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MUNICIPAL SEWAGE SYSTEM ASSET MANAGEMENT GUIDE

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DEPARTMENT OF ENVIRONMENTAL CONSERVATION
DIVISION OF WATER

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Municipal Sewage System Asset Management Guide

What is Municipal Sewage System Asset Management (MSSAM)?

Municipal sewage system asset management (MSSAM) is the practice of managing a municipal sewage treatment plant and the associated sewage collection system's capital assets in a way that protect the public health and the environment while also minimizes the total cost of owning and operating those assets while delivering the desired levels of service. This practice incorporates detailed asset inventories, prioritization of critical assets for the capital improvement program, and long-range financial planning to maintain system performance and build system capacity. Together with the facility's operations and maintenance (O&M) plan, these practices help assure that a municipal sewage system remains properly functioning, well-maintained, and sustainable over the long term.

Why Should Municipalities Practice Sewage System Asset Management?

The purpose of a municipal sewage system is to protect public health and safety, and protect the environment. This goal is best achieved by a well-maintained sewage collection system and treatment plant that reliably conveys and consistently remove pollutants before release to the environment. For purpose of this guidance, the sewage treatment plant and the associated sewage collection system are collectively referred to as a municipal sewage system.

Municipal sewage systems consist of unit processes that have various pieces of equipment used to convey flows through the facility and aid in the removal of pollutants. As mechanical equipment ages and wears, it is increasingly prone to reduced performance and failure. The ability of a municipal sewage system to meet the expected level of service is dependent upon the facility being in a state of good repair.

The benefits of MSSAM include:

- prolonging asset life and aiding in rehabilitation, repair and replacement decisions through efficient and focused operation and maintenance (O&M);
- meeting consumer demands with a focus on the system's financial and functional sustainability;
- setting rates based on sound operational and financial planning;
- improving economic development opportunities in communities by eliminating existing sewage treatment problems that are constraints to development;
- budgeting focused on activities critical to sustained performance;
- meeting service expectations and regulatory requirements;
- improving responses to emergencies;
- improving the security and safety of assets; and

- reducing overall operational costs and capital expenditures.

The NYS 2100 Commission report recommended that New York municipalities should develop and implement wastewater infrastructure asset management plans to identify and maintain the operation of the most critical sewage collection and treatment systems during a severe storm to protect public health and safety. Such plans will also identify the critical assets that must be protected to allow the treatment facilities to recover as quickly as possible after a severe storm or flood.

What is an MSSAM Plan?

Implementation of a properly designed MSSAM plan will support the long-term financial sustainability of a municipality's sewage system and provide the desired level of service at the lowest long-term cost. It is important that the MSSAM plan meets certain minimum standards to guide the municipality in achieving this goal. In 2008, EPA developed a series of asset management guidelines (*Asset Management: A Best Practices Guide, Asset Management for Local Officials, and Building an Asset Management Team*) to provide municipal sewage system owners and operators with a high level framework for the establishment of an asset management plan. The Department has considered EPA's guidance and many other references related to municipal sewage system asset management. The Department also established a Wastewater Infrastructure Subcommittee of the Water Management Advisory Committee (WMAC) in 2013 to advise the Department on a comprehensive strategy to implement MSSAM for municipal sewage systems statewide.

After considering all the relevant references and suggestions from the WMAC Wastewater Infrastructure Subcommittee, the Department provides the following guidelines as the design standards for an MSSAM plan.

The five plan elements that must be included in each MSSAM plan are the following:

1. Inventory of critical assets
2. Level of service
3. Prioritizing critical assets
4. Capital improvement plan
5. Long-range funding strategy

1. Inventory of Assets

An inventory of the system's assets is a necessary first step in creating an effective asset management program. While a complete inventory is essential, not every asset is equally critical to every system's operations. In addition, assets below a certain monetary value may not be practical to include in the inventory. The Department recognizes that the municipal sewage system asset inventory may differ between large systems and small systems in terms of scope and complexity.

Therefore, it is important to know which assets are required to sustain a particular system's operations at the desired level of service and the value of those assets. The

baseline inventory should be realistic and include all items that may be critical to the facility's operation at the desired level of service.

Assets that may be inventoried and assessed include the following:

Wastewater treatment plant assets may include the following:

- Primary, secondary, and tertiary treatment units
- Disinfection equipment
- Pumps
- Blowers
- Buildings
- Electronic components (including control systems)
- Equipment and materials (including gates and valves) which may be required for maintenance, health and safety, and upkeep

Sewage collection and conveyance system assets may include the following:

- Piping
- Pump stations
- Catch basins
- Manholes
- Portable pumps and generators
- Rodding and other collection system maintenance equipment

Laboratory assets may include the following:

- Sampling and analysis equipment
- Inspection equipment

Human assets may include the following:

- Level of operator(s) certification required for the treatment plant
- Number of staff with proper expertise and experience required to maintain and operate the plant and collection system at the expected level of service

The inventory shall include for each asset, at a minimum:

- Brief description
- Location
- Date put into service
- Present operational condition
- Estimated remaining useful life
- Current replacement cost
- Level of redundancy

The inventory should be organized in a manner that is useful to the facility. The Department recommends a hierarchy-based asset inventory system, with assets divided up based on functions (collection system, plant) and then processes (primary clarification, secondary clarification, etc.).

