



# Pricing Water to Achieve Full Cost Recovery

Glenn Barnes

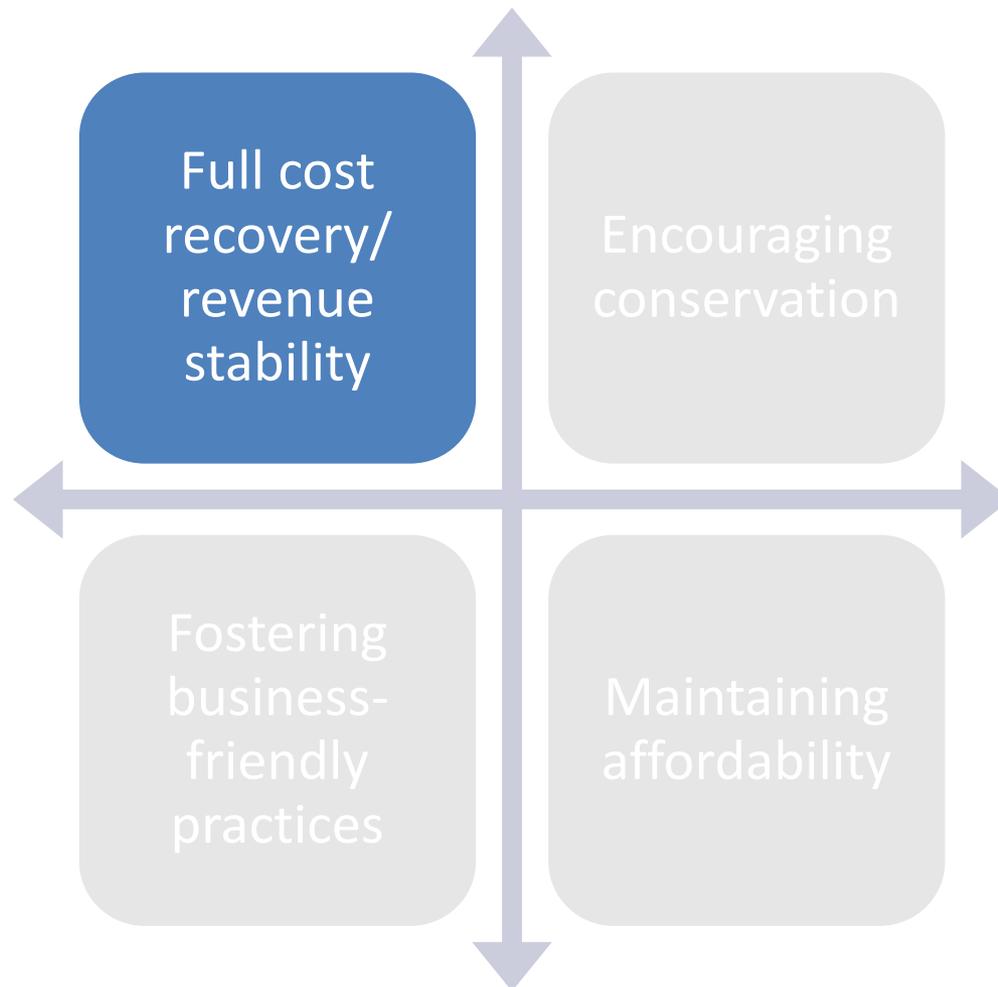
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# Rate Setting Objectives



\*\*\* Example Utility (Demonstration Only)

Rates Comparison
Characteristics
Links
Edit Data or Add Utility

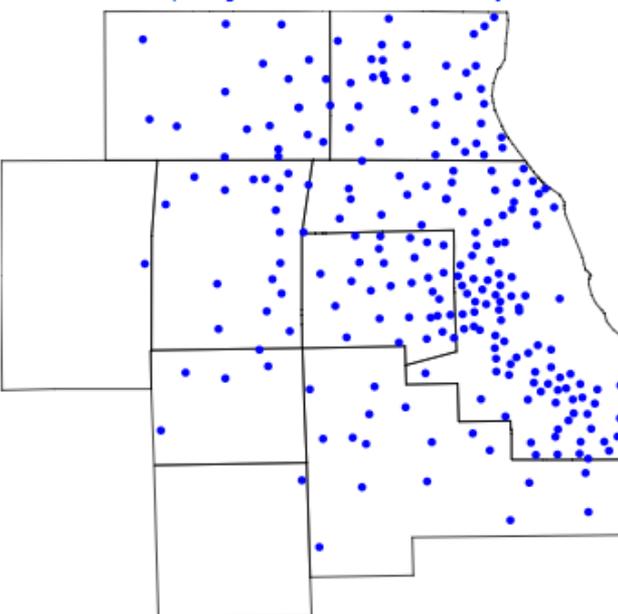
Select residential bill and monthly consumption amount

