



## Section I: My Starting Point for Non-Revenue Water

Year: \_\_\_\_\_ Calendar or Fiscal (Circle One)

My estimate of Non-Revenue Water is: \_\_\_\_\_% or \_\_\_\_\_ MG or \_\_\_\_\_ (other)

My method of estimation is: \_\_\_\_\_

My confidence level in my estimation is (0 to 100%): \_\_\_\_\_

When I think about Non-Revenue Water, my biggest concern is: \_\_\_\_\_

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When thinking about Non-Revenue Water compared to other issues facing our system, I would say Non-Revenue Water is:

- Our biggest problem
- A major problem but not our biggest problem
- Of concern, but not a major problem
- A minor problem
- Not a problem

My Utility's board or governing body would say Non-Revenue Water is:

- Our biggest problem
- A major problem but not our biggest problem
- Of concern, but not a major problem
- A minor problem
- Not a problem



## Section 2: My System's Characteristics

### Water Supplied (Check All that Apply)

- We have our own sources of water (own sources)
- We purchase water from another system (purchased water)
- We sell water in bulk to another system (water exported)

### Own Sources (if checked above)

- All of our sources are metered individually
- All of source water is metered but there are not individual meters (two or more sources are metered together)
- Some of our sources are metered some of our sources are estimated
- None of our sources are metered, all are estimated

### Purchased Water

- Our purchased water is metered at each entry point
- Our purchased water is metered at some entry points but not all
- Our purchased water is not metered

### Bulk Water Exported

- Our exported water is metered at each entry point
- Our exported water is metered at some entry points but not all
- Our exported water is not metered

### Meters for Own Sources, Purchased Water and Exported Water

- Our master meters for our own sources  are  are not tested for accuracy  
If checked is it:  annually or  occasionally
- Our purchased water meters  are  are not tested for accuracy  
If checked is it:  annually or  occasionally
- Our exported water meters  are  are not tested for accuracy  
If checked is it:  annually or  occasionally

## Water Sold

### Customer Metering

- We meter all of our customers
- We meter some, but not all of our customers
- We don't meter any of our customers
- We meter all the customers we bill but don't meter unbilled customers

### Customer Billing

- All of our customers receive a bill
  - Some customers don't receive a bill
- The following customers or types of customers are not billed: \_\_\_\_\_
- \_\_\_\_\_

### Customer Meter Accuracy Testing

- Our customer meters \_\_\_ are \_\_\_ are not tested for accuracy
- If accuracy testing is conducted which meters and how often?
- Residential meters \_\_\_ Yes \_\_\_ No \_\_\_ annually or \_\_\_ occasionally
- Multi-Family residential meters \_\_\_ Yes \_\_\_ No \_\_\_ annually or \_\_\_ occasionally
- Commercial meters \_\_\_ Yes \_\_\_ No \_\_\_ annually or \_\_\_ occasionally
- Large commercial meters \_\_\_ Yes \_\_\_ No \_\_\_ annually or \_\_\_ occasionally
- Other (Specify \_\_\_\_\_) \_\_\_ Yes \_\_\_ No \_\_\_ annually or \_\_\_ occasionally
- Other (Specify \_\_\_\_\_) \_\_\_ Yes \_\_\_ No \_\_\_ annually or \_\_\_ occasionally

### Other Water Uses

#### We Have the Following Water Uses

- Flushing for Water Quality Purposes
  - We meter this use (temporary meter)
  - We estimate this use
  - We do not meter or estimate this use but have data that could be used for this purpose



\_\_\_ Flushing for Other Purposes

\_\_\_ We meter this use (temporary meter)

\_\_\_ We estimate this use

\_\_\_ We do not meter or estimate this use but have data that could be used for this purpose

\_\_\_ Fire Flow Hydrant Testing

\_\_\_ We meter this use (temporary meter)

\_\_\_ We estimate this use

\_\_\_ We do not meter or estimate this use but have data that could be used for this purpose

\_\_\_ Fire Flow for Fire Fighting

\_\_\_ We meter this use (temporary meter)

