A light blue map of North Carolina is centered on the page. The text of the title is overlaid on the map.

Water Efficiency Best Management Practices Manual for North Carolina

Managing Water Resources to Support North Carolina's Future



A light blue map of North Carolina is centered on the page. The title text is overlaid on the map.

Water Audit for Small Systems in North Carolina

Managing Water Resources to Support
North Carolina's Future

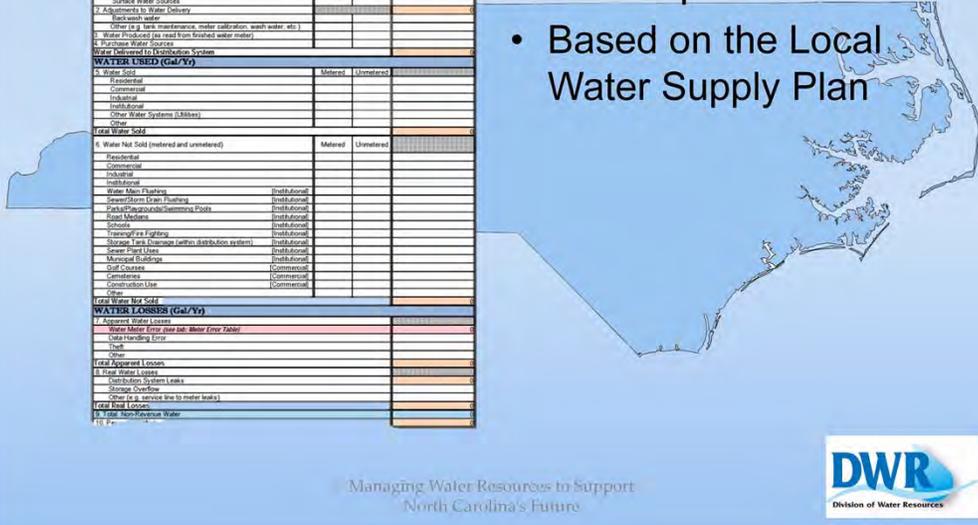


Small System Water Audit

Please print definitions before using. Enter values in non-shaded cells only.
Cells with red triangles contain instructions. Roll over the red triangle to reveal the instruction text.

WATER DELIVERED (Gal/Yr)		2019	
1. Total Source Water Supply (Flow Water)			
Ground Water Sources	Metered	Unmetered	
2. Surface Water Sources			
Surface Water Sources			
Backwash water			
Other (e.g., tank maintenance, water calibration, wash water, etc.)			
3. Water Produced (as read from finished water meter)			
Wastewater Water Sources			
Water Delivered to Distribution System			
4. Water Sold			
Residential			
Commercial			
Industrial			
Institutional			
Other Water Systems (kilobars)			
Other			
Total Water Sold			
5. Water Not Sold (metered and unmetered)			
Residential	Metered	Unmetered	
Commercial			
Industrial			
Institutional			
Water Main Flushing	Institutional		
Lawns/Greens Lawn Flushing	Institutional		
Parks/Picnics/Amusement Parks	Institutional		
Light Towers	Institutional		
Schools	Institutional		
Transfer of air lighting	Institutional		
Storage Tank Flushing (within distribution system)	Institutional		
Leaver Plant Users	Institutional		
Manure Enclosure	Institutional		
Golf Courses	Commercial		
Construction	Commercial		
Construction Use	Commercial		
Other			
Total Water Not Sold			
6. Apparent Water Losses			
Water Meter Error (see also Meter Error Table)			
Leak Handling Error			
Other			
Total Apparent Losses			
7. Water System Losses			
Distribution System Leaks			
Storage Tank Leaks			
Other (e.g., service line to meter leaks)			
Total System Losses			
8. Total Non-Production Water			
Total			

- Excel Spreadsheet
- Based on the Local Water Supply Plan



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Here is what the spreadsheet looks like. Can be adapted to be a yearly process