Water Bill  
  Sewer Bill  
  Water + Sewer Bill

5,000 gallons  
 668 cubic feet

**Monthly Water Bill: \$33.94**

Comparing to **all utilities in survey**



233 rate structures compared

Effects of raising rates by:  0%

### Bill Comparison

Water Bill at  
5,000 gallons  
Median: \$33.60



Min \$3.03   Max \$122.72

### Conservation Signal

Water Price/1,000 gallons, after  
10,000 gallons  
Median: \$6.68



Min \$0.00   Max \$23.93

### Cost Recovery

Operating  
Ratio Incl. Deprec. 2016



### Affordability

Water Bills as % MHI



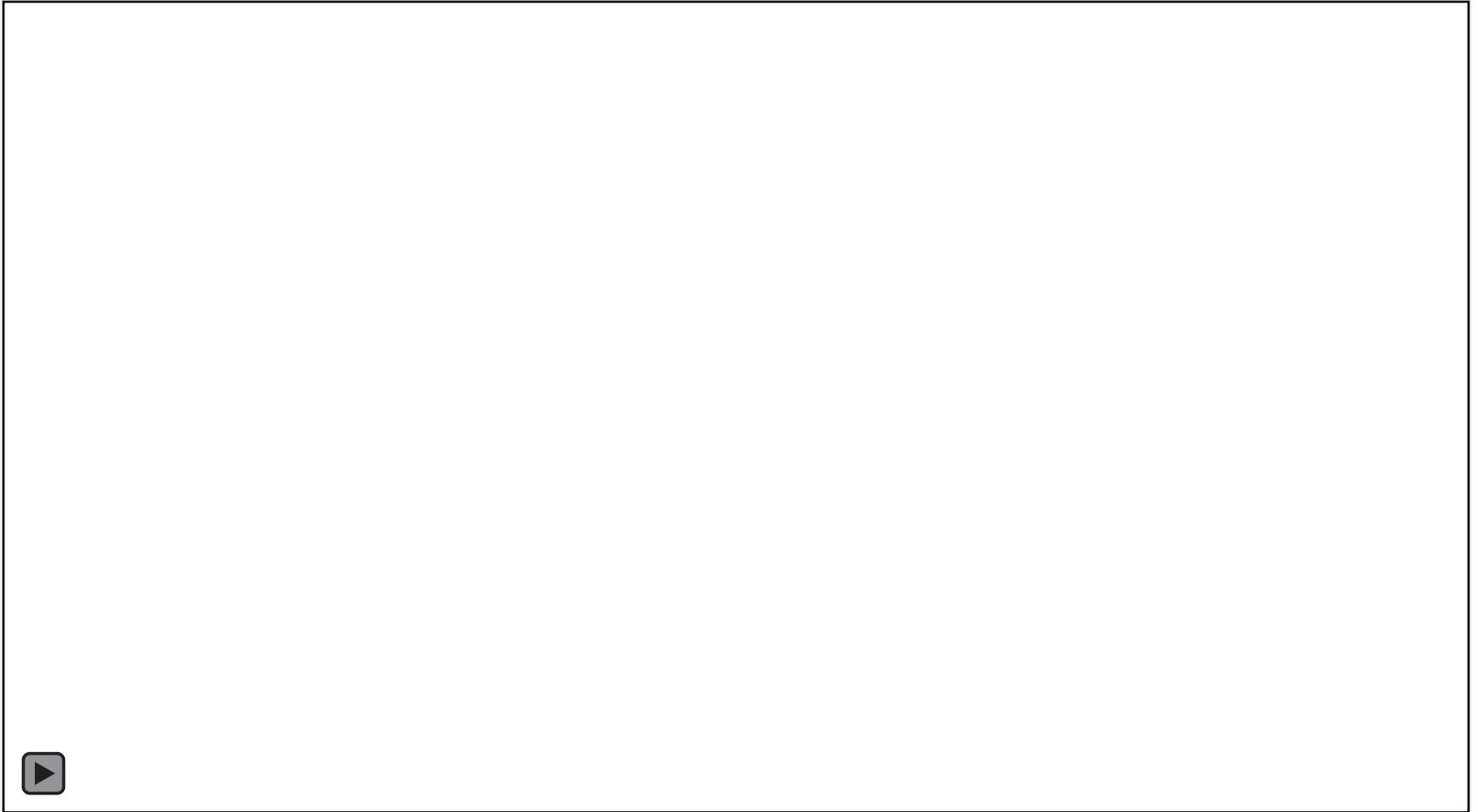


# Session Objectives

- Understand how to calculate the base charges and volumetric charges to cover the full cost of providing water service
- Discuss what factors can impact



# Understanding Water Revenues



<https://www.youtube.com/watch?v=0jf83mE0Lyk>



# Full Cost Pricing

- The goal of full cost pricing is to have the charges for water cover the entire cost of running the water system today and into the future
- Of course, there are many ways in which you can get to the right dollar figure. Some of it comes down to your rate setting philosophy



# Rate Setting Philosophies

- Payment for access vs. payment for volume of product received
- Fixed charges for fixed costs and variable charges for variable costs
- Some mix of the above ideas



# Exercise

Let's figure out some rates for Irvindale that cover the full cost of providing water service

# Non-Rate Revenues

	Account	Budget
1	30-329-00 W/S INTEREST EARNED DEPOS	\$0.00
2	30-334-00 CONTRIBUTIONS/DONATIONS	\$0.00
3	30-335-00 W/S MISC. REVENUE	\$700.00
4	30-336-00 FUND BALANCE APPROPRIATED	\$9,187.87
7	30-345-01 SALES TAX REFUND	\$0.00
9	30-371-01 W/S CHARGES	\$344,445.00
10	30-371-02 W/S ADJUSTMENTS	\$0.00
11	30-373-00 TAP CONNECTIONS	\$1,500.00
13	30-373-02 SERVICE CHARGES/CUT OFFS	\$12,500.00
14	30-373-04 IMPACT FEES	\$1,000.00
15	30-373-05 CAPITAL CONTRIBUTIONS	\$0.00
16	30-374-00 Online W/S Payment Fee	\$1,600.00
17	30-375-80 Contributed Capital - G.R.S.P.	\$0.00
18	30-375-81 Contributed Capital Fund	\$0.00
19	30-377-00 RBEG - Pump Station	\$0.00
20	30-378-00 I&I Study Grant - Commerce	\$12,000.00
22	30-385-00 SALE OF ASSETS	\$0.00
23	30-386-00 TRANSFER FROM OTHER FUND	\$0.00
		\$382,932.87



# For the Exercise

Total Revenues:  
\$382,932.87

Revenues from Rates:  
\$344,445.00



# Payment for Access

- In its pure form, everyone in the water system pays the same amount for access to the system, regardless of how much water they use



# Payment for Access

We charge a flat rate of \$15.00 monthly

P.O. - Box 133  
Jacksonville

We ARE a small town we do NOT have sewage

Jacksonville, GA



# Payment for Access

- What information do we need to make this calculation?
- Total revenue needed from rates
- Total number of accounts

