

Water Audit User Guide

Step 1: Raw Water Production Summary

This step corrects water withdrawal values for meter inaccuracies.

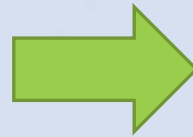
Note, the Water Audit calculations are done in the unit of gallons. The PSAR calculations are in gallons per day (gpd). In order to correct this, all PSAR values must be multiplied by 365.

Checklist

- ✓ Determine your audit period. Most WUPs have a calendar year audit period (January-December). A select few use a fiscal year audit period (October- September).
- ✓ e-Pic meter readings for each well (DID) or Total Withdrawals for each DID during the audit period.
- ✓ Most recent meter accuracy test results for each DID

Step 1: Raw Water Production Summary- Source Water Production Meters

- Enter the Meter ID and DID#
- Using the information from e-PIC, enter the Preliminary Meter reading from the beginning of the audit period for that DID and the Final Meter Reading from the end of the audit period for that DID into the **green** cells.
- Alternatively, you may enter zero for the Preliminary Meter reading from the beginning of the audit period for that DID and the total withdrawal value for the Final Meter Reading from the end of the audit period for that DID into the **green** cells.



SOURCE WATER PRODUCTION METER #1		Confidence
Meter ID:	Old WTP (STANDBY)	100%
Well Name/ Meter Brand (Manufacturer) / Serial No.	SWFWMD DID#	
Final Meter Reading (At End of Audit Period).	16,352,000 Gallons	
Peliminary Meter Reading (At Start of Audit Period):	13,942,000 Gallons	
Uncorrected Total Water Supply:	2,410,000 Gallons	
Percentage (%) Error for Source Meter Inaccuracy:	0%	
Corrected Total Production for This Meter:	2,410,000 Gallons	

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SOURCE WATER PRODUCTION METER #1		Confidence
F5(b). Meter ID:	SOUTH PLANT - DID 1	80%
(Well #1)	Well Name/ Meter Brand (Manufacturer) / Serial No. SWFWMD DID#	
F5(c). Final Meter Reading (At End of Audit Period).	26,996,000 Gallons	
F5(d). Peliminary Meter Reading (At Start of Audit Period):	0 Gallons	
F5(e). Uncorrected Total Water Supply: (Subtracts Line F5(d) above from Line F5(c) above)	26,996,000 Gallons	
F5(e2). Percentage (%) Error for Source Meter Inaccuracy:	-1.73%	
F5(f). Corrected Total Production for This Meter:	27,471,253 Gallons	

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Step 1: Raw Water Production Summary

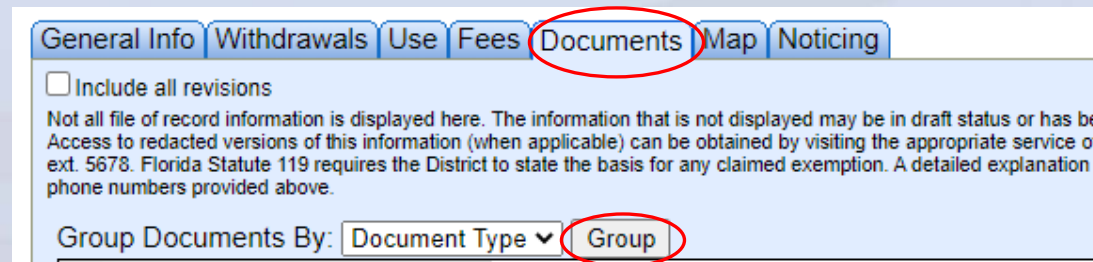
Enter % error for source meter inaccuracy from meter calibration reports. Identifying meter failure could be a critical discovery of the audit process, and so ideally, the meter accuracy tests should be performed within the last year.

To find meter accuracy test results:

- visit our website, click Resources, ePermitting, Water Use Permit then search.



