ASSET MANAGEMENT GUIDE

for

PUBLICLY OWNED TREATMENT WORKS

Revised December 2021

DEPARTMENT OF ENVIRONMENTAL CONSERVATION

DIVISION OF WATER

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A Word from the Director

Dear Reader,

In New York State, water infrastructure is in dire need of repair, replacement or rehabilitation. Despite unprecedented federal and state funding, local municipalities struggle to keep up with increasing costs due in part to local tax cap restrictions and lagging rate changes. Economic growth is dependent upon updated and sound infrastructure that can handle current and increased demand. Without investing in our infrastructure, New York State will not be competitive – New businesses will not invest in our state if they cannot depend on the infrastructure to serve them. An asset management program positions municipalities to be transparent about the state of their wastewater infrastructure needs, plan for improvements or investment, and attract new business.

The Division of Water is pleased to share this Asset Management Guide, which we offer as a tool that can be used by any POTW to help make decisions regarding the management of their assets and develop a sound financial strategy for reinvestment in their infrastructure. Let's face it, nothing lasts forever, and we know that there are many municipal conveyance and treatment systems that have fallen into disrepair.

Asset management programs can be used to: provide clear and concise documentation to support your annual financial planning; educate your community about the costs of wastewater treatment operations and how that translates to individual sewer rates; and help you run your POTW as efficiently and economically as possible. Additionally, going forward an asset management program may better position your projects for funding under DEC's competitive grant programs such that communities taking a proactive approach will be encouraged and rewarded for their efforts.

As an owner or operator of a POTW, you know your system better than anyone and DEC does not intend to dictate the details of how you manage your wastewater infrastructure; it is up to you to decide priorities. We recognize that asset management program development for any organization is an evolutionary journey. All POTWs start at a certain place and, with concerted efforts and dedicated resources, can grow in maturity over time to reap the benefits in service, financing, transparency, and performance. This Guide will help you to develop and evolve your POTW's asset management program.

As you follow the guidance, please send us feedback so that we can continually improve it. We hope this Guide will help you to plan and budget for the capital improvements and management strategies necessary to proactively maintain your water infrastructure into the future.

Sincerely,

Mark Klotz, Director
Division of Water

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Background

In 2012, Governor Andrew M. Cuomo formed the NYS2100 Commission to find ways to improve the resilience and strength of New York State's infrastructure following several severe weather events, including Superstorm Sandy, Hurricane Irene, and Tropical Storm Lee. The Commission included subject area experts who examined key vulnerabilities in critical infrastructure systems and recommended improvements.

The Commission found that vulnerabilities in the State's wastewater infrastructure are worsened by extreme weather events. The Commission recommended strengthening that infrastructure to address the vulnerabilities. The Commission suggested that the State should assist municipalities with the development of facility asset management plans. The New York State Department of Environmental Conservation (DEC) has taken several steps to advance the Commission's recommendations.

In 2013, the DEC established a Wastewater Infrastructure subcommittee of the Water Management Advisory Committee to advise the DEC on a comprehensive strategy to implement asset management for publicly owned treatment works (POTWs) statewide.

In 2015, the DEC released the Municipal Sewage System Asset Management Guide which outlined the minimum required elements of an asset management program. The guidance referenced federal, state, and environmental publications that provided insight into each element and provided a framework that municipalities could follow to start developing asset management programs.

On May 10, 2017, the DEC and the New York State Environmental Facilities Corporation (EFC) launched the Municipal Sewage System Asset Management Pilot Program (Pilot Program) to develop asset management programs with ten volunteer municipalities and gain insight into the development of asset management programs and to understand how asset management could be practiced across the State. The ultimate purpose of the Pilot Program was to update and improve this Guide (formerly known as the *Municipal Sewage System Asset Management Guide*). DEC selected participants that were representative of municipalities with POTWs across the State.

The success of the Pilot Program, including the knowledge and experience gained, influenced the development of this document. The experiences of the participating municipalities have informed the Guide's structure, direction, tools, and level of detail to help others create a successful asset management program. DEC considered EPA's guidance, other references related to asset management for POTWs, and the results of the Pilot Program to create this document and the associated tools.

Chapter 1 Introduction to Asset Management

1.1 What is Asset Management?

An asset is something that has value. For example, you may consider your car a personal asset. It has an associated cost, but it also provides you with a service (i.e., a means of transportation), which may be difficult to quantify. In a municipality, public assets may include roads, sidewalks, trash cans, or lighting. Within a POTW, an asset may include pumps, tanks, buildings, or staff. Assets have both monetary and functional values.

Management is a process of planning, organizing, leading, and making decisions based on available or needed resources. For example, when do you decide to change the oil in your car? What resources do you need? Are you performing the task yourself or is someone else doing it for you? In a municipality, deciding how, where, and when to spend public money can result in heightened scrutiny, so it is important to ensure your decisions are well documented and supported.

At its core, asset management is a process designed to help people decide how, where, and when to spend money to achieve a result. In the car example, if maintenance is needed, what steps are you taking to ensure your mobility is not impacted? Are you able to carpool to work? Do you have money set aside in the event the repair is more than the value of the car? When you consider asset management in your own life, many of the activities you perform or decisions you make are a commonsense approach to manage your available resources.

An asset management program helps to transparently support decisions that affect publicly owned infrastructure. Within a POTW, public resources are used to cover the costs of ownership. As a result, an additional level of accountability is expected. An asset management program memorializes the management strategies that will be used to ensure the sustainable delivery of services.

1.2 Purpose and Use

This document is a reference for good engineering practices as they relate to the development of an asset management program. The Guide provides you, the reader, with an understanding of the minimum components and best practices of asset management as they relate to **POTW** infrastructure.

POTW is used to refer broadly to wastewater infrastructure that may be owned or managed by a municipality and is not specific to only WWTPs. This Guide can be used to develop an asset management program for all wastewater system types including publicly owned sewer systems, combined systems, and stormwater systems.

 *Did you know?* Terms that appear in bold are defined in **Definitions**.

POTWs typically consist of vertical and horizontal wastewater infrastructure. The difference between these infrastructure types is primarily a result of spatial extent. **Vertical assets** are usually associated with structures, buildings, tanks, and other related infrastructure. **Horizontal**

assets are typically associated with conveyance, manholes, regulators, and other such infrastructure. These terms are used throughout the Guide.

This document aims to present you not only with the concepts of asset management, but with specific steps to make asset management a reality in your own municipality.

1.3 Getting Started

An **asset management program** must be supported by all levels of staff, beginning with municipal leadership. A municipality should first form a committed Asset Management Team, as detailed in Chapter 2, to position the asset management program for success. This includes identifying staff from public works, wastewater operations, financial services, engineering or other information systems, and elected or appointed leadership within the municipality.

The adoption of asset management practices often involves an internal cultural shift. Before developing an **asset management program**, it may be helpful to assess the municipality's readiness and identify whether there are potential stumbling blocks that may cause an asset management program to be unsuccessful. If possible, those areas that may prevent successful adoption should be addressed prior to the development of an asset management program. Resources are available to assess organizational readiness.

Toolbox #1 was adopted from the Kansas Department of Health and Environment and can be used to assess your municipality's asset management readiness.

Staff members across the municipality should be actively engaged in the creation, adoption, implementation, and continuous use of the program. With a dedicated team of individuals who know the details of the **asset management program**, the **assets**, and any supporting resources (software, documents, etc.), the municipality will be better equipped to manage change.

1.4 What goes into an Asset Management Program?

In accordance with State regulation in 6 NYCRR Part 750-2.8, each municipality is responsible for making sure its publicly owned infrastructure are properly operated and maintained. An asset management program supports the intent of this regulatory requirement. An asset management program consists of the following components:

1. Asset Inventory
2. Condition Assessment
3. Level of Service Profile
4. Likelihood of Failure, Consequence of Failure, and Risk Assessment
5. Capital Improvement Plans
6. Sustainable Ownership Assessment
7. Maintenance Planning

This Guide provides municipalities with a framework to develop an asset management program and to begin to build a culture of asset management. While every municipality is unique in structure, there are certain universal components that are necessary to develop a sustainable

program. This document will help you develop these minimum components, while also highlighting best practices to maximize the benefits of asset management.

Did you know? The term "must" is used where the action is a necessary component of a comprehensive asset management program.

For example, an asset inventory is a *minimum component* of an asset management program, so the term “must” is used to ensure an inventory is developed. Other terms, such as "should" and "recommend" indicate desirable procedures or methods, with deviations subject to individual consideration. Physically assessing the condition of each inventoried asset is a *best practice*, so the terms “should” or “recommend” are used to highlight the importance of the activity but are not necessary to initially develop the asset management program.

Must	A minimum component of an asset management program.
Recommend	Desirable procedures, methods, and practices to consider in the development or implementation of an asset management program.
Should	

It is anticipated that those developing the initial asset management program will have data gaps or require additional verification before considering the program adequate to rely upon for long-term capital planning. For many, the first step will be ensuring the minimum components of the asset management program are developed before incorporating the best practices.

1.5 What makes a Successful Asset Management Program?

Asset management programs that consist of the following elements have been demonstrated to have the most long-term success. These elements are referred to as the Five Pillars of Success for Asset Management, and they include:

1. Internal and External Knowledge Sharing – Train and retain staff knowledge. Participate in professional associations and organizations where staff can learn how other organizations are utilizing asset management and share experiences.
2. Use the Program Frequently – Work with the program for daily operations, don’t just consider it an inventory of the assets. Continually improve the quality and extent of the data kept on the municipality’s wastewater assets. Manage daily activities to meet stakeholders service expectations (levels of service).
3. Continually Improve the Program – Review and update of the program regularly. Don’t let the software systems, data, and tools become antiquated, take advantage of upgrades, new versions, and new technologies.
4. Be an Asset Management Champion – Adopt and advocate for proactive approaches. Support staff who want to become subject matter experts on asset management and the supporting tools. Use asset management data to support recommendations and decisions.
5. Integrate the System – Use asset management in other areas of the municipality, look for opportunities to share and integrate other department’s data and systems. Prevent the development of duplicate data sets.

An **Asset Management Team** that uses each of the Five Pillars will ensure its municipality has a sustainable and successful asset management program.

Chapter 2 The Asset Management Team, Staffing and Succession Planning

2.1 Introduction

A municipality that has decided to start an asset management program may wonder where to begin. The first step is to recruit a team of knowledgeable and motivated individuals. Each member of the **Asset Management Team** takes on a role in the development and implementation of the program. These members should represent the interests of the different municipal offices and departments that are involved with the behind-the-scenes and day-to-day support of wastewater operations.

A successful **asset management program** requires support from many levels of the municipal government, beginning with an appointed or elected municipal leader who will act as an executive member of the Asset Management Team.

CHAPTER HIGHLIGHTS
In this Chapter you'll learn how to… • Form an Asset Management Team, • Develop a staffing plan, • Develop knowledge retention plans, • Create mission and vision statements.

2.2 Creating an Asset Management Team

An **Asset Management Team** is responsible for developing, communicating, implementing, and sustaining the asset management program. A successful asset management program needs commitment from all levels of the municipality. Asset management is not an exercise that can be done independently or by only one department.

KEY TERM	
Asset Management Team	A diverse group of individuals who represent the different interests of the municipality and are responsible for developing, communicating, and implementing the asset management program.

Certain members of the **Asset Management Team** may provide a new perspective to the asset management program. For example, it may be advantageous if the Quality Assurance Supervisor is not part of the development of the asset management program.

Roles should be assigned to individuals who are able to represent the interests of the affected offices or departments. The **Asset Management Team** may also include representatives from operations, engineering, GIS, finance, among others.

The following table shows members of the Asset Management Team; certain Chapters are linked where it is specifically relevant to the role.

Team Member	Responsibilities
Asset Management Executive	Internally: Provides vision; coordinates intra-agency assignments; commits resources. Externally: Interacts with stakeholders; shares results; puts in needs requests.
Asset Management Coordinator	Internally: Coordinates staff assignments; tracks progress; manages meetings; creates, distributes, and reports information from the Asset Management Program (Chapter 7). Externally: Assists Executive as necessary.
Wastewater Operations Manager	Internally: Develops, maintains, and reports information relating to the WWTP. Externally: Assists Coordinator as necessary.
Conveyance Manager	Internally: Develops, maintains, and reports information relating to conveyance. Externally: Assists Coordinator as necessary; communicates with POSS representatives, if applicable.
Fiscal Officer	Internally: Develops, maintains, and reports information relating to the sustainable ownership status of the municipality (Chapter 6). Externally: Assists Executive or Coordinator as necessary.
Quality Assurance Supervisor	Internally: Assures consistency with this Guide; reviews final documentation and ensures consistency across the program. Externally: Not applicable.
Technical Support Officer	Internally: Maintains and updates EAM and GIS software systems (Chapter 3). Externally: Not applicable.

Additionally, if the POTW serves multiple publicly owned sewer systems (POSS) that are owned by different municipalities, POSS Liaison(s) should be included in the Asset Management Team.

The team member roles may have some overlap but should be consistent with the individual's official job duties. While consultants may be hired to assist in development of an asset management program, they are not members of the Asset Management Team.

Toolbox #2 includes an Asset Management Team worksheet to develop the team, identify responsibilities, and record contacts. This toolbox also contains a worksheet with a reference to all asset management program development steps and recommended meetings that follow the steps of this Guide.

The **Asset Management Team** will vary based on the complexity of the municipality. In a small community, the Asset Management Team may consist of only a few people, while a large community may require more representation. Again, roles should be assigned to individuals who are able to represent the interests of the affected offices or departments.

2.3 Staffing

A POTW cannot function without properly trained staff. It is critical to have certified and qualified staff who will fulfill the municipality's commitment to its customers, regulators, and visitors to the community. A staffing plan and organization chart encourage communication and coordination across a municipality. It also ensures a municipality has an adequate number of knowledgeable staff to support the responsibilities of the POTW.

Toolbox #2 includes a template staffing plan and organization chart.

All staff necessary to support the operations, maintenance, and financing of the POTW must be identified in a staffing plan. The Asset Management Team is responsible for developing a representative staffing plan.

The staffing plan should also be incorporated into the asset management program. Certain components of the asset management program may be developed, implemented or enforced by different departments or individuals within the municipal structure. The staffing plan should describe how information will be communicated and coordinated among all responsible parties.

Did you know? Commercially available enterprise asset management (EAM) software includes features that can track staff assignments, work orders, and purchasing.

2.4 Knowledge Retention and Succession Planning

Knowledge retention and succession planning are key aspects of a sustainable asset management program. This is especially important for municipalities with few staff who are responsible for operations and maintenance. A knowledge retention or succession plan recognizes critical staff and expertise and identifies methods to keep this expertise. Institutional knowledge should be documented so that future staff are not starting with limited information and knowledge about the POTW.

The Asset Management Team should identify personnel that have been identified as possessing institutional knowledge. Representatives from the **Asset Management Team** are responsible for developing knowledge retention/succession plans.

Knowledge Retention Plan / Succession Plan	
Name:	
Example	
Title:	**AM Team Member Role:**
Chief Wastewater Operator	Wastewater Operations Manager
Requirements of Title:	
Grade 4A certification and all associated courses, 15 years of experience, 2 years' experience with asset management program and electronic repository	
Action Plan Highlights:	
Provide current assistant operatory with critical knowledge needed to complete position roles and responsibilities. Reduce time spent re-developing job-related processes.	
Plan to be Implemented by (Name, Title):	
Chief Operator	
Targeted Personnel to Serve as Successor (Name, Title):	
Assistant Operator	
Anticipated Outcome:	
Ensure the WWTP has a prepared new Chief Wastewater Operator prior to retirement of current Chief Operator.	
Estimated Time to Implement (Ideal Situation):	
6 months.	
Time Required to Implement:	
1 years.	
Type of Knowledge:	
Hands on experience with WWTP equipment. Software knowledge of asset management repository.	
Useful Resources:	
NYWEA operator training postings and exam resources.	
Steps to Implement Plan:	
1. Ensure assistant operator has up to date and appropriate certifications. 2. Ensure credentials for Asset Management software are given to assistant operator.	