# Payment for Access

\$344,445.00

*Total Needed Revenue*

\$765.43

*Total Annual Bill*

\$63.79

*Monthly Bill*

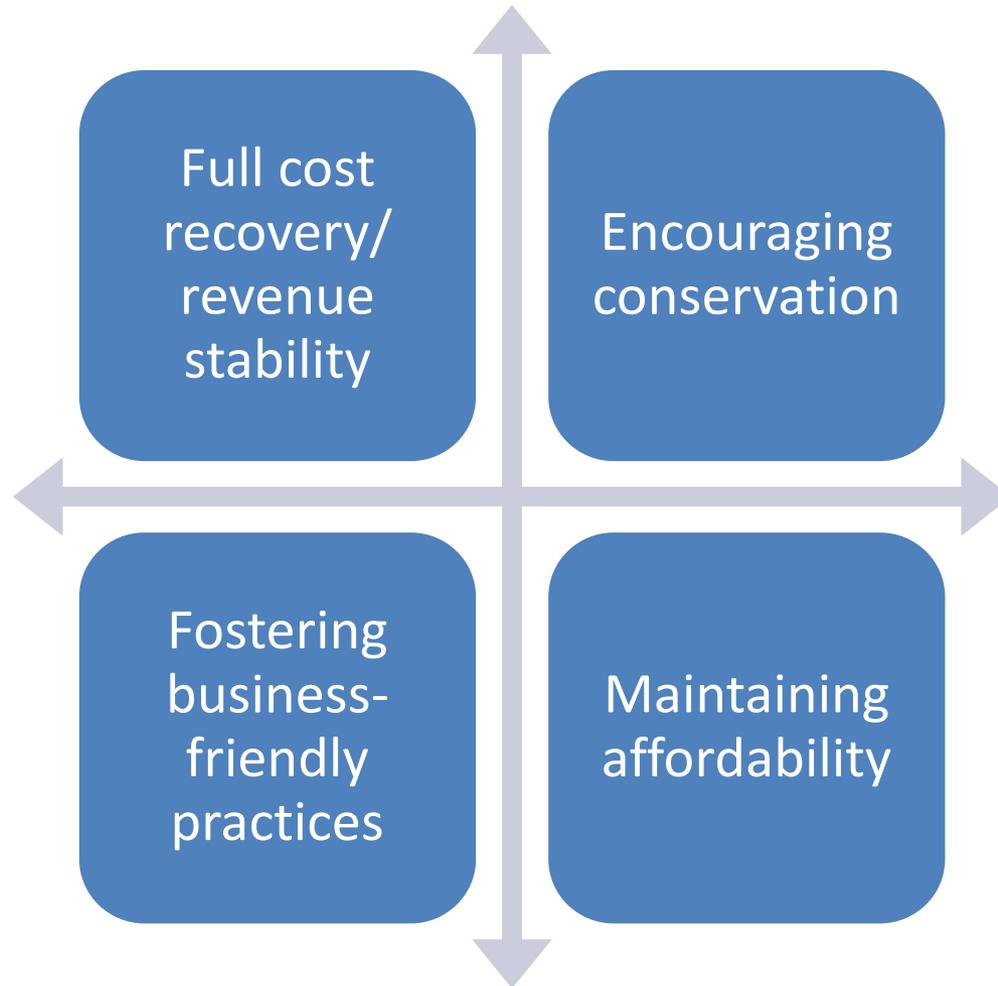
450

*Total Accounts*

12

$$\frac{\$344,445.00}{450} = \frac{\$765.43}{12} = \$63.79$$

# Which Rate Setting Objectives?





# Payment for volume of product received

- In its pure form, everyone in the water system pays for the volume of water received and only for the volume of water received



# Payment for volume of product received

## WATER & SEWER RATES

### In Town

Water	\$ 7.72 per 1000 gallons
Sewer	\$ <del>10.73</del> per 1000 gallons

### Out of Town

Water	\$ 15.44 per 1000 gallons
Sewer	\$ 21.46 per 1000 gallons

Troutman, NC



# Payment for volume of product received

- What information do we need to make this calculation?
- Total revenue needed from rates
- Total gallons sold



# Payment for volume of product received

\$344,445.00

*Total Needed Revenue*

---

 x **1,000** =

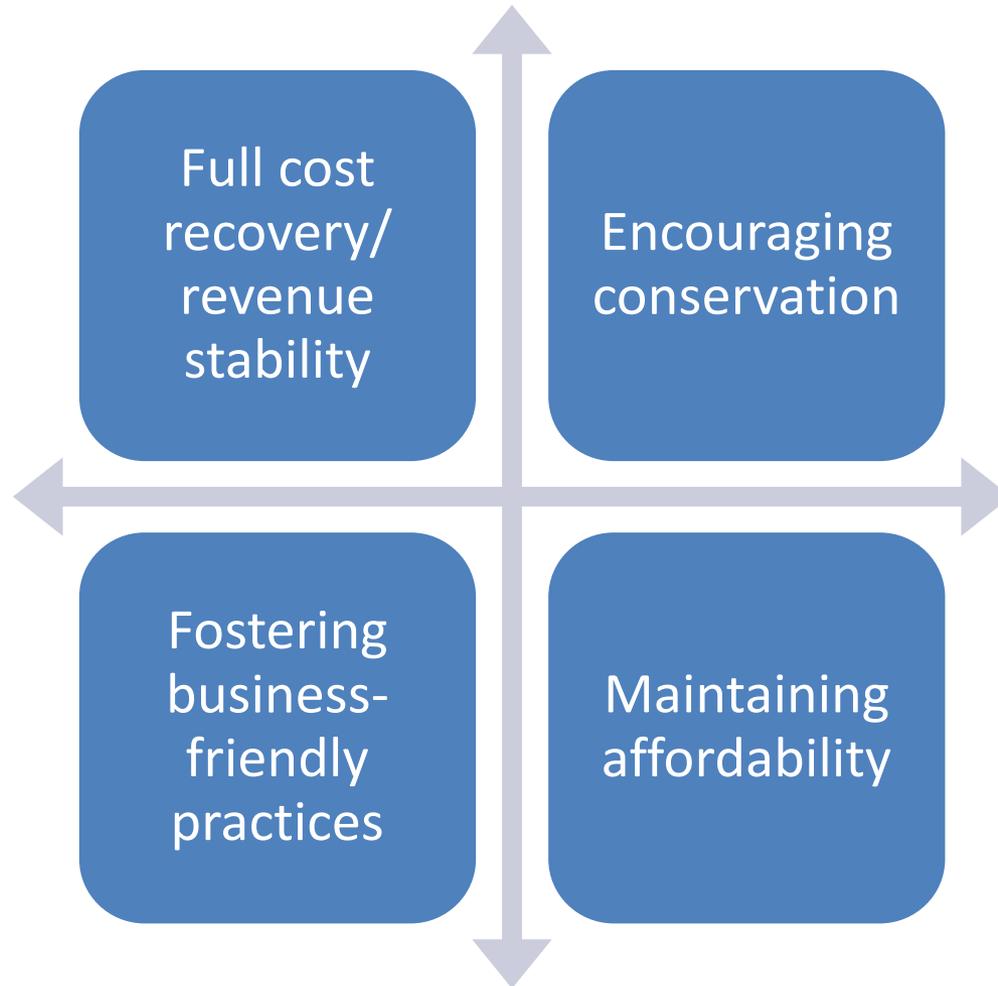
\$10.48

32,877,590

*Total Gallons*

*Price per 1,000 Gallons*

# Which Rate Setting Objectives?



A photograph of industrial water treatment equipment, featuring large blue pipes and machinery, serving as a background for the slide.

# Base Charge for **Fixed Costs**; Volumetric Charge for **Variable Costs**

- In its pure form, all of the fixed costs of the water system would be covered by the base charge, and all of the variable costs would be covered by the volumetric rate



