

Water Loss Control Plan

Introduction:

Utilities seeking ARPA Funding that exceed the 40% water loss by volume threshold set by the State of Tennessee are required to submit a water loss control plan (WLCP) to the Tennessee Department of Environmental Conservation (TDEC) detailing the actions they will take to reduce water loss below the state mandated threshold.

Though each water utility faces unique water loss control challenges the thought process for developing a WLCP is not unique. Further, while the WLCP must be submitted to TDEC, it is fundamentally a utility document. As such the WLCP should:

- 1) help the system define and further its water loss reduction goals, and
- 2) only be one part of a comprehensive Water Loss Control Program.

WLCP Criteria:

There is no required WLCP format, however, your system's WLCP should, at a minimum, address the following criteria:

- 1) Why your system is implementing a WLCP, and who is involved in its development. Consider the WLCP as a tool for potential funding, to inform the governing body and customers, and as a stepwise guide to reducing water loss.
- 2) Your system's known and unknown Water Loss issues. These may include:
 - a. Unknown or unacceptably high Non Revenue Water (NRW)
 - b. Unknown or unacceptably high Real Loss
 - c. Unknown or unacceptably high Apparent Loss
 - d. Unknown or unacceptably high authorized unbilled consumption
 - e. Metering issues
 - f. Etc.
- 3) Data sources available for quantification of Water Loss issues. Assess the following:
 - a. Currently available data sources and their reliability
 - b. Additional data or data sources that must be developed. For new data sources consider whether:
 - i. They can be developed in a cost-efficient manner
 - ii. Other reasons to spend resources on data collection and analysis that may not directly lead to loss reductions? For example, to
 1. Benchmark current performance
 2. Compare current performance to prior established benchmarks
 3. Develop system condition information

4. Optimize asset maintenance, repair and replacement schedules

- 4) Short-, mid- and longer-term goals for the WLCP. These may include (but are not limited to) goals, such as:
 - Refining internal Water Auditing policies, procedures, and data sources
 - Reduction or maintenance of currently acceptable levels of:
 - NRW
 - Apparent Loss/Increase revenue
 - Real Loss
 - Level of service improvements
 - Reducing customer outages
 - Reducing expense associated with leak repairs
- 5) Currently available budgets for WLCP activities and future budget planning & concerns such as:
 - a. labor hours available
 - i. Time that will be spent on WLCP activities
 - ii. How will that time impact other system operations
 - b. other monetary expenses
- 6) Any unique information that is relevant to the system's Water Loss Control efforts.

Your system's WLCP is a living document, not something to be completed once and forgotten. It should be reviewed annually and revised as conditions change to reflect your current and future Water Loss Control plans.

Additional Resources:

A WLCP is only one part of a comprehensive Water Loss Control Program. The attached Appendices contain additional useful loss control resources. Though none of these need to be submitted as part of your WLCP, they will help to further frame your water loss discussion and are designed to help guide, develop and/or improve your system's Water Loss Control Program.

Appendix A: Water Loss Audit Review and Loss Control Planning Checklist: The attached Checklist can be used as a starting point for internal water loss evaluation and loss control planning in conjunction with a current Water Audit. Use it to evaluate your latest water audit results and identify which results and data points you are satisfied with at present, and which will be addressed in the near term and longer term. Include details about water loss controls you plan to implement to reduce water losses in your utility and establish timelines for action. This Appendix includes an example completed Checklist.

Appendix B: Sample Water Loss Audit Procedures Template: Use the attached Water Loss Audit Procedures template to document water auditing procedures at your utility to facilitate

the timely preparation of consistent annual water audits using Version 6 of the AWWA Free Water Audit Software.

Appendix C: Water Loss Control Tools and Resources: Use the included Links to access the Southwest Environmental Finance Center Water Loss Control Switchboard – a wide ranging source of Water Loss Control tools and resources.