\_\_\_ We estimate this use

\_\_\_ We do not meter or estimate this use but have data that could be used for this purpose

\_\_\_ Street Cleaning

\_\_\_ We meter this use (temporary meter)

\_\_\_ We estimate this use

\_\_\_ We do not meter or estimate this use but have data that could be used for this purpose

\_\_\_ Sewer Cleaning

\_\_\_ We meter this use (temporary meter)

\_\_\_ We estimate this use

\_\_\_ We do not meter or estimate this use but have data that could be used for this purpose



\_\_\_ Other Use: \_\_\_\_\_

\_\_\_ We meter this use (temporary meter)

\_\_\_ We estimate this use

\_\_\_ We do not meter or estimate this use but have data that could be used for this purpose

\_\_\_ Other Use: \_\_\_\_\_

\_\_\_ We meter this use (temporary meter)

\_\_\_ We estimate this use

\_\_\_ We do not meter or estimate this use but have data that could be used for this purpose

\_\_\_ Other Use: \_\_\_\_\_

\_\_\_ We meter this use (temporary meter)

\_\_\_ We estimate this use

\_\_\_ We do not meter or estimate this use but have data that could be used for this purpose

#### Unauthorized Water Use/Water Theft

\_\_\_ We have discovered water theft from hydrants and it is a \_\_\_ major problem \_\_\_ minor problem

\_\_\_ We have discovered water theft from illegal connections and it is a \_\_\_ major problem \_\_\_ minor problem

\_\_\_ We have discovered water theft from meter tampering and it is a \_\_\_ major problem \_\_\_ minor problem

We estimate the quantity of water lost through water theft \_\_\_\_ Yes \_\_\_\_ No



### Section 3: My System's Data

#### Water Supplied

**Table 1: Water from Own Sources**

Source Type	Total Annual Flow (MG)	Flow is Measured (Annually, Monthly, Daily)	How Collected (Manual, Automatically)	Data Stored (Paper, Electronic)
<b>Total</b>				

**Table 2: Master Meter Accuracy Testing: Water From Own Sources**

Master Flow Meter Accuracy Test Report	Meter #1	Meter #2	Meter #3	Meter #4	Meter #5
Date					
Duration					
Method					
Accuracy Result					
Over/Under					

**Table 3: Purchased Water**

Location of Purchase Water Meter or Name of Meter	Total Annual Flow (MG)	Flow is Measured (Annually, Monthly, Daily)	How Collected (Manual, Automatically)	Data Stored (Paper, Electronic)
<b>Total</b>				



**Table 4: Master Meter Accuracy Testing: Purchased Water**

Master Flow Meter Accuracy Test Report	Meter #1	Meter #2	Meter #3	Meter #4	Meter #5
Date					
Duration					
Method					
Accuracy Result					
Over/Under					

**Table 5: Bulk Water Exported**

Location of Bulk Export Water Meter or Name of Meter	Total Annual Flow (MG)	Flow is Measured (Annually, Monthly, Daily)	How Collected (Manual, Automatically)	Data Stored (Paper, Electronic)
<b>Total</b>				

**Table 6: Master Meter Accuracy Testing: Exported Water**

Master Flow Meter Accuracy Test Report	Meter #1	Meter #2	Meter #3	Meter #4	Meter #5
Date					
Duration					
Method					
Accuracy Result					
Over/Under					



**Water Delivered to Customers**

**Table 7: Billed, Metered Customers (DO NOT INCLUDE BULK SALES)**

Customer Category	Total Water Sold (MG)	Flow is Measured (Annually, Quarterly, Monthly)	How Collected (Manual, Automatically)	Data Stored (Paper, Billing System, Other Electronic)
<b>Total</b>				

**Table 8: Billed, Unmetered Data**

Customer Category	Number of Customers Per Category	Estimated Flow Per House/month (gallons/month)	Total Flow per Month	Data Stored (Paper, Billing System, Other Electronic)
Residential				
Multi-Family				
Institutional				
Commercial				
Other:				
Other:				
Other:				
<b>Total</b>				