- Enter permit number then search to find the appropriate WUP. Click on view details, documents, then group to find Meter Calibration reports



Step 1: Raw Water Production Summary

- Open the most recent meter accuracy report (example below) to find the average % error
 - Note: if slow the percent is positive, if high the percent is negative

FLOW METER				TEST METER				Percent Error (C/B)*100
Elapsed Time (sec/min)	Totalizer Reading (gals X 1000)		Total A		Total (gals) B	A - B = C C		
284/4.73	Stop	280101	4000	Stop	4057	4057	-57	-1.40
	Start	280097	GPM	Start	0	GPM		
228/3.80	Stop	280109	4000	Stop	4071	4071	-71	-1.74
	Start	280105	GPM	Start	0	GPM		
285/4.75	Stop	280116	5000	Stop	5090	5090	-90	-1.77
	Start	280111	GPM	Start	0	GPM		
				Correction Factor		Average		1.64
1.64% Slow		% High		X Meter Reading		= Total Flow		

Meter Calibration Report

Percentage (%) Error for Source Meter Inaccuracy:

1.64 %

PSAR

Step 1: Raw Water Production Summary – Additional Source Water Production Meters

- Repeat for each DID in the permit, using the Additional Source Water Production Meters blue cells below.

ADDITIONAL SOURCE WATER PRODUCTION METERS			Confidence
F5(b). Meter ID: (Well #2)	SOUTH PLANT -Well 2 Well Name/ Meter Brand (Manufacturer) / Serial No.	2 SWFWMD DID#	80%
F5(c). Final Meter Reading (At End of Audit Period).	54,004,000	Gallons	
F5(d). Preliminary Meter Reading (At Start of Audit Period):		Gallons	
F5(e). Uncorrected Total Water Supply: (Subtracts Line F5(d) above from Line F5(c) above)	54,004,000	Gallons	
F5(e2). Percentage (%) Error for Source Meter Inaccuracy:	0.85	%	
F5(f). Corrected Total Production for This Meter:	53,548,835	Gallons	

* Units of measurement must be consistent throughout worksheet.

Step 1: Raw Water Production Summary

- After filling in each DID's information, you will be left with the Total Raw Source Water Production (Corrected) at the top of the page. This value will be used throughout the spreadsheet.

RAW WATER PRODUCTION SUMMARY

TOTAL RAW SOURCE WATER PRODUCTION (UNADJUSTED):	100,000,145 Gallons
PRODUCTION METER INACCURACIES	-502,513 Gallons
TOTAL RAW SOURCE WATER PRODUCTION (CORRECTED)	100,502,658 Gallons

Step 2: Water Uses

This step is essentially a repetition of your PSAR information. It breaks down where all water within your utility is being used.

Note, the Water Audit calculations are done in the unit of gallons. The PSAR calculations are in gallons per day (gpd). In order to correct this, all PSAR values must be multiplied by 365.

Checklist

- ✓ Completed PSAR
- ✓ Meter accuracy test results for each DID

Step 2: Water Uses – Total System Water Supply

- Total Raw Source Water Production (Corrected) will auto populate into the first cells in Step 2.
- To calculate Water Imported and Water Exported, multiply Line 2 Imports and Line 3 Exports from the PSAR by, respectively.
- If meter inaccuracy percentages from import and/or export meters are known, enter them into the Percentage (%) Error for Source Meter Inaccuracy blue cells. If unknown, leave blank.

PSAR

2	IM	Imported Water Supply itemized list of quantities per supplier. If applicable, include the WUP number (CUP No.) of each supplier listed.	2,740	gpd
3	EX	Exported Water Supply itemized list of quantities per receiver. If applicable, include the WUP number (CUP No.) of each receiver listed.	2,740	gpd

Water Audit Spreadsheet

Water Imported:			
Total Metered Water Imports:		1,000,100	Gallons
Percentage (%) Error for Source Meter Inaccuracy:		-1	%
Total Imports (Metered, Corrected):		1,010,202	Gallons
Water Exported:			
Total Metered Export Consumption (Billed):		1,000,100	Gallons
Percentage (%) Error for Source Meter Inaccuracy:		-1	%
Total Exports (Metered, Corrected):		1,010,202	Gallons



x 365

Step 2: Water Uses – Total System Water Supply

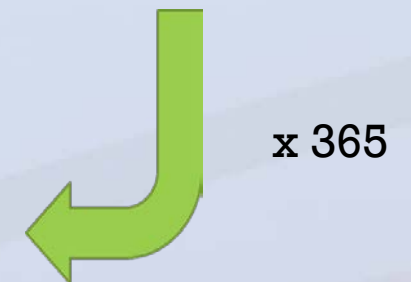
- To calculate Treatment Losses, multiply Part A Line 4 Treatment Loss from the PSAR by 365.
- ***VERY IMPORTANT-** If your Part A Line 4 Treatment Loss from the PSAR, includes a 1% Flushing Deduction, REMOVE the 1% Flushing Deduction from the Treatment Loss total. Treatment Losses should only reflect true treatment loss. All Flushing values will be entered later under Non-Revenue Water Uses.

