



Pricing Water to Achieve Full Cost Recovery

Glenn Barnes

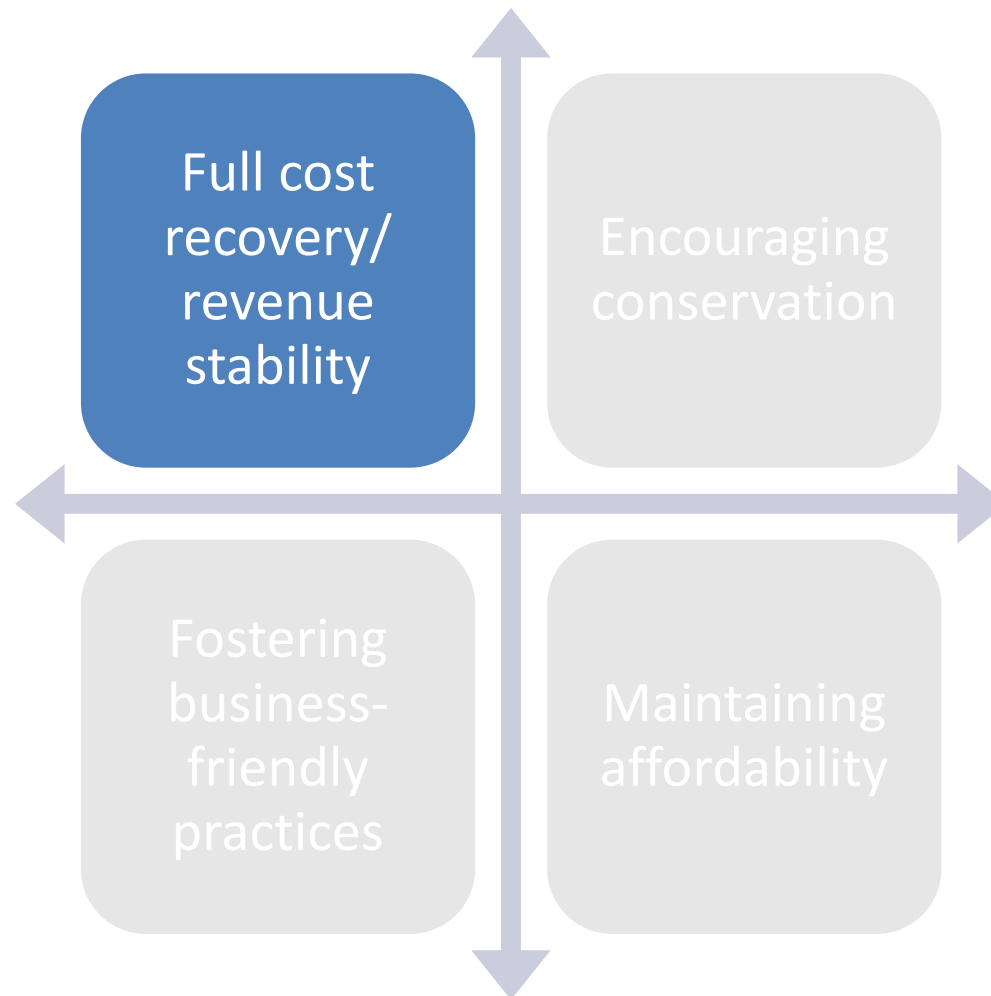
Environmental Finance Center

The University of North Carolina at Chapel Hill

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Rate Setting Objectives





UNC
ENVIRONMENTAL
FINANCE CENTER

Northeast IL Water and Wastewater Rates Dashboard

Rates as of January 1, 2017

Dashboard updated: February 17, 2017



*** Example Utility (Demonstration Only)

Rates Comparison

Characteristics

Links

Edit Data or Add Utility

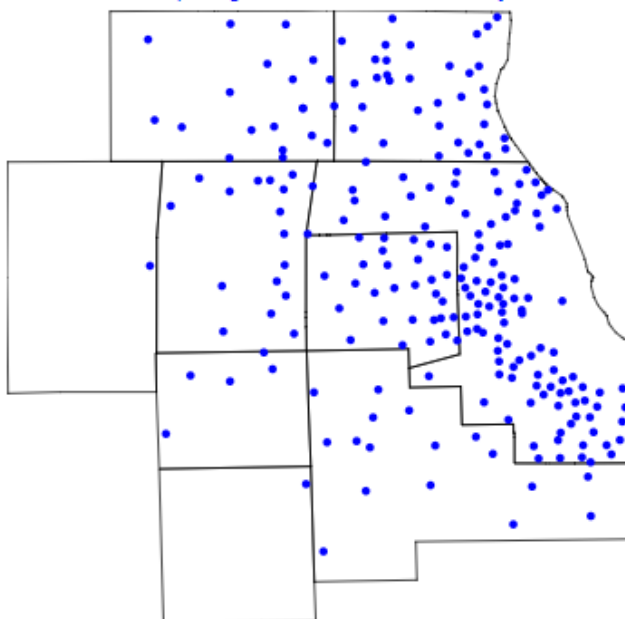
Select residential bill and monthly consumption amount

☒ Water Bill ☐ Sewer Bill ☐ Water + Sewer Bill

5,000 gallons
668 cubic feet

Monthly Water Bill: \$33.94

Comparing to all utilities in survey

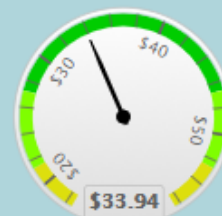


233 rate structures compared

Effects of raising rates by: 0%

Bill Comparison

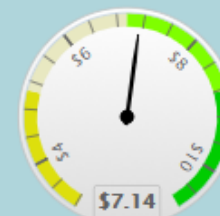
Water Bill at
5,000 gallons
Median: \$33.60



Min \$3.03 Max \$122.72

Conservation Signal

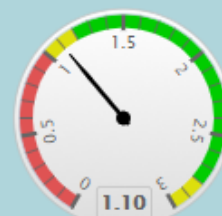
Water Price/1,000 gallons, after
10,000 gallons
Median: \$6.68



Min \$0.00 Max \$23.93

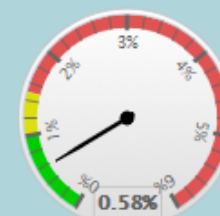
Cost Recovery

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 Irwindale 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

