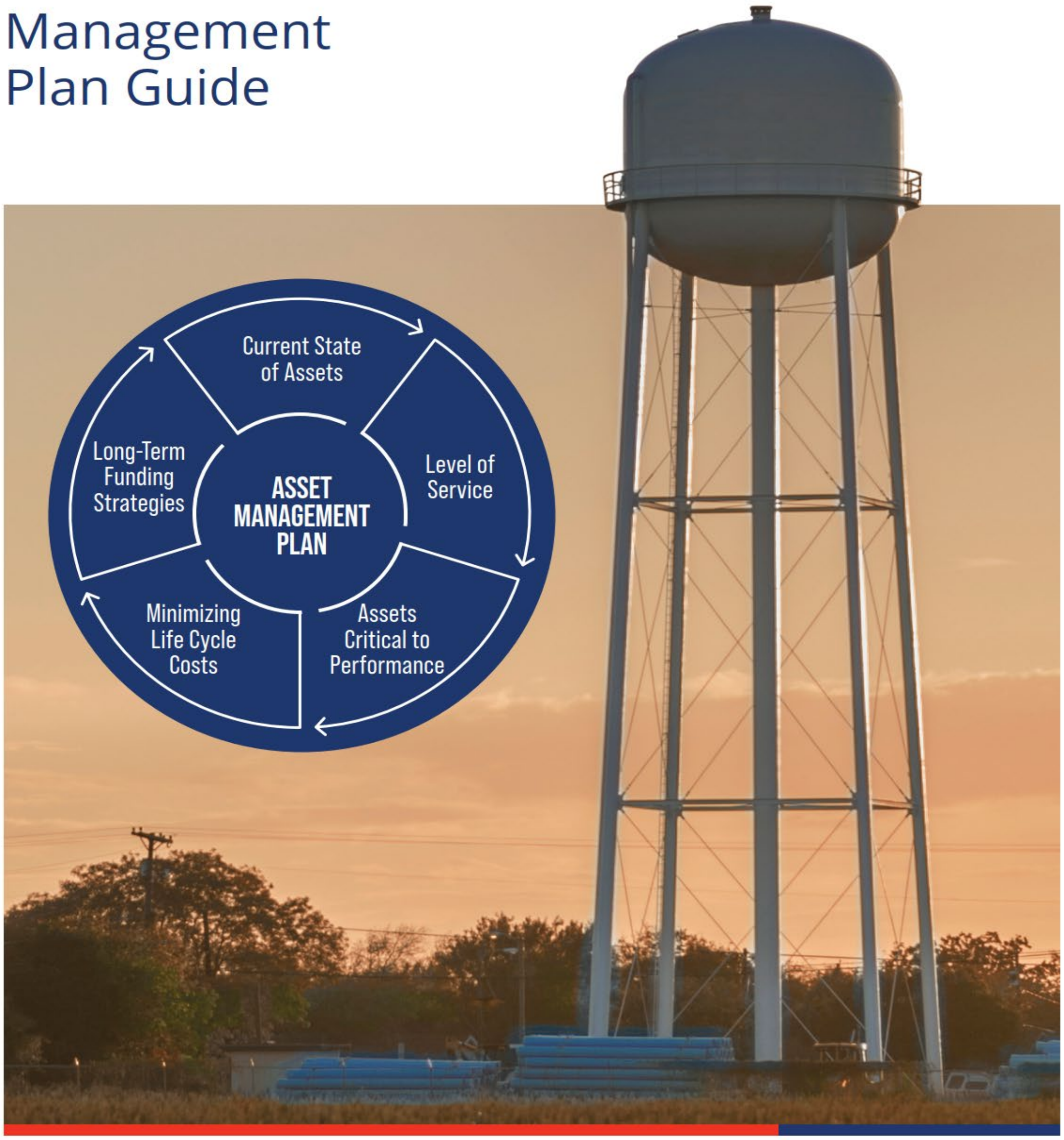
Tennessee Asset Management Plan Guide



TN Department of Environment & Conservation

Asset Management Plan Guide

January 2023

Lead Agency:

Tennessee Department of Environment and Conservation (TDEC)

Contributors:

Tennessee Association of Utility Districts (TAUD)

KCI Technologies

Division of Water Resources Programs:

State Water Infrastructure Grants

Drinking Water

State Revolving Fund

Engineering Services

Contents

DISCLAIMER: The Tennessee Asset Management Plan, including the spreadsheet and assessment methods are intended for the development of an asset management plan (AMP), condition assessment and prioritization of critical asset renewal needs. The assessment of individual assets is scored based on their current condition as compared to a reference standard. In part, or as a whole, the AMP guidance documents are not intended as a substitute for engineered planning and design. The Tennessee Department of Environment and Conservation assumes no liability for utility decisions based on these tools. This document is guidance only and does not create legal rights or obligations. Mention of trade names or commercial products does not constitute an endorsement or recommendation for use.

Executive Summary

Asset management plans (AMP) are a critical component of effectively managing water, wastewater, and stormwater infrastructure. The Environmental Protection Agency defines AMPs as the practice of managing infrastructure capital assets to minimize the total cost of owning and operating them, while delivering the service level customers desire. This management framework has been widely adopted by the water sector to pursue and achieve sustainable infrastructure. Although utility owners and operators build AMPs specific to their system, the foundation of this process is the same. Without a proper AMP, utilities can struggle to maintain compliance with state and federal regulations, secure adequate funding for capital improvements, and address customer needs. A proper AMP strongly supports a utility's technical, managerial, and financial (TMF) capacity to continuously provide safe, reliable drinking water, wastewater, or stormwater services. Well-developed plans for asset management can improve service, reliability, and regulatory compliance; reduce risk and unexpected costs; and enhance communication with customers and stakeholders. These plans also help budget for ongoing maintenance while planning for asset renewal, growth, and capacity expansion in a strategic manner.

This AMP guide outlines basic asset management plan components and is designed to meet the minimum criteria for Water Infrastructure Investment Plan (WIIP) American Rescue Plan (ARP) grants. Some utilities may have asset management programs and plans that far exceed this guide and its companion templates. Other utilities may have elements of an AMP but lack a comprehensive plan to meet the grant requirements. Even if your utility has a robust AMP, your utility should use this guidance to assess your current AMP for areas of potential updates.