# Base Charge for Fixed Costs; Volumetric Charge for Variable Costs

Base Chrg Lower Bound

Rate

38.00

0

0.000000

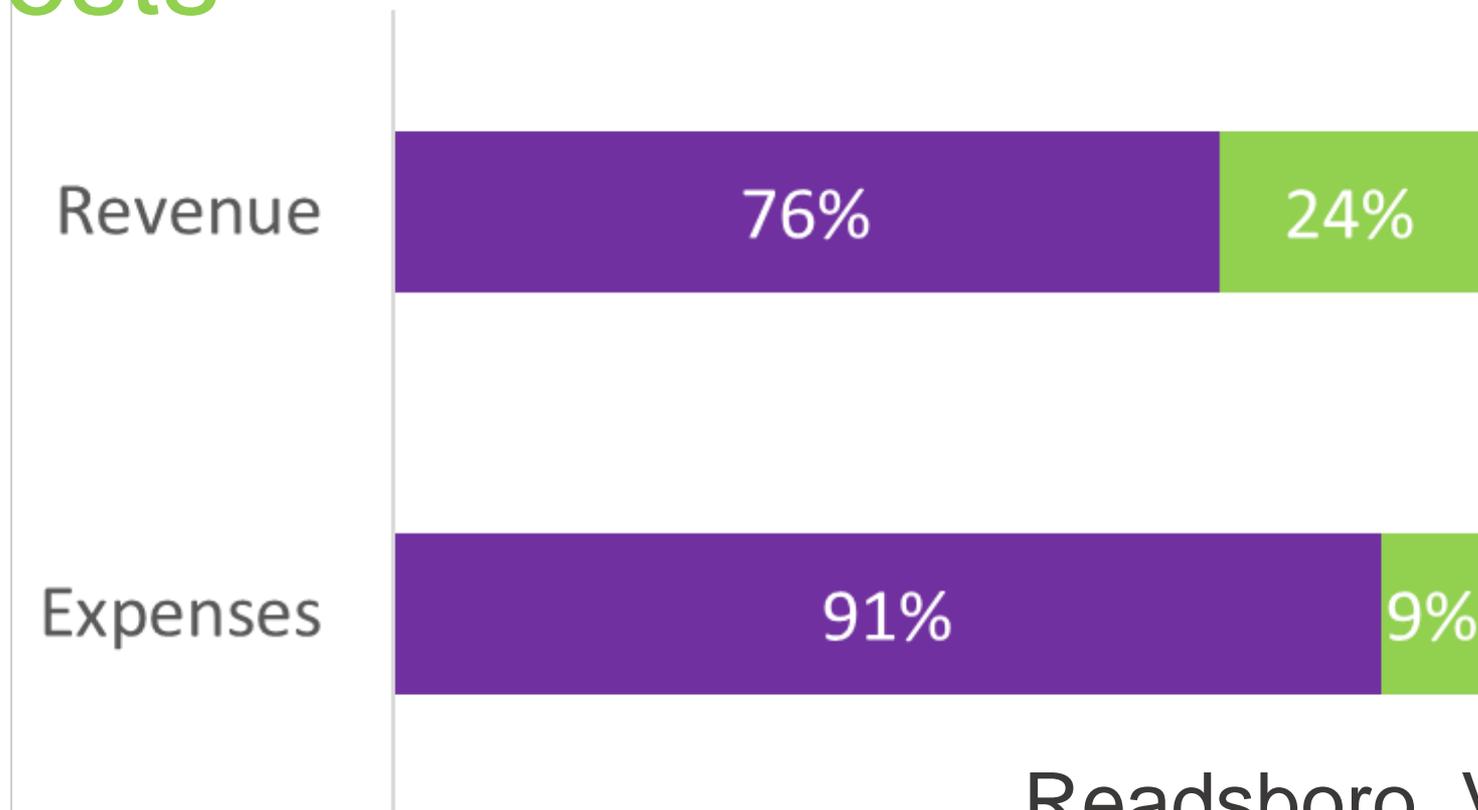
4

9.500000

Readsboro, VT



# Base Charge for Fixed Costs; Volumetric Charge for Variable Costs



Readsboro, VT



# Base Charge for Fixed Costs; Volumetric Charge for Variable Costs

- What information do we need to make this calculation?
- Total revenue needed to cover fixed costs
- Total Accounts
- Total revenue needed to cover variable costs
- Total gallons sold

# Base Charge for Fixed Costs; Volumetric Charge for Variable Costs

$$\frac{\$292,045}{450} = \frac{\$648.99}{12} = \$54.08$$

*Fixed Annual Cost*      *Total Annual Bill*      *Monthly Base Bill*

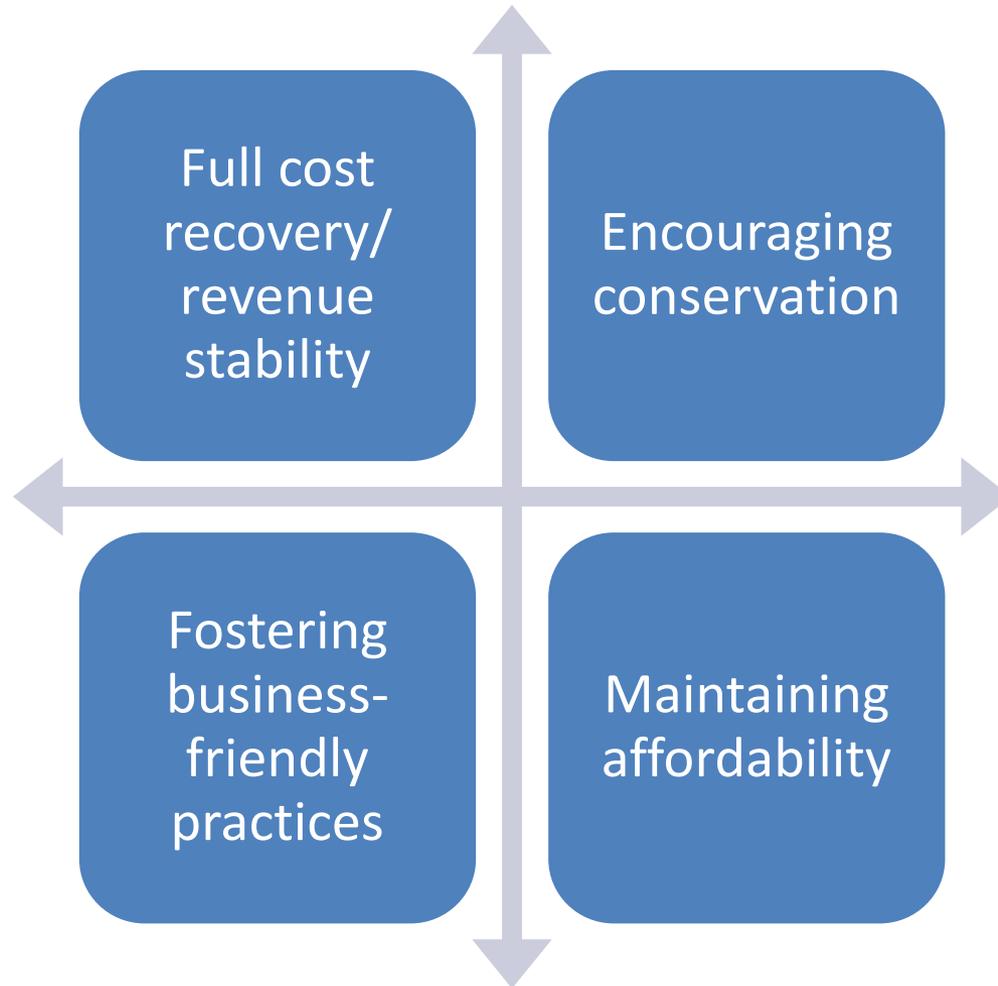
*Total Accounts*

---

$$\frac{\$52,400}{32,877,590} \times 1,000 = \$1.59$$

*Variable Annual Costs*      *Total Gallons*      *Price per 1,000 Gallons*

# Which Rate Setting Objectives?





# \$25 Base Charge; Rest from Volumetric Rates

- Randomly pick a base charge and see what the volumetric charge would need to be



# \$25 Base Charge; Rest from Volumetric Rates

## WATER & SEWER RATES AND FEE SCHEDULE EFFECTIVE

### IN TOWN

WATER MINIMUM (1000 GALLONS)	\$25.00
SEWER MINIMUM (1000 GALLONS)	\$25.00
DISPOSAL FEE	\$ 5.00
ADDITIONAL WATER PER 1000 GALLONS	\$ 6.15

Denton, NC



# \$25 Base Charge; Rest from Volumetric Rates

- What information do we need to make this calculation?
- Total Accounts
- Total Revenue Needed
- Total Gallons

# \$25 Base Charge; Rest from Volumetric Rates

$$12 \times \$25 \times 450 = \$135,000$$

Monthly Base Bill      Total Accounts      Total from Base Bill

$$\begin{array}{r} \$344,445 \\ \text{Total Revenue Needed} \\ - \$135,000 \\ \text{Total from Base Bill} \\ \hline \$209,445 \\ \text{Total Needed from Volumetric} \end{array}$$

\$209,445

Total Needed Volumetric

$$\frac{\$209,445}{32,877,590} \times 1,000 = \$6.37$$

Total Gallons      Price per 1,000 Gallons

# Water and Wastewater Rates Analysis Model

<http://efc.sog.unc.edu> or <http://efcnetwork.org>

Find the most up-to-date version in Resources / Tools

## Water & Wastewater Rates Analysis Model

Version 2.8.2 (last updated August 4, 2015)



Developed by the Environmental Finance Center at the University of North Carolina, Chapel Hill  
<http://efc.sog.unc.edu>



Funded by the U.S. Environmental Protection Agency and the Public Water Supply Section of the North Carolina Department of Environment and Natural Resources

**Get Started**

Download a copy of the model populated with data from an example utility

### DESCRIPTION

A do-it-yourself, simplified financial model to assist utility managers and private system owners in setting water and wastewater rates.