Appendix A: Water Audit Review and Loss Control Planning Checklist

Use the attached Water Audit Review and Loss Control Planning Checklist to evaluate your latest water audit results and identify which results and data points you are satisfied with at present, and which will be addressed in the near term and longer term. Include details about water loss controls you plan to implement to reduce water losses in your utility and establish timelines for action. An example completed Checklist is included. This Checklist can be used by an individual or in a team setting to drive discussion.

Water Loss Control Planning Checklist

I. Contact Information:

- 1) Include contact information for a staff member with knowledge of the water audit and checklist details
- 2) Document the year the Checklist covers.

II. Water Audit Evaluation:

- 1) Under “Audit Results” use the check boxes to self-evaluate Real Loss Volume, Apparent Loss Volume and Unbilled Authorized Consumption. Indicate whether results are, in your opinion, Satisfactory, Unsatisfactory and to be addressed in the near term, Unsatisfactory and to be addressed in a longer term. Select N/A if you have no volume in the category.
- 2) Under “Audit Data Points” select which, if any, water audit data points you plan to address in your Water Loss Control Plan. For example, if you suspect that source meter errors are a significant cause of your calculated Loss Percentage, check the “Unsatisfactory” option that corresponds to the time frame you plan to address that issue in. Only select N/A if you do not have a value for the data point in your Audit.

III. Water Loss Control Plan Implementation Details

- 1) Under “Assessment Details” indicate why you believe results are unsatisfactory. Be specific as possible to aid in decision making, funding, and scheduling. Satisfactory results do not have to be addressed, though you may include information detailing how you plan to keep specific results satisfactory.
- 2) Under “Improvement Plan Steps” discuss actions you plan to take to address your unsatisfactory Audit Results and Data Points. This may include further investigation and data collection to identify specific deficiencies, and/or loss control actions that will be implemented. For example, using the source meter error example discussed above, Improvement Plan steps might include actions such as meter testing and calibration, replacement, policy changes to improve data collection or other steps. If further investigation is required before improvement plans can be implemented explain what investigation that will be undertaken. You are not required to address every audit

deficiency at once. Prioritize action that you believe will reduce water loss in your system and/or will provide you with more accurate data to act upon in the future.

- 3) Provide an estimated timeline for the implementation of any Improvement Plan Steps identified in step 2.
- 4) Indicate what impact you believe improvement plan steps are likely to have within the timeframe you have identified in step 3.

Water Audit Review and Loss Control Planning Checklist

I. Contact Information:	
Utility Name:	
PWDSID #:	
Contact Person:	
Email:	
Telephone/Ext:	
City/Town/Municipality:	
County:	
State:	
Zip Code:	
Creation Date:	
Water Loss Audit Year:	

II. Water Audit Evaluation:

II. Water Audit Evaluation:				
	Evaluation			
Audit Results	Satisfactory	Unsatisfactory – Will address in near term (1-3 years)	Unsatisfactory – Will address in longer term (4-10 Years)	N/A
Real Loss Volume	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Apparent Loss Volume	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Unbilled Authorized Consumption	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Evaluation			
Audit Data Points	Satisfactory	Unsatisfactory – Will address in near term (1-3 years)	Unsatisfactory – Will address in longer term (4-10 Years)	N/A
Volume from Own Sources	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Volume from Own Sources Meter Error Adjustment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Water Imported	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Water Imported Meter Error Adjustment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Water Exported	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Water Exported Meter Error Adjustment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Billed Metered Consumption	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Billed Unmetered Consumption	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Unbilled Metered Consumption	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Unbilled Unmetered Consumption	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Systematic Data Handling Errors	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Customer Metering Inaccuracies	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Unauthorized Consumption	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Length of Mains	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Number of Service Connections	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Average Length of Private Customer Service Line	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Average Operating Pressure	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Customer Retail Unit Cost	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Variable Production Cost	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

III. Water Loss Control Implementation Details:

Use the space below to document steps to be taken to improve unsatisfactory results or data points in future audits, the implementation timeline, and how those steps are expected to reduce water loss. Include appropriate details on budgeting, staffing, etc. if it is available.