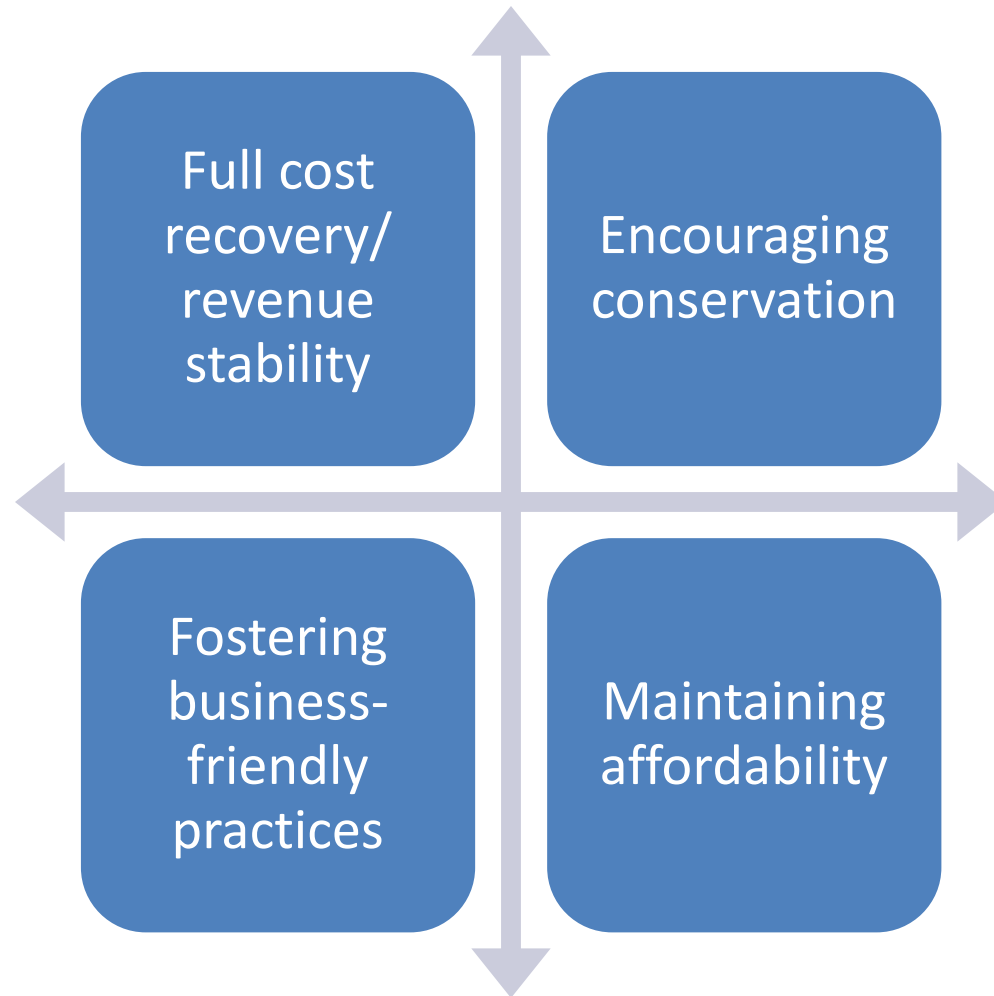
Monthly Bill

450

Total Accounts

12

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 | \$ 10.73 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** =

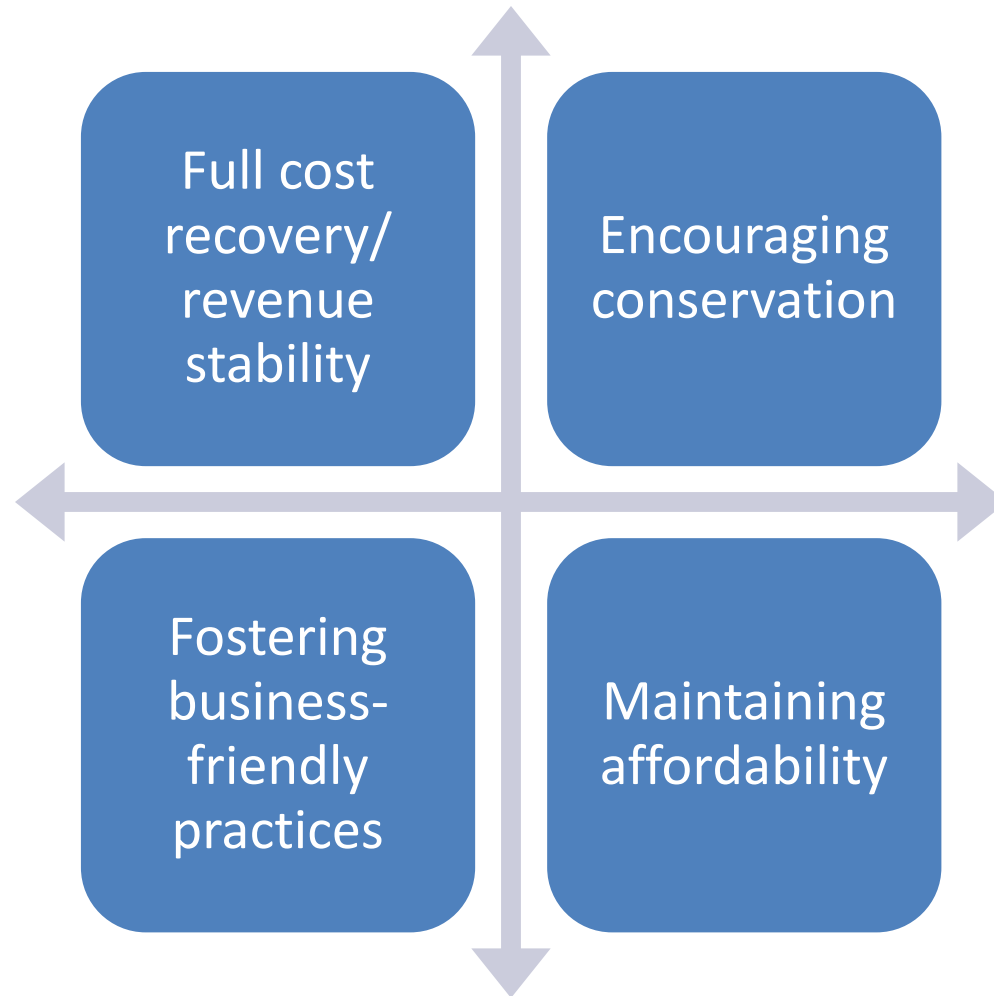
32,877,590

Total Gallons

\$10.48

Price per 1,000 Gallons

Which Rate Setting Objectives?