PSAR

4	TL	Water Treatment Loss (Provide documentation of each type claimed.)	1,370	gpd
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Water Audit Spreadsheet

Treatment Losses			
Filter Backwashing, Metered Treatment Process Losses	500,050	Gallons	
Well Purging	0	Gallons	
Other Treatment Losses (Chlorine Analyzer Feed, Lube Lines, etc)	0	Gallons	
Total Treatment Losses	500,050	Gallons	



Step 2: Water Uses –Billed Water Consumption

- Enter Total Customer Service Connections (Active and Inactive) in the **green** cell. This number *may* be Part B Line 11 “Number of Metered Connections” of the PSAR, however, include any Inactive connections if known.

PSAR

Residential Water Service Category	Number of Dwelling Units	Number of Metered Connections
1. Single Family Dwelling Units	1,000	1,000
2. Multiple Family Dwelling Units	900	450
3. Mobile Home Dwelling Units		
4. Residential Irrigation Accounts	N/A	
5. Subtotal of Residential Service	1,900	1,450
Non-Residential Water Service Category		Number of Metered Connections
6. Industrial/Commercial Uses		50
7. Agricultural Uses		
8. Recreational/Aesthetic Uses		
9. Golf Course Irrigation		
10. Fire and Other Accounted Uses		
11. SUBTOTAL (Add items 5 through 10)		1,500

Water Audit Spreadsheet

<u>BILLED WATER CONSUMPTION:</u>	
Total Customer Service Connections (Active and Inactive)	1,500 Conn.



Step 2: Water Uses – Billed Water Consumption

- To calculate Total Metered Consumption (i.e. total sales), take Part B Line 11 “Average Annual Gallons per Day” and subtract Line 10 Fire and Other Accounted Uses for the PSAR. Multiply this value by 365. Part B Line 10 Fire and Other Accounted Uses from the PSAR will be used later under Authorized Non-Revenue Water Uses.
- If meter inaccuracy percentage is known, enter in the blue cell.

Water Audit Spreadsheet

Residential Water Service Category	Number of Dwelling Units	Number of Metered Connections	Annual Average (gpd)	% of Total	Documentation on an Attached Sheet
1. Single Family Dwelling Units	1,000	1,000	127,854	46.90%	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
2. Multiple Family Dwelling Units	900	450	63,927	23.45%	<input type="checkbox"/> Yes <input type="checkbox"/> No
3. Mobile Home Dwelling Units				0.00%	<input type="checkbox"/> Yes <input type="checkbox"/> No
4. Residential Irrigation Accounts	N/A			0.00%	<input type="checkbox"/> Yes <input type="checkbox"/> No
5. Subtotal of Residential Service	1,900	1,450	191,781	70.35%	<input type="checkbox"/> Yes <input type="checkbox"/> No
Non-Residential Water Service Category	Number of Metered Connections	Annual Average Gallons Per Day	% of Total		
6. Industrial/Commercial Uses	50	31,964	11.73%		
7. Agricultural Uses			0.00%		
8. Recreational/Aesthetic Uses			0.00%		
9. Golf Course Irrigation			0.00%		
10. Fire and Other Accounted Uses		2,740	1.01%		
11. SUBTOTAL (Add items 5 through 10)	1,500	226,485	83.08%		
12. Water Loss		46,118	16.92%		
TOTAL (Add items 11 and 12)(= line 5 on Part A)		272,603	100.00%		

PSAR

Total Billed Metered Consumption (i.e. total sales):		81,666,925	Gallons
Estimated Percentage (%) Error for Service Meter Inaccuracy:		2	%
Apparent Losses to Customer Service Meters		-1,601,312	

(Subtotal Average Annual gpd) MINUS (Fire & Other Accounted Uses gpd) = (Total Billed Metered Consumption gpd) x 365



Step 2: Water Uses – Billed Water Consumption

- Enter any known billed unmetered water consumption in Total Billed Unmetered Consumption. Try to make an accurate estimation of the unmetered water gallonage.
- Estimated Systematic Billing and Reporting Errors auto populates with 0.25% of the earlier calculated Total Billed Metered Consumption (i.e. total sales)

