


Recovering Non-Revenue Water in North Carolina's Water Systems


The AWWA Standard Water Audit & Innovative System Management Strategies

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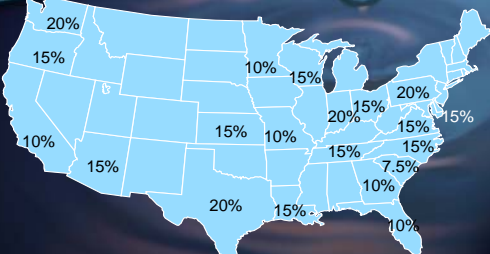


Traditional Water System View of Conservation

- Systems are looking at water conservation through:
 - Reducing / stopping irrigation
 - Reducing household consumption
 - Loss of industry
 - Finding and eliminating leaks in the system
 - Reducing Unaccounted For Water (UFW)
- The challenges:
 - Finding and eliminating leaks now may only cause future problems
 - Simply move leaks "around the system" as system pressure increases
 - Expensive to find and fix, requires money and manpower
 - How do you reduce UFW when you don't know where it is
 - How much UFW is ok?




How Much UFW is ok?




How systems "account" for their water varies **SIGNIFICANTLY** under current general standard

There's a better way!



How is North Carolina looking at Water now?

- Systems submit Local Water Supply Plans to DENR
- Should include detailed information on the water system, including a breakdown of water consumption by:
 - Residential
 - Commercial
 - Industrial
 - Institutional
 - System Process
 - Unaccounted For Water (UFW)
- Some systems provide a more detailed accounting
- How systems "account" for their water varies **SIGNIFICANTLY** under such a general standard



Real Water System Data: Current UFW Approach


System A

- Water Produced – 1,100,000 gpd
- Sales - 640,000 gpd
- UFW – 460,000 gpd
- % UFW – 41.7%
- Cost of Lost Water - \$109,000 per year

System B

- Water Produced – 9,625,000 gpd
- Sales - 8,587,000 gpd
- UFW – 1,038,000 gpd
- % UFW – 10.8%
- Cost of Lost Water - \$246,000 per year


% UFW is a poor & inconsistent performance indicator



Standard Water Balance Format


Own Sources	Total System Input	Water Exported	Authorized Consumption	Billed Authorized Consumption	Revenue Water	Billed Water Exported
				Unbilled Authorized Consumption		Billed Metered Consumption
Water Imported	(allow for known errors)	Water Supplied	Water Losses	Apparent Losses	Non-Revenue Water	Billed Unmetered Consumption
				Real Losses		Unbilled Metered Consumption
						Unbilled Unmetered Consumption
						Unauthorized Consumption
						Customer Metering Inaccuracies
						Systematic Data Handling Error
						Leakage on Mains
						Leakage on Service Lines
						Leakage & Overflows at Storage

Source: AWWA Water Loss Control Committee




Non-Revenue Water (NRW) Instead of UFW

- Systems account for water production, usage & loss consistently
- **NO WATER IS UNACCOUNTED FOR**
- Stop thinking about UFW and start thinking in terms of NRW
 - How much money/manpower does a system spend producing water that doesn't generate any revenue?
 - A certain amount (unbilled authorized consumption) will always be needed
- Now a system can focus a portion of water conservation on reducing:
 - Unbilled Authorized Consumption
 - Apparent Losses
 - Real Losses




Billed Unmetered Consumption

- Does the system bill any customers for service without reading a meter?
- How does the system handle contractor usages? How do they obtain water for construction?
- Does the system meter and bill for contractor line flushing and testing in developments that will be transferred to the system?
- Does the system meter and bill for contractor line flushing and testing in projects that are system funded?




Unbilled metered Consumption

- Does the system read any meters that are not billed? (municipal/system offices, park irrigation, WTP/WWTP, etc.)
- How does the fire department communicate with the system? Do they meter or estimate usage during fires or training? Do they have a form to be used during those events?
- Is water volume used for street flushing by city trucks estimated or metered?



Unbilled Unmetered Consumption

- Estimated usage for line flushing?
- Are fire lines metered? Are the meters read consistently to check:
 - First, for usage?
 - Second, for volume?



Real Water System Data: Using Water Audit Standard

System A

- Water Produced: 1,100,000 gpd
- Sales: 640,000 gpd
- UFW: 460,000 gpd
- % UFW: 41.7%
- Cost of Lost Water: \$109,000 per year
- Miles of Main: 30 mi.
- Service Connections: 3,335
- Average System Pressure: 90 psi


System B

- Water Produced – 9,625,000 gpd
- Sales – 8,587,000 gpd
- UFW – 1,038,000 gpd
- % UFW – 10.8%
- Cost of Lost Water – \$246,000 per year
- Miles of Main: 165 mi.
- Service Connections: 7,414
- Average System Pressure: 70 psi

ILI = 7.2

ILI = 7.0


%UFW doesn't tell us enough – Look at the Infrastructure Leakage Index. These systems are performing about the same.



Infrastructure Leakage Index = Common Measure of Performance

- CARL = Current Annual Real Losses
- UARL = UnAvoidable Real Losses
 - All systems have a level of unavoidable leakage
 - UARL is determined based on factors specific to each system
 - Managing system pressure is the only reliable way to reduce UARL over the life of the system
- ILI is the ratio of CARL to UARL
 - ILI = CARL / UARL
 - The smaller ILI becomes in a system, the closer a system comes to reducing real losses to its unavoidable number

What's a good ILI?