The Tennessee Department of Environment and Conservation (TDEC), Division of Water Resources (DWR), convened public and private partners for the development of this guidance. DWR program managers and staff from Engineering Services, State Revolving Fund (SRF), Drinking Water, and State Water Infrastructure Grants programs along with the Tennessee Association of Utility Districts (TAUD), and KCI Technologies contributed to the guide. Through this working group, DWR has considered the aspects of planning requirements across our drinking water, wastewater, stormwater, and loan programs for the development of this document.

DWR's goal is to increase consistency across the state for water, wastewater, and stormwater infrastructure planning documents. Nevertheless, we suggest users of this guide check with DWR program staff prior to substituting this AMP model in lieu of (or to fulfill) regulatory or loan program requirements.

Using this Guide and Template

Building an asset management plan is not complicated but is does take time and effort. This guide breaks down the specific tasks needed to address the five core components of an AMP. The companion ***Tennessee Asset Management Templates located Appendix 1*** help users assemble the minimum required data and information to begin building a comprehensive plan. These basic spreadsheet templates were designed for use by utility systems of any size. Users should review the entire guide and make a list of information they have already developed which is needed for the template. The templates include areas to document the inventory of the system's assets, the age and estimated useful lives of existing assets, the condition of the assets, the critical nature of the assets, and a description of the timing and expected cost of the replacement of existing assets. Users should contact TDEC at tdec.arp@tn.gov if they would like to customize the templates.

Where possible, this guide highlights the connection between building a comprehensive AMP and addressing critical needs identified as red flags in the Tennessee Infrastructure Scorecard (Scorecard). Users should use this guide to assist them in addressing Scorecard AMP red flags to meet grant criteria in the Non-Competitive Grant Manual for Water Infrastructure Investment Plan funds. Where relevant, call out boxes have been added throughout this guide to highlight certain Scorecard requirements.

In addition, this AMP guide also addresses DWR Drinking Water program and SRF program requirements for Asset Management Planning and Fiscal Sustainability Plans. While some program requirements may have slight modifications or go beyond this basic AMP format, the foundation is the same. More detailed plans (e.g., Master Plans, Capacity, Management, Operation, and Maintenance (CMOM) Plans, Infiltration / Inflow Assessments, Leak Detection Studies, etc.) are often required to support investment decisions, critical needs, or in response to significant non-compliance issues. We suggest users of this guide check with DWR program staff prior to substituting this AMP model in lieu of (or to fulfill) regulatory or loan program requirements.

Figure 1 Capital Improvement Plan Scorecard Requirement

Scorecard Overview and Relationship with the AMP

The Tennessee Infrastructure Scorecard (Scorecard) and the utility's asset management plan can help identify deficiencies in the utility's system and prioritize improvements. The Scorecard provides system metrics for easy identification of the critical needs that should be addressed in the short term and document future progress. To be considered satisfactory on the Scorecard, a utility must have an asset management plan that meets the following criteria:

- Digital map of greater than 75% of the system
- Current asset inventory and condition assessment
- Planned operation and maintenance

- Work order system
- Capital improvement plan and budget
- Meter testing and changeout program
- IT infrastructure to support management decision-making

ASSET MANAGEMENT		WATER LOSS	
Asset Mangement Plan	No	**Unaccounted Water Loss**	17%
GIS Mapping	0-25%	Millions of Gallons/year	420.00
Inventory and Condition Assessment	No	Production Cost/year	$1,000,000
Planned O&M and Work Order System	No	**INFLOW and INFILTRATION**	
Meter Testing & Changeouts	Yes	**Inflow and Infiltration**	60%
Captital Improvement Plan & Budget	Yes	Millions of Gallons/year	41.00
IT Infrastructure	Yes	Treatment Cost/year	$1,000,000,000
MODERNIZATION			
Drinking Water Plant >80% Capacity	No	Wastewater Plant >80% Capacity	No
Age of Drinking Water Plant	30-50 years	Age of Wastewater Treatment Plant	10-30 years
Percentage of lines older than 50 years	25-50%	Percentage of lines older than 50 years	25-50%
COMPLIANCE			
Drinking Water Violations	No	Meeting Wastewater Permit Requirements	No
State Mandated Compliance Order (Water)	No	State Mandated Compliance Order (WW)	Yes
Meeting Order Requirements (Water)	NA	Meeting Order Requirements (WW)	No

Figure 2 Example Tennessee Infrastructure Scorecard

Building an Asset Management Plan

The purpose of asset management planning is to provide the utility with information to make good decisions on the repair and maintenance of existing capital assets, the replacement of existing capital assets, and the addition of new capital assets to the utility's infrastructure.

Once a comprehensive AMP is developed, the utility should treat the AMP as a "living" document. The AMP should be updated annually as assets age, new assets are added, maintenance is performed, and the level of desired service mandates the replacement of assets. The original AMP and annual updates to the AMP give a utility's management and governing board important and relevant information on the maintenance and replacement of aging water infrastructure. This information can be used in capital budget planning to ensure that the utility's financial resources are used efficiently and effectively to maintain and improve the utility's infrastructure.

Figure 3 Asset Management Plan

Capital Assets in an AMP

Drinking water, stormwater, and wastewater systems are made up of assets which include above and below ground utility infrastructure. Defining the business processes for planning, acquiring, operating, maintaining, renewing (includes repair, rehabilitate, and replacement), and decommissioning assets connects an AMP to each asset's lifecycle.

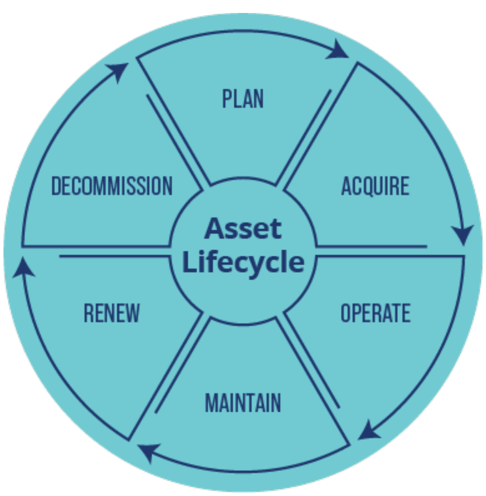


Figure 4 Asset Lifecycle

Water system assets include water treatment plants, pumps, pump stations, storage tanks, mains, valves, meters, and other facilities necessary to operate a water system. Wastewater system assets include treatment plants, pumps, pump stations, gravity mains, force mains, valves, meters, manholes, cleanouts, and other facilities necessary to operate a wastewater system. Stormwater system assets include grey and green infrastructure components like catch basins, junction chambers, stormwater pipes, outfalls, ponds, bioretention cells, permeable parking lots, rain gardens, and other assets necessary to manage, reduce, treat, or recapture stormwater or subsurface drainage water.