### FEATURES

- Comparisons of annual fund balance projections (for up to 20 years) under proposed new rates vs. staying with existing rates
- Adjust rates for the next 1-5 years
- Up to 12 rate structures
- Uniform or block rates (up to 10 blocks)
- Model changes to accounts and water use
- Customizable list of operating and capital expenses
- Building up reserves through rates
- Compare monthly bills under new rates vs. existing rates
- Assess revenue sufficiency and fund balance
- Error notifications

### INSTRUCTIONS

- 1) Navigate using worksheet tabs at bottom of screen or following arrows and clicking on buttons
- 2) In the green "Data Input" worksheets, input data in the dark green cells

**View Results**

Financial forecast of the next few years under 'Existing' rates versus 'New' rates (graphs of cost recovery and end-of-year fund balance)

How new rates compare to existing rates (graphs of monthly bills)

Year:	2015	2016	2017	2018	2019	2020
Rate Existing	\$11.50	\$13.00	\$14.40	\$17.00	\$20.00	\$21.00
Rate New	2,000	2,000	2,000	2,000	2,000	2,000

Block End	4,000 gal/mo	5,000 gal/mo	6,000 gal/mo	7,000 gal/mo	8,000 gal/mo
Rate Existing	\$2.78	\$2.78	\$2.78	\$3.00	\$3.50
Rate New	\$4.00	\$4.50	\$5.00	\$5.50	\$6.00

Error: missing block rates  
Error: missing block size

Watch out for red "Error" messages describing where data entry errors

Created by the Environmental Finance Center at the University of North Carolina, Chapel Hill  
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These numbers are based on  
Irvindale's budget.

Does budget = reality?