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

Revenue

76%

24%

Expenses

91%

9%

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

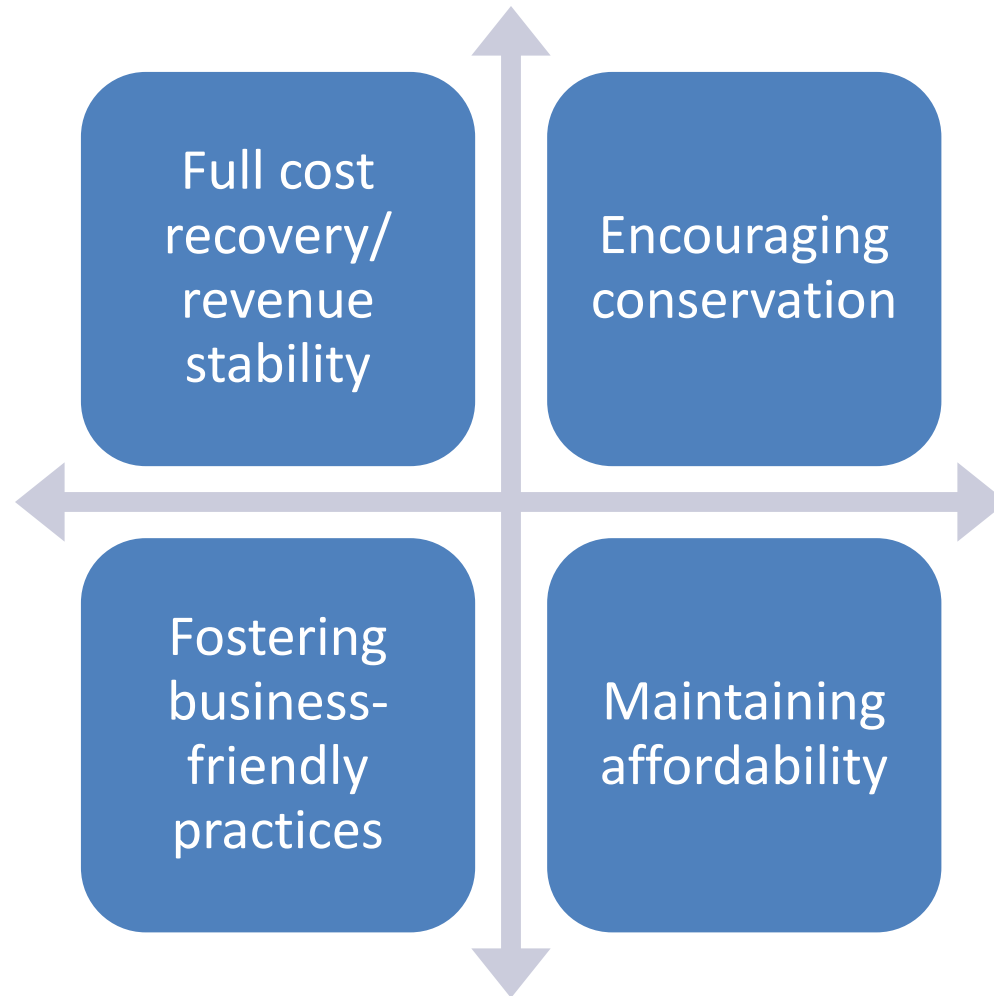


Base Charge for Fixed Costs; Volumetric Charge for Variable Costs

$$\frac{\boxed{\$292,045}}{\text{Fixed Annual Cost}} = \frac{\boxed{\$648.99}}{\text{Total Annual Bill}} = \frac{\boxed{\$54.08}}{\text{Monthly Base Bill}}$$
$$\frac{\boxed{450}}{\text{Total Accounts}} = 12$$

$$\frac{\boxed{\$52,400}}{\text{Variable Annual Costs}} \times 1,000 = \boxed{\$1.59}$$
$$\frac{\boxed{32,877,590}}{\text{Total Gallons}} = \text{Price per 1,000 Gallons}$$

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

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

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

Total Needed Volumetric 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)



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ENVIRONMENTAL FINANCE CENTER

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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

Instructions

Data Input 1

Data Input 2

Financial Forecast

Comp

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 |
|----------|---------|---------|---------|---------|---------|---------|
| Existing | \$11.50 | \$13.00 | \$14.00 | \$17.00 | \$20.00 | \$21.00 |
| New | \$11.50 | \$13.00 | \$14.00 | \$17.00 | \$20.00 | \$21.00 |

| Block End: | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---------------|--------|--------|--------|--------|--------|--------|
| 4,000 gal/mo | \$2.78 | \$2.78 | \$2.78 | \$3.00 | \$3.50 | \$4.00 |
| 7,000 gal/mo | \$4.00 | \$4.50 | \$5.00 | \$5.50 | \$6.00 | \$6.50 |
| 10,000 gal/mo | \$5.00 | \$5.50 | \$6.00 | \$6.50 | \$7.00 | \$7.50 |

Back to top

Error: missing block rates
Error: missing block size

Debt Service and Other Known Annual Expenses for Next 20 Years

| Year | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|-----------------------------|-------------|-------------|-------------|-------------|-------------|-------------|
| Debt Service | \$1,000,000 | \$1,000,000 | \$1,000,000 | \$1,000,000 | \$1,000,000 | \$1,000,000 |
| Other Known Annual Expenses | \$1,000,000 | \$1,000,000 | \$1,000,000 | \$1,000,000 | \$1,000,000 | \$1,000,000 |