**Table 14: Number of Active and Inactive Service Connections**

Total Number of Active Service Connections	Total Number of Inactive Service Connections	Total Number of Fire Connections	Total Number of Connections (Add the Previous Three Columns Together)

**Financial Characteristics**

Total Annual Cost of Operating the System = \_\_\_\_\_

Customer Retail Unit Cost (\$/1,000 gallons)

**Table 15: Rate Schedule (Simplified Calculation)**

Customer Class	Total Annual Flow for Customer Class (MG)	Proportion of Flow by Customer Class	\$/1,000 Gallons per Customer Class	Proportion of Flow by Customer Class X \$/1,000 for the Customer Class
<b>Total</b>			<b>Total</b>	

Note: This calculation does not take into account an increasing block rate and the amount of flow per block. If desired a more detailed rate schedule can be used to break usage into classes and a more accurate flow weighted average for the overall rate can be calculated.

Variable Production Cost (\$/1,000,000)

Cost of Energy for Water Production for Entire Year = \_\_\_\_\_  
 Cost of Chemicals for Water Treatment for Entire Year= + \_\_\_\_\_  
**Total Cost of Energy and Chemicals for Entire Year =** = \_\_\_\_\_

Variable Production Cost (\$/MG) =  $\frac{\text{Total Cost of Energy and Chemicals for Year}}{\text{Total Volume of Water Produced in MG}}$

(Note: In the Total Volume of Water Produced, use the corrected value based on the flow meter error. Can get this number by using the water audit software.)

**Other Data**

In looking at non-revenue water, there are other types of data that are good to collect to improve the understanding of the system and assist in applying the tools to reduce non-revenue water.

**Break Data**

Collect data regarding pipe breaks including the following attributes:

Type of pipe	Size of Pipe	Type of Break
Location of Break	Service or Main	Estimate of Flow
Method of fixing break	How break was found	

**Storage Tank Data**

Collect data regarding tank elevations. This data can be collected daily, weekly, monthly, or annually. If collected annually, the dates of the first and last reads should match the water audit dates.

**Water Rebated to Customers**

If the utility rebates money back to customers in some way following house-side leaks, the amount of water rebated in this manner can be collected to see the impact of these types of rebates.



### Section 4: Data Entry Summary

Input Type	Value or Write Default	Comments
Volume from Own Sources		
Master Meter and Supply Error Adjustment for Supply Master Meters		
Water Purchased/Bulk Water Imported		
Master Meter and Supply Error Adjustment for Bulk Water Imported		
Bulk Water Exported		
Master Meter and Supply Error Adjustment for Bulk Water Exported		
Billed Metered		
Billed Unmetered		
Unbilled Metered		
Unbilled Unmetered		
Unauthorized Usage		
Customer Meter Inaccuracies		
Data Handling Errors		
Length of Mains		
Location of Customer Meters		
Number of Active and Inactive Connections		
Average Operating Pressure		
Total Annual Cost of Operating Water System		
Customer Retail Unit Cost (\$/1,000 Gallons)		
Variable Production Cost (\$/MG)		



## Section 5: Data Grading Summary

Input Type	Data Grade (Not Needed if Default)	Comments
Volume from Own Sources		
Master Meter and Supply Error Adjustment for Supply Master Meters		
Water Purchased/Bulk Water Imported		
Master Meter and Supply Error Adjustment for Bulk Water Imported		
Bulk Water Exported		
Master Meter and Supply Error Adjustment for Bulk Water Exported		
Billed Metered		
Billed Unmetered		
Unbilled Metered		
Unbilled Unmetered		
Unauthorized Usage		
Customer Meter Inaccuracies		
Data Handling Errors		
Length of Mains		
Location of Customer Meters		
Number of Active and Inactive Connections		
Average Operating Pressure		
Total Annual Cost of Operating Water System		
Customer Retail Unit Cost (\$/1,000 Gallons)		
Variable Production Cost (\$/MG)		



## Section 6: Explanations For Data Inputs

The Water Audit Software only allows for 1 number to be entered for the master meter error so if there is more than 1 well, a flow weighted average must be calculated to combine the errors into one number. The flow-weighted average takes into account the fact that each well contributes a different amount of flow to the total. The higher the flow of the well, the greater the impact of the error and the lower the flow the lesser the impact of the error.