To be included in the utility's AMP, an asset should meet at least one of the following criteria:

- Have a cost of $5,000 or greater. Individual utility systems may have established a different cost threshold for a capital asset which should be used by the utility.

- Have a useful life greater than one (1) year
- Is the lowest level where work orders can be generated
- The asset is critical to the delivery of utility service, employee safety, or regulatory compliance.

While developing the AMP, be mindful of the full asset lifecycle of each individual asset. Costs are accumulated over the life cycle of an asset (lifecycle costs) and each component of the cycle can have significant financial impact and affect whether level of service commitments are met.

The Five Core Asset Management Plan Components

Effective management of these assets can be done through a simple, yet comprehensive five component planning process. Utilities begin by identifying all assets and determining the current state of the assets. Next utilities must establish the level of service they intend to provide and strategies for meeting regulatory requirements. Additional components include assessing asset criticality to understand the most serious needs, minimizing the cost of assets over their life cycle through proper operation and maintenance and optimizing efficiency at the plant as well as in the organization. Finally, utility managers and operators need to develop a long-term funding plan and capital investment strategies. These strategies help ensure the system's longevity in operations at a desired level of service for its customers. Finally, developing and maintaining a comprehensive AMP does not have to be linear. Utilities can integrate asset inventories into routine maintenance schedules, build on the level of provided service over time, or work to minimize costs through organizational restructuring when appropriate for your system. The key is to recognize the need for a comprehensive AMP, make a target goal for completion date, and start at the beginning, one step at a time.

Component 1: Current State of the Assets – Inventory and Condition Assessment

To begin an inventory and condition assessment of the utility's assets, these fundamental questions should be addressed:

- What assets do we own?
- Where are they?
- What is their current condition?

Practitioners need to take inventory of utility assets, listing what is owned, documenting the location of each asset, and detailing the condition of the asset. This data should be gathered in one location and be comprehensive, including new and old assets in the system.

Figure 5 Condition Assessment Scorecard Requirement

Inventory

Addressing the current state of the utility's assets involves making a complete list of all assets in the system and documenting key information about each asset. The utility should name each asset (often by using a unique identification number/text); assign a category for the asset; document key attributes such as size, material, manufacturer, model number, etc.; and describe the asset in as much detail as practicable. The utility should include dates of installation or provide its best date estimate using existing records and information provided by employees. If the utility has an asset identification system or has a serial number for the asset, this information should be included in the inventory as a unique identifier. Established utility mapping systems may serve as an inventory so long as it contains the necessary data outlined in this guide and referenced in the companion templates.

Inventory Best Practices

- Have a minimum asset definition (e.g. a pump would be an asset, but the impeller would not)
- Collect data over time as crews are in the field in order to minimize cost
- Track completeness and accuracy of the inventory over time
- Condition data may be kept separately from the asset
- Decide which attributes are important to collect before investing in data collection (install date, size, material, etc.)
- A digital map may serve as the asset inventory

Figure 6 Inventory Best Practices

The goal is to create the best inventory possible given the utility's records, personnel, and financial condition. After the completion of the first inventory, the utility should develop an approach to providing better and more complete information when annual updates are made to the AMP.

Utilities that do not have comprehensive records of their capital assets may find deploying field crews to locate assets and document conditions takes considerable effort. However, over time, maintaining the inventory should become routine and managers and operators will find significant benefits having this knowledge in hand. Do not attempt to complete an inventory all at once. Start with existing information on old and new assets. Utilities may choose to build the inventory and condition information over time, collecting data when field crews respond to maintenance issues or routine system checks. As annual updates are done, more comprehensive data can be included.

Digital Map of System

Once the assets owned by the utility have been identified, it is critical to also establish where those assets are located. This involves mapping the assets that are in the field and recording the location in a digital mapping system easily accessible for use by the utility's employees. The digital map can help operators, managers, and governing board members conceptualize the utility as an entire, interconnected system.

There are several methods of developing and refining a digital map over time. To start, a utility may leverage existing digital record drawings and/or as built documents that can be imported into more common mapping file formats, such as Geographic Information System (GIS) software.

Figure 7 Digital Map Scorecard Requirement

A utility may digitize paper maps by scanning and tracing, or as a guide to place asset features in their approximate location. Often both digital and paper drawings include attribute information (size, material, etc.) that should be populated into the asset inventory spreadsheet or into the GIS layer. Leveraging existing documentation is the most cost-effective method of developing a digital map.

Once existing information has been fully leveraged, field work can fill in data gaps and provide more accurate data. Field work may include spatial data acquisition; collecting attribute data and taking photos to associate with the assets. Spatial data acquisition can range from "redlining" assets in their approximate location into the digital map, to collected "sub-meter" GPS data, or "survey-grade" data that may be "sub-centimeter." Utilities can deploy existing staff armed with cell phones to snap photos and pin those images to the asset location. Including a visual picture of asset locations as part of the digital map is useful, especially for buried assets.

There is a wide range of cost between the lowest and the highest accuracy spatial data acquisition approaches. Also, there is a wide range of costs for non-spatial data collection (e.g., sizes, materials, etc.) When planning, it is recommended to calculate "per asset" costs to collect the data. If using internal staff, you may estimate the time to collect data on each asset, or how many assets can be collected in a day, and then use burdened labor rates along with an estimate of how many assets need data collection to improve estimate cost and schedules. It is important to also include the cost of needed equipment (e.g., GPS equipment, tablets/laptops, etc.) in cost estimate planning. Contracting out asset data collection may be more efficient for the utility. Always request several quotes from survey companies if contracting this work out.