1. Assessment Details:

2. Improvement Plan Steps:

3. Implementation Timeline:

4. Expected Impact:

Appendix A: Long Term Planning Checklist Example

I. Contact Information:	
Name of Utility:	Anytown Water System
PWSID#:	TN123456
Contact Person:	John Doe
Email:	John.doe@anytownwater.com
Telephone/Ext:	(123) 456-7890
City/Town/Municipality:	Anytown
County:	Any County
State:	TN
Zip Code:	12345
Creation Date:	April 22, 2023
Water Loss Audit Year	2022

II. Audit Evaluation	Evaluation			
Audit Results	Satisfactory	Unsatisfactory – Will address in near term (1-3 years)	Unsatisfactory – Will address in longer term (4-10 Years)	N/A
Real Loss Volume	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Apparent Loss Volume	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Unbilled Authorized Consumption	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Evaluation				
Audit Data Points	Satisfactory	Unsatisfactory – Will address in near term (1-3 years)	Unsatisfactory – Will address in longer term (4-10 Years)	N/A
Volume from Own Sources	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Volume from Own Sources Meter Error Adjustment	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Water Imported	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Water Imported Meter Error Adjustment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Water Exported	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Water Exported Meter Error Adjustment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Billed Metered Consumption	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Billed Unmetered Consumption	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Unbilled Metered Consumption	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Unbilled Unmetered Consumption	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Systematic Data Handling Errors	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Customer Metering Inaccuracies	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Unauthorized Consumption	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Length of Mains	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Number of Service Connections	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Average Length of Private Customer Service Line	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Average Operating Pressure	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Customer Retail Unit Cost	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Variable Production Cost	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

II. Water Loss Control Implementation Details:

Use the space below to document steps to be taken to improve unsatisfactory results or data points in future audits, the implementation timeline, and how those steps are expected to reduce water loss. Include appropriate details on budgeting, staffing, etc. if it is available.

Assessment Details:

We believe that the Volume from Own Sources (VOS) value, which is based on weekly meter reads is significantly overstated, and that high losses calculated in our 2022 water audit are at least partially the result of inaccurate source metering. Although we had assumed meters were reading accurately, post-2022 audit investigations indicate that some are overreading by a considerable amount. 3 active source meters are installed without the minimum lengths of straight piping required for accurate readings and none of the meters have been tested or calibrated since their initial installation.

Improvement Plan Steps:

We will improve our VOS value by implementing an annual source meter testing and calibration program in 2023. We have 12 source meters but 8 of them provide 75% of our supply volume. Management has set aside funds to have the 8 most productive meters tested and calibrated in 2023. We plan to test and calibrate all meters annually starting in 2024. The three meters identified as being incorrectly installed will be tested to determine their exact error. Management hopes to have resources in place during 2024 to cover removal and re-installation of those 3 meters. We plan to continue performing annual water audits using the AWWA audit software to track the results of our ongoing water loss control efforts.

Implementation Timeline: *We expect to have accurate Volume from Own Sources data for the 2023 audit.*

Expected Impact:

We expect our meter testing and installation improvements to reduce audit calculated water loss considerably. Though we do not have enough data in hand to make an accurate estimate of the reduction in percentage or gallon terms now, we believe that it will reduce loss below the state 40% loss by volume threshold for the 2023 audit. As we continue to refine meter testing protocols, we expect all future audits to contain accurate supply data. It is our intention to continue annual water auditing even if future audits show real losses below the 40% loss by volume threshold so that we can track our water loss control progress over time.

Appendix B: Sample Water Loss Audit Procedures Template

Use the attached Water Loss Audit Procedures template to document water audit procedures at your utility to facilitate the timely preparation of consistent annual water audits using Version 6 of the AWWA Free Water Audit Software.

The template contains audit definitions as well as sections to document critical audit information such as: water loss control team members; loss control team meeting frequency; the locations for audit data; data derivation methodologies; parties responsible for developing audit data; timing for data delivery, and methods for communicating water audit results to internal and external stakeholders.