Functional Utility Expenses that Grow Every Year

| Category | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|--------------|--------------|--------------|--------------|--------------|--------------|
| Administrative | \$100,000 | \$100,000 | \$100,000 | \$100,000 | \$100,000 | \$100,000 |
| Capital Expenses | \$200,000 | \$200,000 | \$200,000 | \$200,000 | \$200,000 | \$200,000 |
| Construction | \$100,000 | \$100,000 | \$100,000 | \$100,000 | \$100,000 | \$100,000 |
| Engineering | \$50,000 | \$50,000 | \$50,000 | \$50,000 | \$50,000 | \$50,000 |
| General Services | \$100,000 | \$100,000 | \$100,000 | \$100,000 | \$100,000 | \$100,000 |
| Interest | \$100,000 | \$100,000 | \$100,000 | \$100,000 | \$100,000 | \$100,000 |
| Regional Sewer Authority operations & maintenance | \$100,000 | \$100,000 | \$100,000 | \$100,000 | \$100,000 | \$100,000 |
| Regional Sewer Authority capital expenses | \$100,000 | \$100,000 | \$100,000 | \$100,000 | \$100,000 | \$100,000 |
| Regional Sewer Authority debt service | \$100,000 | \$100,000 | \$100,000 | \$100,000 | \$100,000 | \$100,000 |
| Regional Sewer Authority other | \$100,000 | \$100,000 | \$100,000 | \$100,000 | \$100,000 | \$100,000 |
| Regional Sewer Authority total | \$1,000,000 | \$1,000,000 | \$1,000,000 | \$1,000,000 | \$1,000,000 | \$1,000,000 |
| Regional Sewer Authority total (including debt service) | \$2,000,000 | \$2,000,000 | \$2,000,000 | \$2,000,000 | \$2,000,000 | \$2,000,000 |
| Regional Sewer Authority total (including debt service and capital expenses) | \$3,000,000 | \$3,000,000 | \$3,000,000 | \$3,000,000 | \$3,000,000 | \$3,000,000 |
| Regional Sewer Authority total (including debt service, capital expenses, and construction) | \$4,000,000 | \$4,000,000 | \$4,000,000 | \$4,000,000 | \$4,000,000 | \$4,000,000 |
| Regional Sewer Authority total (including debt service, capital expenses, construction, and engineering) | \$5,000,000 | \$5,000,000 | \$5,000,000 | \$5,000,000 | \$5,000,000 | \$5,000,000 |
| Regional Sewer Authority total (including debt service, capital expenses, construction, engineering, and general services) | \$6,000,000 | \$6,000,000 | \$6,000,000 | \$6,000,000 | \$6,000,000 | \$6,000,000 |
| Regional Sewer Authority total (including debt service, capital expenses, construction, engineering, general services, and interest) | \$7,000,000 | \$7,000,000 | \$7,000,000 | \$7,000,000 | \$7,000,000 | \$7,000,000 |
| Regional Sewer Authority total (including debt service, capital expenses, construction, engineering, general services, interest, and regional sewer authority operations & maintenance) | \$8,000,000 | \$8,000,000 | \$8,000,000 | \$8,000,000 | \$8,000,000 | \$8,000,000 |
| Regional Sewer Authority total (including debt service, capital expenses, construction, engineering, general services, interest, regional sewer authority operations & maintenance, and regional sewer authority capital expenses) | \$9,000,000 | \$9,000,000 | \$9,000,000 | \$9,000,000 | \$9,000,000 | \$9,000,000 |
| Regional Sewer Authority total (including debt service, capital expenses, construction, engineering, general services, interest, regional sewer authority operations & maintenance, regional sewer authority capital expenses, and regional sewer authority debt service) | \$10,000,000 | \$10,000,000 | \$10,000,000 | \$10,000,000 | \$10,000,000 | \$10,000,000 |
| Regional Sewer Authority total (including debt service, capital expenses, construction, engineering, general services, interest, regional sewer authority operations & maintenance, regional sewer authority capital expenses, regional sewer authority debt service, and regional sewer authority other) | \$11,000,000 | \$11,000,000 | \$11,000,000 | \$11,000,000 | \$11,000,000 | \$11,000,000 |
| Regional Sewer Authority total (including debt service, capital expenses, construction, engineering, general services, interest, regional sewer authority operations & maintenance, regional sewer authority capital expenses, regional sewer authority debt service, regional sewer authority other, and regional sewer authority total) | \$12,000,000 | \$12,000,000 | \$12,000,000 | \$12,000,000 | \$12,000,000 | \$12,000,000 |

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
Funded by the U.S. E.P.A. and the N.C. Department of Environment and Natural Resources



These numbers are based on
Irvindale's budget.

Does budget = reality?



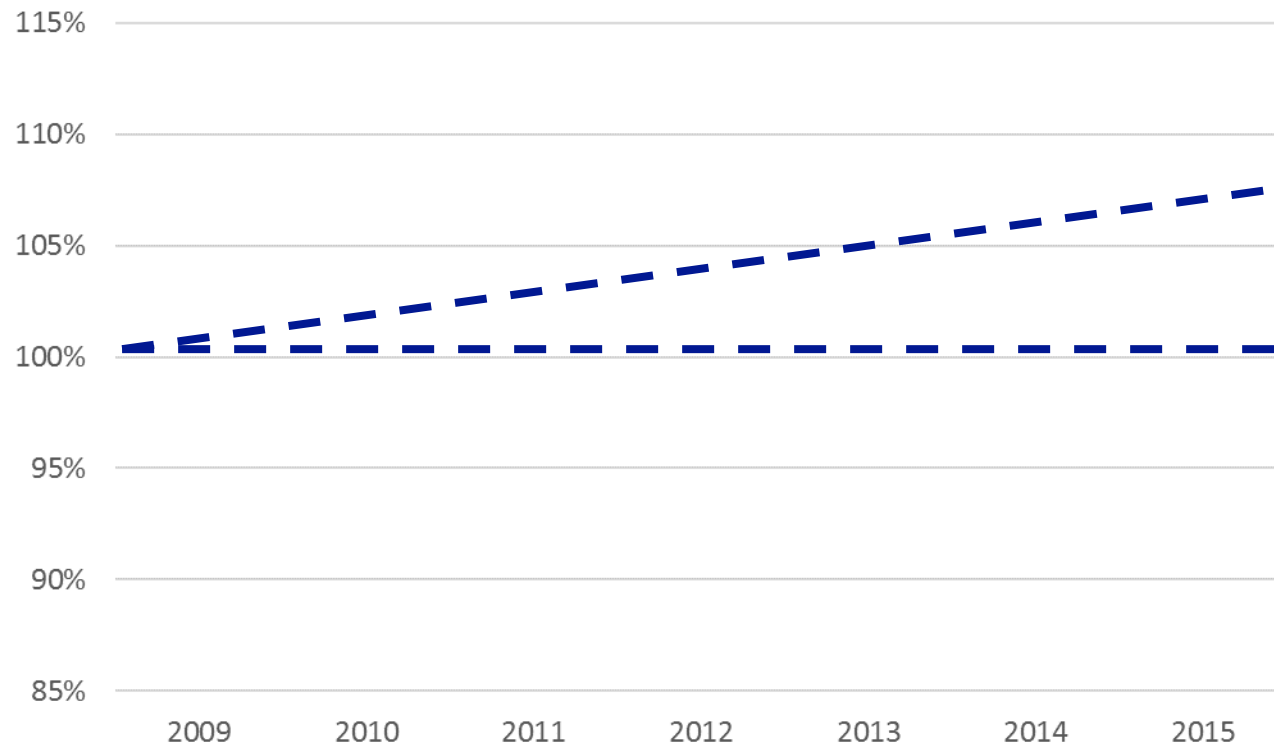
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Does