Small System Water Audit

Volume From Own Sources	Water Sold	Authorized Consumption	Billed Authorized Consumption	Revenue Water
	Water Supplied		Unbilled Authorized Consumption	Non-Revenue Water
Water Losses		Apparent Losses		
Water Purchased		Real Losses		

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Here is what the spreadsheet looks like. Can be adapted to be a yearly process

Small System Water Audit



- Tailored for smaller systems
- Less detail needed than AWWA
- Still necessary to have cooperation of the town staff

dreamstime.com
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The Keystone of the BMPs for Water Systems

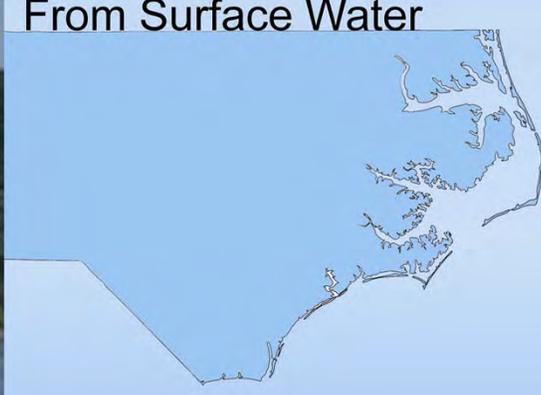
Water Delivered (gal/year)

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Total water supply RAW Water

From Surface Water



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Total Water Supply RAW Water

From Ground Water



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Adjustments to Water Delivery

Backwash Water



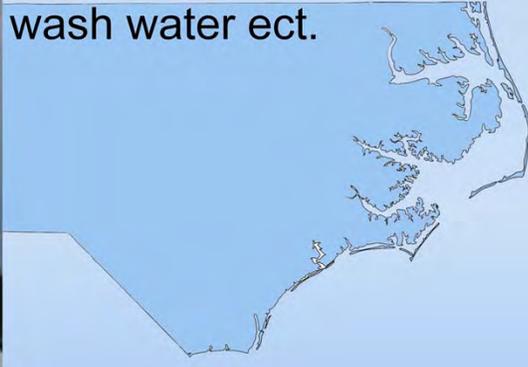
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Adjustments to Water Delivery



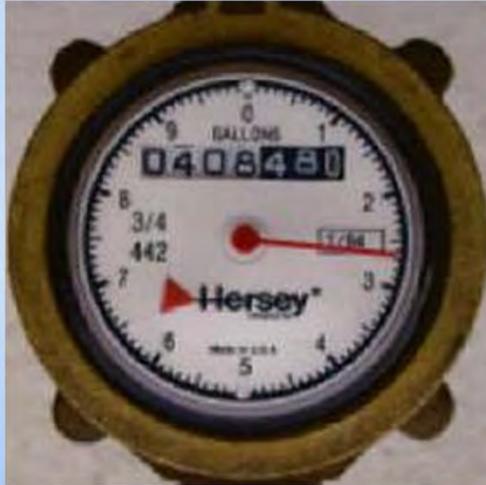
Other: Tank maintenance, wash water ect.



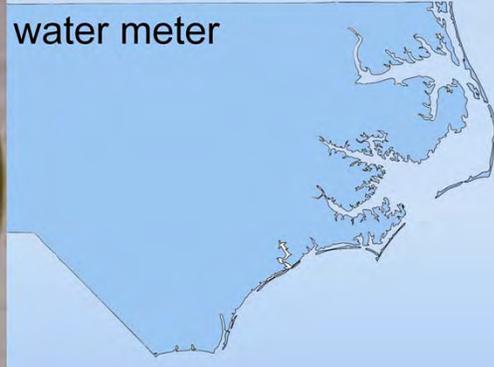
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Water Produced