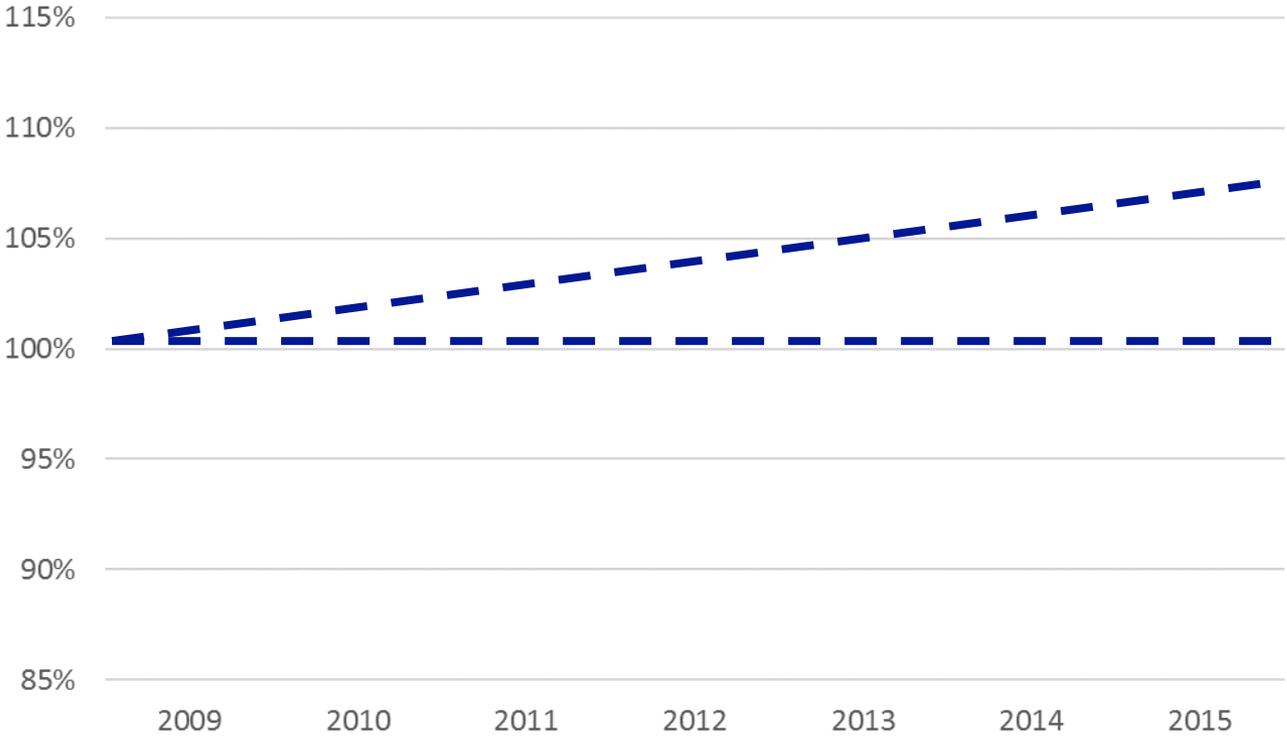


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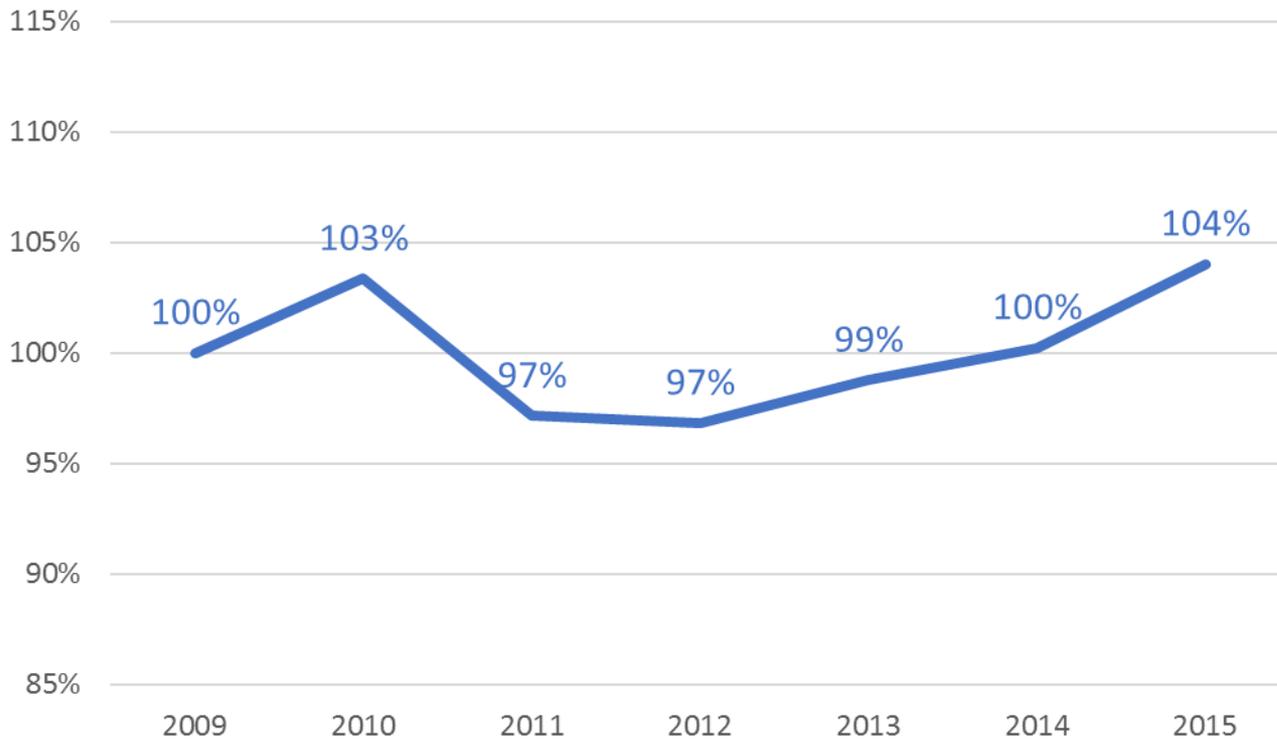
Does

Maybe

Consider the annual revenues of a small water and wastewater system that has not changed its rates in 7 years (real life example)



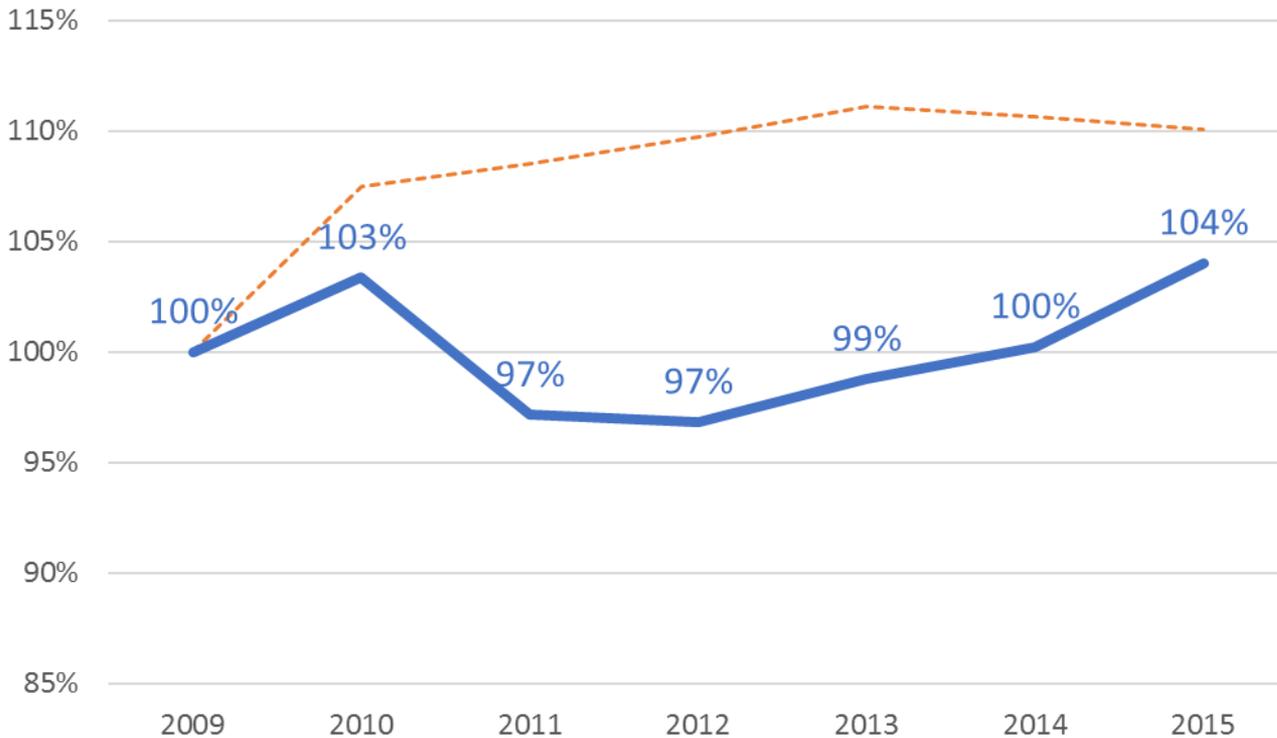
Operating revenues from a small municipal water and wastewater system fluctuated every year, despite water and wastewater rates not changing for those seven years



Total operating revenues of the water and wastewater enterprise fund in each fiscal year are compared to the FY2009 total. Certified municipal population estimate in each year is compared to the 2009 estimate.

Data sources: Annual audited financial statements of a municipality in North Carolina, compiled by the NC Local Government Commission; and certified municipal population estimates by the State Demographic branch of the NC Office of State Budget and Management. Data graphed by the Environmental Finance Center at the University of North Carolina, Chapel Hill.

Operating revenues from a small municipal water and wastewater system fluctuated every year, despite water and wastewater rates not changing for those seven years. And despite municipal population growing over time.



Total operating revenues of the water and wastewater enterprise fund in each fiscal year are compared to the FY2009 total. Certified municipal population estimate in each year is compared to the 2009 estimate.

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What could be causing this variation?

# Rate Changes



As rates go up, usage goes down

As a rule of thumb, typically usage goes down 3-4% for every 10% increase in rates

# Population Change



Customers could be coming into your system or leaving your system

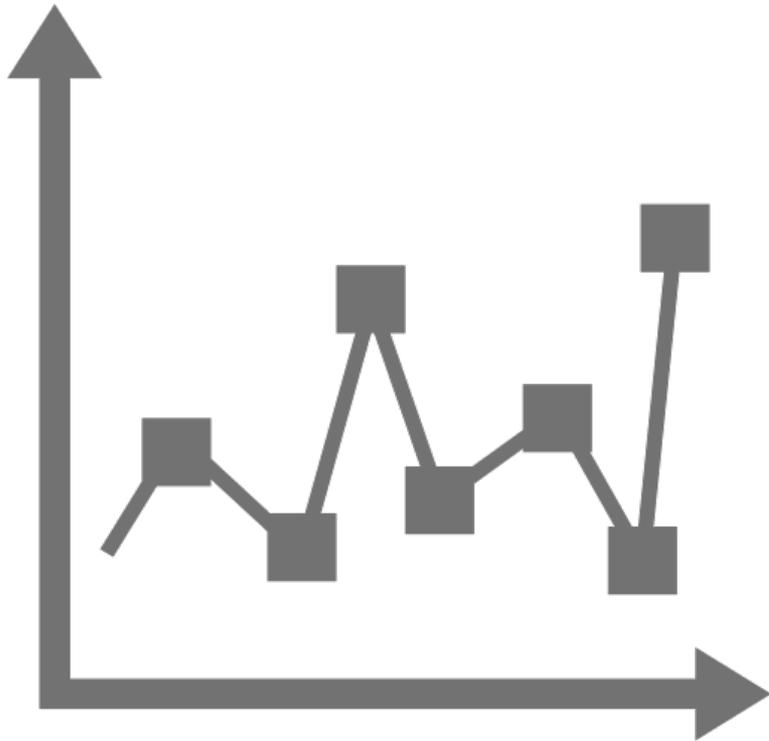
# Loss of a Big Customer



Some customers use significantly more water than others. Losing a single big user can have a disproportionate impact on revenues