Figure 1. Example of a Knowledge Retention Plan for a Chief Operator.

Existing staffing plans should be used as a reference for starting a knowledge retention plan. A successful asset management program allows for seamless transitions as staff turnover and responsibilities change.

 Toolbox #2 includes a template staffing plan.

Once the initial asset management program is developed, the Asset Management Team should consider creating a process to educate staff about asset management practices that are applicable to the POTW. You may also want to develop a certification program for new and current members of the Asset Management Team so that everyone is up-to-date, informed, and aware of the specifics of your POTW's asset management program.

2.5 Mission and Vision Statements

A mission statement is a short description that outlines the purpose of an organization. It typically defines why it exists, who it exists for, what its goals are, and what service is provided. It is also a tool that leaders can use to express their desires and intentions.

The **Asset Management Team** is responsible for ensuring that the POTW has a mission statement that communicates its purpose and direction as well as a vision statement that identifies the actions the POTW is taking to implement its mission.

KEY TERM	
Mission Statement	Conveys the purpose, focus, and direction of the organization.
Vision Statement	Provides the action that the organization is taking to implement the Mission Statement.

A mission statement is meant to communicate the organization's purpose and direction to its employees, customers, regulators, and other stakeholders. Since a mission statement defines the ongoing purpose and focus of the organization, it does not typically change over time, even as leadership changes.

Most municipalities have mission statements that outline the purpose, focus, and direction of their organizations' efforts. Many municipalities also have mission statements for the various departments that exist within the local government. The example below shows a mission statement for the Town of Tessa's POTW.

EXAMPLE

Mission: We engage in sustainable operations to deliver safe and reliable wastewater services to our customers, including residents, tourists, and businesses to support our Town's vibrant and diverse community.

As the Asset Management Team develops the asset management program, it may decide to revisit its mission statement.

Toolbox #2 includes a worksheet to aid in the development of the POTW's mission and vision statements.

A vision statement is a companion to the mission statement. It shows the actions the organization is taking to implement its mission. It also identifies the organization's goals for growth or self-improvement. The **Asset Management Team** is responsible for ensuring that the POTW has a vision statement that communicates the actions being taken to implement the mission of the POTW.

The following example shows a vision statement for the Town of Tessa.

EXAMPLE

Vision: Implement, refine, and reassess our sustainable delivery of services by engaging staff, residents, customers, and other stakeholders in the goals of our asset management program so that we are always striving to improve.

As the Asset Management Team develops the asset management program, it may decide to revisit its vision statement. Mission and vision statements are effective communication mechanisms and allow a POTW to transparently engage with stakeholders at a high-level. After you have developed a Level of Service Profile (Chapter 4), you may decide to incorporate specific goals into your POTW's mission and vision statements.

2.6 Conclusion

A successful asset management program starts with the **Asset Management Team**. By recruiting a diverse group of individuals from various offices and departments within the municipality, the asset management program should represent the competing demands facing the community. The Asset Management Team should understand the staff, challenges, and overall mission and vision of the POTW and be able to document and communicate this information.

Remember, a pillar of a successful asset management program is "Internal and External Knowledge Sharing." It is important to ensure that all staff who support the wastewater system are kept up-to-date and informed so that everyone is working toward a common goal.

In the next chapter, you will learn how the **Asset Management Team** can develop and assess the asset inventory.

Chapter 3 Electronic Asset Inventories

3.1 Introduction

Municipalities may not be aware of the value, condition, or the extent of the infrastructure that they own and manage. An asset inventory provides a detailed itemization of all the assets that exist within vertical and horizontal infrastructure.

Existing documentation of assets, work orders, drawings, maps, reports, and plans are used to assist the inventory process. Asset information must be collected and retained in an electronic asset inventory. An asset management program is an ongoing process and an electronic inventory allows for immediate updates as new information becomes available. As conditions change within the municipality, the asset inventory should change as well.

Who is involved? The Asset Management Coordinator, Wastewater Operations Manager, Conveyance Manager, Fiscal Officer, and Technical Support Officer may each be involved in documenting the current state of the assets.

CHAPTER HIGHLIGHTS
In this Chapter you'll learn how to… • Define and identify assets, • Select enterprise asset management (EAM) and Geographic Information Systems (GIS) software, • Create an asset inventory, • Establish a process hierarchy, • Determine the condition of each inventoried asset.

3.2 Defining and Organizing Assets

An **asset** is any component necessary to convey or treat wastewater and is specific to each POTW. Assets include equipment, structures, and other components related to the wastewater system, and have independent identities and ages.

KEY TERM	
Asset	Any component necessary for the conveyance or treatment of wastewater.

The asset inventory must include all assets that meet the **Asset Management Team's** definition of an asset and that satisfy one or more of the following criteria:

- Possesses a service life equal to or greater than three (3) years.
- Requires unbudgeted expenditures to replace.
- Provides a safe and healthy work environment.
- Required by Local, State or Federal regulations.
- Requires documented calibrations or inspections.
- Necessary for the supply of electricity.
- Requires special ordering or long lead time.

Toolbox #3 includes a list of questions to help identify assets.

Larger assets might seem like one entity but may need to be considered as separate, individual assets. For example, a pump station is comprised of many assets that influences its operation and need to be considered individually. A pump station includes a structure and a roof, but may also include slide gates, bar screens, pumps, flow meters, sensors, valves, electrical control panels, backflow preventers, and piping. Each of these represent individual assets.

In the pump station drawing below, how many assets do you see?

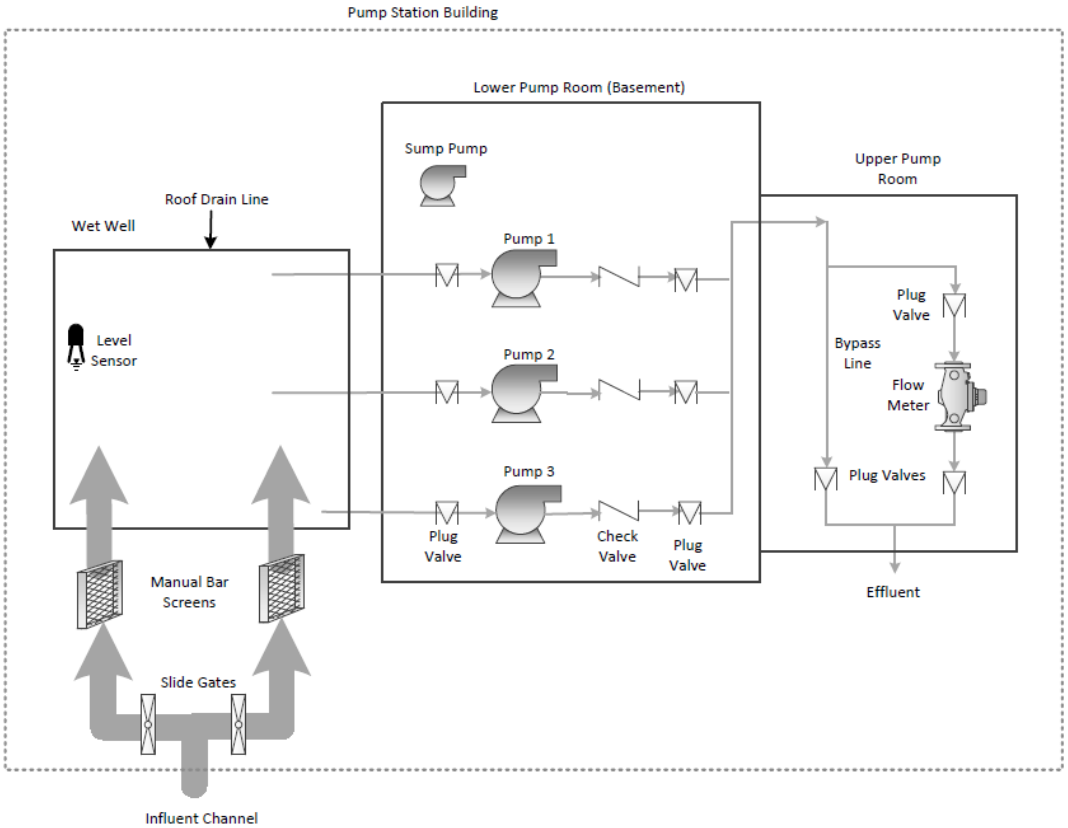


Figure 2: A process diagram for a pump station. Assets related to electrical supply are not shown.

The total number of assets will depend on the **Asset Management Team's** definition of an asset. However, using the criteria provided above, there are at least 30 vertical and horizontal assets depicted in the process diagram.

While the definition of an asset is general, it provides the Asset Management Team with some discretion in the development of the inventory. An **asset inventory** can have several hundred to tens of thousands of assets, so it is critical that the inventory be clearly organized. The table below illustrates the number of assets that may be included in an asset inventory. This table was developed using data from the State's Asset Management Pilot Program and by following the criteria listed above.

Population Served[1]	Miles of Sewer	No. WWTP Assets[2]	No. Collection System Assets	Total No. POTW Assets
2,000	12	300	450	750
15,000	55	1,100	2,600	3,700
30,000	180	2,100	7,900	10,000
100,000	230	2,000	10,000	12,000

As you compare the table to your own POTW, keep in mind that an asset inventory depends on many factors. Although the population served and miles of sewer generally correspond to the total number of POTW assets, there may be outliers.

The asset inventory needs to be organized in such a way that information can be easily retrieved. That means that it is important that each asset receive its own unique identification number. These identification numbers should not be order dependent as it would be difficult to incorporate new assets. When new assets replace old assets, they should receive a new identification number so that all tracking history from the decommissioned asset remain available to POTW staff to inform management strategies and future purchases.

Did you know? Decommissioned assets that are no longer in use may have valuable data that should be retained.

For example, consider a scenario where a pump is due to be replaced. The pump is considered an asset because it has a service life equal to or greater than 3 years. It has an identification number, AS000054, with run-time data and service history. A new pump is purchased to replace it. If the new pump is assigned number AS000054, the associated run-time data and service history for the old asset will be incorrectly associated with the new asset. Alternatively, all that data may be erased so that the new asset starts off with a clean slate. This information can be used to inform future purchases or maintenance procedures, so it is important that it remain available to municipal staff. The new asset should receive a new identification number.

As personnel develop the asset inventory, they may identify additional assets that were previously unknown. Since an asset management program is a dynamic process, these assets should be

[1] Population estimate assumes an individual uses 100 gallons per capita per day.
[2] Total WWTP assets includes pump station assets.

added to the electronic inventory, with unique asset identification numbers, as they are discovered.

When building an asset inventory, organization is key. Relevant resources should be stored in the electronic asset inventory for redundancy, preservation, and ease of reference. All drawings, reports, O&M manuals, and other relevant information should be preserved in an electronic format. This may also be a good opportunity to set aside documents that have been superseded.

The following example shows how folders could be organized to support inventory development.

EXAMPLE

Sam is the Wastewater Operations Manager on the Town's Asset Management Team. The Asset Management Coordinator asked Sam to organize documents related to the POTW. Sam creates electronic folders and identifies the information that should be included in each. Sam's work is shown below:

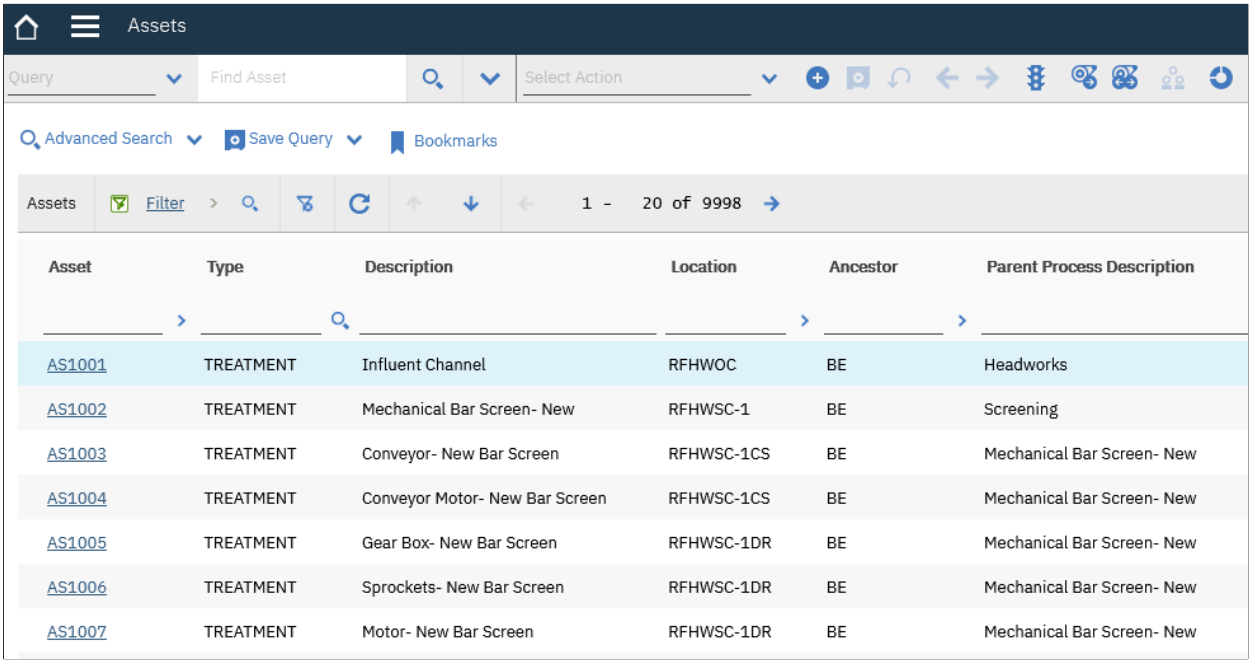
Folders			
WWTP	**Conveyance**	**Pump Station**	**Budgets**
- Historic information - Plans & Specs - Reports - O&M history - O&M manuals - Aerial imagery - Administrative (Staffing, training) - Past work orders - Folders for each process	- Historic information - Plans & Specs - O&M history - Complaint logs - Maps and GIS - Staffing - Reports - As-builts	- Historic information - Plans & Specs - As-builts - O&M history - Staffing - Past work orders	- Past approved budgets - Unplanned expenditures - List of accounts and users - Billing history - CIP history - Current pending projects - Operations cost

3.3 Electronic Databases

The asset management program must be based around an electronic asset inventory so that information can be readily adjusted as circumstances within the municipality change. This Guide consistently references two types of electronic asset inventories that are necessary for a successful asset management program: **enterprise asset management (EAM)** software **and Geographic Information Systems (GIS)** software.

EAM software allows users to manage the entire lifecycle of an asset, from installation to repair to replacement. It integrates work order functions with assets to develop a maintenance history. EAM software supports the pillars of a successful asset management program.

The figure below shows a screenshot from IBM Maximo. Pay attention to the asset numbering (i.e., AS1001, AS1002, etc.) and location/process-location labels (i.e., RFHOC, RFHWSC-1, etc.) as these are discussed later in the chapter.