Water Audit
Spreadsheet

Total Billed Unmetered Consumption	0 Gallons	
Estimated Systematic Billing and Reporting Errors	204,167 Gallons	204,167 AWWA Default 0.25%

Step 2: Water Uses – Authorized Non-Revenue Water Uses

- Authorized Non-Revenue Water Uses values, will be found *within* different areas of the PSAR.
- Total Water Main/Distribution System Flushing will be found *within* Part B Line 12 Water Loss of the PSAR, but it will not be the entire value. This value will reflect all Flushing. ***IMPORTANT- If a 1% Flushing Deduction was claimed on the PSAR, that 1% Flushing value is added here PLUS additional Flushing values counted as Water Loss.**

PSAR

Non-Residential Water Service Category	Number of Metered Connections	Annual Average Gallons Per Day	% of Total
6. Industrial/Commercial Uses	50	31,964	11.73%
7. Agricultural Uses			0.00%
8. Recreational/Aesthetic Uses			0.00%
9. Golf Course Irrigation			0.00%
10. Fire and Other Accounted Uses		2,740	1.01%
11. SUBTOTAL (Add items 5 through 10)	1,500	226,485	83.08%
12. Water Loss		46,118	16.92%
TOTAL (Add items 11 and 12)(= line 5 on Part A)		272,603	100.00%

Line Flushing Data Example *IMPORTANT 1% Flushing Deduction not taken in this example

2019 Flushing			
Description	Flow Rate (gallons/ min)	2019 Total Time (min)	Total (gallons)
Hydrant Flushing	500	720	360,000
Line Flushing - Point 1	500	360	180,000
Line Flushing - Point 2	500	500	250,000
Line Flushing - Point 3	500	420	210,000
TOTAL 2019 Flushing (gallons)			1,000,000

Water Audit Spreadsheet

Total Water Main/Distribution System Flushing			
Metered Flushing		1,000,000	Gallons
Unmetered Flushing		0	Gallons

Step 2: Water Uses – Authorized Non-Revenue Water Uses (Continued)

- Authorized, Non-Revenue Water Uses will be found *within* Part B Line 10 Fire and Other Accounted Uses of the PSAR. Place the corresponding values in the appropriate blue cells and multiply by 365.

PSAR

Non-Residential Water Service Category	Number of Metered Connections	Annual Average Gallons Per Day	% of Total
6. Industrial/Commercial Uses	50	31,964	11.73%
7. Agricultural Uses			0.00%
8. Recreational/Aesthetic Uses			0.00%
9. Golf Course Irrigation			0.00%
10. Fire and Other Accounted Uses		2,740	1.01%
11. SUBTOTAL (Add items 5 through 10)	1,500	226,485	83.08%
12. Water Loss		46,118	16.92%
TOTAL (Add items 11 and 12)(= line 5 on Part A)		272,603	100.00%

Authorized, Non-Revenue Water Uses example

	Description	
2. FIRE DEPARTMENT	Fire hydrant use- Fire rescue training 1/14/19	112,000
	Fire hydrant use- Fire rescue training 6/14/19	83,850
	Fire hydrant use - hydrant flow tests 8/7/19	303,000
	Fire hydrant use - House fire 8/3/19	1,200
SUB TOTAL		500,050

Water Audit Spreadsheet

Authorized, Non-Revenue Water Uses		
Metered Uses		
a. Metered Fire Fighting, Testing, and Training:	500,050	Gallons
b. Metered Utility Uses (WWTF, Pump Stations, etc):	0	Gallons
d. Other Metered Uses (Specify):	0	Gallons
Unmetered Uses		
d. Unmetered Fire Fighting, Testing, and Training:		Gallons
e. Unmetered Utility Uses (WWTF, Pump Stations, etc):		Gallons
f. Other Unmetered Utility Uses (Specify):		Gallons
Tank Storage		
g. Tank Storage/Filling/Draining:	0	Gallons
Total Authorized Non-Revenue Water Uses:	500,050	Gallons

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Step 2: Water Uses – Unauthorized Consumption, Real Water Losses and Estimated Leakage