Some of the above inventory information may be difficult to find, so a literature search and representative sampling of a portion of the facility's assets to calculate the full asset value may be used. For example, when surveying the age, size, and condition of collection system piping, a representative number of manholes may be opened for inspection of the age, size and condition. Using this information, the condition of the entire system can be estimated. Alternately, examining any existing as-built or approved plans and specifications for equipment and systems may also provide information.

As assets are rehabilitated, repaired, or replaced, the inventory should be updated so that it will become more accurate over time. At a minimum, the facility should revisit and update its asset inventory on an annual basis. Dates of initial service, replacement, planned replacement or rebuild, and current criticality and operational rankings should be verified. Sample organizational spreadsheets for asset inventory can be found in the resources section of the *NYWEA Asset Management Task Force White Paper*, April 24, 2014.

One or more maps of the wastewater treatment facility and sewer collection system should be developed. The map(s) should be of sufficient detail, and at a scale to identify all critical assets in the inventory, as well as any other critical features, such as roads, which are necessary to access the wastewater treatment plant or outfall. Paper maps, Geographic Information System (GIS) based maps, or CAD-based maps are all acceptable. Both GIS and CAD-based map technologies allow the map(s) to be integrated with the asset inventory.

Such map(s) should include, at a minimum, the following:

- All sanitary and combined sewer lines and related manholes, catch basins, and CSO regulators
- Coding of pipe size and materials
- All known or suspected connections between the sanitary or combined sewer and storm drain systems
- All SPDES permitted outfalls, including the treatment plant outfall(s), combined sewer outfall(s), and remote treatment facility (RTF) outfall(s)
- All pump stations and force mains
- Wastewater treatment facilities, including all treatment processes
- All surface waters and wetlands within the service area
- 100 year and 500 year floodplains and aquifer recharge areas
- Disaster preparedness measures and equipment (e.g. floodwalls), and other major appurtenances such as siphons and air release valves
- Scale and north arrow

- Distance between manholes and the direction of flow

2. Level of Service

In order to determine the priority or criticality for each sewage treatment component in the system, one must first determine the desired level of service to be provided by the treatment and collection system.

The desired level of service should consider, at a minimum:

Compliance with applicable SPDES permit requirements

The desired level of service for regulatory purposes is SPDES permit compliance. To maintain compliance, the system must be able to reliably provide the level of treatment necessary to meet permit requirements and effluent limitations. Reliability is the ability of the equipment to meet the manufacturer's expected design life while operating with a minimum level of time out of service.

Protection of public health and safety

The desired level of service should also provide for proper operation and maintenance of the treatment and collection system, which is essential for the protection of public health and safety. This aspect of the level of service requires a robust and reliable plan to respond to treatment system failures and bypasses in order to assure proper treatment to the maximum extent practicable. The plan should include guidelines and a response protocol that ensures a timely and efficient response to collection system issues, such as sewer backups and force main breaks, to minimize exposure of the public to untreated sewage. The facility should also maintain sufficient staffing to cover routine and emergency service.

Ratepayer expectations

The system should provide the most efficient and economical way to deliver services to its ratepayers over the long term. The continued reliable performance of the treatment and collection system at the lowest cost is both an expectation and requirement of the ratepayers using the system. Energy cost is a substantial component of the overall operating budget for a sewage treatment plant and the sewage conveyance system, as much as 40% can go toward energy use according to a study[1] by New York State Energy Research & Development Authority (NYSERDA). Reducing energy consumption at the wastewater treatment plant will lower the long term operating cost of the facility. Additionally, lower energy consumption will lead to a lower carbon footprint for the facility, helping to combat climate change. Reductions in treatment system efficiency or chemical feed rates necessary to maintain effluent quality are not considered acceptable methods of energy reduction.

The municipality should monitor and minimize its sewage treatment and conveyance system's energy consumption, improve the energy efficiency of the treatment process

1 New York State Energy Research & Development Authority, Water & Wastewater Energy Management Best Practices Handbook, March 2010.

equipment, and maximize renewable energy use and production. Such activities may include specification of equipment, fixtures, and appurtenances with lower energy use during replacement and rehab, installation of solar panels or other renewable energy sources, and generation of energy from anaerobic digestion or other waste-to-energy methods. Additionally, NYSERDA has made guidance available, such as the *Water & Wastewater Energy Management: Best Practices Handbook* (March 2010) and the *Municipal Wastewater Treatment Plant Energy Evaluation* (March 2006), to aid municipalities in conducting energy audits and selecting best practices for sewage treatment facility energy management.