A well-executed Water Audit Procedures document will guide a person unfamiliar with water loss auditing through the steps of developing a water audit for your system using your system's information. If a new staff member can duplicate your last water audit using the Water Audit Procedures, then you have documented the process correctly. The Water Audit Procedure is a living, legacy document. It should reflect the currently used processes, data sources, etc., and always be updated to include changes in auditing procedures.

Water Loss Control (WLC) is best approached in a holistic manner using a team approach and the development of a Water Audit Procedures document should be approached the same way. The data required for WLC analysis will be developed by staff in a variety of system departments and should not occur in a vacuum. Similarly, development and implementation of WLC strategies, policies and processes will also require inter-departmental problem solving and cooperation.

Start by creating a Water Loss Control Team (WLCT) made up of relevant staff and stakeholders. A WLCT typically has representatives from operations, billing, accounting and management but may also include IT staff, GIS specialists, conservation staff, and even outside stakeholders or data sources such as fire departments or other significant water users.

Your WLCT can develop your system's Water Audit Procedures using the template to guide discussion. Be sure to:

- 1) Articulate why your system is implementing a Water Loss Control Program (WLCP) and the role the Audit plays.
- 2) Document your system's known and suspected Water Loss issues.
- 3) Examine data sources that are available for quantification of Water Losses and determine what additional data will be required.
- 4) Define WLCT member roles and deliverables. Determine which individuals and/or departments will develop or compile source data, and the timelines for data delivery so that the water audit compiler can prepare your annual water audit in a timely manner. For example, if a billing staff member will compile billed metered consumption volumes,

make sure they know exactly what is being asked for, what format to deliver it in, what backup data is required, and when and to whom the data should be delivered.

- 5) Review or define appropriate short-, medium- and long-term goals for water auditing and implementing a WLCP. (Note the Free Water Audit Software's Loss Control Planning tab provides guidance in this area.)
- 6) Discuss and define budgets for current and future WLCP activities

Note that the Water Audit Procedures is a living document. Review it annually as part of the water audit development process and make appropriate updates to reflect changes in team members, responsibilities, data sources, policies, calculations, etc.

SAMPLE AWWA WATER AUDIT PROCEDURES (USING v6 OF THE AWWA'S FREE WATER AUDIT SOFTWARE)

I. INTRODUCTION

In [Year], [Utility] began conducting an annual internal water usage audit using the American Water Works Association (AWWA) / International Water Association (IWA) water audit methodology to determine volumes of non-revenue water.

[Utility] uses the AWWA's free Water Audit Software (WAS) to develop its annual audit, because the WAS is recognized as the industry standard tool to account for non-revenue water. Non-revenue water is divided into three categories: unbilled authorized usage (either metered or unmetered), apparent losses (unauthorized consumption, customer meter inaccuracies and systematic data handling errors), and real losses (leakage from services and mains, and leakage and overflow from storage tanks.)

[Utility] has chosen to conduct its annual water audit based on a [fiscal or calendar] year – [insert dates].

[Utility] staff members with responsibility for developing water audit data and compiling the annual audit should verify that all audit input data, particularly consumption and use volumes aligns to audit period.

Meter reading schedules and billing cycles will not always align with the audit period. Input data such as supply or consumption volumes that overlaps the start and/or end of the audit period should be pro-rated to align it to the audit period. Where pro-rating is necessary, clear explanations of the methodology used for arriving at a prorated value must be provided. Where data cannot be aligned to the audit period for any reason, the data compiler should provide a clear explanation of challenges faced and determine whether the variation from the audit period will materially impact the audit results.

The following internal procedures document sources of the audit data entered by the Water Auditor into the water audit software and assign responsibility to staff and departments for developing and maintaining the data necessary to complete the audit in a timely fashion each year.

II. WATER LOSS CONTROL TEAM MEMBERS & MEETINGS

_____ recognizes that effective water loss control requires a team effort and input from departments across the utility. _____ has therefore created a standing Water Loss Control Team (WLCT) with membership drawn from multiple utility departments. WLCT Membership is position based and, the duties and responsibilities associated with WLCT membership are tied to specific positions at the utility

Water Loss Control Team Members:

Department	Position	Current Incumbent

[Utility] Staff should coordinate their efforts to avoid duplication of efforts and to ensure that the most accurate data possible is collected

III. AUDIT DEFINITIONS

The following definitions are used throughout the AWWA's WAS and M36 water audit manual. A water balance figure is shown after the definitions to provide a visual of each audit component and how it contributes to either revenue or non-revenue water volumes.