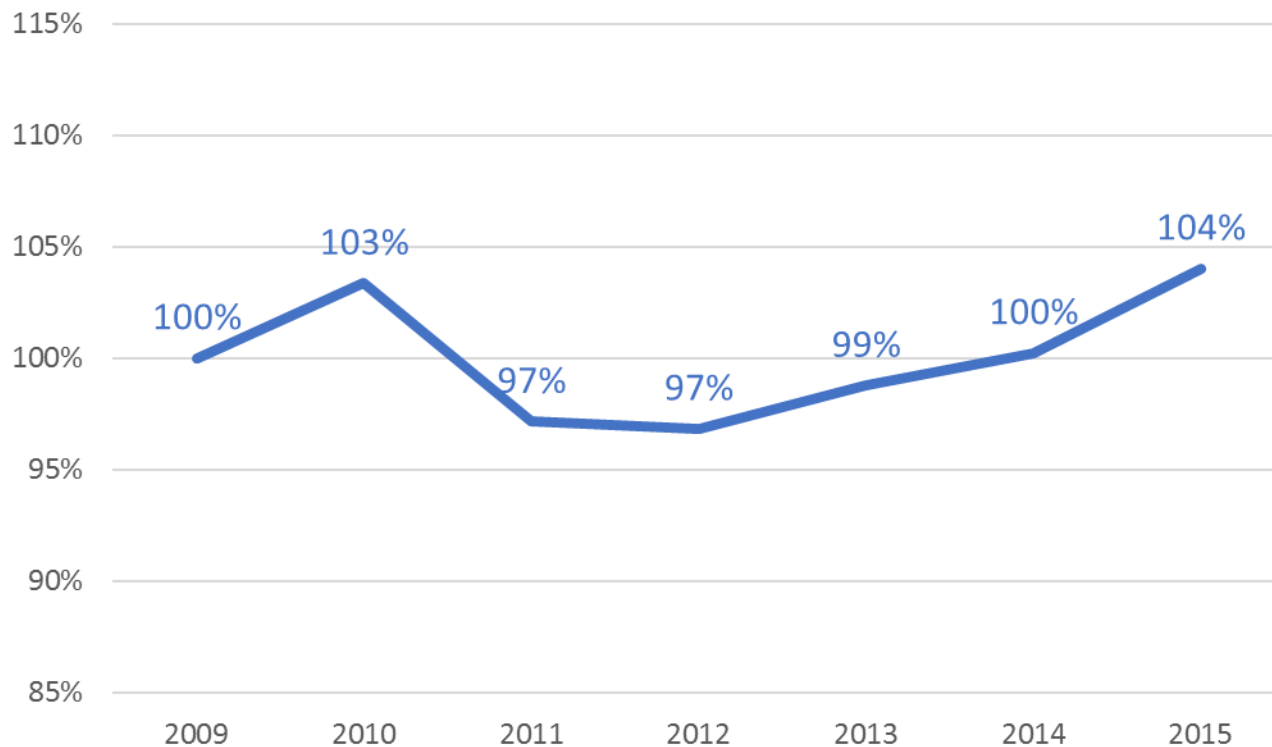
A large, dark blue, multi-lobed cloud-like shape that serves as a container for the word 'Maybe'.

Maybe

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



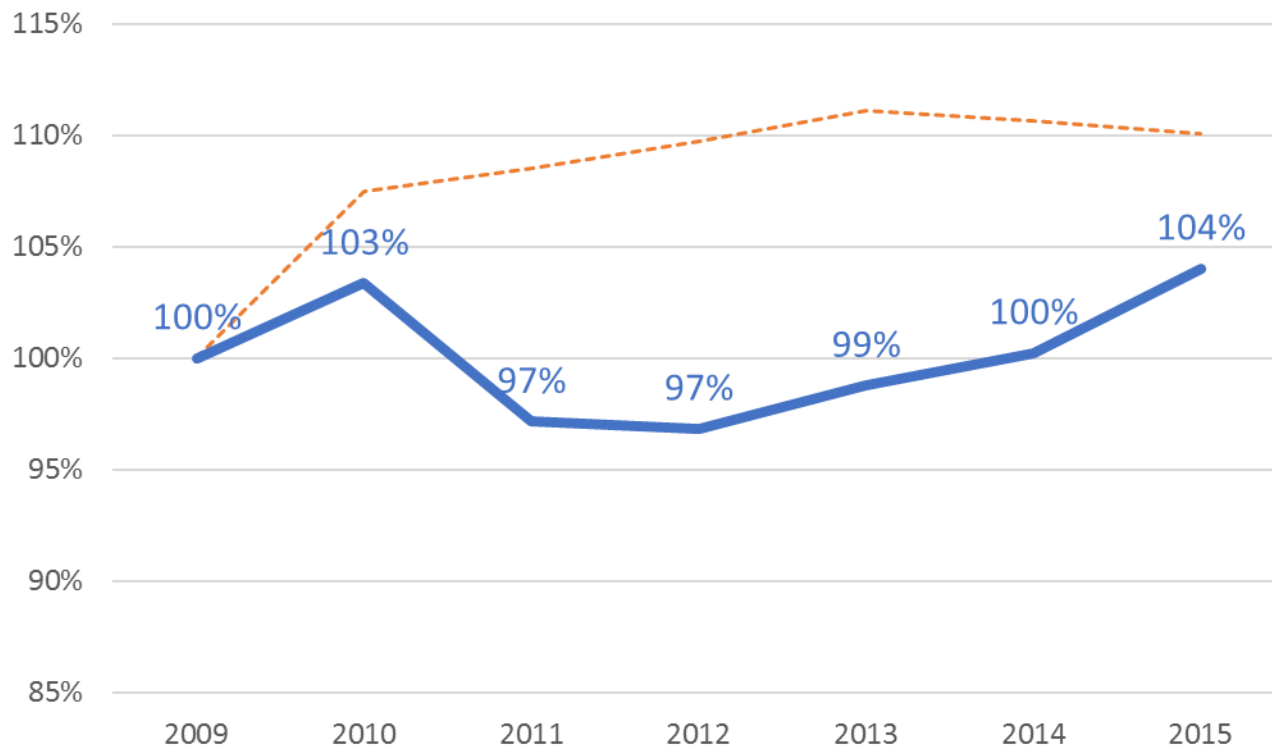
Operating revenues from a small municipal water and wastewater system fluctuated every year, despite water and wastewater rates not changing for those seven years