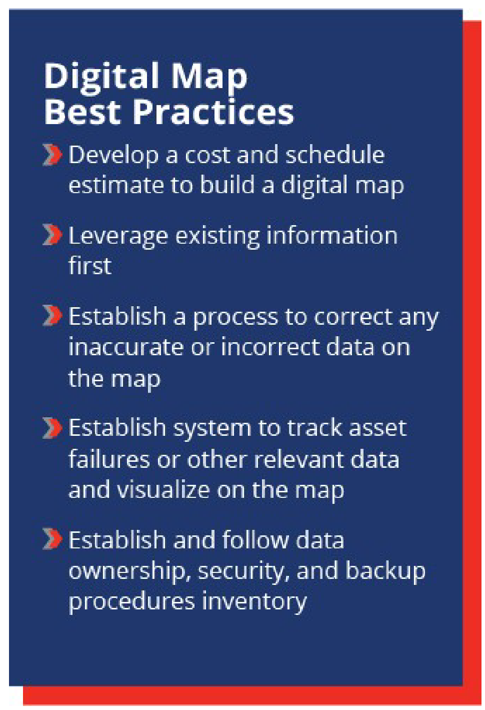


Figure 8 Digital Map Best Practices

There is a wide range of digital mapping products, ranging from free open-source software that work well for small systems, to more costly and powerful enterprise products. Products with broad local government and utility user communities come with a higher price. Free and lower cost products may be less feature rich and less widely used in the water, wastewater, and stormwater utility market. Regardless of the system, data ownership and security policies and procedures should be established. Utilities should consult with their peers and are encouraged to share industry best practices when sourcing mapping software. Examples of a few digital mapping software products include Diamond Maps and QGIS, or ESRI and MapInfo for higher end, feature rich software systems. There are many alternative products that are equivalent to the software mentioned above. It is recommended that utilities research software options to select the product that will suit the systems needs best.

Asset Condition

The physical condition of each asset should be assessed and documented. This process includes the anticipated useful life of service of the asset and when the asset was installed or purchased. The remaining useful life is assessed by assigning a percentage to the estimated total useful life of the asset (e.g., if an asset's anticipated useful life is 80 years, and has 75% of its remaining useful life remaining, it is estimated to have 60 years remaining of useful life). An individual asset may or may not function as needed over its anticipated useful life. If the functionality of an asset has been reviewed, and it is in worse condition than anticipated, the remaining useful life may need to be reduced, or if the condition is better than anticipated, the useful life may be extended.

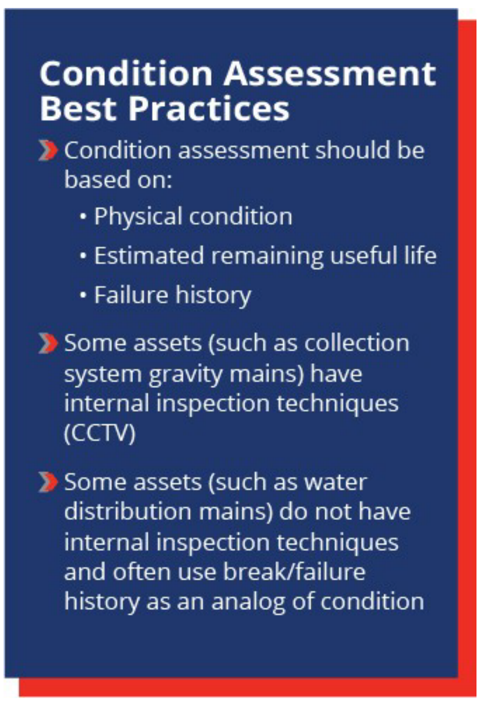


Figure 9 Condition Assessment Best Practices

If repairs or maintenance of an asset has extended its useful life, then the length of any such extension should be recorded. When performing a condition assessment, the date of the review and condition information should be documented.

An evaluation of the remaining useful life of each asset will assist the utility in deciding to continue to maintain or repair an asset, and when to replace it. Routine maintenance to extend the life of an asset may be more cost effective than replacing an asset. Typically, spending more on routine maintenance means spending less on replacement. Routine maintenance may be prioritized forcritical assets rather than expending funds on those that are less critical.

Information on the remaining useful life of each asset, as well as routine maintenance and repairs will help determine an assets likelihood for failure.

The templates in this guide walk a user through the inventory and condition assessment process. Drop-down categories for asset types, asset rankings, asset history, and risk of failure formulas are provided for each asset entry. This allows the utility to create a comprehensive inventory and condition assessment as detailed or as simple as the user decides. Information which can be used to make these assessments include:

- the date of installation of the asset (from the inventory section above)
- estimate of total useful life (i.e. when first installed)

- recent inspection records
- the history of failures, repairs and maintenance to the asset
- the opinions of utility personnel who work on the asset
- the assessment of engineers or other professionals on large or costly assets when economically feasible.

Component 2: Level of Service

Clearly defining the required level of service is critical to successful utility operations. All Asset Management Plan components contribute to improving the utility's level of service through better decision-making.

The utility's needed level of service is a measure of how well an asset, an infrastructure system, or an organizational function is meeting its intended purpose. Levels of service may be tied to physical performance of asset(s), customer expectations, or be defined via regulatory requirements.

A utility's primary focus for level of service should be its customers. Customers expect clean, safe drinking water from their taps and sufficient quantity to meet their needs. They expect a similar level of service when they flush their toilet. When a water related issue arises, and the service breaks down, they expect quick repair response times from their water provider.

At an asset specific level, a common level of service relates to its capacity. For example, a sewer pipeline may be designed to convey a certain peak flow while keeping the flow within a certain portion of the pipe (commonly measured as depth of flow (d) divided by the diameter of the pipe (D), or d/D). If the peak flows are less than the design d/D, the pipe is exceeding its level of service expectation. If the peak flows are more than the design d/D (e.g., surcharging into the manhole), it is not meeting its level of service expectation.

At an infrastructure system level, common levels of service relate to regulatory compliance. The water distribution system assets, collectively, must meet water quality standards. Many assets and organizational functions that manage, operate, and maintain those assets must work together to meet these requirements. At a minimum, regulatory requirements under water, wastewater, and stormwater permits must be met. If the level of service is not met, the utility risks regulatory enforcement action.

Level of Service Best Practices

- Analyze current and future customer demand
- Understand actual capacity for assets, and compare with current flows
- Understand current and future regulatory requirements
- Determine if capacity, reliability, and regulatory requirements are being met by current system assets
- Establish response time goals for service requests

Figure 10 Level of Service Best Practices

Regardless of the type of level of service, it is important for utilities to define the expected level of service at the asset, system, and customer levels. Then measure the actual levels of service being provided and compare those to the expectations. This is key in prioritizing system investments.