Asset	Type	Description	Location	Ancestor	Parent Process Description
AS1001	TREATMENT	Influent Channel	RFHWOC	BE	Headworks
AS1002	TREATMENT	Mechanical Bar Screen- New	RFHWSC-1	BE	Screening
AS1003	TREATMENT	Conveyor- New Bar Screen	RFHWSC-1CS	BE	Mechanical Bar Screen- New
AS1004	TREATMENT	Conveyor Motor- New Bar Screen	RFHWSC-1CS	BE	Mechanical Bar Screen- New
AS1005	TREATMENT	Gear Box- New Bar Screen	RFHWSC-1DR	BE	Mechanical Bar Screen- New
AS1006	TREATMENT	Sprockets- New Bar Screen	RFHWSC-1DR	BE	Mechanical Bar Screen- New
AS1007	TREATMENT	Motor- New Bar Screen	RFHWSC-1DR	BE	Mechanical Bar Screen- New

Figure 3. A screenshot of an asset inventory in IBM Maximo, an EAM software.

The selected EAM software must be able to support the asset management program, including staffing and those assets that are associated with **vertical** and **horizontal infrastructure**. Configurations may be necessary to incorporate some of the recommendations in this Guide.

Did you know? Commercially available EAM software allows the user to upload supporting resources directly to the asset! Supported file types include .pdf, .xls, .csv, .txt, .doc, .gif, .jpg, and .ppt.

GIS-based mapping allows users to view assets across spatial distances. Many GIS software options can also be integrated into EAM software. GIS mapping is useful for managing **horizontal assets** that are located at offsite locations relative to the WWTP.

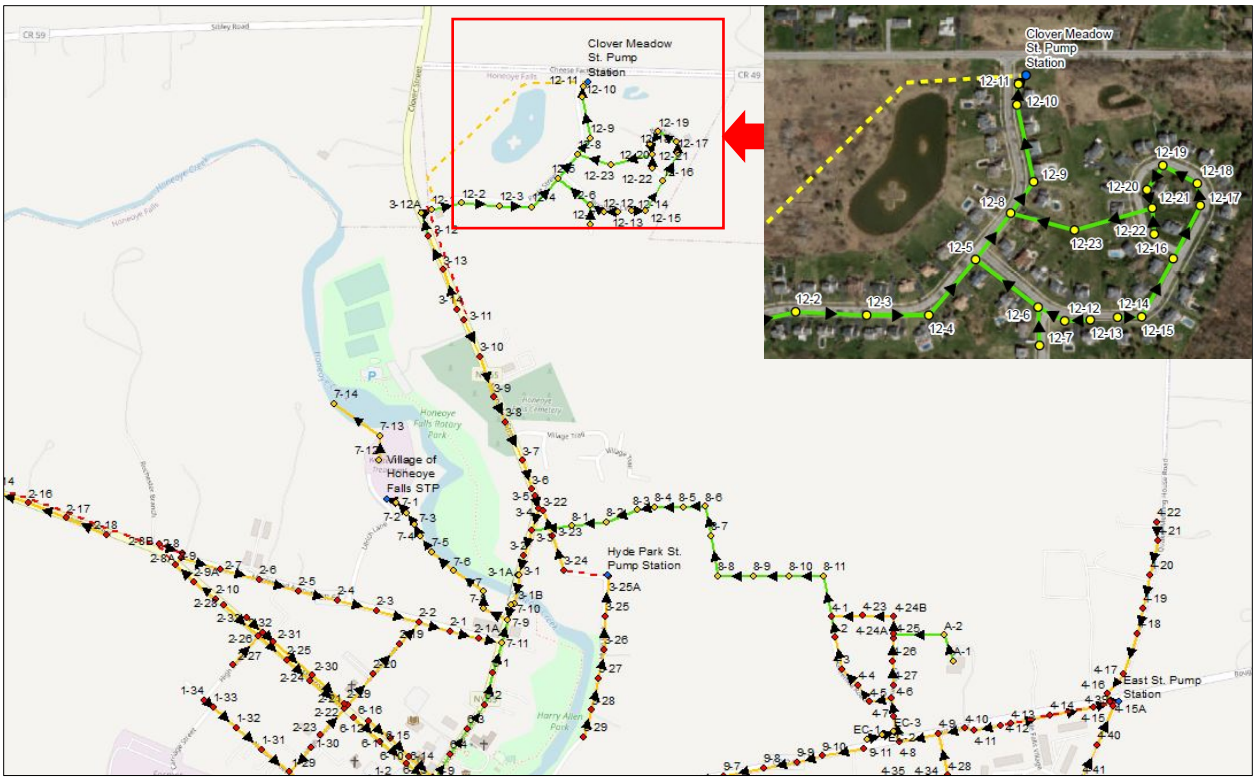


Figure 4. A screenshot of a GIS map in ESRI ArcGIS. This map shows asset condition (green = good, yellow = average, red = poor) throughout the collection system.

The selected GIS software should support the asset management program, including asset details relating to condition, installation date, risk, as well as other attributes.

A resource entitled Geodatabase Specifications outlines the structure of a geodatabase.

3.4 Asset Hierarchy

Assets must be organized in an **asset hierarchy.** An asset hierarchy provides a defined organizational structure and improves a municipality's ability to plan and execute projects. While a POTW can use different hierarchical structures to organize assets, the Guide assumes the hierarchy follows a process-location structure as detailed below.

In a process-location asset hierarchy, high-level processes and locations are assigned their own identifiers. These are typically numeric or alphanumeric values, such as PL00006. This allows municipal staff to easily identify assets that fall under certain processes or locations. Earlier in the chapter, you were introduced to some examples of asset identification numbers, including a pump that was identified by the number AS000054. The asset identification number is different from the process-location identifiers.

Did you know? Most commercially available EAM software use hierarchies to organize assets.

A process-location hierarchy starts with the highest-level process, such as wastewater treatment or conveyance, then subprocesses, such as preliminary and disinfection, and finally, structures or locations. A process-location asset hierarchy should be broken down into a minimum of three process-location levels unless a location is reached earlier.

The levels should use identifiers that allow new levels to be added without affecting the existing hierarchical structure. If you decide to add a new treatment train, you should not need to rename or renumber any of the other process-location levels.

In the following example, the Town of Tessa starts to develop its process-location asset hierarchy.

EXAMPLE

The Town of Tessa owns and operates a POTW, which includes a WWTP, two pump stations, and conveyance system. The Asset Management Team starts to list out the processes and supporting units. The Team decides to define whether the named processes and units are a high-level process, a subprocess, or a location.

<table>
<tr><th>WWTP
(high-level process)</th><th>Pump Stations
(high-level process)</th><th>Conveyance
(high-level process)</th></tr>
<tr><td>Headworks (subprocess)
• Influent Pumping</td><td>PS #1 – Central (location)
• Influent System
• Bypass
• Support Equipment
• Valve Pit</td><td>Manholes (subprocess)
• Manhole 717 (location)</td></tr>
<tr><td>Primary (subprocess)
• Clarifier #1 (location)</td><td rowspan="3">PS #2 – Lake St. (location)
• Influent System
• Bypass
• Support Equipment
• Valve Pit</td><td>Gravity Sewer (subprocess)</td></tr>
<tr><td>Secondary (subprocess)
• Aeration Tank #1 (location)
• Aeration Tank #2 (location)</td><td rowspan="2">Pressure Sewer (subprocess)</td></tr>
<tr><td>Disinfection (subprocess)
• UV Bank #1 (location)</td></tr>
</table>

In the example above, the Asset Management Team identified high-level processes, subprocesses, and locations. You may have noticed that once the Team identified a “location,” it did not continue to identify processes or locations. Once you have concluded the unit has a clearly defined location (e.g., Pump Station #1 – Central), this can be a stopping point for the Process-Location level as demonstrated in the next example.

Now that the Asset Management Team has a list of the major components, it can associate each with process-location identifiers (IDs). In the following example, the Town of Tessa associates the list of major components to process-location levels.

EXAMPLE

The Asset Management Team begins to assign Process-Location Levels and IDs to the high-level processes, subprocesses, and locations.

Process-Location ID	Level 1	Level 2	Level 3
PL00001	WWTP		
PL00001 - 1		Primary	
PL00001 - 1 - 1			Clarifier #1
PL00001 - 2		Secondary	
PL00001 - 2 - 1			Aeration Tank #1
PL00001 - 2 - 2			Aeration Tank #2
PL00001 - 3		Disinfection	
PL00001 - 3 - 1			UV Bank #1
PL00002	Pump Stations		
PL00002 - 1		PS #1 - Central	
PL00002 - 2		PS #2 – Lake St.	
PL00003	Conveyance		
PL00003 - 1		Manholes	
PL00003 - 1 - 2			Manhole 717
PL00003 - 2		Gravity Sewer	
PL00003 - 3		Pressure Sewer	
PL00001 - 3 - 2			*UV Bank #2*

For Level 2 and Level 3 process locations, the proceeding levels are inherited. The Asset Management Team decides to use PL00001 to identify the WWTP. Process-Locations that fall under the WWTP therefore inherit PL00001. The Asset Management Team will be using this organizational structure as it begins to upload the asset inventory to its EAM software system.

After the Process-Location chart is developed, the Wastewater Operations Manager shares that the WWTP is adding another UV Bank to its Disinfection process. The Asset Management Team adds another Process-Location ID, PL00001 - 3 – 2, as a placeholder for the project.

As assets are added to the inventory, they will be associated with the process-location identifiers. For example, as the Asset Management Team inventories assets related to Aeration Tank #2, the assets will be given the same process-location identifier, PL00001 - 2 - 2. As the Team starts to plan projects, it will be able to use this identifier to quickly associate related assets.

 Toolbox #3 includes a template asset hierarchy.

3.5 Asset Inventory Development

Once the electronic inventories are in place and the process-location hierarchy is defined, the **Asset Management Team** can begin to inventory assets. This step requires physically visiting

the assets and recording critical asset-specific information. The inventory must include all **vertical** and **horizontal assets**, including those associated with the WWTP, pump stations, and conveyance system.

A comprehensive inventory helps raise awareness of the value, condition and extent of the infrastructure and forms the basis of an effective management program. This information is critical to the success as it forms the foundation for planning.

The vertical infrastructure is usually the initial focus of most POTWs because they include the most visible assets and receive frequent maintenance. The total number of **vertical assets** is mostly dependent on the complexity and needs of the service area. For example, there will be more assets in a 10 million gallons per day ("MGD") WWTP as compared to a 1 MGD WWTP. If there are permit limits that require additional treatment, such as phosphorus removal, that will increase the number of supporting assets.

The horizontal infrastructure often includes the oldest and most neglected infrastructure. The total number of **horizontal infrastructure assets** is mostly dependent on the size and distribution of the service area. There will be more assets in a service area that spans thirty miles as compared to one that spans two miles.

Did you know? Some providers of EAM software have cloud-based storage options. This means the Asset Management Team can take its program on the go! For some assets, it may be useful to have a mobile device that allows staff to complete the asset inventory while in the field. Information from the asset inventory should ultimately be stored in the electronic systems.

For each asset, certain data such as installation date, serial number, or design life should be recorded to support a complete inventory. The table below shows examples of inventory data for both vertical and horizontal assets and where it might be used.

Inventory Information	Purpose
GPS Coordinates	GIS mapping
Location Description (e.g., cross-streets, building, floor)	Asset identification, resilience
Elevations	Resilience
Ownership	Level of service, capital improvement planning
Physical Qualities (e.g., invert elevation, diameter, depth, material)	Condition scoring, consequence of failure
Replacement Cost	Capital improvement planning
Cost Index Year (i.e., reference year for cost data)	Capital improvement planning
Installation Date	Condition scoring, likelihood of failure
Age	Condition scoring, likelihood of failure
Design Life	Condition scoring, likelihood of failure

Toolbox #3 includes an asset inventory template as well as examples of additional information the Asset Management Team may want to record. This template is not a substitute for the EAM or GIS software.

3.6 Condition Assessment

Depending on the environment, maintenance practices, or frequency of use, assets may experience reduced or extended service lives. A **condition assessment** provides insight into the current state of the assets. The Asset Management Team must *assess* or *assume* condition for each asset in the inventory.

KEY TERM	
Condition Assessment	An investigation of an asset's attributes for indications of damage or deterioration.
Attribute	A specific feature, component, or part of an asset (e.g., enclosure, bearing, cabling).
Classification	A group of assets that share common attributes (e.g., actuators, conventional pumps, generators).

It is important to assess asset condition to understand the **likelihood of failure** and **remaining useful life** to allow for prioritization and planning. In some instances, however, it may be infeasible to assess condition. Therefore, it is acceptable to assume condition as long as it is clear that condition has not been confirmed in the field.

! There is an inherent risk in assuming asset condition and it is recommended that all assets be field verified.

Condition information may prompt municipal staff to take action earlier than expected to avoid potential failures. Conversely, it may provide assurances that certain projects and asset replacements can be delayed.

Each asset in the inventory must have a condition score. The method of assessment may include a physical assessment or an assumed estimate. If you are assuming condition, you may consider factors such as environmental conditions or known materials to make a reasonable determination. Condition scoring must be conducted in a standardized manner that is reproducible and consistent.

Examples of asset classifications include:

- Actuators,
- Conventional pumps,
- Mechanical equipment,
- Fluid measurement equipment,
- Generators,

- Electrical equipment,
- Electrical switchboards,
- Pipes and fittings.

Toolbox #4 provides worksheets for each category that identify the specific features or components (attributes) to consider and a standardized means of assessment and scoring.

For each classification there are specific attributes that need to be considered to determine condition. Attributes include features, components, or parts that can be inspected to evaluate an asset's condition. Often, attributes include mechanisms that can be independently replaced to extend the life of assets.

Once an asset is installed and in use, it will start to experience wear and tear. The type of deterioration an asset experiences will depend on its **classification** and the **attributes** that may be present.

Did you know? EAM software users can track and filter information such as classification, manufacturer, and model/serial numbers.

3.7 Condition Scoring

A clearly defined standardized attribute scoring system reduces the risk of subjective assessments. For this reason, each applicable asset **classification** must have a clearly defined scale that will ensure staff can independently assess condition and reach similar conclusions. The table below shows an example of a defined condition scale.

Description	Score
Good condition with no wear or tear.	1
Some wear and tear, but no significant issues.	3
Damage or lack of intended functionality	5

Industry standard condition protocols, such as those available through the International Organization for Standardization (ISO), may be considered when developing a condition assessment protocol. The number of condition **attributes** will vary based on the asset **classification**. For example, mechanical equipment may have five attributes (surface appearance, structure appearance, vibration/oscillation, temperature, and noise) whereas ferrous pipes and fittings may have two (leaks, surface appearance).

As you will see later in the Guide, each equation that is presented is scored on a 1 – 10 scale. To normalize the condition score to a scale of 1 – 10, the score for each attribute is summed, averaged, and multiplied by 2 as noted in the equation below.

Equation 1
$$\text{Condition Score} = \sum \frac{\text{Attribute Scores}}{\text{Number of Attributes}} \times 2$$

This scoring system provides an objective means of scoring the various assets that can be used to estimate the remaining useful life and assess likelihood of failure and risk in the next chapter. With this information, the Asset Management Team can target rehabilitation or replacement years for capital improvement planning.

Toolbox #4 includes a list of common asset classifications and attributes. It also provides a score sheet that allows the user to develop condition scores for various classifications of assets.

The following example shows a condition assessment for an emergency generator.

EXAMPLE

The Town of Tessa has an emergency generator for its Central Pump Station. Sam performs a condition assessment and uses the standard asset classification for the assessment. Sam determines the emergency generator belongs to the generator classification. The table below shows the results of the assessment.