- **Volume from Own Sources:** the annual volume of water withdrawn from Water Authority wells and surface water resources and treated for potable water distribution.
- **Authorized Consumption:** the annual volume of metered and/or unmetered water taken by registered customers, or used by the Water Authority for legitimate uses such as treatment processes, water quality flushing, street cleaning, etc. Authorized usage can either be billed or unbilled.
- **Apparent Losses:** unrecorded consumption resulting from customer metering inaccuracies, theft of service, and systematic data handling errors.
- **Real Losses:** the annual volume of water lost through all types of leaks, breaks/overflows on mains, finished water reservoirs, and service connections on the Water Authority's side of the customer meters.
- **Non-Revenue Water:** all water that is not billed to a customer including unbilled authorized usage, all real loss, and all apparent loss.
- **Water Balance:** (example shown below) a standard graphical representation of water as it moved through the Water Authority distribution system during the audit year from source to customer, dividing water into Supply, Authorized Consumption and Losses, as well as Revenue Water and Non-Revenue Water (NRW.)

Volume from Own Sources	Total Water Supply (corrected for known errors)	Authorized Consumption	Billed Authorized Consumption	Billed Water Exported	Revenue Water	
				Billed Metered Consumption		
				Billed Unmetered Consumption		
			Unbilled Authorized Consumption	Unbilled Metered Consumption		
Unbilled Unmetered Consumption						
Imported Water		Water Losses	Apparent Losses	Customer Metering Inaccuracies		Non-Revenue Water
				Systematic Data Handling Errors		
				Unauthorized Consumption		
	Real Losses		Leakage on Transmission and Distribution Mains			
			Leakage and Overflows at Storage Tanks			
			Leakage on Service Connections up to point of customer metering			

IV. AUDIT DEVELOPMENT GUIDANCE

WATER SUPPLIED

Volume from Own Sources

The volume from own sources is the volume of potable water withdrawn from supply sources (rivers, wells, etc.) that is controlled by the utility and then treated for distribution. **This value includes the flow from** [Insert details]

File Name & Description: [Insert details]

Data derivation methodology: [Insert details]

Data provided by: [Insert details]

Water Imported

Water imported includes any water that is purchased from another utility.

File Name & Description: [Insert details]

Data derivation methodology: [Insert details]

Data provided by: [Insert details]

Water Exported

The water exported volume is the bulk water conveyed and sold by the utility to neighboring water systems that exist outside of their service area.

File Name & Description: [Insert details]

Data provided by: [Insert details]

Data derivation methodology: (Query or screen shots)

Master Meter and Supply Error Adjustment

For each of the previous three inputs, a master meter and supply error adjustment must be calculated and given a validation score. The adjustment is the weighted average of the collective error for all metered and achieved flow for all days of the audit period. A meter may be inaccurate by under-registering flow (not capturing all flow, negative value or percentage in the water audit software) or by over-registering flow (overstating the actual flow, positive value or percentage). Error in metered data can also occur due to data gaps caused by temporary outages of the meter or related instrumentation. All meter testing conducted during the audit year on all wells, finished water from the treatment plant, import, and/or export meters should be included. The error values should be averaged for a percentage input and totaled for a volume input.

File Name & Description:

Volume from own Sources: [Insert details]

Water Imported: [Insert details]

Water Exported: [Insert details]

Data provided by: _____

Volume from own Sources: [Insert details]

Water Imported: [Insert details]

Water Exported: [Insert details]

Data derivation methodology:

AUTHORIZED CONSUMPTION:

Billed Metered Authorized Consumption

Billed metered volume is all metered consumption that is billed to retail customers, excluding wholesale and/or non-potable usage customers.