The Tennessee Infrastructure Scorecard provides minimum service level targets that utilities should strive to achieve. Examples include:

- Comply with all safe drinking water standards and/or wastewater discharge permit limits
- Achieve a satisfactory score on an annual compliance audit, or drinking water sanitary survey
- Respond to respond to customer complaints within X-hours

Understanding both the condition and capacity of assets helps a utility understand whether those assets are meeting their expected level of service. An asset may not perform at the appropriate level of service as it degrades over its useful life. In addition, the required level of service may have changed with time, due to increases in customer demand or more stringent regulatory requirements. The more critical the asset the more important it is that the asset meets (or exceeds) its expected level of service.

Component 3: Critical Assets

Not all assets are equally important for meeting the utility's level of service goals and maintaining regulatory compliance. Some assets are extremely critical to operations and others are not. The criticality of assets should be considered when determining the level of investment of utility personnel and financial resources.

The template provides a table for utilities to rank the criticality of each asset based on its likelihood of failure score and various criteria relating to consequence of failure. The consequence of failure criteria include:

- Redundancy
- Population served affected by failure
- Regulatory impact of failure
- Public health or environmental concern of failure

Critical Assets Best Practices

- List assets according to how critical they are to system operations
- Conduct failure analysis (e.g. root cause analysis, failure mode analysis)
- Determine the probability and consequences of failure
- Be proactive in reducing failure risk of critical assets - consider monitoring, preventative maintenance, redundant equipment, spare parts, etc.

Figure 11 Critical Assets Best Practices

The asset criticality score is determined by multiplying the risk of failure score times the aggregate of the consequence of failure scores. The criticality score is then used to rank the criticality of all assets included in the table.

Component 4: Minimizing Life Cycle Costs – Capital Improvement Plan

After developing an inventory, determining current condition and capacity, and criticality of its assets, the utility needs to prioritize the repair, rehabilitation, and replacement of its capital assets. In some cases, optimizing operation and maintenance efforts can extend the useful life of assets and defer capital investments. Minimizing life cycle costs often involves a balance between operations and maintenance to preserve assets that meet their level of service requirements and capital investment in cases where existing assets simply cannot meet the level of service required.

Alternative strategies for operations and maintenance may involve adjusting the organizational structure, prioritization of staff based on asset criticality, or adopting new techniques for more effective condition assessment and level of service monitoring. Examples may include establishing a dedicated maintenance division, updating standard operating procedures, or upgrading information technology infrastructure and software (e.g., maintenance management or work order system, field/mobile applications, etc.).

Figure 12 Life Cycle Cost Best Practices

Understanding which assets to replace, and how to fund each project, will determine the long-term capital improvement strategy of a utility. The excel workbook template assists the utility in prioritizing the replacement of assets by the completion of the following information on each asset:

- The estimated replacement cost
- The expected replacement date
- The asset’s condition (from the Asset Condition section above)
- The asset’s criticality (from the Critical Assets section above)

If the utility takes the time to fill out the template correctly, the tool will generate a prioritized list of critical assets in need of replacement. Utility management and operators should use the list as a tool to show decision makers the importance of capital projects. The template will give elected or appointed officials a vision for the future needs of the utility past the current fiscal year. Current and future needs, in conjunction with the critical asset list, are the basis for a capital improvement plan.

Once a utility establishes a prioritized list of critical assets in need of replacement, a capital improvement plan should be developed. The capital improvement plan should specify project priorities and the anticipated funding source for each one. The projects should be listed by the year in which they are planned. At a minimum, the capital improvement plan (CIP) should include the following information:

- Description of the project
- Establish the need for and benefits of the project, including reductions in energy costs, sewer overflows, or water loss where applicable
- Estimate of project cost
- Estimate of impacts on operations and maintenance
- Funding source(s)

Component 5: Long-Term Funding Plan – Rate Evaluation

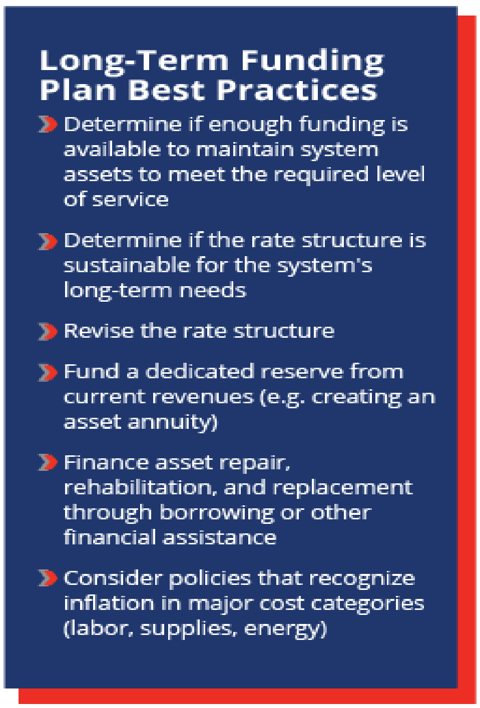


Figure 13 Long-Term Funding Best Practices

Long-term funding is critical to meeting future operating and capital improvement needs. Asset management provides the basis for reasonable rate setting and long-term fiscal sustainability. A utility should review and evaluate its rates annually as part of its budgeting process for each fiscal year. At a minimum, rates must produce sufficient revenues to cover the utility's annual operating expenses, including depreciation, and its annual debt costs. If the utility has outstanding debt, rates must be sufficient to produce enough revenues to meet the utility's debt service coverage ratio. If the utility seeks to finance any capital improvements through its monthly rate structure, the rates must be sufficient to produce the cash needed to finance such rate-funded capital improvements.

Water and wastewater utilities owned and operated by local governments (including utility districts and utility authorities) are legally required to set rates to cover their operating expenses, debt costs, depreciation, and reasonable reserves. Utilities may want to consider hiring an independent consultant to perform rate studies to ensure its rates meet all statutory and regulatory requirements. Some counties and municipalities have established a fee and/or stormwater utility to fund and respond to stormwater system needs.

A utility should consider the following when evaluating its rates annually:

- Amount of fixed operating costs
- Amount of variable operating costs
- Inflation
- Anticipated changes in employee staffing levels
- New depreciation from major infrastructure placed in service
- New debt costs for the next fiscal year
- Anticipated customer growth

- New operating expenses caused by regulatory compliance
- Other known and anticipate changes

When a utility has established customer classes with different rate structures, the utility must ensure these rate classes are just and reasonable. Using an outside rate consultant is recommended when the utility seeks to establish different rate structures for customer classes or to verify that existing rates are covering the costs of each customer class. A rate consultant will perform a cost of service study to support the rates for each customer class.