As read from finished
water meter



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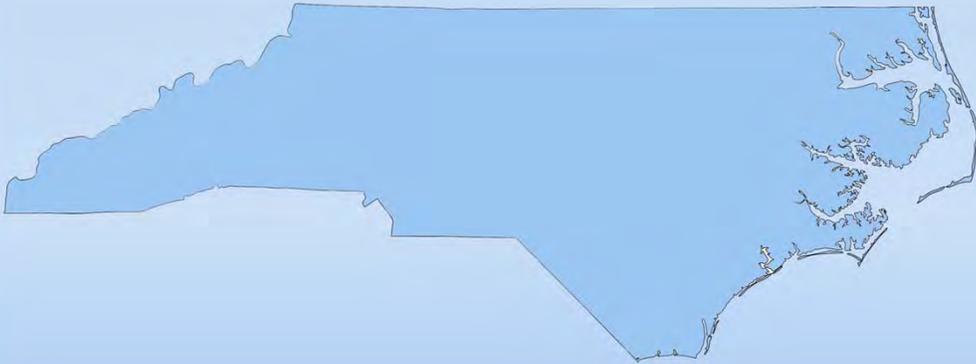
Purchased Water Sources



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Water Used (Gallons/Year)



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Water Sold

Residential



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May include: Boarding houses, Family care homes, Guest houses, Home occupations, Home professional offices, Manufactured Homes, Manufactured Home Parks, Multi-family dwellings, Planned unit developments, Residential accessory uses, Single-family dwellings, Vacation homes, Two-family dwellings (duplex), Three-family dwellings (triplex), etc

Water Sold

Residential



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Water Sold

Commercial



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May include: Animal hospitals, Automobile repairs, Automobile sales, Automobile service stations, Banks, Barber/beauty shops, Business offices, Bus Stations, Butcher shops, Cab stands, Convenience stores, Dental clinics, Exterminators, Farms, Farm machinery showrooms, Fish markets, Funeral homes, Golf courses, Hardware stores, Hotels, Kennels, Laundry/dry cleaning storefronts, Medical clinics, Mobile home showrooms, Motorcycle showrooms, Nurseries, Paint/wallpaper showrooms, Parking lots, Pet shops, Print shops, Professional service agencies, Radio/TV repair shops, Recreational vehicle sales and service, Restaurants, Retail stores, Seed/feed stores, Shoe repair shops, Specialized service agencies, Studios (art, photo, design, etc.), Television or radio broadcast stations, Theaters, Train stations, etc.

Water Sold

Industrial



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Manufacturing Facilities, Processing Facilities, Utilities, etc.

Water Sold

Institutional



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Hospitals, Assisted living facilities, Correctional facilities, Schools, Colleges, Churches, Government buildings, Police stations, etc.