The municipality should establish a reliable method of communicating the system's operation and performance to the ratepayers. This information may be communicated through town meetings, newsletters, annual reports to ratepayers, mailing with sewer bill and/or a website. Information that should be communicated to the ratepayer includes statistics on permit compliance, overflow events, response time for repairs, system maintenance and capital improvement projects.

3. Prioritizing Critical Assets

Following completion of the asset inventory, an assessment should be made to determine the criticality and condition of each of the identified assets relative to the expected level of service of those assets. Not every asset presents the same failure risk or is equally critical to the system's operation. Critical assets are those the municipality determines to be essential to the operation of the treatment and collection system, those that may have a high risk of failure (old, poor condition, etc.), and those that present major consequences if they do fail (major expense, adverse environmental impacts, safety concerns, etc.).

A ranking system should be used to identify, assess, and prioritize critical assets. This may consist of a scoring system that ranks each asset on a numeric scale for the criticality and condition of that asset. The Department recommends that the critical asset ranking system be designed to work with existing vulnerability analyses or other systems currently in use by the facility.

The criticality score should consider the following:

- Protection of public health and safety
- Compliance with applicable SPDES permit requirements
- Potential impacts of an asset's failure on interruption of service to residences or businesses
- Potential impacts of a critical portion of the treatment or collection system becoming disabled
- Financial consequences of the failure of that asset to the facility's operations
- Likely risk or frequency of the loss of that asset
- Vulnerability of an asset to a 25-year/24-hour storm or located within the 100-year floodplain

The condition score should consider the following:

- Age
- Redundancy
- Availability of parts
- Cost
- Number of hours of use
- Remaining useful life
- Maintenance history

Equipment that meets the highest degree of criticality should have redundant unit(s) that can readily be placed into service to minimize the interruption of flow or treatment.

Human assets, such as plant operators, maintenance staff, and other staff, should also be assessed based upon their criticality to the operation of the treatment and collection system. For example, is the operator nearing retirement? Is the assistant operator qualified to take over should the chief operator leave, or does the assistant need to take further operator certification courses?

Examples of worksheets that may be used to inventory and rank the criticality of assets can be found in the resources section of the *NYWEA Asset Management Task Force White Paper*, April 24, 2014.

4. Capital Improvement Plan

A Capital Improvement Plan (CIP) is a short-range multi-year plan that should include, at a minimum, the following information:

- List of capital projects or equipment to be purchased, repaired or replaced
- Projects ranked in order of criticality
- Plan for financing the projects
- Timetable for the construction or completion of the projects

A CIP typically forecasts at least five years into the future and is updated annually or biennially to reflect completed projects and/or changes in planned projects or priorities for the next five or more years. Projects identified in the CIP may be derived from the critical asset ranking analysis to be rehabilitated, upgraded, or replaced to maintain the expected level of service at the lowest life cycle cost of the equipment or system components. A life cycle cost analysis looks at the costs of a particular asset on an annual basis over its entire life span. Capital and O&M costs generally represent the majority of the life cycle cost of an asset. Capital costs should not be the sole factor in selecting a particular technology or equipment. O&M costs are also an important consideration in determining the most cost-effective technology to adopt and whether an asset is replaced or rehabilitated.

When equipment and system components are upgraded or replaced, the municipality should ensure that any new equipment is designed and built with the adequate level of storm and flood resiliency. *New York State 2014 Design Standards for Intermediate Sized Wastewater Treatment Systems* provides some design guidelines for locating a facility and equipment relative to floodplains. *NEIWPCC TR-16: Guides for the Design of Wastewater Treatment Works* has more detailed discussions and guidelines on storm and flood resiliency design for sewage treatment equipment and sewer systems.

5. Long-Range Funding Strategy

An O&M plan identifies the day-to-day needs to maintain the system and deliver the expected level of services. The CIP identifies the rehabilitation, replacement and any improvements of the system to minimize catastrophic system failure and meet future growth and regulatory requirements. A long-range funding strategy should be identified by the municipality to pay for these needs. As part of this funding strategy, a succession plan for replacing critical staff should be developed for continued operation of the facility at the desired level of service.

- The long-range funding strategy should include the following: Proper sewer rate
- Adequate temporary use surcharge (e.g., tourist and seasonal use in Catskills and Adirondacks)
- Sewer service fee commensurate to the level of service
- Financing options, such as state and federal loan and grant programs

A discussion of CIP financing, such as revising the rate structure, funding a dedicated reserve from current revenues (i.e. creating an asset annuity), and low or no interest borrowing should be included in the plan.

The rate structure should identify the various sewer use rates charged to residential, commercial, and industrial users, and the approximate percentages of the revenue generated to be used for capital costs, O&M costs, debt service as well as funds directed to a capital reserve account for future capital improvements. This multi-year financial plan should take a broad look at the facility's overall financial status over the CIP planning period.

RELATED REFERENCES

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