Rate evaluation for each customer class is a straightforward process. Typically, costs are broken down into two categories, fixed and variable. Variable costs change based on the amount of water produced or wastewater treated. These costs include energy, chemicals, and wages of employees working in the treatment plant, among others. Fixed costs do not change no matter the amount of water produced, or wastewater treated. Fixed costs include wages of customer service employees, debt payments, insurance, lease payments, and professional fees.

Other Considerations: Scorecard Summaries & Fiscal Sustainability Plans

TDEC has adopted Asset Management Plan requirements that address other regulatory and state-wide priorities. This section highlights requirements of a Fiscal Sustainability Plan that is required by the State Revolving Fund for Clean Water treatment works loan projects. It also includes additional Scorecard requirements for IT Infrastructure, Work Order Management, and Meter Testing and Changeouts.

Fiscal Sustainability Plan Requirements

To meet the minimum requirements for a Fiscal Sustainability Plan as required by the State Revolving Fund program, the AMP should also include the following elements:

- Organizational structure
- Plan of operation
- Operation and maintenance manual
- Water and energy conservation efforts

Excerpts from SRF's Fiscal Sustainability Plan Guidelines are included in Appendix 4 for reference.

Organizational Structure

Employees are the utility's biggest asset. When evaluating asset needs, utilities should determine the optimal organizational structure for the utility. A strong organizational structure fosters employee communications and expectations and reduces internal staff conflicts and staff turnover. The organizational structure should lay out a clear chain of command for the management of employees and the management of the infrastructure.

Utilities should consider the following when creating an organizational structure (or chart):

- Job descriptions that include primary roles and responsibilities
- Number of staff/direct reports
- License requirements
- Minimum requirements for each position

Additional staffing recommendations:

- Salary surveys
- Staffing plan
- Workforce development and training needs
- Administrative support

Plan of Operation

A plan of operation is important for any utility system. This plan may also be known as standard operating procedures. The utility should have a plan detailed enough that any qualified individual can operate the system with appropriate training. This will also preserve institutional knowledge when employees retire or find other employment.

Staffing and training procedures are an important element in the Plan of Operation. These procedures assure supervisory, operations, maintenance, laboratory support, and administration personnel are hired and trained in a timely manner. A staffing plan and organizational structure can be independent of the Plan of Operations, as described in the previous section, or as part of the Plan describe here.

The establishment of an adequate laboratory, data recording, and reporting system should be developed for reporting or process control requirements. Any special training needs related to a laboratory control program should also be included. After a significant upgrade or construction of new facilities, utilities should consider plant start-up costs and procedures. These start-up procedures will assist in optimizing operations and set the proper framework for long-term, trouble-free, efficient plant operation under all operating conditions. The Plan of Operation should also identify any necessary actions such as dry and wet testing of equipment, instrument calibration, and a review of process control procedures during the start-up period.

Safety procedures and expectations need to be detailed in the Plan of Operations. All drinking water and wastewater treatment facilities employees must adhere to all Federal, State and local safety requirements. Effective training for employees on safety protocols, as well as the development of a safety program should be part of the Plan of Operations. Training updates should be conducted when major updates to a facility have occurred. All hazardous conditions should be appraised and appropriately considered in the safety and health plan. The training program should be responsive to identified needs and guidance.

Additional considerations:

- Having comprehensive rules and regulations governing water and wastewater services to customers and keeping such rules and regulations up to date
- Developing a robust safety and technical training program for employees to safely and effectively operate and maintain utility assets and meet level of service expectations
- Developing procedures to comply with the regulatory requirements of state agencies such as the Comptroller's Office and the Tennessee Public Utilities Commission (TPUC) when applicable
- Establishing and maintaining internal controls as recommended by the Comptroller's office
- Ensuring billing and accounting programs are adequate for the collection of utility revenues, financial reporting, and the assessment of capital assets
- Establishing a system for securing and maintaining capital improvement construction records and as-built utility infrastructure
- Identifying and implementing recordkeeping and record retention procedures

Operations and Maintenance Manual

The utility should have an operations and maintenance manual (O&M manual) which describes standard operation procedures and preventive maintenance schedules or plans, for the utility's water, wastewater, or stormwater system. Utilities may have chapters for each facet of the operation of the utility's system including the utility's water or wastewater treatment plant, water distribution system, wastewater collection system, water meters, pump stations, water tanks, and laboratory. The O & M manual should also include emergency preparedness plans. Appropriate preparedness plans detail specific emergency response guidance to minimize the possibility of plant failures under all emergency conditions which may occur. Utilities should also highlight a training regime to ensure all staff are knowledgeable on how to respond in an emergency scenario.

Part of a robust O & M manual will include information on proper maintenance management. A maintenance management system considers the need for training to operate the system and/or to deal with complex equipment maintenance problems.

Additional considerations:

- Develop forms to properly document compliance with the utility operating procedures and maintenance schedules
- Have a scalable work order system to support the size of the utility
- Ensure that operating procedures are designed to comply with TDEC rules and regulations governing water and wastewater systems
- Supply lists for chemicals used in the treatment, process or process control, and laboratory supplies
- The provision of necessary maintenance tools and spare parts
- Include training required to properly perform the operating procedures and record

keeping

- Include appropriate inspection procedures for management and supervisory employees to achieve compliance with the O&M manual
- Include a safety manual for all facets of the utility's system

Water and Energy Conservation Measures

Utilities should identify water and energy conservation measures as part of a comprehensive asset management strategy. These measures should be reviewed and updated as necessary annually. Moreover, a utility must certify that it has evaluated water and energy conservation project opportunities as part of an SRF loan application.