Generators		
Attributes	Score (1 – 5)	Condition Description
Cabling – Color and Brittleness	1	Coating pliable and providing good insulation protection, some or no minor signs of discoloration
Internal Components – Deterioration/Overheating	1	None or some components showing minor signs of deterioration
Use – Hours Run	3	Less than 10% of lifetime estimate
Protective Enclosure – External Condition/ Cooling /Sealing	1	Coating cracks/flakes, undercoat<20%, Signs of corrosion, seal wear but no dirt entry, fair ventilation

Sum (of all attributes)	**Average** (1-5)	**Asset Condition Score** (multiply average by 2)
6	1.5	3.0

Sam finds that the emergency generator is in good condition. It has a score of **3.0** out of 10.

If any individual component scores poorly, consideration should be given to make improvements, replace the component, or correct the issue. If something is identified that is unsafe during the condition assessment, repairs need to be made as they are identified.

The following sections provide additional guidance for horizontal condition assessments.

3.7.1 Horizontal Assets

The condition of the horizontal assets is often poorly understood. Part of the reason is that often the horizontal assets cannot be easily accessed. Unless smoke testing, dye testing, CCTV inspections, or other technologies are performed routinely, the initial condition will likely need to be assumed or estimated based on the age and material of construction.

! While condition assessments may be assumed, there is an inherent risk in assuming asset condition and it is recommended that all assets be field verified.

When determining an initial condition score based on age, municipalities must use the installation date (known or assumed) and knowledge of previous work conducted. Reviewing installation dates and materials on record drawings can help assign estimated condition assessments. For example, the Conveyance Manager may know that pipe installed by ABC contractor in 1973 was poorly installed and prone to failure, so the Asset Management Team may decide to assume all such pipes are in poor condition.

When assuming condition scores, all pipes in the municipality that possess like characteristics should be scored similarly, unless other underlining conditions are identified. Previous studies and closed-circuit television (CCTV) inspection logs can also help assign condition assessment scores based on noted areas of concern.

While physical inspection of the collection system is not required, there is an inherent risk in assuming asset condition without field verification. Regular inspections as part of a long-term operation and maintenance program will provide a better understanding of current conditions and reduce this risk. As information is gained, the condition scores should be updated.

The **Asset Management Team** should incorporate regular inspections as part of a long-term operation and maintenance program to better understand current conditions.

The **condition scores** will be used to estimate the remaining useful life and assess likelihood of failure and risk in the next chapter. With this information, the Asset Management Team can target rehabilitation or replacement years for capital improvement planning.

Toolbox #4 includes condition scoring sheets for assets associated with the vertical and horizontal infrastructure.

3.7.2 Optional: Condition Scoring with PACP Data

Some municipalities may have performed recent condition assessments using a Pipeline Assessment and Certification Program (PACP) inspection process. A PACP inspection uses a standardized protocol to assess condition. The results can be readily integrated into a calculated condition score.

Toolbox #4 includes a PACP spreadsheet that can be used to estimate the condition of horizontal assets.

The calculation for condition score based on PACP data has not been widely vetted and the process outlined in Toolbox #4 is still considered experimental. Municipalities should carefully review the condition scores and make sure they align with known information.

3.8 Conclusion

The **Asset Management Team** now has a comprehensive list of vertical and horizontal infrastructure assets in the POTW, as well as a standardized condition score for each asset based on its classification. As the municipality acquires new assets and replaces existing assets, the Asset Management Team should update the asset inventory in the electronic repository with this information.

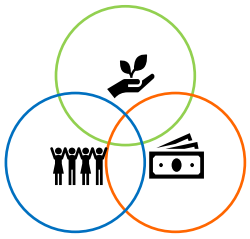
Remember, a pillar of a successful asset management program is to “Continually Improve the Program” so that the information is current.

In the following chapter, you will learn more about the community stakeholders and the expectations those stakeholders may have. Meeting the needs and expectations of those stakeholders is known as level of service.

Chapter 4 Level of Service

4.1 Introduction

Municipalities that own and operate **POTWs** are providing a valuable service to their communities. As with any service, there are stakeholder expectations that need to be considered. It is the responsibility of the municipality to understand and meet the needs of its stakeholders. In terms of asset management, this is known as defining the level of service.



Level of service reflects the values of the municipality and affects how **risk** is evaluated. It represents the intersection of social, environmental, and financial considerations. Services provided by POTWs can be grouped into categories that account for these considerations. These service categories include health and safety, system reliability, regulatory compliance, and fiscal impact. Without a defined level of service, a municipality may not be prepared to meet **stakeholder** expectations. Sewer extensions, WWTP expansions, emergency repairs, and new regulations can impact municipal decisions in different ways.

The economic vitality of a community may be limited if stakeholder expectations are not realized. For example, a municipality that wants to attract investment by installing a sewer extension, may not be able to proceed with the work if the WWTP is flow limited. If adequate capacity is a priority for the municipality, it should be captured in the level of service.

Stakeholders should be aware of the services that will be provided and have an opportunity to inform the direction of focus. This process helps municipalities create and maintain good relationships with those that affect or are affected by the **POTW**. If stakeholders are aware of the municipality's priorities and needs, they will be more understanding of the decisions that are made. However, municipalities similarly need to be accountable to their stakeholders and keep them informed or they will risk losing support.

Who is involved? All members of the Asset Management Team may be involved.

CHAPTER HIGHLIGHTS

In this Chapter you'll learn how to…

- Identify stakeholders and expectations;
- Develop one SMART goal per service category;
- Create tracking and reporting procedures;
- Assign weightings for each service category;
- Complete a Level of Service Profile.

4.2 Level of Service Profile

The Level of Service Profile is an overview of municipal commitments**.** It answers questions about the **POTW** services that are considered priorities, the goals that are measured, and the performance that is delivered.

KEY TERM	
Level of Service Profile	An overview of municipal commitments that relates stakeholder expectations to performance goals.

A complete Level of Service Profile includes the following components:

1. Service Categories – Which services does the municipality prioritize? How are they ranked in order of importance?
2. Stakeholders – Who does the POTW serve?
3. Expectations – What do staff, businesses, and regulators expect? Which services do they value?
4. Goals – How do the stakeholder expectations translate into Specific, Measurable, Attainable, Relevant, and Time-bound (SMART) goals? What is the maximum performance level that is achievable? How is the POTW currently performing?
5. Progress – How are the goals tracked? Where is the information stored? Is the POTW on track to meet its goals? What feedback have the stakeholders provided?

Toolbox #5 includes a blank Level of Service Profile.

The following sections outline how to answer these questions and develop a **Level of Service Profile**.

4.3 Service Categories

Level of service reflects the intersection of social, environmental, and financial interests. These factors affect municipal planning. As municipalities consider projects, they need to balance these interests. In asset management, social, environmental, and financial factors are represented by **service categories**.

Social	**Environmental**	**Financial**
•Health and Safety •System Reliability	•Regulatory Compliance •System Reliability	•Fiscal Impact •System Reliability

These service categories provide a framework for the Level of Service Profile. Depending on the dynamics of the community, municipalities will prioritize these categories differently. As the Asset Management Team develops the Level of Service Profile, members should consider how the

stakeholders affect municipal decisions. The completed **Level of Service Profile** will include percent weightings for each category to prioritize decisions and evaluate asset risk.

4.4 Stakeholders and Expectations

Stakeholders may care about certain services more than others. As the **Asset Management Team** starts to develop the POTW's Level of Service Profile, members should identify their stakeholders and provide each group with an opportunity to provide feedback. Stakeholders that feel heard will be more supportive of municipal decisions and provide better feedback.

The table below shows an example of stakeholders that may make up a municipality and the different ways feedback could be provided:

Stakeholder	Feedback Options
Resident	Complaint line (non-emergency police line and Department of Public Works line), social media, quarterly focus group meetings, Planning Board meetings, open houses
Staff	Quarterly survey, anonymous comment box
Commercial	Bi-annual survey
Industrial	Bi-annual survey
Regulatory	Annual inspections, outreach to DEC

It is important that all voices are heard, not just the loud ones! The Asset Management Team may need to think creatively about different ways to solicit feedback on the expectations of each stakeholder group.

Toolbox #5 includes an example of a stakeholder survey that the Asset Management Team can use to solicit feedback.

Complaints occur when **stakeholder** expectations are not met. Once a municipality understands its stakeholders' expectations, it can start to relate them to the service categories and identify the priorities of the POTW. The table below shows an example of how a municipality may relate the service categories to its stakeholders' expectations:

Service Category	Stakeholder	Expectation
Health and Safety	Staff	Safe work environment.
	Public	No exposure to untreated wastewater.
System Reliability	Staff	Minimal overtime work. Properly functioning equipment. Minimal nuisance factors.
	Public	No service disruptions. No service backups. Minimal nuisance factors.
Regulatory Compliance	DEC	Compliant with SPDES requirements.
	Building Compliance	Compliant with building code.
	Fire Code	Compliant with fire code.
	Public	No fines or penalties. No unnecessary expense. Ensuring environmental protections.
Fiscal Impact	Rate payers (residential, commercial, industrial)	Equitable rate structure. Minimize debt service. Minimize emergency spending.

While municipalities should strive to meet **stakeholder** expectations, there will inevitably be areas that fall short. Municipalities are balancing multiple priorities within their communities, some of which may be in conflict. However, municipalities should be transparent to their stakeholders and indicate the areas of focus. Once the stakeholders are identified and expectations are documented, the Asset Management Team can begin to develop goals for the POTW.

4.5 Goals

For each service category, municipalities must develop goals that are representative of their stakeholders' expectations. There must be at least one goal for each service category so that municipalities can track the performance of their POTWs and ensure consistent delivery of services. Successful asset management programs use Specific, Measurable, Attainable, Relevant, and Time-Bound (SMART) goals.

There are different ways that expectations can be translated into goals. For example, stakeholder complaints may mean an expectation isn't being met. If the **Asset Management Team** can associate a complaint to a **stakeholder** expectation, the complaint may be a good starting point for a goal.

In the following example, the Town of Tessa develops SMART goals for the POTW:

EXAMPLE

The Town of Tessa's Asset Management Team has documented "no service backups" as a stakeholder expectation. It receives customer complaints via email, town hall drop box, and by letter. The Asset Management Team organized the complaints during inventory development and now stores them in an electronic database. The Team notices a large portion of these complaints are sewer backups from the collection system.

Specific

For each service category, stakeholder feedback can provide specific goals. Does the municipality have a tracking system for customer complaints? What is the community saying about the POTW? In this example, stakeholders expect no service backups and have submitted complaints regarding sewer backups. The Asset Management Team uses this complaint as a starting point for a SMART goal.

SMART Goals – Specific	
Vague	**Specific**
Reduce customer service complaints.	Reduce **sewer backup events**.

Measurable

Each goal should provide the municipality with metrics that can be evaluated. Usually, this means there needs to be *something* to evaluate against. The POTW's current performance provides a baseline or starting point to measure progress. In the previous step, the Asset Management Team wants to reduce sewer backup events. Is there a log or work order for tracking the number of sewer backups? What baseline will the Asset Management Team use to measure progress? The number of customer complaints may not represent the number of sewer backup events.

In this case the Asset Management Team has already organized relevant documentation, so the complaints are in a centralized location. If collection methods are not currently in place, the Asset Management Team would need to create a workplan to develop the information.

SMART Goals – Measurable	
Unmeasurable	**Measurable**
Provide reliable wastewater service.	Reduce **the number of** sewer backup events **as compared to the previous fiscal year.**

Attainable

Goals are not meant to be impossible. They may present a challenge, but they should be physically capable of being met. Technology can be a limiting factor and equipment may need to

be rehabilitated, installed, or optimized to meet a specified goal. In the previous step, the Asset Management Team wants to reduce the number of sewer backup events as compared to the previous fiscal year. What is the target value? How many sewer backup events occurred last year? What reduction is attainable, but pushes the POTW to do better?

SMART Goals - Attainable	
Impossible	**Attainable**
Eliminate all sewer backups.	Reduce the number of sewer backup events **by 10%** as compared to the previous fiscal year.

Relevant

Goals should be relevant to the service categories and the stakeholder expectations. Goals are used to track performance and drive projects, so they need to reflect the areas of importance in the POTW. In the previous step, the Asset Management Team continued to build upon its goal to reduce the number of sewer backup events. How does this goal relate to the service categories and stakeholder expectations?

SMART Goals - Relevant	
Irrelevant	**Relevant**
Reduce the number of sewer backup events by 10% to keep complaints down.	Reduce the number of **verified** sewer backup events by 10% as compared to the previous fiscal year. **This is a System Reliability goal to address stakeholder expectations (no service backups).**

Time-Bound

Each goal should be assessed over a specified time period. Without setting a timeframe, goals will have no beginning and no end. Timeframes provide stakeholders with assurances that their concerns are being addressed. In the previous step, the Asset Management Team associated the goal to a service category and a stakeholder expectation. How often will goal progress be assessed? What timeframe will be considered?

SMART Goals - Time-Bound	
Infinite	**Time-Bound**
Reduce the number of sewer backup events by 10% as compared to the previous fiscal year.	Reduce the number of sewer backup events by 10% **per year** as compared to the previous fiscal year. This is a System Reliability goal to address stakeholder expectations (no service backups).

The Asset Management Team now has a goal that is specific, measurable, attainable, relevant, and time-bound - **SMART**.

SMART Goal
Reduce the number of sewer backup events by 10% per year as compared to the previous fiscal year. This is a System Reliability goal to address stakeholder expectations (no service backups).

Goals should not be revised often. If a municipality changes its goals frequently, it may cause stakeholders to question the truthfulness of the information that is reported. Remember, stakeholders that are well informed and feel listened to are more understanding of municipal decisions. If the POTW is struggling to meet a goal, that may present an opportunity to involve stakeholders and find a transparent solution.

Once goals have been set for each of the **service categories**, the Asset Management Team can identify how progress will be tracked and reported.

A complete **Level of Service Profile** includes tracking and reporting procedures that monitor goal progress. This is an opportunity for municipalities to keep their stakeholders informed about successes or failures that may affect them. By tracking progress, municipalities may find that they need to publicly revisit goals or make significant improvements in order to meet the expectations of their stakeholders.

For a complete Level of Service Profile, the **Asset Management Team** should be able to answer the following questions:

1. What information needs to be tracked?
2. Where will this information be stored? How will it be accessed?
3. Who is responsible for gathering this information?
4. Who will be tracking goal performance?
5. Who will be reporting out goal performance? How often will progress be reported?

This information should be documented in the **Level of Service Profile**.

4.6 Setting Priorities

After completing the activities detailed above, the Asset Management Team should have a good understanding of the needs of the POTW. The next step is to assign weightings to each of the service categories that reflect the municipality's priorities. These weightings will affect the way risk is assessed for each asset in the inventory.

The **Asset Management Team** must develop weightings on a percentage basis. It is recommended that the team review the information developed up to this point before setting the

weightings. The Team should consider the goals that were developed and consider the impact to **stakeholders** if certain goals are missed.

For **service categories** with a lot of goals, it may be reasonable to assess a higher weighting. Weightings are meant to focus and highlight the categories that are important to the POTW. The following table shows how a municipality may decide to set the weightings.