The calculation is done by taking the proportion of flow provided by each well times that well's error. The errors are then added together to get the total flow-weighted average. The example below is provided to show how this calculation can be completed.

**Master Meter Testing Results**

Master Flow Meter Accuracy Test Report	Well #1	Well #2	Well #3
Date	2/3/2014	2/4/2014	2/5/2014
Duration	6 hr	6 hr	6 hr
Method	Clamp-on (ultrasonic)	Comparative meter (test port)	Clamp-on (ultrasonic)
Accuracy Result	6.30%	1.10%	2.80%
Over/Under	Over	Under	Under

The table below shows how to calculate the flow weighted average from the well data. The first row has been completed as an example. Complete the remaining two rows and add the results in the final column together to get the flow weighted average.

**Flow Weighted Average Master Meter Error**

Total Flow from Well (MG)	Proportion of Flow (Total Flow from Well/Total Flow of All Wells)	% Meter Error (+ number if over read, - number if under read)	Proportional Meter Error
212.72	$212.72/485.21 = 0.438$	+6.3	$0.438*(+6.3) = +2.75$
175.80			
96.69			
<b>485.21</b>	<b>Flow Weighted Average Meter Error</b>		

One way to check the answer is to look at the range the number has to be within. In this case, the highest over read is 6.3% and the highest under read is 2.8%. (Recall that over reads are + numbers and under reads are negative numbers.) In this case, the answer for flow weighted average must be within the range of +6.3% and -2.8%.

**Is your answer for flow weighted average between +6.3% and -2.8%? \_\_\_\_ Yes \_\_\_\_ No**

If your answer is no, check your math again before moving on.

### Customer Retail Unit Cost

This is the customer's cost to purchase the next 1,000 gallons. It's used to value apparent losses. It is only one entry so it must include both the residential and non-residential rates in proportion. It does not consider the base rate. An example of this calculation is presented below.

In this example, the rate structure includes 2 rates – residential rate is \$1.71 per thousand gallons, and non-residential rate is \$1.35 per thousand gallons. The proportion of residential sales can be determined by dividing the residential flow by the total flow (residential + non-residential flow.) The non-residential sales can be determined the same way by dividing the total non-residential sales by the total sales. These proportions are used to determine the

To calculate the input, a simple weighted calculation is needed:

$(\text{Residential rate } (\$/1000)) \times (\text{residential proportion of sales}) + (\text{non-residential rate } (\$/1,000 \text{ gallons})) \times (\text{non-residential proportion of sales}) = \text{weighted } \$/1,000 \text{ gallons}$

An added consideration, the utility also operates a wastewater treatment facility. The rates for wastewater are: \$1.95/1,000 gallons for residential customers and \$1.74/1,000 gallons for non-residential customers. Apparent losses also impact wastewater revenues. Therefore, wastewater rates should also be added to the customer retail unit cost. When wastewater is included, the calculation below should be used:

$(\text{Residential Water Rate}) \times (\text{residential proportion of sales}) + (\text{non-residential Water Rate}) \times (\text{non-residential proportion of sales}) + (\text{Residential Wastewater Rate}) \times (\text{residential proportion of sales}) + (\text{non-residential Wastewater Rate}) \times (\text{non-residential proportion of sales}) = \text{total weighted customer retail cost including water and wastewater}$

The following table may be helpful in calculating the total customer retail cost.

1	2	3	4	5	6	7	8
Category	Flow	Proportion of Flow by Category	Rate for Water (\$/1,000)	Proportion of flow X Rate (Column 3 X Column 4)	Rate for Wastewater (\$/1,000)	Proportion of flow X Rate (Column 3 X Column 6)	Wastewater + Water (Add Columns 5 and 7)
Residential							
Non-Residential							
Total							