Systems should consider the following when reviewing water and energy efficiency projects:

- Examining future costs and future cost savings. Not all programs labeled as energy efficient will make sense from a cost standpoint. If the cost of a program which conserves energy exceeds the eventual cost savings, then the utility must consider the willingness of its customers to pay higher rates to obtain energy savings.
- Using renewable energy sources such as solar panels or wind turbines. Renewable energy sources may be used to power a water or wastewater plant or a pump station. Small solar panels may be used to power zone meters and its telemetry systems. Natural gas may be considered as an alternative energy source.
- Retrofitting or replacing high energy use components of a system immediately or waiting until additional upgrades are needed. If a blower motor in a wastewater plant still has 10 years of useful life, replacement to save a few dollars on an electric bill may not make sense.
- Reviewing water-loss audits and determining whether water conservation measures make financial sense. The cost to install zone meters and appropriate software to pinpoint what areas of a system have the most water loss may be the most economical first step to address water loss.
- Considering water reuse or reclamation projects which use treated wastewater for irrigation or other permitted uses. Water reuse can be viewed as recycling water. A utility may consider using non-potable water for cleaning vehicles and flushing toilets.

Additional Scorecard Requirements

The remainder of this section provides guidance on the following elements that must be addressed as requirements in the Scorecard, but not been specifically covered previously:

- Meter Testing and Changeout Program
- IT Infrastructure
- Work Order System

Additional Scorecard Requirement

- Meter Testing and Changeouts
- IT Infrastructure
- Planned O&M and Work Order System

Meter Testing and Changeout Program

Figure 14 Additional Scorecard Requirements

Meters are the cash registers for a utility. Large commercial meters of 6 inches and above should be tested annually. Smaller meters may be tested less frequently. Utilities should establish testing zones and pick an appropriate number of residential meters and small commercial meters to test annually. For example, if a testing zone has 200 residential meters, the utility may choose to test 10% of those residential meters, 20 meters, annually.

Additional considerations:

- The age of the utility's meters
- The length of warranty for each type of meter
- Cost effectiveness of testing meters in-house or outsourcing meter testing

IT Infrastructure

IT Infrastructure is a critical tool in locating, inventorying, and making decisions on maintaining/repairing/replacing capital assets. IT Infrastructure may be "purchased" in a variety of ways (ownership, leases, service contracts, licenses, etc.) and may be implemented "on-premise" or in the "cloud." IT infrastructure includes the following components:

- Computers and devices such as tablets or mobile phones (w/updated software)
- Software including Geographic Information System (GIS), work order management, etc.
- Secure network and data storage
- Internet Connectivity in the office and field
- Appropriate high-speed internet for facilities E-Reporting to TDEC

IT Infrastructure can save a utility both fiscally and in human capital by managing assets in a proactive rather than reactive way and increasing efficiency. Being proactive allows for better time management of employees. Using technology to help identify and prioritize the replacement and maintenance of the utility's assets frees up employees to perform other duties.

Work Order System

A valuable tool for maintaining records of failures, preventive maintenance, inspections, and repair work performed on utility assets is commonly called a work order system. Work order systems can be included in the utility's billing and accounting software program or can also be standalone software solutions or programs. A work order system - computerized or otherwise - can be a valuable tool for a water, wastewater, or stormwater utility. An example work order and standard operating procedure are provided in Appendix 3. Small utilities may find it difficult to manage a computerized system or may not see a sufficient benefit due to the cost or its limited number of employees. For all others, a computerized work order system may be highly beneficial in scheduling work, tracking costs, ensuring maintenance is performed on schedule, and determining what parts were used during the repairs. They can also help identify assets that need to be replaced due to the cost of repair exceeding an asset's value.

Asset Management References

- Water and Wastewater Utility Evaluation Guidance Document: Asset Inventory & Assessment, Capital Cost, and Operating Cost Analyses; NCDEQ, February 2022.
  This reference is relatively current and has very good tables and appendices, including photographs of typical utility assets with the authors' condition ratings.

- Reference Guide for Asset Management Tools; USEPA, May 2014.
  This reference provides asset management plan components and implementation tools for small and medium sized drinking water and wastewater systems.

- Leading Business Practices in Asset Management; AWWA, May 2017.
  This reference includes case studies in best practices from 13 utilities ranging from 10,000 to 1,000,000 customers.

Appendix 1: Example Asset Management Spreadsheet Templates

- **Drinking Water Inventory Workbook-Version 1**
  - If you own or operate a drinking water system, please use this workbook.
- **Drinking Water Inventory Workbook Example-Version 1**
  - Illustrative example of a drinking water system inventory.
- **Wastewater Inventory Workbook-Version 1**
  - If you own or operate a wastewater system, please use this workbook.
- **Wastewater Inventory Workbook Example-Version 1**
  - Illustrative example of a wastewater system inventory.
- **Stormwater Inventory Workbook-Version 1**
  - If you own or operate a stormwater system, please use this work.
- **Stormwater Inventory Workbook Example-Version 1**
  - Illustrative example of a stormwater system inventory.

Users should contact TDEC at tdec.arp@tn.gov if they would like to customize these templates.

Appendix 2: Example Description of Asset Classes and Criticality

Water Systems		
Asset Class	**Description**	**Criticality**
Transmission Mains	Larger pipes that move large quantities of water from source to distribution mains	High
Distribution Mains	Distributes water to the system	High - Medium
Services	Conveys water from the main to a building or fire protection system	Low - Medium
Valves	Control flow in the distribution system. Categorized as critical, in-line, and specialty (blow off, ARV, PRV)	Varies
Fire Hydrants	Connection structure used for extracting water	High
Meters	Measure the volume of water passing through a pipe or to a customer	Low for small meters and Medium for large meters
Storage Tanks	Holds water for system	High
Pumps	Moves water from one location to another	High
Water Treatment Plants	Removes or reduces unwanted chemicals or microorganisms from water system	High

Stormwater Systems		
Asset Class	**Description**	**Criticality**
Conveyance	Transport stormwater from location to location	High
Catch Basins (Inlets)	Device that intakes water into stormwater drainage system	Medium
Stormwater Outfalls	Discharges stormwater into drainage system	High - Medium
Ponds	Collects and stores stormwater runoff	Low - Medium
Channel	Open conveyance that transports water from location to location	Medium - Low
Stormwater management features, e.g., rain gardens, bioretention cells, permeable parking lots	Used to manage, reduce, treat, or recapture stormwater and subsurface drainage	High - Low

Wastewater Systems		
Asset Class	**Description**	**Criticality**
Pump Stations	Lifts wastewater in the system	High
Force Mains	Conveys wastewater in the system using pressure	High - Medium
Gravity Mains	Conveys wastewater in the system using gravity	High - Medium
Services	Connection between mains and building	Low - Medium
Manholes	Used to access conveyance	Varies
Meters	Measure the flow rate of water passing through a pipe or outlet	Low for small meters and Medium for large meters
Pumps	Transfers sewage solids and liquids from one place to another	High
Wastewater Treatment Plants	Facility used to treat wastewater in order to remove pollutants	High