Priority Weighting	Service Category	SMART Goal
35%	Health and Safety	There will be zero beach closures due to WWTP operations during our Town's recreation season (April 1 – November 15).
		There will be zero OSHA defined recordable injuries on an annual basis.
30%	System Reliability	Reduce the number of verified sewer backup events by 10% per year as compared to the previous fiscal year.
20%	Regulatory Compliance	The POTW will meet all SPDES permit limits on a quarterly basis.
15%	Fiscal Impact	Overtime hours will be less than 10% of regular hours on a monthly basis. For a 40-hour week, this means no more than 4 additional hours per week or 16 hours per month.
		Operations cost will not exceed allocated budgets by more than 5% each fiscal year.

As alluded to earlier, these weightings factor into the asset **risk** assessment. If certain assets underperform, the POTW may not be able to meet its level of service goals. This will have direct implications for any assets that might affect the SMART goals.

Toolbox #5 can be used to document the priority weightings and complete the Level of Service Profile.

4.7 Conclusion

At this point, the **Asset Management Team** should have a completed **Level of Service Profile**. In the following chapter, the Asset Management Team will apply the results of the Level of Service Profile to the inventoried assets to determine risk and prioritize resources based on their potential impact to the level of service.

Remember, a pillar of a successful asset management program is "Use the Program Frequently" and ensure that it reflects the needs of the stakeholders in the municipality.

Assets that affect the POTWs ability to meet its goals will have a higher risk and will drive capital investments. In the next chapter, you will learn about **consequence** and **likelihood of failure**. Each **asset** will be reviewed and compared to the specified service goals to assess the potential for impacts. Assets that can no longer perform may negatively affect the ability of the POTW to deliver the expected service and may need to be prioritized. This assessment is known as the Risk Analysis.

Chapter 5 Assessing Asset Risk

5.1 Introduction

Municipalities are required to operate and maintain the **POTW** in a manner that protects the public from illness and disease, and the environment from damage and toxic effects. But, when there is so much to do, how should resources be prioritized? An asset risk assessment provides municipalities with a transparent decision-making process that can be used to prioritize work and efficiently manage resources.

In the Guide, **Risk** is the probability of a disruption to the **level of service**. Some assets may require a higher degree of reliability to consistently meet the service goals and, as a result, will have a higher risk score. For example, a municipality that has a goal tied to beach closures may identify assets in the disinfection system as high risk. If those assets experience a decline in performance or failure, the **POTW** may see an increase in beach closures and be unable to meet its service goal.

Other assets may be able to function in a deteriorated condition without significantly impacting service goals and may have a lower risk score as a result. For example, a municipality that has a goal tied to minimal customer service disruptions may identify assets related to sludge processing as lower risk. If those assets experience a decline in performance, they may not affect the ability of the POTW to meet its service goal. For a municipality to complete a risk assessment, it must consider all inventoried assets and assess the potential for impacts.

Who is involved? The Asset Management Coordinator, Wastewater Operations Manager, Conveyance Manager, and Technical Support Specialist may be involved in this task.

CHAPTER HIGHLIGHTS

In this Chapter you'll learn how to…

- Develop an Impact Definition and assess each asset for impacts,
- Calculate the consequence of failure,
- Estimate service life and remaining useful life,
- Calculate the likelihood of failure,
- Determine risk for all assets,
- Identify risk mitigation strategies for high-risk assets.

5.2 Consequence of Failure

Consequence of failure reflects the potential impact to the level of service goals when an asset is unable to meet performance expectations or is unexpectedly taken out of service (i.e., experiences a critical failure). Each inventoried asset must include a consequence of failure score so that critical assets may be identified.

KEY TERM	
Consequence of Failure	The potential impact to the level of service goals if an asset is unable to meet performance expectations or is unexpectedly taken out of service (e.g., critical failure).

Assessing the consequence of failure requires that each asset be reviewed and compared to the service goals in system reliability, health and safety, regulatory compliance, and fiscal impact.

As **assets** serve different purposes, the impacts affect the **level of service** goals in different ways. For example, an inadequately sized pump may have a greater impact on system reliability goals than the other service categories. Alternatively, a broken dissolved oxygen probe may have more implications for regulatory compliance goals.

The amount of redundancy in a system design has significant influence on consequences of failure and should be considered. For example, if the plant has sufficient capacity in secondary clarification to have a tank offline and still handle a wet-weather event, the consequences of a drive failure on one tank are less than if all tanks have to be operational during a peak flow event. However, as redundancy is a regulatory requirement for some parts of the treatment train, missing redundant structures may impact regulatory compliance goals.

The **Asset Management Team** needs to consider these impacts when assessing each asset's consequence of failure.

 Toolbox #6 includes a Consequence of Failure worksheet.

5.2.1 Defining Impacts

Assets will impact service goals in different ways. These impacts will vary from negligible to severe depending on the asset and service goal under review. Before performing an impact assessment, however, it is important that municipalities define what constitutes a Negligible, Low, Moderate, and Severe impact so that the Asset Management Team shares a common reference point.

One way to consider the severity of an impact is to ask, "How long can we be without this asset before we will experience problems? One hour, one day, one week, one month, or perpetually?"

The **Asset Management Team** needs to review the SMART goals for the POTW to develop the impact definitions. These impact definitions reflect the SMART goals that were created in Chapter 4. The table below shows an example of a complete **impact definition** for each **service category**.

Impact Definition					
Scale		**Service Categories**			
Narrative	**Numeric**	**Health & Safety**	**System Reliability**	**Regulatory Compliance**	**Fiscal Impact**
Negligible	1	No potential injuries or adverse health effects.	Can be without asset for 1-month or more.	No violations.	Absorbed within the budget line item. Will not result in overtime.
Low	4	No infectious disease or release of chemicals or contaminants within area. Minor injuries possible.	Cannot be without asset for 1-week.	Violation with no formal enforcement action.	Absorbed within the current budget. Will result in overtime hours.
Moderate	7	Possibility of infectious disease or release of chemical or contaminants. Major injuries possible.	Cannot be without asset for 1-day.	Potential for formal enforcement action with potential fines.	May require transfer from reserves. May exceed maximum allowable overtime hours.
Severe	10	Potential workplace reportable injury due to extreme unsafe conditions.	Cannot be without asset for 1-hour.	Potential for major enforcement action or Consent Decree.	May require new borrowing or impact rates. Exceeds maximum allowable overtime hours.

When using this scale, in-between values (i.e., 2, 3, 5, 6, 8, and 9) should not be used because those numbers are not defined. For example, one person may feel a score of 5 means “Moderate,” whereas someone else may think it means “Low.”

It is also important that individuals with professional knowledge and experience are involved in the impact definition and assessment. Recall that the level of service categories include health & safety, system reliability, regulatory compliance, and fiscal impact. Individuals with professional knowledge and experience working with these categories are responsible for defining and assessing the potential impact to the service goals.

5.2.2 Assessing Impacts

In Chapter 4– Level of Service, the **Asset Management Team** developed service goals for the POTW that were reflective of municipal priorities. Now, each asset needs to be related to these goals and assessed for potential impacts.

Rules of thumb when assessing impacts:

- Consider the most reasonable worst-case scenario,
- Do not consider simultaneous failures,
- Use realistic results,
- Redundancy reduces impact of failures,
- If consensus cannot be reached, err on the high impact side.

This assessment is applicable to both **vertical** and **horizontal infrastructure assets**. However, as the **Asset Management Team** performs its review, members may assess the impacts differently depending on the characteristics of the asset.

The following example is provided to illustrate the deliberation process. The Asset Management Team is not expected to describe its rationale in detail but should follow the criteria included in its Impact Definition.

EXAMPLE

The Asset Management Team is assessing the impacts of several assets including the electrical panel at the Central Pump Station, MH-51, and a segment of pipe between MH-50 and MH-51. Using the agreed-upon Impact Definition, the Team determines the following:

	SMART Goals		
	1. Zero beach closures due to WWTP operations during Town's recreation season (April 1 – November 15). 2. There will be zero OSHA defined recordable injuries on an annual basis.		
	Asset	**Impact**	**Rationale**
Health & Safety	AS0055181 (Electrical Panel)	7	If the asset cannot function, there is a possibility of infectious disease or release of chemical or contaminants that could result in beach closures. Staff who work with the asset need to follow proper health and safety procedures or risk potential recordable injury.
	AS0000874 (MH-51)	4	The asset is located far from beaches, so negligible impact to beach closures. Staff who work with the asset may experience confined space entry, so minor injuries are possible.
	AS0000028 (Sewer MH-50 to MH-51)	1	The asset is located far from beaches, so negligible impact to beach closures. Staff cannot access asset, so no potential for injuries.

System Reliability	**SMART Goals**		
	1. Reduce the number of sewer backup events by 10% per year as compared to the previous fiscal year.		
	Asset	**Impact**	**Rationale**
	AS0055181 (Electrical Panel)	10	Cannot be without asset for 1-hour or will start to see backups.
	AS0000874 (MH-51)	7	Cannot be without asset for 1-day or will start to see backups.
	AS0000028 (Sewer MH-50 to MH-51)	7	Cannot be without asset for 1-day or will start to see backups.
Regulatory Compliance	**SMART Goals**		
	1. The POTW will meet all SPDES permit limits on a quarterly basis.		
	Asset	**Impact**	**Rationale**
	AS0055181 (Electrical Panel)	10	If the asset cannot function, there is potential for major enforcement action or Consent Decree.
	AS0000874 (MH-51)	4	If the asset cannot function, there is potential for permit violations with no formal enforcement action.
	AS0000028 (Sewer MH-50 to MH-51)	4	If the asset cannot function, there is potential for permit violations with no formal enforcement action.
Fiscal Impact	**SMART Goals**		
	1. Overtime hours will be less than 10% of regular hours on a monthly basis. For a 40-hour week, this means no more than 4 additional hours per week or 16 hours per month. 2. Costs will not exceed allocated budgets by more than 5% each fiscal year.		
	Asset	**Impact**	**Rationale**
	AS0055181 (Electrical Panel)	10	If the asset cannot function, there is potential to exceed the maximum allowable overtime hours. It may require transfer from reserves due to emergency condition.
	AS0000874 (MH-51)	4	If the asset cannot function, it may result in overtime hours. Costs will be absorbed within the current budget.
	AS0000028 (Sewer MH-50 to MH-51)	4	If the asset cannot function, it may result in overtime hours. Costs will be absorbed within the current budget.

As the **Asset Management Team** performs the impact assessment, it may find that many assets can be scored similarly. Identifying those assets that have the same impacts can speed up the process and allow for a more efficient review. The Asset Management Team may want to consider using the **GIS software** to evaluate the **horizontal infrastructure assets** systematically.

Did you know? Commercially available mapping tools, such as ESRI ArcGIS, can be used to assess impacts to horizontal infrastructure across spatial distances. Calculations, buffers, and layering tools can help speed up the review.

5.2.3 Scoring Consequence

After the assets have been reviewed for impact, the consequence of failure score can be calculated. Remember that during the Level of Service development, the Asset Management Team assigned priority weightings to each service category to reflect municipal priorities. Those percent weightings are now incorporated into the consequence of failure scoring.

Consequence of failure is calculated according to the equation below.

Equation 2
$\text{Consequence of Failure} = \sum (\text{Impact} \times \text{Priority Weighting})$

Each impact is multiplied by the priority weighting and then summed together to calculate the consequence of failure. As outlined in the introduction, consequence of failure is scored on a 10-point scale.

Toolbox #6 will perform these calculations automatically as information is entered into the spreadsheet.

The following example shows how to score the **consequence of failure** for the Electrical Panel and MH-51.

EXAMPLE

The Asset Management Team is developing the consequence of failure score for the Electrical Panel at the Central Pump Station and MH-51. The Team described its rationale in detail in the previous example and is now putting the pieces together. The Team finds the following:

Asset: AS0055181 (Electrical Panel)	**Level of Service Categories**			
	Health & Safety	**System Reliability**	**Regulatory Compliance**	**Fiscal Impacts**
Percent Weighting	35%	30%	20%	15%
Impact	7	10	10	10
Consequence of Failure (1 – 10)	(7 x 35%) + (10 x 30%) + (10 x 20%) + (10 x 15%)			
	9			

Asset: AS0000874 (MH-51)	Level of Service Categories			
	Health & Safety	System Reliability	Regulatory Compliance	Fiscal Impacts
Percent Weighting	35%	30%	20%	15%
Impact	4	7	4	4
Consequence of Failure (1 – 10)	(4 x 35%) + (7 x 30%) + (4 x 20%) + (4 x 15%)			
	4.9			

The Asset Management Team members discuss the results and agree that they make sense given the inputs. If the results of the consequence of failure scores do not align with what the Asset Management Team would expect, the members may decide to revisit one of the earlier steps to confirm the inputs were correctly developed.

Did you know? Commercially available EAM software can perform these calculations automatically!

The following sections take the **Asset Management Team** through the process of determining likelihood of failure.

5.3 Likelihood of Failure

Likelihood of failure is used to estimate when an asset will no longer be able to perform as required. Once service goals are impacted, the assets are failing to deliver promised services. The likelihood of failure takes into consideration each asset's service life, condition, and remaining useful life. Each inventoried asset must include a likelihood of failure score so that critical assets may be identified.

KEY TERM	
Likelihood of Failure	An estimate of when an asset will no longer be able to perform as required (i.e., when it can no longer meet the level of service goals).
Service Life	Also known as design life. Specified by the manufacturer or estimated based on best professional judgement.
Remaining Useful Life	A calculated value that considers service life, age, and condition.

Likelihood of failure only considers when an asset may negatively impact the **level of service** goals. It is not an assessment of how assets should be managed, such as running to failure or

proactively replacing. Those assessments happen when the Asset Management Team determines the POTW's strategy for operations, which is covered in Chapter 6.

5.3.1 Service Life

An asset's service life is typically estimated by a manufacturer, seller, or distributor. This information can be found in equipment cut-sheets, O&M manuals, design, or manufacturer reports. However, a documented service life may not always be readily available, especially if the asset was installed many years ago. In these cases, the service life should be estimated.

Toolbox #6 includes a list of service life estimates for a variety of asset types. These estimates are based on published research, industry standards, and professional experience. If an asset type is not listed in the worksheet or if there is other information known about the asset, use best professional judgement to estimate service life.

EXAMPLE

Sam is performing a risk assessment of assets that affect the service goal for System Reliability. Sam is currently reviewing horizontal infrastructure assets located on Main Street. Sam has fairly complete records but is missing manufacturer-specified service life estimates for manholes.

Sam refers to the Risk Analysis Toolbox and develops the following information:

Asset Type	Examples	Typical Service Life	Reference
Manhole	Doghouse, influent, process-supportive, collection	75 years	Professional Experience

Sam has seen manufacturers' estimates for new manholes that range between 50 to 100 years. Sam determines 75 years is a reasonable timeframe.

If you decide to estimate the service life by relying on personal experience, make sure to document the decision and explain the reasoning. With good documentation, work can be replicated or recreated later, if necessary.

5.3.2 Remaining Useful Life

One of the fields included in the asset inventory is asset age. However, age alone is not enough to tell how much life remains in an asset. A pump that is a year or two old might sound young, but where is it in its lifespan?

The **remaining useful life** considers age, service life, operating environment, maintenance, quality, and condition to estimate an asset's end of life. Due to environmental or operational conditions, and maintenance, an asset may show reduced performance earlier than anticipated. Conversely, some assets may continue to perform well longer than expected.

There are different ways to estimate the remaining useful life of an asset. The equations outlined in this document and included in the Toolbox #6 assume assets follow a linear deterioration curve, but this is not always the case. Some assets may deteriorate in a non-linear manner, so if you

have manufacturer information or other published studied to rely upon, it may be reasonable to develop a more refined analysis.