Water Sold

To Other Water Systems

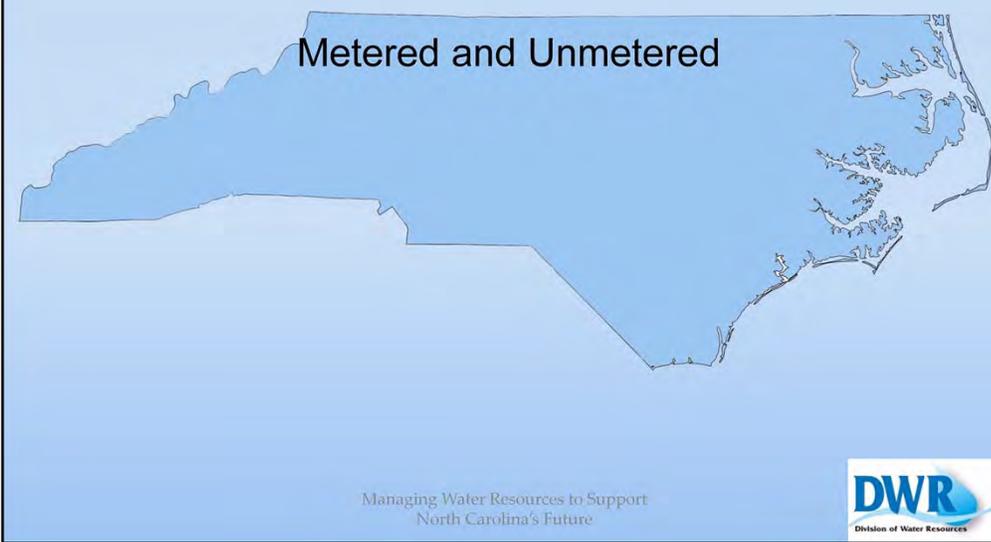


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Water Not Sold

Metered and Unmetered



Water Not Sold



Residential



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Water Not Sold



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Water Not Sold

Institutional



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Water Not Sold

Water Main Flushing



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Water Not Sold



Sewer Storm
Drain
Flushing



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Water Not Sold

Parks



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Water Not Sold

Playgrounds



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Water Not Sold

Swimming Pools



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Water Not Sold

Road Medians



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Water Not Sold

Schools



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Water Not Sold

Training Fire Fighting



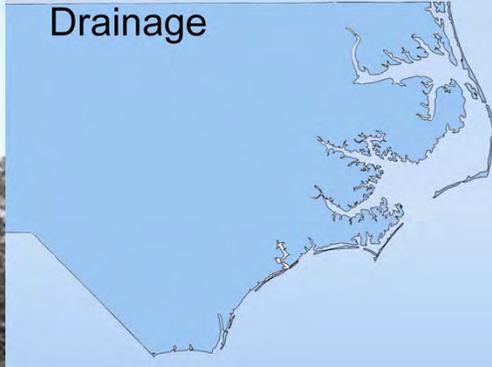
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Water Not Sold



Storage Tank
Drainage



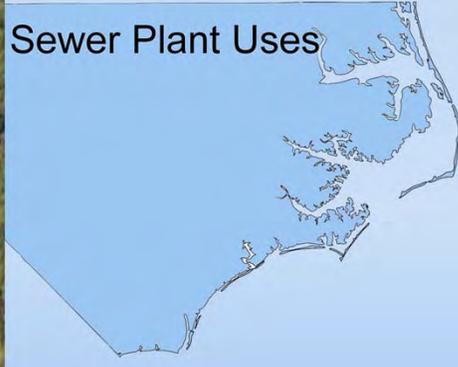
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Water Not Sold



Sewer Plant Uses



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Water Not Sold



Municipal
Buildings



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Water Not Sold

Golf Courses



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Water Not Sold



Cemeteries



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Water Not Sold



Construction
Use

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Small System Water Audit

WATER LOSSES (Gal/Yr)	
7. Apparent Water Losses	
Water Meter Error (see tab: Meter Error Table)	0
Data Handling Error	
Theft	
Other	
Total Apparent Losses	0
8. Real Water Losses	
Distribution System Leaks	0
Storage Overflow	
Other (e.g. service line to meter leaks)	
Total Real Losses	0
9. Total Non-Revenue Water	0
10. Percentage Water Loss	0
11. Annual Cost of Apparent Losses	\$ -
12. Annual Cost of Real Losses	\$ -
13. Cost to Produce Water* (see tab: Cost to Produce Calculator)	\$ -
14. Retail Charge for Water* (see tab: Retail Charge Calculator)	\$ -

*Value per 1,000 Gal.

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- Excel Spreadsheet
- Based on the Local Water Supply Plan
- Apparent Losses
- Real Losses

Apparent and real losses are listed separately and totaled as non-revenue H2O.

Apparent Water Losses



Theft



Apparent Water Losses

Meter Misread



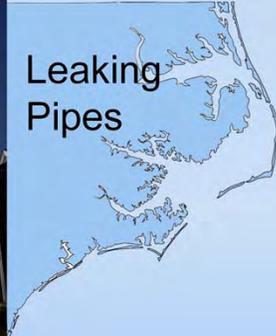
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Real Water Losses



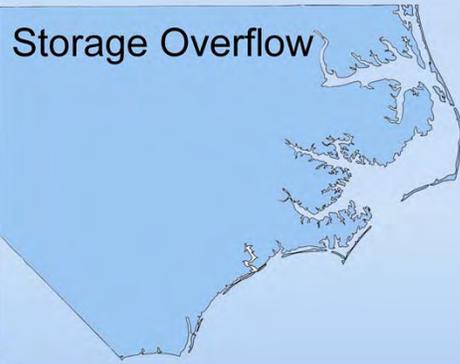
Leaking
Pipes



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Real Water Losses



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Annual Cost of Apparent Loss

