future rate increases. Collection system management should be aware of the procedures for calculating user rates and for recommending and making user rate changes as often as necessary to manage, operate and maintain the efficiency and effectiveness of the utility.

The major categories of operating costs are labor, utilities, and supplies. Cost accounting for these categories includes information on unit costs, total costs, and the amount/quantities used.

The cost of preventive and corrective maintenance and major collection system repairs and alterations are major items in the yearly operating budget and capital improvement program (CIP). The Borough

keeps an adequate record of all maintenance costs, both in-house and contracted, plus the costs from spare parts. This will assist in the preparation of the next year's budget as well.

A capital improvement fund is part of the Borough's budget in order to keep the system operating properly in the future. Capital planning starts with a look at changes in the community. Where are the areas of growth in the community? Where are the areas of decline, and what are the anticipated changes in industry within the community? After identifying the changing needs in the community, the existing utility structure should be examined and weak spots identified. Expected capital improvements within the next year, two years, five years, and ten years are also identified. Once all of this information has been compiled, it is prioritized and a timetable developed for improving each of the areas identified.

Asset Management

Asset management, created to foster more efficient financial and physical resource investments and to prolong the life of the infrastructure system components, can be defined as managing infrastructure capital assets to minimize the total cost of owning and operating them while delivering the service level customers desire.

Use of asset management procedures help protect the wastewater collection system and extends financial resources by:

- Making sure components are protected from premature failure through proper operation and preventive and predictive maintenance.
- Facilitating proactive capital improvement planning and implementation over longer cycles to reduce annual and overall costs.
- Reducing the need for expansions and additions through demand management.
- Reducing the cost of new or planned investments through economic evaluation of options using life-cycle costing and value engineering.
- Focusing attention on results and by clearly defining responsibility, accountability, and reporting requirements within the organization.
- Maintaining stable and justifiable user rates.

An emphasis on asset management can better ensure that the key components of a strategic business plan, such as level of service definition, rate setting, budgeting, financing, and value engineering are taken into consideration.

Asset management and environmental management systems (EMSs) have valuable attributes and can complement each other, but they are not the same. The asset management approach helps the Borough optimize maintenance and replacement cycles to cost-effectively ensure that the sewer collection system runs smoothly and to accurately predict capital funding needs over a long planning horizon. It assumes that the Borough has identified its environmental compliance goals and has incorporated them into the planning process. By contrast, EMSs are designed to help the Borough identify and manage a full range of environmental, public health, and safety issues—both regulated and unregulated (i.e., surface water, groundwater, air quality, noise, etc.) EMSs are designed to help integrate these issues into an overall system that can help continually improve environmental

performance and provide other important business benefits like reduced costs through energy and water conservation, reduced chemical usage, reduced risk of noncompliance, to name a few.

The key elements of asset management are:

- Level of service definition.
- Selection of performance goals.
- Information systems.
- Asset identification and valuation.
- Failure impact evaluation and risk management.
- Condition assessment.
- Rehabilitation and replacement planning.
- Capacity assessment and assurance.
- Maintenance analysis and planning.
- Financial management.
- Continuous improvement.

Level of Service Definition

A basic level of service definition for most collection systems will be to deliver reliable sewer collection services at a minimum cost, consistent with applicable environmental and health regulations.

Examples include:

- Ensuring adequate system capacity for all service areas.
- Eliminating system bottlenecks due to pipe blockages or other system defects.
- Reducing peak flow volumes through inflow/infiltration (I/I) controls.
- Providing rapid and effective emergency response service.
- Minimizing cost and maximizing effectiveness of CMOM programs.

Performance Measurements

Performance measurements are specific indicators designed to assess whether level of service objectives are being met.

Some examples of performance measurements for the Borough include:

- Annual performance goals for sewer system inspection, cleaning, maintenance, rehabilitation, and capital improvement.
- Correlating grease control education and enforcement measures with expected reductions in the number, distribution, and severity of grease blockages.
- Correlating illegal connections (sump pumps, roof leaders, foundation drains, etc.) education with wet weather SSO's.
- Establishing maximum hourly and monthly peak flow volumes to meet all agreements with the City of Allentown and LCA.
- Establishing maximum emergency response time to emergency calls, tracking customer complaints and dealing with claims for private property restoration.

- Performing cost-benefit analysis of key completed activities, taking into account expected vs. actual outcome and budgeted vs. actual cost.

Information Systems

Each utility must analyze its information needs. The Borough has evaluated and documented its existing information systems, and recently purchased a state of the art SCADA system. The next step is to perform a side-by-side comparison between identified information needs and existing systems to reveal gaps. A prioritized, phased plan was developed to fill in the gaps.

For the Borough, information is most efficiently managed by use of asset management software programs that help organize the data, perform many standard analyses, and facilitate planning, scheduling, and budgeting. These programs range in cost and complexity from affordable, simple applications to very complex, expensive solutions—from several thousand dollars to several hundred thousand dollars. The Borough is currently considering the purchase of newer, more state of the art software to assist with asset management, workflow, and other important needs for its programs.

A geographic information system (GIS) links database information to points on the map, which are primarily defined by manhole locations and their connecting sewer segments. The GIS is linked to the asset management system, sewer system model applications, and even billing systems to some degree. Asset Identification and Capitalization Asset identification is the process of identifying and numbering the primary components in the sewer system. The GIS is linked to information systems and aggregate data for financial, economic, technical and management use.