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

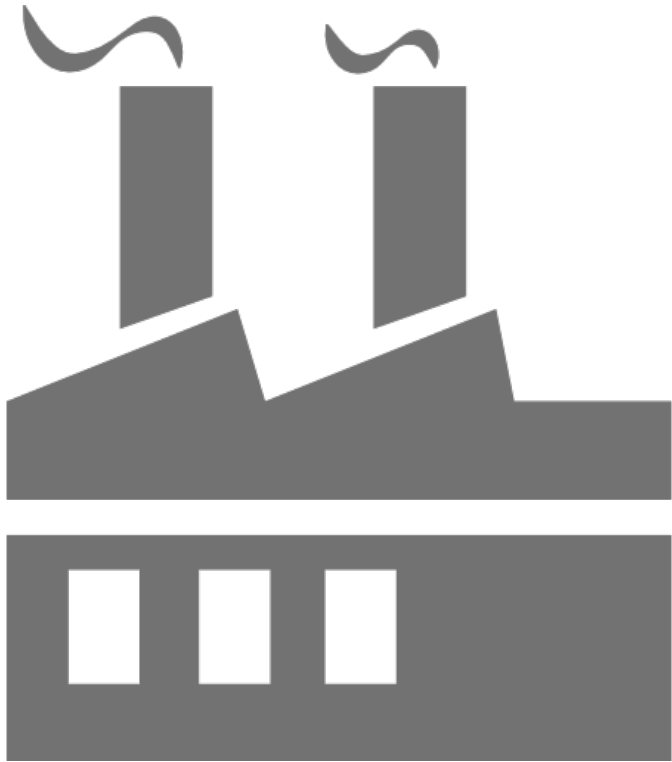
As a rule of thumb, typically usage goes down 3-4% for every 10% increase in rates

Population Change



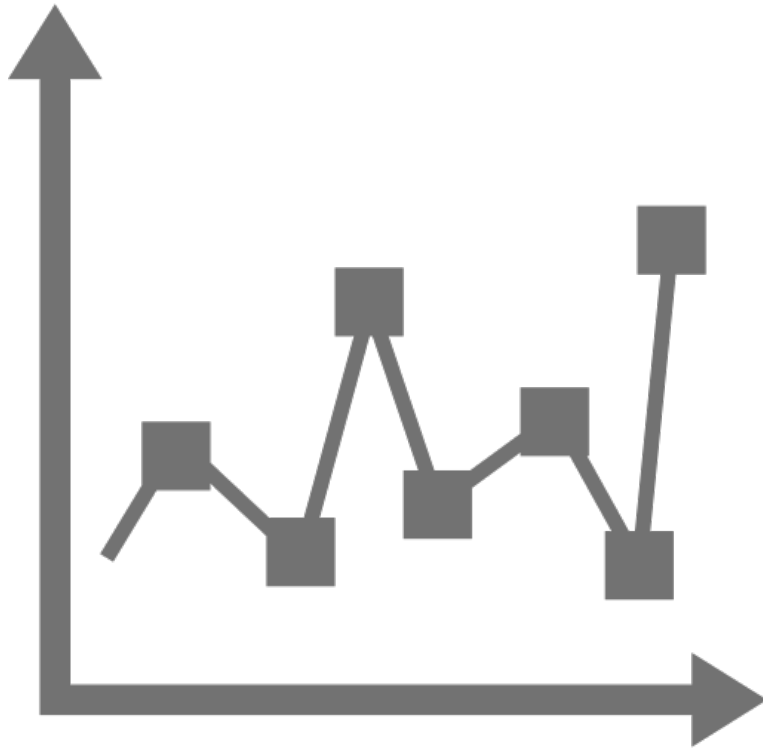
Customers could be coming into your system or leaving your system