- Water delivered but not paid for
- Retail charge for each user type
- Affected by rate adjustments
- Affected by level of system oversight
 - Water accountability
 - Water security



Annual Cost of Real Loss

- Water produced and lost in distribution
- Inclusive production cost to system
- Affected by fluctuating costs
- Affected by operational efficiency
 - Water loss abatement program
 - Asset Management Plan



System Cost to Produce Water

- Personnel Cost
- Non-personnel Cost
- Capital Reserve Set-Aside
- Asset Management Plan
 - Looks at system assets
 - Comprehensive
 - Integrates nicely into capital planning



Retail Charge for Water

- Average charge applied for each use type
 - Residential
 - Commercial
 - Industrial
 - Institutional
- Weighted average calculated in spreadsheet



Small System Water Audit

WATER LOSSES (Gal/Yr)	
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- Excel Spreadsheet
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Apparent and real losses are listed separately and totaled as non-revenue H2O.

Case Study Mars Hill

- Water Audit performed 2008
- Recommendations

Troubleshoot billing software

Replace Mars Hills College turbine meters with compound meters

Active leak detection for the cross-country transmission line

Replace MHC two 6" meters and 2" Madison Manor meter with compound auto-read meters



Case Study Mars Hill

- Active leak detection workshops for Mars Hill's staff:
 - Develop Unidirectional Flushing Strategy and Valve Inventory/Exercise Program.
 - Maintain Standardized Leak Detection/Repair Flushing Records.
 - Add distribution system personnel to support development of leak detection program.
 - Develop meter inventory and systematic replacement of meters 7 years or older with automatic read meters; target (minimum) 5-10% replacement each year.
 - Perform water rate study.

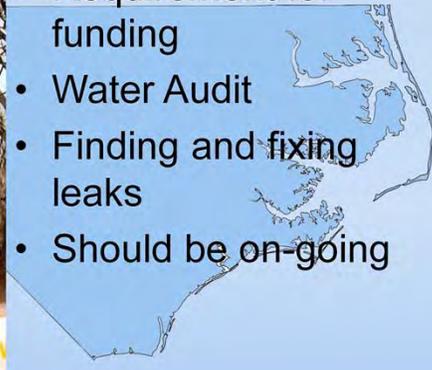
Case Study Mars Hill— Actions Taken

- Successful efforts have been made to reconcile outliers and glitches in the software of the billing system.
- Missing accounts were restored and all metered, but unbilled accounts are now in consumption records.
- The Town is setting aside funds (approx. \$16,000) to replace the Mars Hill College turbine meters with compound meters (4 – 2" & 1 – 6").
- Town staff are now keeping records on leak detection, repairs, and flushing.
- Town Staff regularly evaluate unauthorized consumption.
- A radio-read meter replacement program has begun; 107 out of 800 meters have been replaced thus far with the oldest meters being replaced first.
- The Town did a water rate study and now has an increasing block rate. (The town formerly had a fixed flat-rate for water rate structure).

Water Loss Abatement Program



- Requirement for funding
- Water Audit
- Finding and fixing leaks
- Should be on-going



Process leak finding and repairing. Making it less random.

Water Loss Abatement Program

➤ Leak Detection Methods

- Records Review
- Appearance
- Flow Monitoring
- Leak Detection Equipment
 - Acoustic Devices
 - Thermal Devices
 - Electromagnetic Devices
 - Chemical Detection Devices



Water Loss Abatement Program

➤ Fixing System Leaks

- Repair
- Rehabilitation
- Replacement



➤ Operation and Maintenance

- Asset Management Plan
- Design and Material Standards
- Modeling

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919-707-9021



WATER = MONEY
DON'T WASTE IT

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