File Name & Description: [Insert details]

Data derivation methodology: [Insert details]

Data provided by: [Insert details]

Billed Unmetered Authorized Consumption

The billed unmetered volume is all billed consumption that has been approved to not be metered by the utility. Any water that is supplied to neighboring utilities that is unmetered and billed should **not** be included in this value.

File Name & Description: [Insert details]

Data derivation methodology: [Insert details]

Data provided by: [Insert details]

Unbilled Metered Authorized Consumption

This input is any metered consumption which is authorized by the utility but for any reason is deemed by policy to be unbilled. This volume includes water consumed by the

utility itself during distribution. It does **not** include water supplied to neighboring utilities (water exported) which may be metered but not billed. **This information includes well wash and unaccounted events such as reservoir drainage.**

File Name & Description: [Insert details]

Data derivation methodology: [Insert details]

Data provided by: [Insert details]

Unbilled Unmetered Authorized Consumption

Unbilled unmetered is authorized consumption that is neither billed nor metered. **This water includes water used in activities such as firefighting, flushing of water mains, street cleaning, fire flow tests, and more.** The Water Audit Software includes a default value of 0.25% of Billed Authorized Consumption that can be used in the absence of utility specific data for this water loss category. However, it is a best practice to attempt an estimate or calculation of Unbilled Unmetered Consumption.

[Determine whether the utility will use the Audit Software default value, or a calculated value. Include details of Utility processes used to uncover and document Unbilled Unmetered Authorized Consumption. If the default value is used, include procedures for determining whether default value is reasonable for the Utility.]

File Name & Description: [Insert details]

Data derivation methodology: [Insert details]

Data provided by: [Insert details]

WATER LOSSES:

APPARENT LOSSES

Apparent losses include all types of metering inaccuracies, theft of service (unauthorized consumption), and systematic data handling errors.

SYSTEMATIC DATA HANDLING ERRORS

Inaccurate readings, consumption estimates, billing system account activation, archiving, retrieval, and reporting software glitches, and other data-handling issues are common sources of error which may result in the over or under reporting of consumption. The Water Audit Software includes a default value of 0.25% of Billed Authorized Consumption that can be used in the absence of utility specific data for this water loss category.

File Name & Description: [Insert details]

Data provided by: [Insert details]

Data derivation methodology: [Insert details]

CUSTOMER METERING INACCURACIES

Customer meter under-registration is often a significant source of lost revenue and unrecorded consumption. Such under-registration may be the result of meter wear over time, or due to the mis-sizing of meters for specific applications.

The water audit uses one value (either a percentage, or a calculated volume) to account for all consumption errors due to metering inaccuracies and applies it to both billed and unbilled metered consumption. No default value is provided and, although a 0 value may be used for this category it is not recommended.

Customer metering inaccuracies should be calculated using a weighted average from the small and large meter testing in the audit year including both billed and unbilled metered consumption.

[Include details of meter testing programs (if any) including information about meter types/sizes, and the testing protocols used for each and how the value for this data point was calculated.]

File Name & Description: [Insert details]

Data provided by: [Insert details]

Data derivation methodology: [Insert details]

UNAUTHORIZED CONSUMPTION (THEFT)

Unauthorized consumption is water that is taken from the utility through illegal connections, bypasses, hydrant tapping, meter tampering or any other method where water is consumed without utility permission and no revenue is generated. The Water Audit Software includes a default value of 0.25% of Billed Authorized Consumption that can be used in the absence of utility specific data for this water loss category. However, it is a best practice to attempt an estimate or calculation of unauthorized consumption.

[Determine whether the utility will use the Audit Software default value, or a calculated value. Also include details of any Utility processes used to uncover and document theft. If the default value is used, include procedures for determining whether default value is reasonable for the Utility.]

REAL LOSSES

The Water Audit Software calculates a Real Loss volume by subtracting all documented and estimated consumption from documented and estimated supply. This value is presented as a “lump sum” and is not broken down into further into mains, service line and tank overflow losses.