Remaining useful life can be calculated according to the following equations:

Equation 3 for Age **≤** Service Life
Remaining Useful Life = ((-0.125 × Condition Score) + 0.75) × Service Life + (Service Life - Age)

Equation 4 for Age **>** Service Life
Remaining Useful Life = ((-0.125 × Condition Score) + 0.75) × Service Life

Did you know? Commercially available EAM software can be configured to perform remaining useful life calculations automatically.

Assets in good condition (scores less than or equal to 5) will see additional years added to the remaining useful life. Assets in fair to poor condition (scores greater than or equal to 6) will see years subtracted from the **remaining useful life**.

EXAMPLE

Sam is continuing to assess risk for the horizontal infrastructure assets located on Main Street. Sam is focusing on two manholes that were installed at different times and have different condition scores. For MH-43, Sam sees that the asset is 45 years old and uses **Equation 3** to determine the remaining useful life. Sam's work is shown in the following table:

AS0000879 (MH-48)	
Service Life	75 years
Age	45 years
Condition	7
Remaining Useful Life	((-0.125 × **7**) + 0.75) × **75** + (**75** - **45**)
	21 years

Due to the asset's condition, MH-43 does not have any additional years added to its remaining useful life. In fact, due to the poor condition score of 7, the asset loses 9 years. Sam moves on to the next manhole.

For MH-51, Sam sees that the asset is 76 years old, which is older than the service life estimate. Sam uses **Equation 4**.

AS0000874 (MH-51)	
Service Life	75 years
Age	76 years
Condition	5
Remaining Useful Life	((-0.125 × 5) + 0.75) × **75**
	9 years

This manhole is in a fair condition. Despite its age, the asset still has 9 years of life remaining.

This example demonstrates the importance of good maintenance. Preventive maintenance can extend an asset's useful life and delay costs associated with asset replacement. As shown in the example, even though the asset is older than its expected service life, as long as it is in fair condition, the analysis shows there is life remaining.

Toolbox #6 will automatically calculate the remaining useful life from the service life, age, and condition.

5.3.3 Likelihood of Failure Scoring

Now that service life and **remaining useful life** have been identified, the Asset Management Team can determine the likelihood of failure. Likelihood of failure is scored on a **10-point scale** and is calculated according to the following equation:

Equation 5

$$\text{Likelihood of failure} = \frac{\text{Service life - Remaining Useful Life}}{\text{Service Life}} \times 10$$

This equation calculates the fraction of life consumed and then brings the value to a common scale. The example below shows the process of developing a likelihood of failure score.

EXAMPLE

The Asset Management Team is developing a likelihood of failure score for the electrical panel at the Central Pump Station. Sam has already determined the service life and remaining useful life. Now, Sam is developing the likelihood of failure score. Sam's work is shown in the table below:

AS0055181 (Electrical Panel)	
Service Life	20 years
Remaining Useful Life	16.5 years
Likelihood of Failure (1-10)	$\frac{20 - 16.5}{20}$ x 10 = **1.75**

The next section brings together the **consequence of failure** and **likelihood of failure** scores to quantify asset **risk**.

5.4 Risk Scoring

Risk is the probability of a disruption to the **level of service**. Risk is determined by considering both the likelihood of failure and the consequence of failure. A comprehensive asset management program uses a standardized risk assessment to allow for project prioritization. Each inventoried asset must include a risk score so that critical assets may be identified.

KEY TERM	
Risk	The probability of a disruption to the level of service.

Risk is scored according to the following equation:

Equation 6
Risk = Likelihood of Failure × Consequence of Failure

Did you know? Commercially available EAM software can be configured to perform risk calculations automatically.

Risk is scored on a **100-point scale**. Assets that are higher risk will have scores closer to 100. Since the Asset Management Team has already developed both the likelihood of failure and consequence of failure scores, they can now calculate the risk scores.

The following example shows how to perform this calculation.

EXAMPLE

Sam is developing risk scores for assets in the Central Pump Station. Sam focuses on the electrical panel. Sam's work is shown in the table below.

Asset	Likelihood of Failure	Consequence of Failure
AS0055181 (Electrical Panel)	1.75	9
Risk Score (1-100)	LOF x COF = 1.75 x 9 = 15.75	

The Asset Management Team should confirm that the risk scores make sense. If the risk seems too high or too low, members of the Asset Management Team may need to double check the inputs and make sure their math is correct.

Toolbox #6 will automatically calculate the risk scores as consequence and likelihood of failure scores are entered.

Once risk scores have been developed, the Asset Management Team can create different types of reports to view and share the information. For example, a visual aid such as a color-coded matrix may be useful if it is presented to the public.

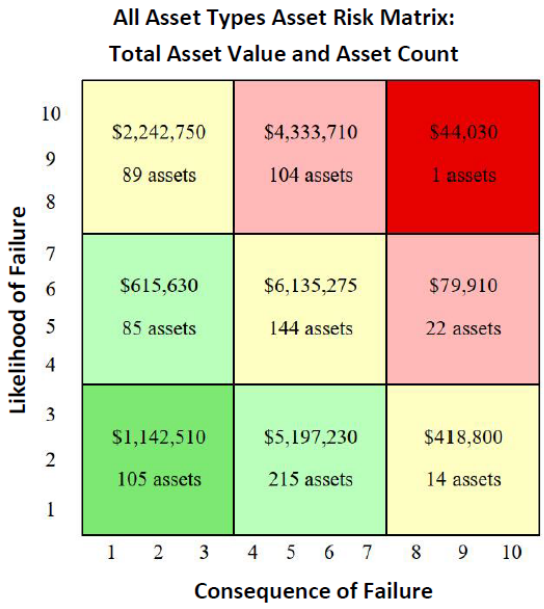


Figure 5. A Risk Matrix for Inventoried Assets from IBM Maximo, an EAM software.

In Figure 5, assets identified in the bottom left corner (bright green) have the lowest **consequence of failure** and **likelihood of failure**, and therefore have the lowest **risk**. Conversely, assets identified in the top right corner (bright red) have the highest **consequence of failure** and **likelihood of failure**, and therefore have the highest **risk**. Due to the age of the collection system, horizontal assets typically have higher risk scores.

Did you know? Commercially available EAM software can generate risk charts or matrices.

If a municipality is planning future projects, a risk matrix may be a useful way to visualize impact. A risk matrix also supports several of the Five Pillars of a successful asset management program – Internal and External Knowledge Sharing, Use the Program Frequently, and Be an Asset Management Champion.

5.5 Mitigating Risk

Risk mitigation involves the identification of specific steps to control or prevent a hazard from causing harm or disrupt service commitments. The goal of risk mitigation is to reduce risk to a tolerable or acceptable level.

For an asset management program to be effective, there needs to be a strategy to mitigate risks when they are identified. The level of risk that is tolerable or acceptable is defined by the municipality and supported by the Level of Service Profile.

For all assets that are identified as high-risk, the Asset Management Team must identify a Risk Mitigation Strategy. In the Guide, an asset is considered high-risk if it has a risk score greater than 60. However, the Asset Management Team may use a different threshold.

A risk mitigation strategy may consist of non-structural (BMPs, inspections, reassessments) or structural (replacement, repair, redundancy) actions depending on the risk tolerance of the municipality. Risk mitigation strategies do not need to be complicated. They can be as simple as inspecting assets more regularly. Alternatively, a more involved strategy may be to develop redundancy by purchasing additional, supporting assets.

The **Asset Management Team** may decide to implement **risk** mitigation strategies for assets that are lower risk but are a concern for other reasons. For example, an asset with a higher likelihood of failure score may need to be checked on more often to make sure the condition has not deteriorated. The Asset Management Team is encouraged to explore different options as it identifies risk mitigation strategies.

Below is an example of risk mitigation strategies for an asset that is lower risk, but that has a high consequence of failure.

EXAMPLE

The Asset Management Team is reviewing risk management strategies for assets at the Maple Road Pump Station. Sam has identified the Electrical Panel, AS0025674, as a high-risk asset because it has a score of 70 out of 100. The following risk mitigation plan has been identified for this asset.

Maple Road Pump Station: Risk Mitigation Plan				
Asset	Strategy	Responsible Person	Time	Cost
Electrical Panel	**Short Term** Install back-up generator. Replace the cover of the panel with a new water-tight cover. Assess condition quarterly.	Sam	30 days to install generator 7 days to install new cover 20 min staff time per quarter	$5,000 for generator $200 for new water-tight cover 20 min staff time per quarter
	Long Term Since Likelihood of Failure is high due to flood risk, asset should be elevated, which will require re-wiring electrical.	Sam	Incorporate into next pump station project.	Needs assessment.

The Asset Management Team has decided to apply three, short-term risk mitigation strategies.

Toolbox #6 includes a spreadsheet to help the Asset Management Team document risk mitigation strategies.

5.6 Conclusion

An asset **risk** assessment provides municipalities with a transparent decision-making process that can be used to prioritize work and efficiently manage resources. At this point, the Asset Management Team should have completed a risk assessment for all assets in the **POTW**. Now, the Team can begin to consider future projects and expenditures.

Remember, a pillar of a successful asset management program is “Be an Asset Management Champion.” This means incorporating the asset management program and results into projects to proactively plan.

In the following chapter, you will learn how to use this information to manage operation and maintenance costs and plan for capital improvements. Effective asset management allows a municipality to make informed decisions regarding POTW investments.

Chapter 6 Planning, Managing, and Funding

6.1 Introduction

Asset management is a tool that allows municipalities to make informed financial decisions about the management of their assets. These decisions require planning capital improvement projects, allocating funds for improvements via operation and maintenance (O&M) budgets, or performing increased **preventive** or **predictive maintenance** activities.

Infrastructure is an expensive investment and is usually built to last – but it won't last forever. Infrastructure planning requires that municipalities consider long-term trends to ensure money is well spent. For example, climate change will affect future design standards. Municipalities may want to consider the impact of design changes when planning investment in the wastewater system.

As a rule of thumb, planned maintenance costs one-third less than unplanned maintenance for the same task[3]. Municipalities that adopt **predictive maintenance** procedures can save their rate-payers money and reduce the risk of emergency conditions. With the supporting information included in an asset management program, decisions can be made transparently.

This Chapter reviews some of the practices that the **Asset Management Team** may use to plan, manage, and fund infrastructure investments.

Who is involved? The Asset Management Coordinator, Wastewater Operations Manager, Conveyance Manager, Fiscal Officer, and Technical Support Specialist may be involved in this task.

CHAPTER HIGHLIGHTS

In this Chapter you'll learn how to…

- Identify current and future flood risk,
- Ensure work orders include all defined maintenance activity fields,
- Create a risk-based Capital Improvement Plan,
- Evaluate sustainable cost of ownership.

6.2 Resilient Infrastructure

As climatic events become more frequent and severe, State and Federal governments are recommending the incorporation of resilience measures to withstand future stressors.

In this Guide, **resilience** refers to the ability of a POTW to return to normal operations in the shortest amount of time. Normal operations mean that the POTW is meeting its service

[3] US Environmental Protection Agency. *Fundamentals of Asset Management Step 7. Optimize Operations & Maintenance (O&M) Investment.*

expectations. An asset may experience an unplanned failure if it is not adequately protected, which could prevent a return to normal operations.

KEY TERM	
Resilience	The ability of a POTW to return to normal operations in the shortest amount of time.
Resilience Class	A descriptive term that reflects the current resilience status of an asset. Examples include Prevention, Protection, or Preparation.

New York State has taken several steps to provide resilience guidance and direction to those taking on new infrastructure projects. The Community Risk and Resiliency Act (CRRA) requires applicants for permits for certain projects to consider future physical risk due to climate change, including but not limited to, risks due to sea level rise, storm surge and flooding.

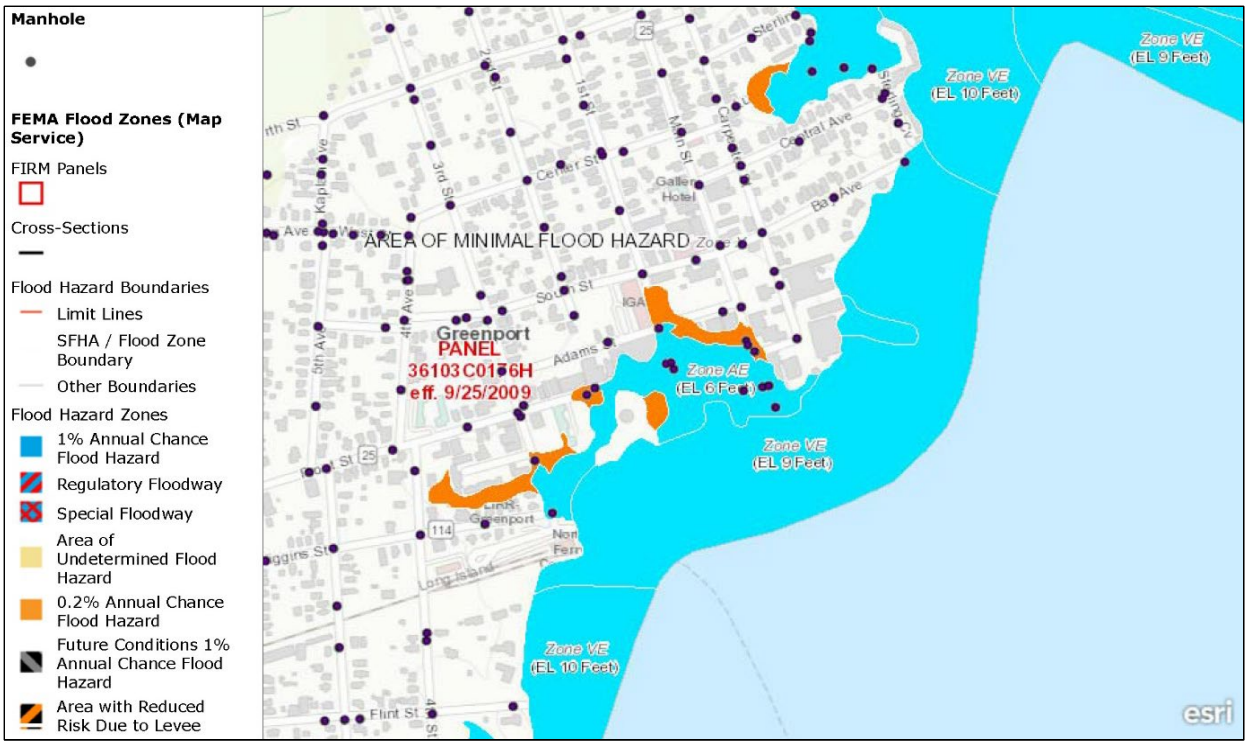


Figure 6. This map shows the location of manholes relative to FEMA Flood Zones.

The *New York State Flood Risk Management Guidance for Implementation of the Community Risk and Resiliency Act (August 2020)* includes recommendations to protect infrastructure. For WWTPs and pump stations, there are specific recommendations for non-critical and critical equipment in tidal and nontidal areas. These recommendations include adding a specific amount of base flood elevation (BFE) to account for projected higher riverine flows or sea level rise, as well as adding additional freeboard.

Did you know? An asset is critical if it is necessary for the conveyance or treatment of wastewater.

CRRA requires consideration of both present and estimated future conditions. The State has published additional supporting resources to estimate future conditions. These include *Estimating Guideline Elevations*, *Using Natural Measures to Reduce the Risk of Flooding and Erosion*, and *Guidance for Consideration of Flood Risk in Smart Growth Public Infrastructure Assessment*.