For instance, sewer main segments are identified by location, length, material, size, slope, burial depth, beginning and ending manholes, and approximate or actual age. The numbering system used to assign unique identifiers to components should be based on manholes, with the sewer segments numbered according to their relationship to the beginning and ending manholes.

Map data is verified with physical system inspection methods such as closed-circuit TV (CCTV), sonar/CCTV, static camera, or person-entry. Latitude/longitude coordinates were previously established and verified using global positioning surveying (GPS) techniques.

Complete sewer system inspection is an expensive and time-consuming undertaking that must be carefully planned and coordinated to support many aspects of the asset management program. The Borough is prioritizing and planning inspections over a period of years, as previously highlighted. Highest priority for inspection shall be given to sewers that have known defects, have caused or contributed to SSOs or treatment plant violations, have negatively impacted users, or have the potential to impact sensitive environmental or drinking water sources.

SCADA System

The existing Supervisory Control and Data Acquisition (SCADA) system monitors the operation of various systems within the Borough, including the Borough's drinking water wells, as well as the Borough's sewer flow at each of the Borough's four (4) master sewer meters.

The SCADA system's ability to monitor sewer flows includes:

- Monthly, daily, hourly, and more detailed flows at each master meter

- Digital and graphic reporting of recorded flows

Data collected from the sewer meters is used to prepare reports of daily flows at each meter station and for the cumulative daily Borough flow. These reports are generated and transmitted to LCA monthly and are used by Borough staff as one of the available tools for ongoing sewer system condition assessment.

The SCADA system is monitored continuously to ensure that it is operating correctly. An on-call or on-duty employee monitors the system 24 hours per day, 7 days per week, 365 days per year.

Asset Capitalization

In general, the capitalized amount of an asset is defined as its acquisition cost (design, construction, land acquisition, etc.), plus capital improvements, minus accrued depreciation. For the Borough, this valuation is established at the subsystem level—force mains, sewer mains, service laterals, manholes, etc. and at the overall system level.

Failure Impact Evaluation and Risk Management

The potential impacts from sewer line failures are being assessed on a system-wide basis. The goal is to identify those areas of the system that will have the most impact if a failure occurs, and focus asset management resources to minimize the risk.

Condition Assessment

Condition assessment is performed to identify assets that are underperforming, determine the reason for the deficiency, predict when failure is likely to occur, and determine what corrective action is needed and when. A condition level measurement scale is used, and a minimum acceptable condition is established and incorporated into the administrative rules governing the operation of the collection system (municipal and city ordinance, and statute, etc.) Whatever benchmarks are chosen, they refer primarily to the physical condition of the system and its components.

Components found to be in poor condition, or with severe defects and high failure impact ratings, shall be addressed as soon as possible after they are discovered. Less severe defects can be prioritized for more frequent inspection or cleaning, repair, rehabilitation, or replacement.

Rehabilitation and Replacement Planning

Proactive rehabilitation and replacement planning provides the best opportunity for capital cost savings. By rehabilitating or replacing sewers and other components before they fail, the utility automatically avoids costs such as emergency contractor fees, staff overtime, unplanned repairs, and SSO cleanup costs. Additional savings can be achieved through coordination of sewer construction with other construction projects, replacing longer segments, and phasing construction over a period of years.

The Borough continues to establish and update a capital replacement plan. Currently, the plan includes items such as the purchase of a new sewer flushing and vacuum truck, new nozzles and a sled, root cutters, and other equipment that is essential to maintaining and operating the system. In addition, the plan includes the significant repair and replacement of the master meters in the Borough.

Borough Sewer System O&M Resources

Public Works Staff

The Borough of Emmaus has a well-staffed Public Works Department to maintain the sanitary sewer system. The Public Works Department has a full-time Director to oversee Department personnel and the operation of the system. The Department has two (2) inspectors who are certified and experienced in the operation, inspection, and repair of sanitary and storm sewer systems. There are also two (2) operators who are trained in the operation of remote CCTV inspection equipment. When needed for emergency repairs or planned work, there are approximately eight (8) Public Works staff members available to assist with sanitary sewer system projects.

Equipment

In addition to the staff, the Borough has a wide range of equipment for monitoring, inspecting, and repairing sewer system facilities. Some of this equipment, such as excavators, dump trucks, generators, portable work light systems, and portable pumps, can be used for other general municipal work including street repair, parks, and water and storm sewer system maintenance.

Other specialized Borough equipment available for use in a sewer system maintenance:

- Flushing Truck – 1991 Camel Jet on Ford F800 chassis, with 1,000 gallon water tank, 1,000 feet of hose, general cleaning nozzle, and 8”-10” root cutter
- CCTV Van – 1998 Ford F350 van with Pearpoint Flexitrac mainline camera system
- Portable Sewer Camera – General Gen-Eye video inspection/location system
- Portable Lateral Camera – Ridgid SeeSnake mini video inspection/location system
- Manhole Leveling System - Mr. Manhole Gold Series cutter/extractor, with heavy-duty hydraulic auger drive adaptor for mounting on excavator boom
- Portable Flow Loggers – Global Water FL16 flow logger/recorders with Windows-based software
- Portable Sewer Ventilating System
- Portable Pressure Washer System
- Portable Gas Monitors
- Magnetic Manhole Cover Lift