[Include any procedures in place to collect and analyze loss related data for comparison to Audit calculated values. The calculated Real Loss volume should be reviewed for reasonableness in light of other system data and a leakage component analysis (LCA) is recommended. If the Utility plans to conduct an LCA the details should be included here.]

SYSTEM DATA

Length of Mains

The length of main includes all active water distribution main for potable water, **not** including the customer service connections. Pipeline leads to fire hydrants should be included.

File Name & Description: [Insert details]

Data provided by: [Insert details]

Data derivation methodology: [Insert details]

Number of Active and Inactive Service Connections

The number of **active and inactive service connections** includes all potable water main distinct piping connections including customer fire flow lines. This number does **not** include the pipeline leads to fire hydrants.

File Name & Description: [Insert details]

Data provided by: [Insert details]

Data derivation methodology: [Insert details] (Query or screen shots)

Average Length of Customer Service Line

The average length of the customer service line is the length of line measured from the point of ownership transfer to the customer water meter. If the customer water meter exists near the ownership transfer point (usually the curb stop), this distance is zero because the meter and the transfer point are the same. This situation is often encountered when a customer water meter is in an underground meter box or pit outside of the building. If water meters are typically located inside the customer premise, it is up to the auditor to estimate a system-wide average length based on the various customer land parcel sizes and building locations in the service area. The length will be shorter in areas of high density and longer in areas of low density. If the auditor selects “Yes” for this input, this distance is set to zero and the data grading score for this component is set to 10.

File Name & Description: [Insert details]

Data provided by: [Insert details]

Data derivation methodology: [Insert details] (Query or screen shots)

Average Operating Pressure

The average operating pressure input value is the average pressure for the system during the audit year

File Name & Description: [Insert details]

Data provided by: [Insert details]

Data derivation methodology: [Insert details] (Query or screen shots)

COST DATA

Customer Retail Unit Charge

The customer retail unit cost is the weighted average cost across all customer classes and rate tiers, excluding wholesale customers, for one unit of water. All differences in customer charges and fees should be analyzed to calculate the average cost.

File Name & Description: [Insert details]

Data provided by: [Insert details]

Data derivation methodology: [Insert details] (Query or screen shots)

Variable Production Cost

The cost to produce and supply the next unit of water. This cost is determined by calculating the summed unit costs for ground and surface water treatment and all power used for pumping from the source to the customer. The variable cost includes at a minimum energy and treatment cost, as well as the costs of water acquisition (if any).

File Name & Description: [Insert details]

Data provided by: [Insert details]

Data derivation methodology: [Insert details] (Query or screen shots)

Total Annual Cost of Operating System

Total Annual Cost of Operations is an optional input and is not required to complete the water audit.

File Name & Description: [Insert details]

Data provided by: [Insert details]

Data derivation methodology: [Insert details] (Query or screen shots)

Key Performance Indicator Targets

The Water Audit Software allows targets for the following four Key Performance Indicators (KPIs) to be documented:

Unit Total Losses (gal/conn/day)

Unit Apparent Losses (gal/conn/day)

Unit Real Losses (gal/conn/day)

Unit Real Losses (gal/mile/day)

Any input target values are graphed on the Dashboard tab of the Water Audit Software. [Include details of whether KPI targets are to be included and how they are derived.]

V. COMMUNICATING AUDIT RESULTS TO STAKEHOLDERS

Communicating successes, setbacks and needs to stakeholders is critical to the development and maintenance of a successful water loss control program. The knowledge gained through water loss auditing and other water loss control measures can, and should, be shared with stakeholders.