Setting a Target ILI

Target ILI Range	Water Resources Considerations	Operational Considerations	Financial Considerations
1.0-3.0	Available resources are greatly limited	Leakage above this level requires expansion to existing infrastructure	Water resources are costly to develop or purchase
3.0-5.0	Water resources are believed to be sufficient to meet long term needs	Existing water supply infrastructure capability is sufficient	Water resources can be developed or purchased at reasonable expense
5.0-8.0	Water resources are plentiful, reliable	Superior reliability capacity and integrity of water	Cost to purchase water is low
Greater than 8.0*			

*Operational and financial considerations may allow long term ILI, but this is not an effective utilization of water as a resource. This is discouraged.

Source: AWWA Water Loss Control Committee



ILI is a Start.

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- UFW - 1,038,000 gpd
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- Cost of Lost Water - **\$246,000 per year**
- Miles of Main: 165 mi.
- Service Connections: 7,414
- Average System Pressure: 70 psi

ILI: 7.2

CARL: ?

UARL: 63,866 gpd

ELL: ?

ILI: 7.0


CARL: ?

UARL: 147,589 gpd

ELL: ?

We need to know the Economic Level of Leakage!

Source: AWWA Water Loss Control Committee



Economic Level of Leakage (ELL)

- The ELL is somewhere between the CARL and UARL
- Below the ELL, every dollar invested trying to reduce real losses returns less than a dollar in cost savings or revenue enhancement
- If a system is above its ELL, then implementing strategies to reduce real losses makes economic sense
- Below the ELL, a system should invest resources in other areas of the system
- The ELL can change as water production/purchase costs change and customer revenues change

Source: AWWA Water Loss Control Committee



Managing Apparent Losses

Meter accuracy error
Meters do not register actual volumes passing

Unauthorized Consumption
Theft and illegal consumption

Existing Apparent Losses

Economic Level


Unavoidable Apparent Loss

Data transfer errors between meter and archives
Poor customer accountability

Data analysis
Errors Between archived data and data used for billing/water balance

• As each component receives more or less attention, the losses will increase or decrease
 • The operator strives to keep losses to a minimum

Source: AWWA Water Loss Control Committee



Managing Real Losses

More efficient Leakage Management

Improved response time for leak repair

Existing Real Losses

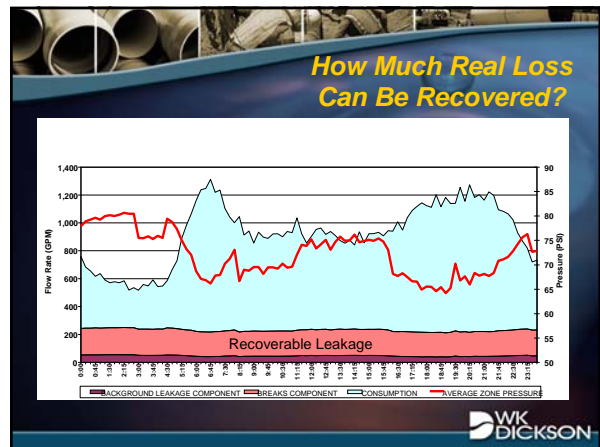
Economic Level

Unavoidable Real Losses

Pressure Management & Level Control


Improved System Maintenance Replacement Rehabilitation

Source: AWWA Water Loss Control Committee


How much does it cost to implement recovery strategies?

- Determine the Retail Price of Water
 - Apparent Losses
- Determine the Variable Production Cost of Water
 - Real Losses

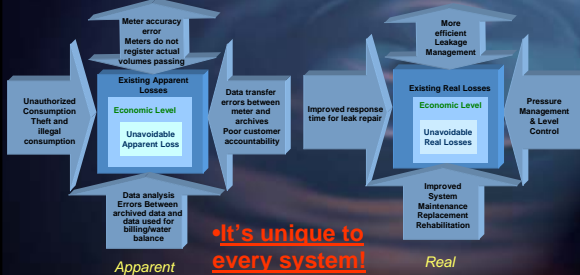


How much does it cost to implement recovery strategies?

- Assess Cost Benefit of Varying Recovery Strategies
- Calculate Estimated Payback Period
- Can compare strategies and make wise economic choices



Which strategy is most cost-effective?



Apparent

- Unauthorized Consumption Theft and illegal consumption
- Meter accuracy error Meters do not register actual volumes passing
- Existing Apparent Losses
- Economic Level
- Unavoidable Apparent Loss
- Data analysis Errors Between archived data and data used for billing/water balance


Real

- Existing Real Losses
- Economic Level
- Unavoidable Real Losses
- Improved System Maintenance Replacement Rehabilitation

Interventions: Data transfer errors between meter and archives Poor customer accountability, Improved response time for leak repair, Pressure Management & Level Control, More efficient Leakage Management

It's unique to every system!

Source: AWWA Water Loss Control Committee



Why Use Standard Water Auditing?

- Communities develop a clearer understanding of system performance
- Management knows more about the economic performance of the system
- Funding agencies can clarify the value of their investment in a system
- State agencies can use the data in conjunction with existing data to help "challenged" systems
- Communities develop strategies that *really* impact *real losses* in the system
- Communities realize immediate opportunities to:
 - Conserve Water
 - Enhance Revenues
 - Reduce Expenses