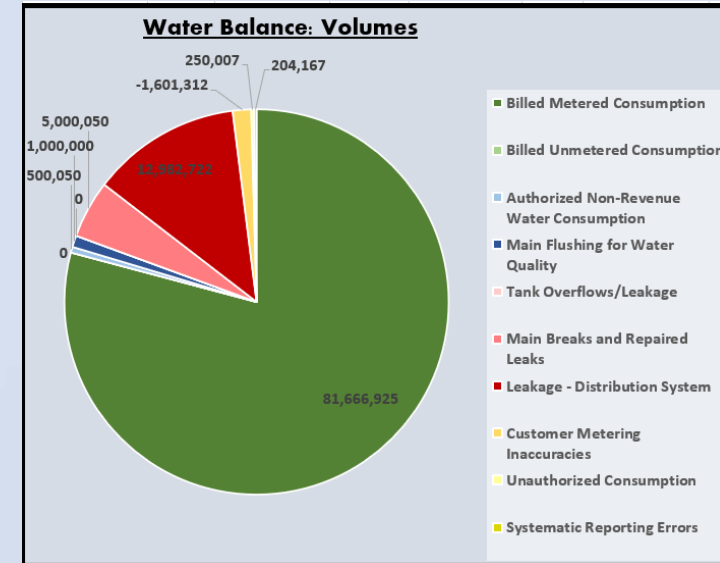
- Total Unauthorized Consumption will auto populate with 0.25% of distribution system flows, however, if an estimate of theft/unauthorized consumption is known, enter it into the **green** cell.
- For Real Water Losses, enter any known gallons lost due to system breaks and leaks in the **blue** cells.
- Estimated Leakage will auto populate according to previously entered values.

<u>UNAUTHORIZED CONSUMPTION</u>	
Total Unauthorized Consumption <i>(Estimate theft/unauthorized consumption or use AWWA default estimate)</i>	250,007 Gallons
<u>REAL WATER LOSSES</u>	
Repaired Distribution System Leaks/Line Breaks:	5,000,050 Gallons
Tank Overflows and Leakage	0 Gallons
<u>ESTIMATED LEAKAGE</u>	
LEAKAGE- DISTRIBUTION SYSTEM (UNACCOUNTED WATER)***	12,982,722 Gallons

AWWA Recommended Value for Unauthorized Consumption:
250,007 Gallons (0.25% of distribution system flows)

Step 3: Audit Summary

- This tab auto-fills using data inputted in the prior 2 tabs.
- The water balance breaks down your system's water into various uses. Categories generally become more specific as you move left to right across the diagram. Volumes are also displayed in a pie chart.



Raw Source Water Production 100,000,145	System Volume Input (Adjusted) 101,502,758	Water Supplied 100,002,608 100.0% (Distribution System Volume)	Authorized Consumption 83,166,975 83.2%	Billed Authorized Consumption 81,666,925 81.7%	Billed Metered Consumption 81,666,925 81.7%	REVENUE WATER 81,666,925 81.7%
Imports 1,000,100		Water Losses 16,835,633 16.8%	Real Losses 17,982,772 18.0%	Unbilled Authorized Consumption 1,500,050 1.5%	Billed Unmetered Consumption 0 0.0%	NON-REVENUE WATER 18,335,683 18.3%
		Treatment Losses 500,050	Apparent Losses -1,147,138 -1.1%	Authorized Non-Revenue Water Consumption 500,050 0.5%	Authorized Non-Revenue Water Consumption 500,050 0.5%	
		Exports 1,000,100		Main Flushing for Water Quality 1,000,000 1.0%	Main Flushing for Water Quality 1,000,000 1.0%	
		Supply Meter Inaccuracies -502,513		Tank Overflows/Leakage 0 0.0%	Tank Overflows/Leakage 0 0.0%	
				Main Breaks and Repaired Leaks 5,000,050 5.0%	Main Breaks and Repaired Leaks 5,000,050 5.0%	
				Leakage - Distribution System 12,982,722 13.0%	Leakage - Distribution System 12,982,722 13.0%	
				Customer Metering Inaccuracies -1,601,312 -1.6%	Customer Metering Inaccuracies -1,601,312 -1.6%	
				Unauthorized Consumption 250,007 0.3%	Unauthorized Consumption 250,007 0.3%	
				Systematic Reporting Errors 204,167 0.2%	Systematic Reporting Errors 204,167 0.2%	

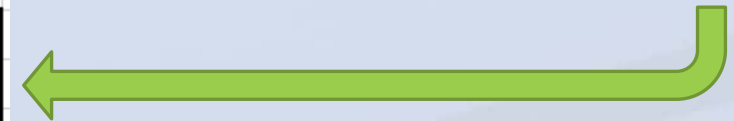
Page 1

Step 4: Utility Tools

- This tab evaluates Utility Performance
- The cells below in green contain the data you need to complete this step
- For number of service connections, count both active and inactive if available. Otherwise, use active connections which are reported in PSAR Part B, Line 11.