# Economic Conditions



Economic downturns can cause customers to cut back on water use. Conversely, periods of economic growth can lead to higher water consumption

# Changes in Collection Rates



Even if the number of customers doesn't change, how often they are paying you may be changing

# Weather



Rainy conditions or dry/drought conditions can impact how much water customers use for outside irrigation



# Water Use Restrictions



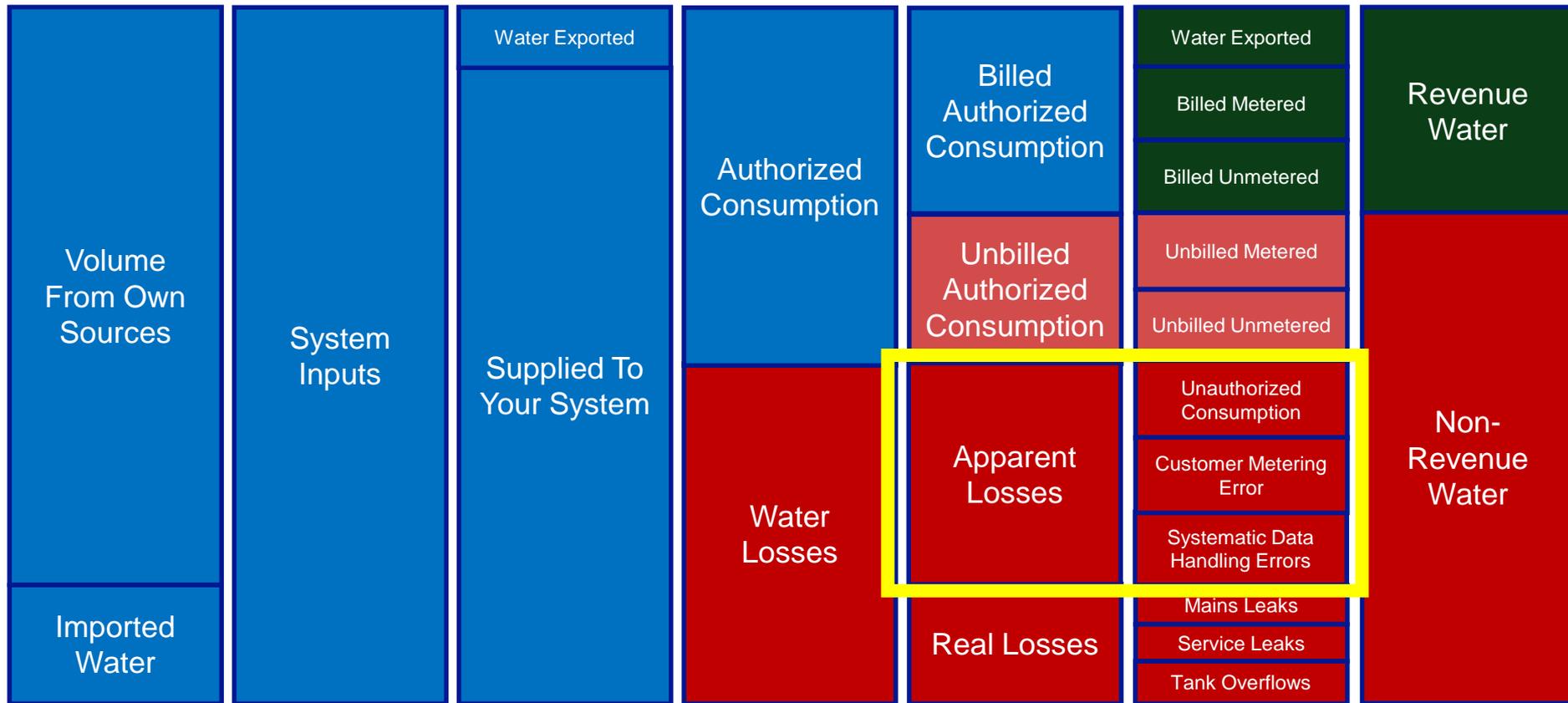
Whether due to water supply shortages or drought conditions, restricting water use will obviously impact revenues

# Technology



Fixtures use less water today than in the past, and overall per capita water demand is decreasing across the country

# Bill Correctly





# What to do?

- Multiple forecasts based on different assumptions
- Ideally, be conservative

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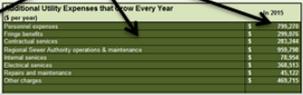
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# Water Utility Revenue Risk Assessment Tool

The screenshot shows the title page of an Excel spreadsheet titled "Water Utility Revenue Risk Assessment Tool". The subtitle is "How Much Revenue Might Be Lost When Residential Customers Reduce Consumption?". Logos for the Water Research Foundation and UNC Environmental Finance Center are displayed. It indicates "Version 1.0" with a date of "November 15, 2013". The developers are listed as "The Environmental Finance Center at the University of North Carolina, Chapel Hill" and "Water Research Foundation". A link is provided to access a video tutorial. A text box explains the tool's purpose: to determine the proportion of residential revenues at risk of loss when demand patterns change. Another text box notes that the tool uses simplifying assumptions based on thousands of real customer records. A final text box states the tool is focused on revenue projections and assessment, comparing two different residential rate structures.

- Excel tool (simplified)
- Focus on residential revenues
- Utility inputs own:
  - Rate structure details
  - Residential customer water use profile
  - Weather patterns
  - Assumptions on price elasticity
- Tool estimates the proportion of revenues that may be lost due to changes in water use patterns due to:
  - Rate increase, alone or plus:
  - Normal weather pattern changes, or
  - One-time, significant and sudden conservation effort

Free to download and use at

[www.waterrf.org](http://www.waterrf.org)

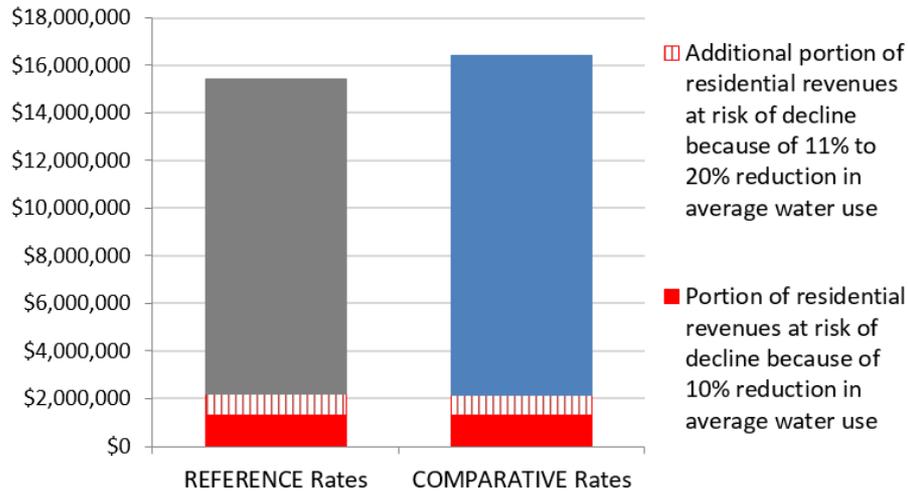
[www.efc.sog.unc.edu](http://www.efc.sog.unc.edu)

# Water Utility Revenue Risk Assessment Tool

## Comparing Revenues After a Significant Decline in Water Use

How do the total revenues compare under both rate structures if there is a reduction of 10% - 20% in average water use and subsequent demand distribution shifts?