Appendix 3: Example Work Order Form and Standard Operating Procedure

(Insert Name of Utility) WORK ORDER #

Requested by

NAME:		DATE:	
EMAIL:		PHONE:	

Completed by

NAME:		DATE:	
EMAIL:		PHONE:	

ASSET ID:		ASSET CATEGORY:		
ADDRESS:				
GIS LOCATION:	LONGITUDE:		LATITUDE:	

STEP 1: DESCRIBE NEEDED WORK	STEP 2: DESCRIBE WORK PERFORMED	STEP 3: DESCRIBE ASSET CONDITION

RESPONSIBLE PERSONNEL FOR REPAIRS:		CONFIRMATION OF COMPLETE WORK:	
DATE COMPLETED:		DATE COMPLETED:	
COMPLETED BY:		REVIEWED BY:	

Personnel Signature: ______________________________________

Reviewer Signature: ____

Utility Work Order Standard Operating Procedure

Introduction

A work order system is an important aspect to a utilities ability to properly operate and maintenance equipment. Work orders also provide valuable data that ties into a utilities Asset Management Plan (AMP). Utilities should ensure that work orders are delegated to appropriate personnel who are familiar with the inventory and O&M information to keep all utility assets in appropriate working order. This SOP is designed to guide system personnel in assigning and completing work orders in an efficient manner.

Requested By

The Requested By boxes are intended to provide data as to who is requesting the work be done on the asset. Typically, this will be Utility Supervisor or administrative support personnel. The name, date of request, email, and phone number provide important data to the individual reviewing the work order later in the process and gives the assigned personnel points of contact during the project's progress.

Completed By

The Completed By section is intended to be filled out by the personnel responsible for completing the required task. This section is where the bulk of information will be managed. It is, therefore, important for the personnel completing this information to be aware of asset details for work to be completed in an efficient manner and to tie into the utilities AMP. The individual responsible for completing the work order should fill out the Name, Date of Request, Email, and Phone number for proper communication with the requestee.

Additionally, the responsible individual will also add important data about the asset. The ***Asset I.D.*** will be the official name and/or number assigned to the asset that links to the utilities AMP. The ***Asset Category*** will be an indicator of the area of the utility that applies to the specific asset (i.e., Water Plant, Wastewater Plant). The category will also link directly to the utilities AMP. ***GIS Location (with a minimum of 5 decimal places)*** will provide the utility the precise location that the asset being maintenance is located. Longitude and Latitude should be provided and can be linked from the utilities mapping system. A description box has been provided to detail the exact work done to the asset. Responsible personnel can provide valuable data such as parts used to complete the task (linked back to Inventory), current condition of the asset, and likelihood of asset failure. These components can assist the personnel responsible for the utilities AMP to keep the assets updated for future considerations.

Signatory Lines

Upon completion of the work assigned, the Requestee and the Responsible Party should provide confirmation that work was completed, date work was completed, reviewing personnel name, and signatures to assist future utility personnel in tracking the assets O&M and condition.

Appendix 4: State Revolving Fund - Fiscal Sustainability Plan (FSP) Guidance

For loans approved after October 1, 2014, loan recipients shall develop and implement a fiscal sustainability plan for treatment works proposed for repair, replacement, or expansion.

Exemptions:

- Projects not classified as treatment works
- New treatment works (Does not include physically replacing i.e. demolition and replacement or adding capacity of an existing system)
- Upgrades that do not involve repair, replacement, or expansion (i.e. adding advance treatment)

The following are **minimum** requirements for FSPs:

- An inventory of the critical assets that are part of the treatment works,
- An evaluation of the condition and performance of the critical assets,
- Implementation of water and energy conservation efforts,
- A plan for maintaining, repairing, and replacing the treatment works,
- A plan for funding operation and maintenance activities

Resources for Asset Management Planning

- EPA's Asset Management Best Practices Guide (2008)
- EPA's Handbook for Small Public Water Systems STEP Guide Series (2003)
- EPA's Check Up Program for Small Systems (CUPSS), Free asset management software for small wastewater and drinking water systems
- Cityworks – An ESRI based, public asset management software for water infrastructure
- Plan-It - Capital Improvement Plan Software
- PubWorks – Software for Public Works
- Cartegraph - Public Works and Utilities Software

Energy Use Assessments

- EPA's Energy Use Assessment Tool
- New York State Energy Research and Development Agency (NYSERDA) Energy Benchmarking Tool
- The Office of Energy Efficiency and Renewable Energy Facilities Self-Audit Checklists

Water Efficiency Tools

- EPA's WaterSense Program
- EPA's Water Conservation Plan Guidelines
- AWWA Water Audit Software
- AWE Water Conservation Tracking Tool

THIS PAGE INTENTIONALLY LEFT BLANK

TN Department of Environment & Conservation

Asset Management Plan Certification Form

Inclusive of Fiscal Sustainability Plan Certification

Utility Name		
Street Address		**P. O. Box Number**
City	**State**	**Zip Code**

Asset management plans (AMP) are a critical component to effectively managing a water infrastructure system. Technical, managerial, and financial capacity is necessary for a water system to continuously provide safe, reliable drinking water and wastewater services. Systems that have a robust AMP demonstrate improved technical, managerial, and financial capability to operate and maintain the system.

The AMP shall include at a minimum the following. Personnel will check the appropriate box as it applies:

Organizational Structure	
Plan of Operation (Drinking Water and/or Wastewater Facilities)	
Operation and Maintenance Manual (Drinking Water and/or Wastewater Facilities)	
Digital Map of System	
Asset Inventory and Condition Assessment	
Capital Improvement Plan	
Water and Energy Conservation Efforts	
Rate Evaluation	

I hereby certify that I am an authorized representative for [UTILITY NAME] and pursuant to the ARP Non-Competitive Grant Contract [APPLICATION ID] the [UTILITY NAME] has developed and is implementing an AMP (inclusive of the requirements of an FSP) that meets the requirements established by the State of Tennessee. Upon the request of the State of Tennessee, the Participant agrees to make the AMP (which includes the FSP requirements) available for inspection and/or review.

Signature of Authorized Representative	**Date**
Printed Name	**Phone Number / Email Address**