6 NYCRR Part 490 also established official State sea-level rise projections for tidally influenced geographic areas. For municipalities located in these areas, the projections may be useful for project planning.

A comprehensive asset inventory provides enough information to complete a resilience assessment. However, there may be additional information related to the waterbody that the **Asset Management Team** will need to track down. The following procedure provides some steps to consider in a resilience assessment:

Step 1. Determine whether assets are in a tidal or non-tidal zone.
• Tidal areas include the coastal waters of New York and Long Island, as well as the Hudson River south of the Federal Dam in Troy.
Step 2. Designate assets as critical or non-critical.
• All assets involved in the conveyance or treatment of wastewater are considered critical.
Step 3. Identify a BFE + freeboard and sea-level rise projection based on the asset's location.
• If the BFE is not available on FEMA Flood Insurance Rate Maps (FIRMs) or geodatabases, follow the process as described in *Estimating Guideline Elevations* to determine a BFE.
Step 4. If the asset is in a building, determine building name, building floor description, and finished floor elevation.
• Describe where the information came from (design drawings, field survey, assumption, etc.).
Step 5. Determine the asset's invert elevation or the elevation of the tank. channel top of wall / manhole rim associated with the asset.
• Compare results to flood elevations. • Describe where the information came from (design drawings, field survey, assumption, etc.).
Step 6. Determine applicable strategies.
• Resilience Strategy – What is an ideal strategy that would make the asset resilient? • Interim Resilience Strategy – What is realistically achievable? • Contingency Resilience Strategy – If no strategies can be implemented immediately, what operational or response strategies can be put in place?

Step 7. Assign flood resilience class based on a comparison of the asset elevation and BFE, as well as the existence of applicable strategies.
• Prevention – Asset is already above the BFE and is resilient. • Protection – A barrier or other type of flood proofing in place to protect the asset. • Preparation – An emergency response or contingency operation plan is in place. • None – Nothing being done protect the asset from flood waters.
Step 8. Assign primary failure mode.
• Physical mortality – The asset most likely fails due to age and condition. • Level of Service – The asset most likely fails due to an inability to meet stakeholder expectations. • Efficiency – The asset most likely fails due to decreased efficiency relative to similar assets. • Capacity – The asset most likely fails due to increased demand.

The Federal Emergency Management Agency (FEMA) has an online mapping repository that can be used to view Federal Insurance Rate Maps (FIRMs) to identify vulnerable assets. This link is to the FEMA Map Service Center where the Asset Management Team can enter an address and view available Effective or Preliminary FEMA FIRM Panels or Databases for the area of interest: https://msc.fema.gov/portal/home.

Did you know? Through NYSDEC, municipalities can access hundreds of different GIS mapping tools, including flood zone layers. Visit https://gis.ny.gov/ for more information.

New York State works with FEMA to update the Flood Insurance Rate Maps across the state. Municipalities may contact DEC Floodplain Management Unit if there are questions regarding these maps or to determine if there are any map updates underway.

In the following example, Sam follows the steps described above to perform a resilience assessment.

EXAMPLE

Sam is completing a resilience assessment of several assets, including an electrical panel at the Central Pump Station and MH-43. Sam determines the following:

Step 1. Determine whether assets are in a tidal or non-tidal zone.
• The POTW is in a nontidal area.
Step 2. Designate assets as critical or non-critical.
• The electrical panel and MH-43 are both necessary for the conveyance or treatment of wastewater. They are critical assets.
Step 3. Identify a BFE + freeboard and sea-level rise projection based on the asset's location.
• The electrical panel is located in a 100-year floodplain. The BFE is 900 feet. The BFE + freeboard is 903 feet. • MH-43 is not currently located in a floodplain. Per the procedures in *Estimating Guideline Elevations*, MH-43 is also not in a future floodplain. There is no applicable BFE.

Step 4. If the asset is in a building, determine building name, building floor description, and finished floor elevation.
• The electrical panel is located in the Central Pump Station on the first floor. The grade of the finished floor is 900 feet. This was collected as part of the inventory development.
Step 5. Determine the asset's invert elevation or the elevation of the tank. channel top of wall / manhole rim associated with the asset.
• The bottom of the electrical panel is 902 feet. It is short of the recommended elevation for critical assets (BFE + 3 feet). This was collected as part of the inventory development.
Step 6. Determine applicable strategies.

• Electrical Panel
  ○ Resilience Strategy – Elevate asset to 903 feet (BFE + 3 feet) to make resilient.
  ○ Interim Resilience Strategy – Protect asset through constructed barrier.
  ○ Contingency Resilience Strategy – Emergency response plan outlines operating procedures during a flood event.

Step 7. Assign flood resilience class based on a comparison of the asset elevation and BFE, as well as the existence of applicable strategies.
• Electrical Panel   ○ Preparation – An emergency response or contingency operation plan is in place.
Step 8. Assign primary failure mode.
• Electrical Panel   ○ Physical mortality – The asset is most likely to fail due to its elevation.

The electrical panel, which is a critical asset in a 100-year floodplain, is currently managed under a Contingency Resilience Strategy. Sam identifies that the POTW is using a Preparation framework and will follow an emergency response in the event of a flood.

Once potentially vulnerable assets have been identified, the Asset Management Team can start to plan out **resilience** measures. Resilience projects can include short-term or long-term measures. For example, if a pump station is located in a flood-prone area, a short-term or Interim Resilience Strategy may include purchasing sandbags to protect the pump station during storm events. A long-term or Resilience Strategy may include elevating vulnerable assets.

In the example, Sam may recommend that the municipality adopt a different management approach and incorporate a Resilience Strategy in a planned or future project at the Central Pump Station. Since the electrical panel is only one-foot short of the recommended elevation, it may be relatively easy to make a change so that it is in the *Prevention* Resilience Class.

6.3 Managing and Maintaining Assets

A key aspect of an asset management program is creating, executing, and tracking maintenance activities. This process allows a municipality to see the **total lifecycle cost** of operating and maintaining a POTW. O&M activities are not limited to only routine tasks; they encompass routine, preventive, predictive, and corrective work.

KEY TERM	
Routine Maintenance	The normal support, periodic and minor in nature, required to sustain performance and *achieve* expected life. Example: Check the oil level.
Preventive Maintenance	The servicing performed in order to reduce the likelihood of failure and *extend* expected life. Example: Changing a car's oil every 4,000 miles.
Predictive Maintenance	Performing maintenance activities based on measured conditions. Example: Change the oil after an oil sample shows deterioration.
Corrective Maintenance	Unplanned or unanticipated work, usually emergency. Example: Replacing the engine gaskets because the engine overheated from poor oil conditions.

It is important to understand the difference between the types of maintenance activities and the way each may impact the level of service. If a municipality chooses to only provide **routine** and **corrective maintenance** activities, it may be providing a reduced level of service in one or more of the service categories. Municipalities should balance the types of O&M activities they engage in to ensure they are delivering the expected level of service.

The work order is a standardized method of tracking asset maintenance. They should be used when performing any maintenance activity, whether it is **routine**, **preventive**, **predictive**, or **corrective**. In the short-term, work orders include detailed information that helps assigned staff to complete the task. In the long-term, work orders provide a history of the labor and materials required to maintain an asset. This information can be used to assess the total cost of asset ownership.

A work order should include standardized fields to collect specific information about the maintenance activity. A work order should include, at a minimum, the following:

- Procedures to be followed to complete the maintenance activity,
- Planned and unplanned maintenance costs,
- Estimated and actual labor and material costs,
- Maintenance type (routine, preventive, predictive, corrective).

In an **EAM** software system, work orders are typically tracked against a specific asset so the asset's history can be easily recorded and reviewed. Work orders should be periodically reviewed to inform trends and indicate performance relative to the level of service goals.

Did you know? EAM software has built-in work order tracking to create an integrated system. This is a pillar of a successful asset management program.

EXAMPLE

Sam is using the municipality's EAM software to review all work orders that involved **corrective maintenance** over the past year. Sam finds the following:

Date	Asset	Issue	Corrective Action
1/5/19	MH-51	Backup complaint.	Grease ball, jetted and vacuumed the line.
3/10/19	MH-51	Backup complaint.	Grease ball, jetted and vacuumed the line.
4/25/19	MH-51, Sewer MH-50 to MH-51	Backup complaint.	Grease ball, jetted and vacuumed the line, noticed influent pipe slightly out of alignment.
7/8/19	RAS Valve	Won't close.	Fixed valve.
8/5/19	MH-51, Sewer MH-50 to MH-51	Backup complaint.	Grease ball, jetted line, noticed influent pipe slightly out of alignment.
8/6/19	Standby Blower	Bearing failure on start-up.	Replaced bearing.
11/20/19	MH-51, Sewer MH-50 to MH-51	Backup complaint.	Grease ball, jetted line, pipe moderately out of alignment.

Sam notices there have been five corrective maintenance activities associated with a single manhole, MH-51. It also appears that the sewer line between MH-50 to MH-51 is affected. If Sam looks back further, Sam may find that these issues have been going on for far longer.

While the asset inventory includes replacement cost, other costs should be captured as well. If they aren't being tracked, O&M, repair, or rehabilitation costs can easily cause budgeting issues.

As discussed earlier, work orders allow municipalities to track real-time O&M expenditures. Work orders should capture staff time, salaries and benefits, equipment, and materials to accurately represent the cost associated with the operation of the **POTW**.

The next example shows how O&M history can be used to determine areas that need improvement.

EXAMPLE

Sam decides to look closer at the O&M history for MH-51 and Sewer MH-50 to MH-51 to understand the labor hours and costs associated with the corrective maintenance work.

MH-51, Sewer MH-50 to MH-51			
Date	**Time (minutes)**	**Materials & Labor**	**Cost**
1/5/19	120	Jet truck, two staff	$100
3/10/19	60		$50
4/25/19	120		$150 (Overtime)
8/5/19	120	Jet truck, two staff, replaced nozzle	$100 + $500 (nozzle)
11/20/19	180	Jet truck, two staff	$225 (Overtime)
Total Labor	**600**	-	**$625**
Total	**600**	-	**$1,125**

Sam should review the level of service goals and assess the impact of ongoing corrective maintenance for these assets. It may be time to start planning a project for repair, rehabilitation, or replacement.

Rehabilitation costs should be estimated based on experience with manufacturers and equipment repair service charges. If rehabilitation cost is not known, the **Asset Management Team** may assume a cost based off another known cost, such as 25% of the replacement cost.

This information can be incorporated into the **Capital Improvement Plan**.

6.3.1 Preventive Maintenance Programs

Creating and implementing a defined preventive maintenance program has many benefits. Extending the useful life of an asset and reducing the asset's lifecycle cost are benefits that are easily understood and quantified.

KEY TERM	
Preventive Maintenance Program	A regularly scheduled maintenance event with reporting and documentation following the event.
Key Performance Indicator (KPI)	A quantifiable measure used to evaluate the success rate in meeting performance objectives.

Although you can often assume experienced staff will know when to check and service specific assets, without a formal schedule in place – what happens when that person leaves suddenly or becomes sick and unable to work? How will the person taking over know what to do if there is no plan in place?

When creating a **preventive maintenance** program, it is important to:

- Define the work to be completed, including the equipment and materials needed, as well as an estimated completion time.
- Assign the work to specific assets (many assets may need the same/similar preventive maintenance completed).
- Set up a scheduling parameter to trigger the work to be completed on a specific asset. This could be calendar based, usage based, time based, condition based or even based on the asset's consequence of failure.

In the following example, Sam develops a preventive maintenance program for MH-51.

EXAMPLE

Sam has identified that MH-51 and the sewer line between MH-50 and MH-51 has had many reactive maintenance activities. Sam wants to reduce unplanned or unscheduled work associated with these assets, so develops the following preventive maintenance job plan for MH-51:

Task #	Description	Duration	Materials
5	Set up safe work area (i.e., cones)	30 min	Cones, truck
10	Test for gas	<5 min	PID
20	Remove cover	5 min	Manhole key, manhole cover lift
30	Observe flow	<5 min	Stopwatch
40	Examine structural features of sewer line, interior of manhole, manhole frame and cover, etc.	5 min	-
50	Clean work area and remove all debris	15 min	Trash bag

Since complaints have come in at least once a quarter, Sam decides that the preventive maintenance activity should occur quarterly.

It is worth noting that preventive maintenance programs are meant to address equipment failures *before* they occur. For example, you should be sure to replace a wear plate in a pump before it wears through and starts causing additional damage to the pump casing.

Key performance indicators for a well-executed preventive maintenance program include:

1. Compliance with the preventive maintenance schedule,
2. Accuracy in preventive maintenance task completion (accurate estimates of labor, materials and other resources – helps in scheduling),
3. Timeliness of work completion based on the preventive maintenance schedule,
4. Results of the preventive maintenance program (reduction in reactive work, extension of an assets useful life and therefore capital investment, etc.

Over the long term, as the **preventive maintenance** program continues to be implemented, it can be optimized to best save the POTW time and money.

Without a formal preventive maintenance program in place, a **POTW** can get caught in a perpetual cycle of unscheduled breakdowns, reactive maintenance work, and premature asset failure.

6.3.2 Planned and Predictive Maintenance Programs [Reserved]

6.4 Capital Improvement Plan

A **capital improvement plan** (CIP) is a multi-year projection of potential projects and their estimated costs. CIPs can reflect short-term or long-term projection periods. A short-term CIP is typically a 5 to 10-year projection and should accurately reflect potential projects and their costs. A long-term CIP may forecast 10 or more years into the future.

KEY TERM	
Capital Improvement Plan	A multi-year projection of potential projects and their estimated costs.

While the costs associated with long-term CIPs may not be accurate, they can still be powerful planning tools. A long-term CIP must be risk-based and project far enough into the future to capture the lifespan of most of the assets in the asset inventory. In the Guide and Toolboxes, a 25-year projection period is recommended at a minimum. Within this timeframe, it is likely that many assets will need to be replaced at least once, with some exceptions.

When developing a CIP, the Asset Management Team may consider separating the vertical and horizontal infrastructure assets. Since horizontal infrastructure is often much older than the vertical infrastructure in many municipalities across New York State, it can sometimes overshadow other projects.

 Toolbox #7 is an Excel-based Capital Improvement Plan model.

The CIP must include all assets in the **asset inventory**. The CIP should distinguish the budgets that will be used to manage asset investment. The Asset Management Team should identify whether an asset will be repaired, rehabilitated, or replaced utilizing existing O&M budgets or if new financing for projects will be necessary.

For POTW's with collection systems, a portion of the CIP budget should be allocated to investigating and replacing horizontal assets that are past their remaining useful life and are in poor condition.