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

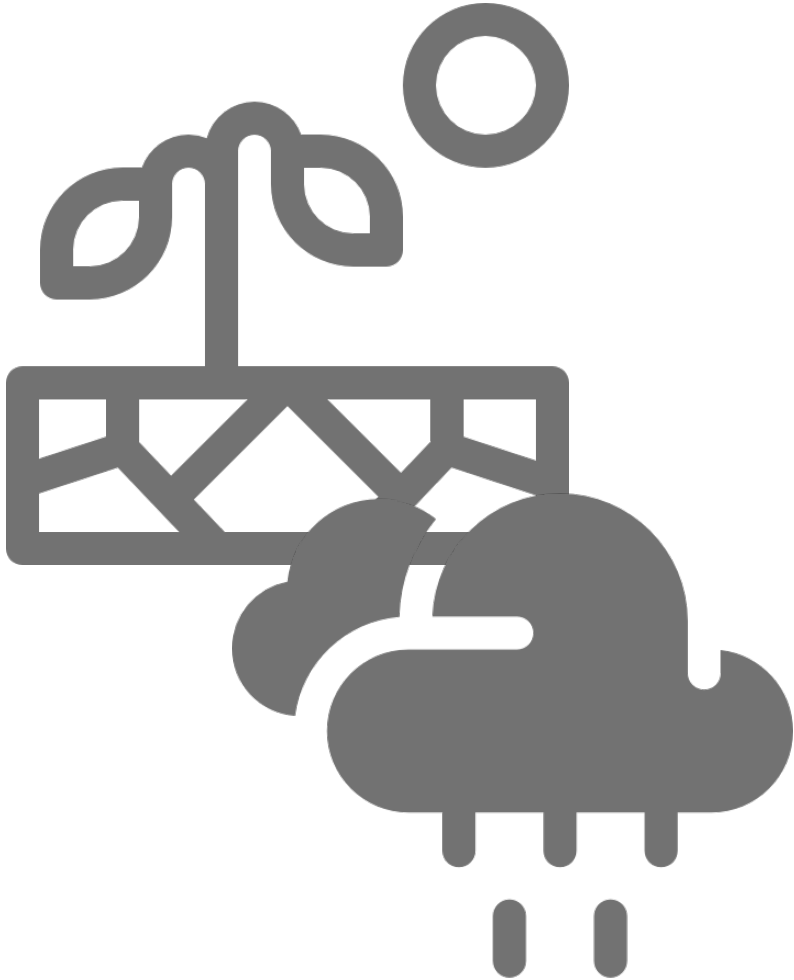


Even if the number of customers doesn't change, how often they are paying you may be changing





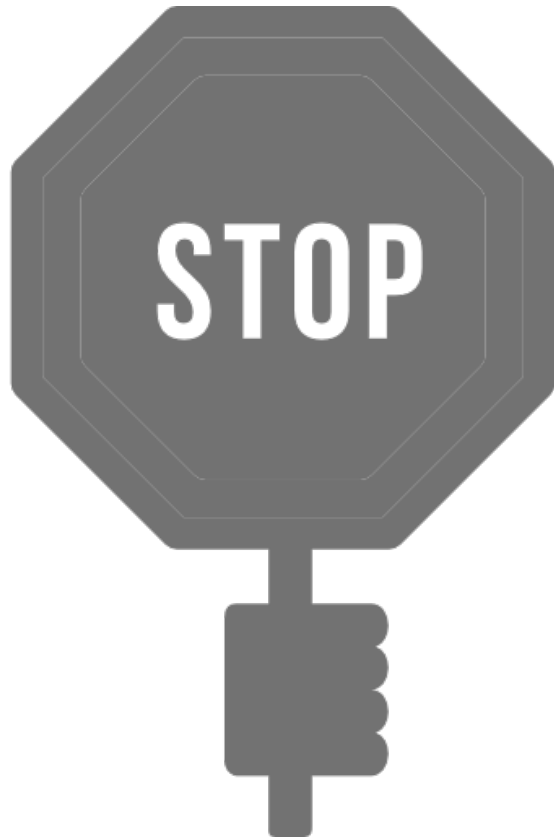
Weather



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



Water Use Restrictions



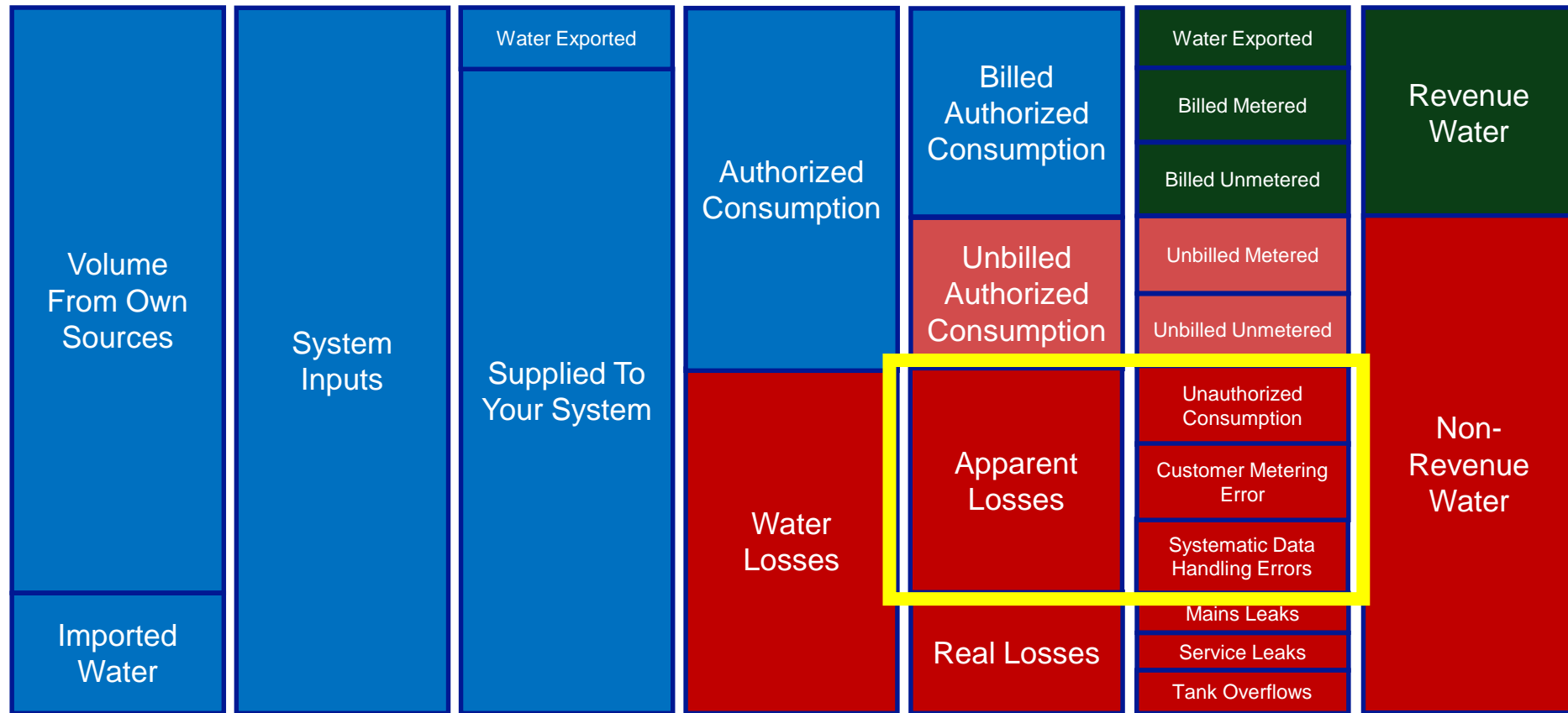
Whether due to water supply shortages or drought conditions, restricting water use will obviously impact revenues