Portions of Annual Revenues under REFERENCE and COMPARATIVE Rate Structures that are at Risk of Loss Due to Significant Reductions in Average Water Use



Decline in Total Annual Revenues for a:	REFERENCE Rates	COMPARATIVE Rates
10% reduction in avg use	\$1,311,000	\$1,319,000
20% reduction in avg use	\$2,181,000	\$2,167,000
10% reduction in avg use	8.5%	8.0%
20% reduction in avg use	14.2%	13.2%

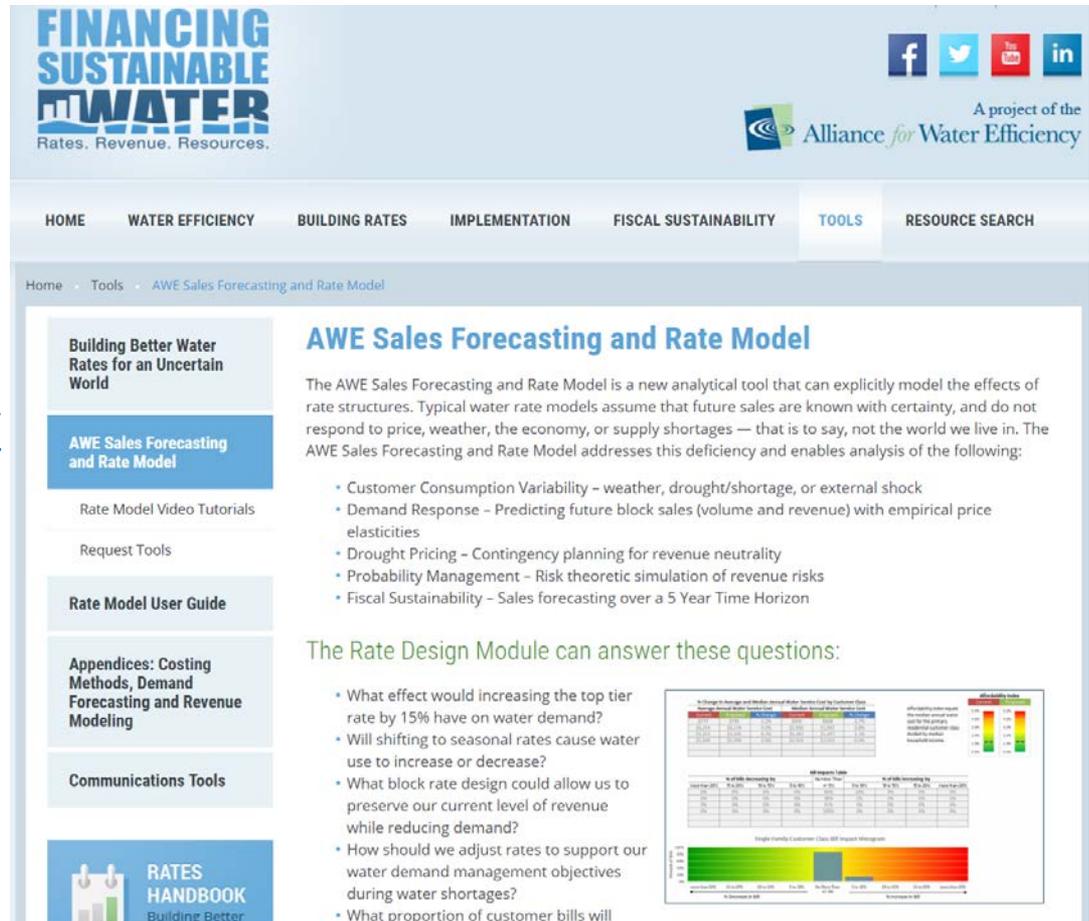
The comparative rate structure generates revenues that are MORE resilient to sudden and significant declines in residential water use than the revenues generated by the reference rate structure. Revenues under the comparative rate structure are projected to drop 8% - 13.2% for a 10% - 20% reduction in average water use, and their related shifts in demand distribution. These declines occur after including the effect of price elasticity when adjusting rates from the reference rate structure to the comparative rate structure. By comparison, revenues under the reference rate structure are projected to drop 8.5% - 14.2% for the same declines in residential water use.

# AWE Sales Forecasting and Rate Model

Available for

Alliance for Water Efficiency members

<http://www.financingsustainablewater.org/>



**FINANCING SUSTAINABLE WATER**  
Rates. Revenue. Resources.

A project of the Alliance for Water Efficiency

HOME WATER EFFICIENCY BUILDING RATES IMPLEMENTATION FISCAL SUSTAINABILITY TOOLS RESOURCE SEARCH

Home · Tools · AWE Sales Forecasting and Rate Model

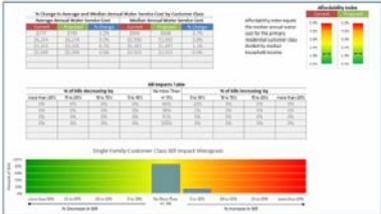
## AWE Sales Forecasting and Rate Model

The AWE Sales Forecasting and Rate Model is a new analytical tool that can explicitly model the effects of rate structures. Typical water rate models assume that future sales are known with certainty, and do not respond to price, weather, the economy, or supply shortages — that is to say, not the world we live in. The AWE Sales Forecasting and Rate Model addresses this deficiency and enables analysis of the following:

- Customer Consumption Variability – weather, drought/shortage, or external shock
- Demand Response – Predicting future block sales (volume and revenue) with empirical price elasticities
- Drought Pricing – Contingency planning for revenue neutrality
- Probability Management – Risk theoretic simulation of revenue risks
- Fiscal Sustainability – Sales forecasting over a 5 Year Time Horizon

The Rate Design Module can answer these questions:

- What effect would increasing the top tier rate by 15% have on water demand?
- Will shifting to seasonal rates cause water use to increase or decrease?
- What block rate design could allow us to preserve our current level of revenue while reducing demand?
- How should we adjust rates to support our water demand management objectives during water shortages?
- What proportion of customer bills will



Heatmap showing the impact of rate changes on water demand and revenue. The heatmap is color-coded from green (positive impact) to red (negative impact). The x-axis represents different rate scenarios and the y-axis represents different metrics.



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