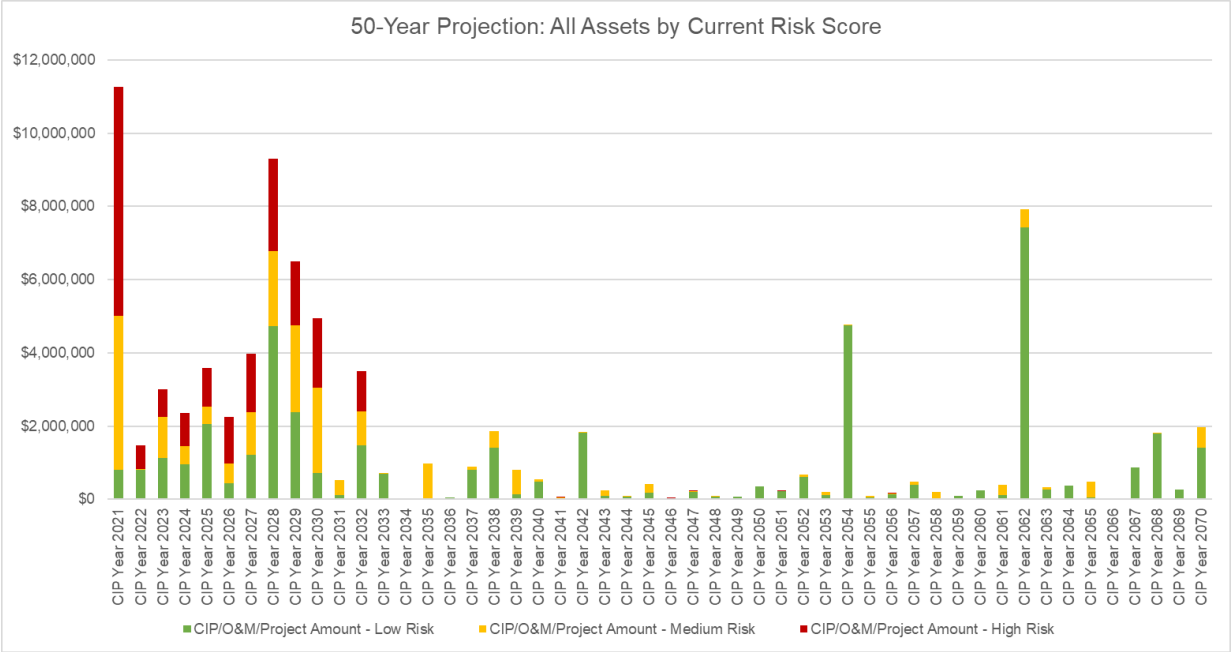


Figure 7. A graphical representation of asset risk, cost, and CIP year from Toolbox #6.

As discussed earlier, if a CIP is under development, a municipality may want to consider incorporating resilience measures. Many POTWs may be at risk of flooding due to the increased frequency of climatic events. As long-term capital improvement projects are identified, it is important to consider making these assets more resilient or incorporating other mechanisms to protect them.

For example, a municipality may consider a relocation project for a pump station that regularly floods and has reached the end of its useful life. Alternatively, the municipality may instead consider elevating assets to prevent flooding or premature failure.

Similarly, if flooding is a concern, but a large capital investment is not projected or the potential relocation of assets is not feasible, a resilience project could be added to the CIP to elevate or barricade assets to mitigate potential damage due to flooding.

Toolbox #7 can also be used to help identify resilience projects.

6.5 Sustainable Ownership and Funding Strategies

By owning and operating a POTW, municipalities are providing a service. As with any service, there are costs that need to be considered now and in the future. When assessing service costs, municipalities need to consider a lot of factors including current debt service, ongoing maintenance, and future projects. Once these factors are understood, municipalities should set rates that allow them to recoup the costs of ownership. Sustainable ownership should be a goal that municipalities are striving towards. Each municipality must review its sustainable ownership status.

Did you know? Commercially available EAM software often includes integrated purchasing and billing features to help track income and expenditures.

A sustainably owned and operated POTW means that rates are a sufficient and stable source of funds. Charging for the full cost of delivering the expected level of service will ensure the **POTW** is able to provide the service now and in the future. As an added benefit, being transparent about the cost of ownership allows **stakeholders** to understand the value of the service and may cause some to become more mindful about their expectations.

The **Asset Management Team** can follow these steps to assess whether the POTW is operating sustainably:

Step 1. Determine current costs.
• This may include debt service, O&M, CIP, personnel, and other potential costs specific to the municipality.
Step 2. Determine current revenues.
• This may include current rates, interest, subsidy, transfer payments, and other sources of income.
Step 3. Set aside a reserve.
• Money should be set aside every year. • The exact amount should be informed by the 5-year CIP.
Step 4. Determine required revenue.
• Once current costs, current revenues, and a target reserve are identified, the required revenue can be determined. • The required revenue should be revisited on an annual basis.
Step 5. Identify cost-covering rates.
• Each municipality may have different local, county, or state restrictions that need to be considered when setting rates. • Consider rate stability, rate predictability, number of customers, customer classes, usages, and customer needs.
Step 6. Consider implementing rate changes.
• Before making changes to rates, consideration should be given to several factors including public perception, regulatory requirements, and ease of rate administration. • Providing transparent rationale can help customers understand the needs of the POTW.
Step 7. Review rates annually.
• Ideally, rates, structure, and setting procedures should be reviewed on an annual basis. • A coordinated review by a third party can help maintain transparency.

Toolbox #8 includes a sewer rate model that municipalities can use to determine sustainable ownership status.

A municipality that is undertaking a significant capital project may be eligible for financial assistance. It is important that municipalities understand their demographics (median household income, population and geographic location) and their qualifying funding programs.

Currently, there are many funding programs that are focused on POTW infrastructure, including:

- **DEC:** New York Water Quality Improvement Project Program (WQIP) Grants
- **DEC & EFC:** New York Wastewater Infrastructure Engineering Planning Grant (EPG)
- **EFC:** New York Clean Water State Revolving Fund (CWSRF)
- **EFC:** New York Integrated Solutions Construction (ISC) Grant Program
- **EFC:** New York Green Innovation Grant Program (GIGP)
- **CoBank:** Rural Water and Wastewater Lending
- **New York Department of State (DOS):** New York Local Government Efficiency (LGe) Grant Program
- **Northern Border Regional Commission (NBRC):** Northern Border Regional Commission Area Development Fund
- **New York State Office of Homes and Community Renewal (NYOHCR):** New York Community Development Block Grant (CDBG) Program - Small Cities
- **U.S. Department of Agriculture (USDA) Rural Utility Service (RUS):** New York Community Facilities Direct Loan & Grant Program
- **U.S. Department of Agriculture (USDA) Rural Utility Service (RUS):** New York Water & Waste Disposal Loan & Grant Program

EPA's **Water Finance Clearinghouse** is also a good resource for up-to-date funding opportunities.

6.6 Conclusion

Asset management is a tool that allows municipalities to make informed financial decisions about the management of their assets. At this point, you should understand the importance of tracking O&M activities; the process of developing a risk-based CIP model; and, the factors that should be considered when analyzing the sustainability of the services provided by the POTW.

Remember, a pillar of a successful asset management program is to "Integrate the System" so that information is shared throughout the municipality and can be incorporated into the work performed by different departments.

With the supporting information included in an **asset management program**, decisions can be made transparently.

Chapter 7 Implementation and Reporting

7.1 Introduction

All municipal staff who work with the **POTW** play a role in the implementation of an **asset management program**. This includes elected officials, financial personnel, and the staff who work with vertical and horizontal infrastructure. In this Chapter, the **Asset Management Team** will explore how to work with the asset management program after development.

Who is involved? All members of the Asset Management Team may participate.

CHAPTER HIGHLIGHTS

In this Chapter you'll learn how to…

- Document decisions in an Asset Management Report,
- Report to stakeholders annually.

7.2 Asset Management Plan

By following the examples, completing Toolbox items, and utilizing the **EAM** and **GIS** software, the Asset Management Team has created a lasting program that will exist long after elected officials change and staff turnover. As there are so many variables at play in an asset management program, the decisions made during program development must be documented in an asset management plan.

The **asset management plan** is an overview of the decisions made by the Asset Management Team as it developed the asset management program. For example, in Chapter 3 you may have decided to follow a different condition scale than what was included in the Guide. Since others will take over the management of the asset management program in the future, you should document this decision so that new staff know why it was important to use a different process.

The Asset Management Team must document these decisions and rationale in an asset management plan.

Updating information, such as asset condition, may affect other areas of the asset management program. The **Asset Management Team** should revisit the program on a regular basis and periodically update the asset management plan to reflect the current status of the **POTW**.

An asset management plan can also be used as an internal training tool. The Asset Management Team may consider sharing the **asset management plan** with other municipal staff and officials to further support financial decisions and ideas.

A resource entitled Asset Management Plan has been made available for reference and use.

As new **assets** are purchased, old **assets** are decommissioned, new staff arrive, and new goals are set, the Asset Management Toolbox items should be reviewed and updated. Routine review helps keep the asset management program up to date and useful.

The challenges facing POTWs are constantly evolving as new issues emerge. It is important that POTWs run as efficiently as possible so that municipalities can make the most of financial and staffing resources.

Continuous improvement includes:

- System improvements based on new permitting and regulations,
- Updating the asset inventory as new equipment is acquired and old equipment is decommissioned,
- Regular assessment of asset condition over time,
- Determining asset data gaps and refining asset inventory data,
- Tracking work orders and executing O&M activities,
- Reviewing level of service goals,
- Educating and involving new staff and the community.

Toolbox #9 includes a list of tasks, recommended frequencies, and relevant references.

7.3 Integrating Operation & Maintenance Practices [Reserved]

7.4 Public Outreach and Education

An **asset management program** adds transparency to a municipality's decision-making process. An annual report is an opportunity to communicate to stakeholders, highlight successes, and identify priorities for the coming year. This report may take the shape of a document, presentation, or other media. There are many ways that the Asset Management Team can communicate results to stakeholders. Websites, mailers, and public meetings are just some examples of communication tools.

The annual report should contain specific elements. These include:

- Narrative description of POTW, regulator identification numbers (e.g. SPDES), and receiving waterbody (if applicable),
- Map of service area,
- List of Asset Management Team members,
- Level of Service goals,
- Comparison of operations and preventive maintenance costs,
- Current income, revenue, deficit, and summary of present financial status,
- List of assets with risk scores greater than 60,
- Planned capital improvement plan activities for a 5-year period.

Resources, including a template Annual Report, Alternative Annual Report, and Outreach Meeting, have been made available for reference and use.

7.5 Conclusion

Congratulations! You now have the tools and knowledge to begin development and implementation of an **asset management program** for your municipality's POTW. While this Guide solely focuses on the wastewater sector in a municipality, application of **asset management** is far reaching. Similar practices can be applied to drinking water, stormwater, or even transportation departments.

Ensure the **asset management program** is successful by advocating for proactive approaches throughout the municipality. While the potential projects may seem daunting, there is no better time to begin investing in your community than now.

Resource Quick Reference

1. **Chapter 1: Introduction to Asset Management**
    a. Toolbox #1 (Excel)
    b. Asset Management IQ Test (PDF)
2. **Chapter 2: Asset Management Team, Staffing, Succession**
    a. Toolbox #2 (Excel)
    b. Blank Knowledge Retention / Staffing Plan (Word)
3. **Chapter 3: Current State of the Assets**
    a. Toolbox #3 (Excel)
    b. Example Geodatabase Specifications (PDF)
    c. Toolbox #4 (Excel)
4. **Chapter 4: Level of Service**
    a. Toolbox #5 (Excel)
    b. Level of Service Workshop (PowerPoint)
5. **Chapter 5: Risk Analysis**
    a. Toolbox #6 (Excel)
6. **Chapter 6: Planning, Managing, and Funding**
    a. Toolbox #7 (Excel)
    b. Example Capital Improvement Plan (Excel)
    c. Toolbox #8 (Excel)
    d. Example Simple Rate Analysis (Excel)
    e. Example Advanced Rate Analysis (Excel)
7. **Chapter 7: Implementation and Reporting**
    a. Toolbox #9 (Excel)
    b. Asset Management Plan (Word)
    c. Annual Report (Word)
    d. Alternative Annual Report (Publisher)
    e. Outreach Meeting (PowerPoint)

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14. *Municipal Sewage System Asset Management*, New York State Department of Environmental Conservation, https://www.dec.ny.gov/chemical/101412.html

15. *NYS GIS Clearing House*, New York State Information Technology Services, https://gis.ny.gov/.

16. *NYWEA Asset Management Task Force White Paper*, New York Water Environment Association, April 2014, https://www.nywea.org.

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Definitions

Asset - Any component necessary for the conveyance or treatment of wastewater.

Asset Hierarchy - A defined structure to organize and group assets.

Asset Inventory - A list of assets with details about each one (installation date, original cost, condition, and such). Also known as an asset register.

Asset Management - A process to help people decide how, where, and when to spend money to achieve a result.

Asset Management Plan - An overview of the decisions made by the Asset Management Team in development of the asset management program.

Asset Management Program - A process to ensure assets are properly operated and maintained. For a POTW, it consists of an asset inventory, condition assessment, level of service profile, likelihood of failure, consequence of failure, risk assessment, capital improvement plans, sustainable ownership assessment, and maintenance planning.

Asset Management Team - A diverse group of individuals who represent the different interests of the municipality and are responsible for developing, communicating, and implementing the asset management program.

Attributes - A specific feature, component, or part of an asset (e.g., enclosure, bearing, cabling). See also **Condition Assessment.**

Capital Improvement Plan - A multi-year projection of potential projects and their estimated costs.

Classification - A group of assets that share common attributes (e.g., actuators, conventional pumps, generators).

Condition Assessment - An investigation of an asset's attributes for indications of damage or deterioration.

Consequence of Failure - The potential impact to the level of service goals if an asset is unable to meet performance expectations or is unexpectedly taken out of service (e.g., critical failure).

Corrective Maintenance - Unplanned or unanticipated work, usually emergency.

Critical Asset - Assets with consequence of failure scores greater than six.

Enterprise Asset Management Software - An electronic database that handles every aspect of running a public works or asset-intensive organization.

Geographic Information Systems - An electronic database that is designed to store, retrieve, manage, display, and analyze all types of geographic and spatial data.

Horizontal Assets - The pipes of the conveyance or collection system. May include associated assets (i.e., manholes).

Impact Definition - A numeric and narrative description of negligible, low, moderate, or severe impacts to a SMART goal for consequence of failure scoring. See also **Consequence of Failure**.

Key Performance Indicator (KPI) - A quantifiable measure used to evaluate the success rate in meeting performance objectives.

Knowledge Retention and **Succession Plan** - Documentation of critical staff and expertise within the POTW and identifies methods to keep this expertise.

Level of Service - A reflection of the values of the municipality.

Level of Service Profile - An overview of municipal commitments that relates stakeholder expectations to performance goals.

Likelihood of Failure - An estimate of when an asset will no longer be able to perform as required (i.e., when it can no longer meet the level of service goals).

Predictive Maintenance - Performing maintenance activities based on measured conditions.

Preventive Maintenance - The servicing performed in order to reduce the likelihood of failure and extend expected life.

Preventive Maintenance Program - A regularly scheduled maintenance event with reporting and documentation following the event.

Publicly Owned Treatment Works (POTW) - Any device or system used in the treatment or conveyance of municipal sewage that is owned by a municipality (including recycling or reclamation of materials).

Remaining Useful Life (RUL) - A calculated value that considers service life, age, and condition.

Resilience - The ability of a POTW to return to normal operations in the shortest amount of time.

Resilience Class - A descriptive term that reflects the current resilience status of an asset. Examples include Prevention, Protection, or Preparation.

Risk - The probability of a disruption to the level of service.

Routine Maintenance - The normal support, periodic and minor in nature, required to sustain performance and achieve expected life.

Service Category - Represent social, environmental, or financial interests and provides a framework for the **Level of Service Profile**.

Service Life - Also known as design life. Specified by the manufacturer or estimated based on best professional judgement.

Staffing Plan - Documentation of staff necessary to support the operations, maintenance, and financing of the publicly owned treatment works.

Stakeholder - Customers, businesses, regulators, industries, etc., who have a stake in the services provided by the POTW.

Sustainable Ownership– The recovery of all service costs through user charges. Commonly referred to as Full-Cost Pricing.

Vertical Assets – The assets associated with the WWTP, pump stations, and other vertical infrastructure (i.e., compost facility, structures, etc.)