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


Water and Wastewater Rates Analysis Model

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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 |
|-----------------------------|---------|---------|---------|---------|---------|---------|
| Debt Service | \$11.50 | \$13.00 | \$14.50 | \$16.00 | \$17.50 | \$19.00 |
| Other Known Annual Expenses | \$2.00 | \$2.00 | \$2.00 | \$2.00 | \$2.00 | \$2.00 |

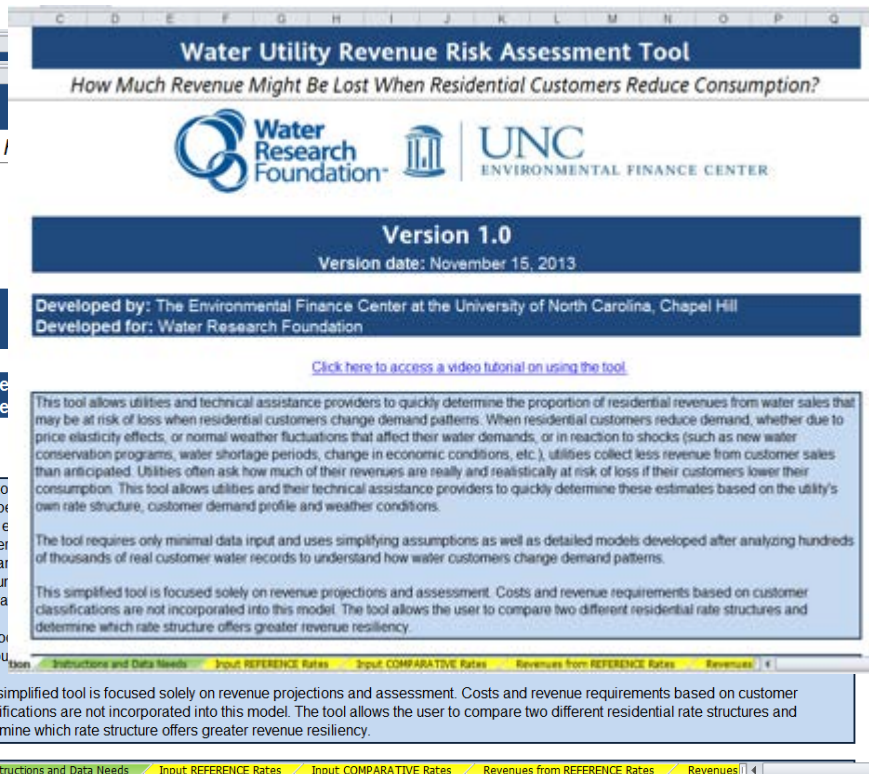
| Category | 2015 |
|---------------------|-----------|
| Administrative | \$190,000 |
| Capital Expenses | \$200,000 |
| Construction | \$100,000 |
| Engineering | \$100,000 |
| General Services | \$100,000 |
| Information Systems | \$100,000 |
| Legal Services | \$100,000 |
| Management | \$100,000 |
| Other | \$100,000 |

| Block | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---------|--------|--------|--------|--------|--------|--------|
| Block 1 | \$2.78 | \$2.78 | \$2.78 | \$2.78 | \$2.78 | \$2.78 |
| Block 2 | \$4.00 | \$4.00 | \$4.00 | \$4.00 | \$4.00 | \$4.00 |
| Block 3 | \$5.00 | \$5.00 | \$5.00 | \$5.00 | \$5.00 | \$5.00 |

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Water Utility Revenue Risk Assessment Tool



- 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

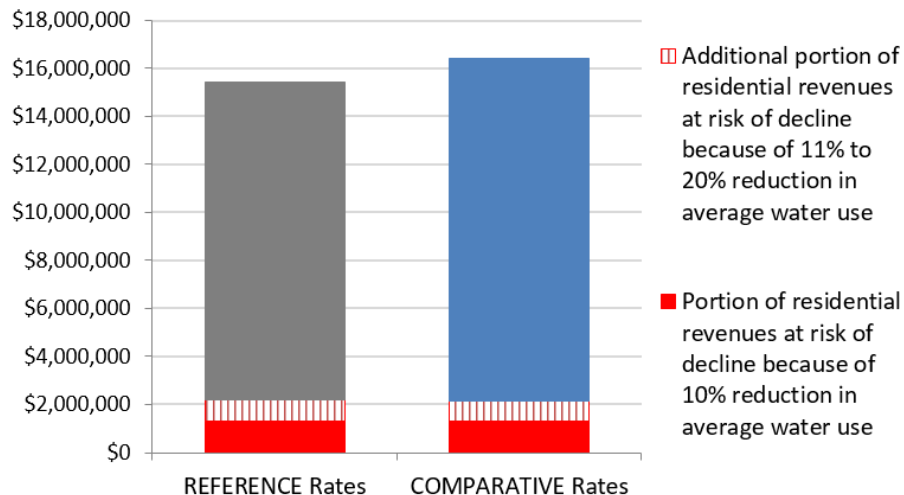
www.waterrf.org
www.efc.sog.unc.edu

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/>



A project of the
 Alliance for Water Efficiency

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Building Better Water Rates for an Uncertain World

AWE Sales Forecasting and Rate Model


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Appendices: Costing Methods, Demand Forecasting and Revenue Modeling

Communications Tools

 **RATES HANDBOOK**
Building Better

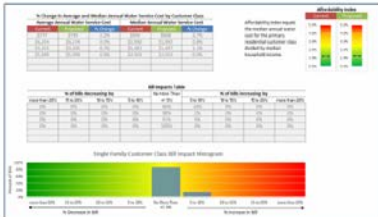
AWE Sales Forecasting and Rate Model

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





Pricing Water to Achieve Full Cost Recovery

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