Residential Water Service Category	Number of Dwelling Units	Number of Metered Connections
1. Single Family Dwelling Units	1,500	1,500
2. Multiple Family Dwelling Units	200	50
3. Mobile Home Dwelling Units		
4. Residential Irrigation Accounts	N/A	50
5. Subtotal of Residential Service	1,700	1,600
Non-Residential Water Service Category		Number of Metered Connections
6. Industrial/Commercial Uses		400
7. Agricultural Uses		
8. Recreational/Aesthetic Uses		
9. Golf Course Irrigation		0
10. Fire and Other Accounted Uses		
11. SUBTOTAL (Add items 5 through 10)		2,000
12. Water Loss		
TOTAL (Add items 11 and 12)(= line 5 on Part A)		

SYSTEM ATTRIBUTES		
Length of mains	120	miles
Number of Active and Inactive service connections	2,000	Connections
Average Operating Pressure	50	PSI
Average Length of Service Lines beyond Customer meters*	0	ft
<i>*(use "0" if meters are at the curbstop)</i>		
COST DATA		
Total Annual Operating Costs (Annual Budget)	\$ 500,000	\$/Year
Customer Retail Unit Cost (average)	\$ 3.00	\$/1000 gals
Variable Production Costs (or Import Costs)	\$ 2.00	\$/1000 gals



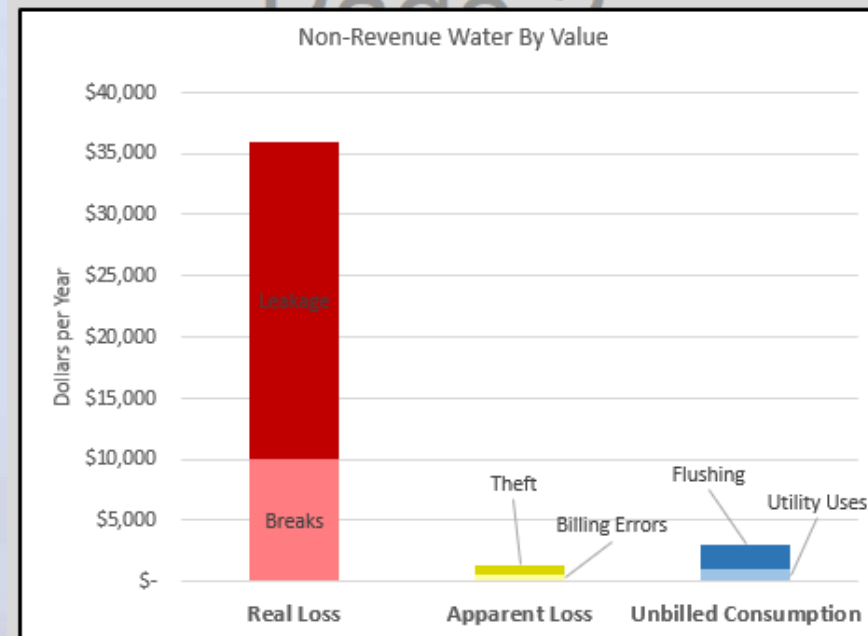
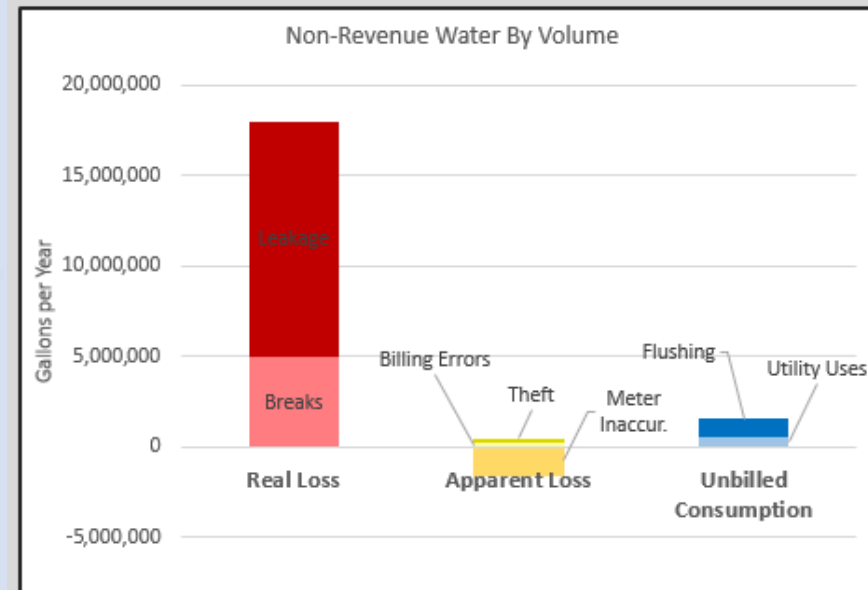
Step 4: Utility Tools