[Utility] has identified the following list of stakeholders:

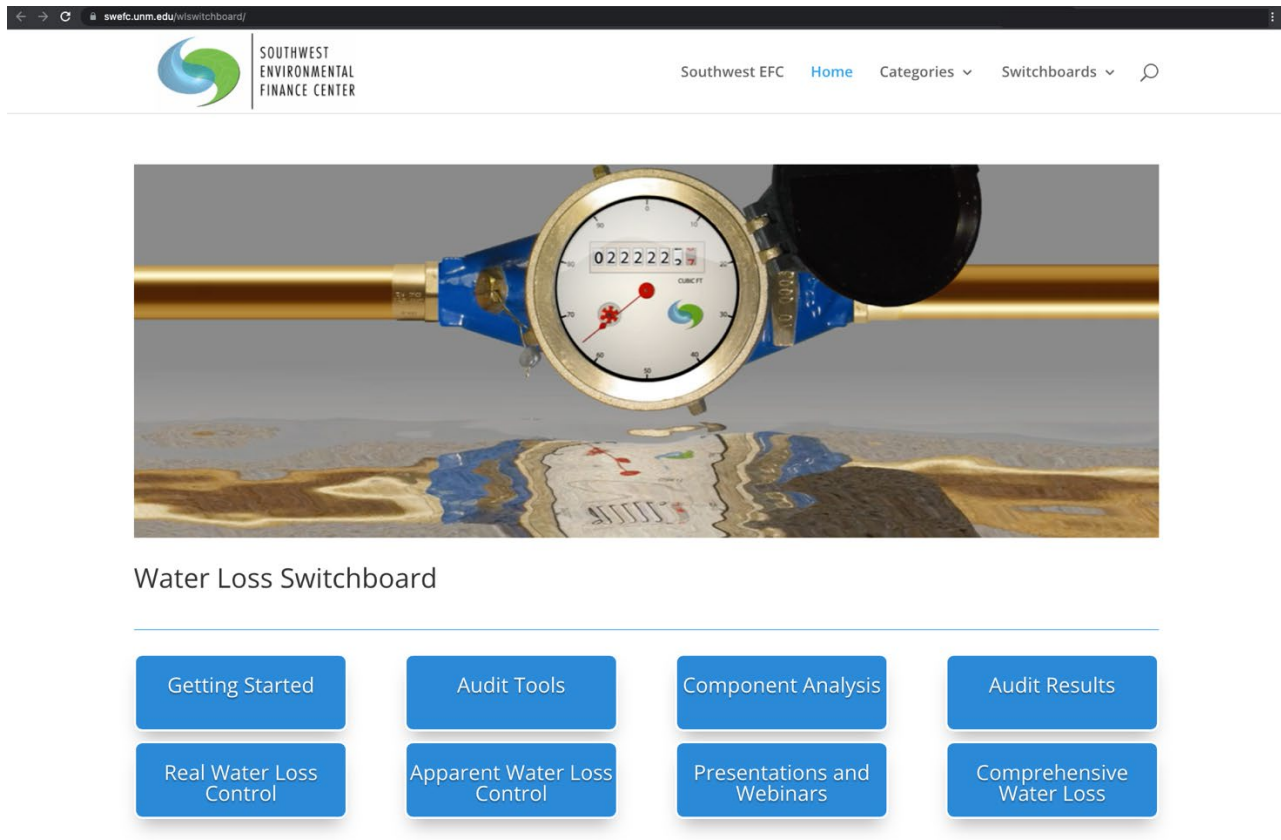
[Insert details]

Stakeholder	Role	Information to be shared	Frequency of communication
[Insert details]			

Appendix C: Water Loss Control Tools and Resources

A variety of water loss control tools and resources can be found on the Southwest Environmental Finance Center's (SW EFC) [Water Loss Control Switchboard](https://swefc.unm.edu/wlswitchboard/):
<https://swefc.unm.edu/wlswitchboard/>

Tools and resources are grouped into the eight categories shown below and are searchable using the magnifying glass icon located in the top right corner of the website.



Water Loss Switchboard

- Getting Started
- Audit Tools
- Component Analysis
- Audit Results
- Real Water Loss Control
- Apparent Water Loss Control
- Presentations and Webinars
- Comprehensive Water Loss

Note that while the Water Loss Switchboard is free and most of the listed resources are available free of charge, some resources hosted on other websites may require registration with the resource provider and/or a fee.

While designed to be comprehensive, the SW EFC Water Loss Switchboard is not the only source for water loss control guidance, and you are encouraged to seek out other sources of information and assistance.