- Once you input the data on the previous slide, the remaining cells auto-populate.
- These detail losses and non-revenue water. This data, along with the water balance in Step 3, will be useful in filling out the water audit report

Utility Performance Indicators			
<u>System Attributes</u>			
Real Losses	17,982,772	Gallons	
Apparent Losses (Lost Revenue Water)	-1,147,138	Gallons	
Unbilled Consumption (Utility Uses)	1,500,050	Gallons	
Non-Revenue Water	18,335,683	Gallons	
Unavoidable Real Loss	17,322,900	Gallons	
Unavoidable Real Loss	47,460	gpd	
Infrastructure Leakage Index	1.0	ILI	
<u>Financial Performance</u>			
Cost of Real Losses	\$ 35,966	per year	
Lost Revenue	\$ (3,441)	per year	
Cost of Unbilled Water Consumption (Utility Uses)	\$ 3,000	per year	
Cost of Non-Revenue Water	\$ 35,524	per year	
Non-Revenue Water Percentage (by Volume)	18.7%	of Water Supplied	
Non-Revenue Water Value as a Percentage of Operating Cost	7.1%	of Operating Budget	
<u>Operational Efficiency Metrics</u>			
Non-Revenue Water per connection per day	25	gpd/connection	
Real Losses per connection per day	25	gpd/connection	
Real Losses per mile of main per day	411	gpd/mile	
Real Losses per Connection per PSI	0.5	gpd/connection/PSI	
Lost Revenue Water per Connection per day	-2	gpd/connection	

Step 4: Utility Tools

- You will also find non-revenue water by volume expressed in both gallons per year and dollars per year to help your utility focus its water loss reduction efforts.



Water Audit Report

- After completing the Water Audit, write the report using the template located in the website with information generated by the audit and historical water loss information relating to the utility.

WATER LOSS SUMMARY

Provide basic information about the primary types of water loss experienced by the utility. Provide information about the utility system that is useful to understanding the types of water use and water loss in that utility. The narrative should answer the following types of questions:

- What are the potential factors contributing to overall water loss?
- What's the system history/background as it relates to water loss?
- What are potential sources of uncertainty in estimating water loss? Does the utility have enough information at this time to make informed decisions on reducing water loss?

2017 WATER AUDIT RESULTS

Discuss the results of the current water audit. Water loss should be broken down into estimated volumes for each type of loss. Discuss how confident the utility staff are in the estimates of different sources of loss. It may be good to break this section down into types of water use and water loss such as:

WATER LOSS CONTROL PROGRAM

Provide general information on recent/current utility operations and how they relate to water loss. What are some factors that have led to different types of water loss in the past few years? What is currently being done to quantify and reduce water loss? Useful information may include:

Water Audit Report

- The most important part of the report is the Remedial Action Plan. This is to discuss the steps and actions to reduce water loss below 10%. Below the plan is a list of SOPs and dates to be filled in to follow along with the plan.

REMEDIAL ACTION PLAN

Create a plan to reduce water losses to below 10%. Discuss how the different sources of loss in the system can be reduced and better quantified. The timeframe of reducing losses will be based on the types of loss and the different actions or practices required to reduce those losses, as well as utility resources.

SOPs and Action Items

Fill out the table below to list SOPs and utility improvements that can help to reduce water loss or better quantify difference sources or water loss or consumption, based on the results of the water audit. Only list SOPs that relate to the losses occurring in the system. Don't fill up the list with SOPs the utilities is already practicing.