THE COST OF APATHY: ECONOMIC DRIVERS MAKE THE CASE FOR WATER SUPPLY DIVERSITY

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INTRODUCTION

Athens-Clarke County recently completed a unique Economic Risk-Based Assessment of its water supply portfolio. A water supply portfolio is similar to a portfolio of financial investments. A good financial portfolio is diverse and includes a variety of assets, so that if one or two fail others are still available to draw from. In a comparable way, when a community has a diverse water supply portfolio, they are protected if one or two water sources dry up during drought or become unavailable for other reasons.

The goal of the Economic Risk-Based Assessment was to help the county move away from the traditional crisis-based management approach to drought characterized by the hydro-illogical cycle. This approach is institutionally imbedded in drought management throughout the country. The National Drought Mitigation Center's illustration of the cycle explains it well. People are apathetic to drought when precipitation is near normal. It takes some time after a drought begins for people to become aware of it, and even more time for them to be concerned. When the economic impacts start to occur, panic kicks in. Eventually, rain starts again and the cycle begins anew.

It is ineffective just to explain that a worse drought is certain to arrive eventually and expensive, drought-related infrastructure is a good investment. An economic case must be made for diversification of water supplies. The Athens-Clarke County Public Utilities Department (ACC) used a risk-based economic model to explain the risk of entering into a severe drought and its potential economic impacts. The resulting ACC Reuse System Master Plan is a testament to the effectiveness of the Economic Risk-Based Assessment.

MEMORIES OF DROUGHT

ACC's drinking water comes from three sources: the Bear Creek Reservoir, the North Oconee River, and the Middle Oconee River. ACC relies on the Bear Creek Reservoir during water shortages. The Reservoir is controlled by the Upper Oconee Basin Water Authority (UOBWA) and shared with three other counties that depend upon it at all times.

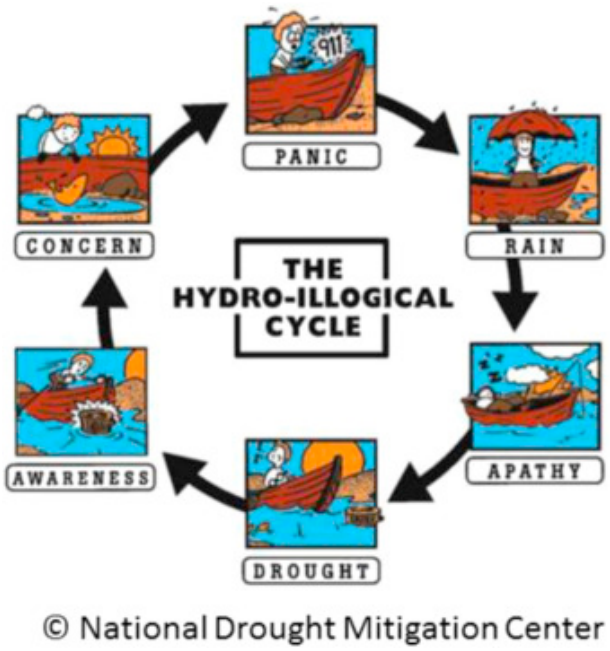

Figure 1. The Hydro-Illogical cycle

Being so high up in the Upper Oconee Watershed, only about 50 miles from the headwaters, the drinking water watershed area is relatively small. During severe drought, ACC's only raw water source is the Bear Creek Reservoir. The worst drought on record occurred in 2007-2008. During this drought, it was estimated that as little as 45 days of water supply remained in the reservoir. Since that epic drought, ACC has experienced exceptional drought two additional times.

The good news is that the community has responded to frequent drought; average water consumption has decreased 28% since 2006. Due to lower demands, the two more recent droughts in 2012 and 2016 did not impact the reservoir as much as they would have before the 2007-2008 drought. Consequently, the recent droughts did not have as great an impact on customers or the local economy. ACC tapped into the benefits of conservation and improved efficiency during droughts.

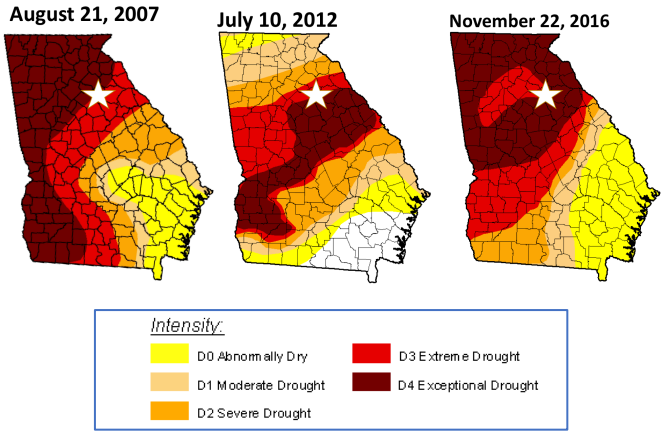

Figure 2. Drought in Athens Clarke County

As time goes by, the memories of water shortage difficulties during the 2007-2008 drought are fading. Anecdotal stories of drought impacts are not as powerful as they once were and people have been starting to fall back into the apathy of the hydro-illogical cycle. The Economic Risk-Based Assessment shows the possible economic impacts if drought preparedness strategies are delayed. The Assessment combined the risk of entering drought conditions that would require strict water demand reductions and the economic impact of these water demand reductions.

The Assessment evaluated the chances and impacts of drought conditions under existing (2015) and future demands. The goal was to show the cost of not diversifying the water supply portfolio and to motivate elected officials and residents to invest in needed infrastructure. The Assessment started with a comprehensive hydrologic model that evaluated the probability of entering into a drought that would require water use reductions. Then the economic model determined the economic impacts of implementing specific reductions.

Drought Risk

The UOBWA' Drought Management Policy/Contingency Plan identifies Drought Response Levels for its four member counties. Levels 1-5 correspond to water use reductions from 0% to more than 20%. The Assessment's hydrologic model developed probabilities of entering a drought that would trigger various drought response levels.

The hydrologic model utilized historic water demands, reservoir levels, streamflows, rainfall, and evaporation. It showed that in any given year, at 2015 water demands, there is about a 12% chance of entering into a drought that could require a water use reduction. Using 2050 demands, the model predicts a 5% chance of entering a drought that would trigger a level 4 response, requiring a 16-20% demand reduction.

Table 1. Upper Oconee Basin Water Authority water use reductions as a function of drought response levels.

Drought Level	Water Use Reduction
1	0 – 5%
2	6 – 10%
3	11 – 15%
4	16 – 20%
5	> 20%

Table 2. Athens-Clarke County water-use profile, consumption analysis (mgd).

Use Category	2006	2013	Change
Commercial	2.4	1.9	-22%
Institutional	2.4	1.7	-29%
Industrial	3.3	1.9	-44%
Multi-family residential	2.0	1.7	-17%
Single-family residential	4.8	3.6	-24%
Total	14.8	10.7	-27%

In order to comprehend the impacts of water use reductions, it is important to understand water use in ACC a decade ago and water use now. ACC's water use has decreased dramatically since 2007. This drop occurred due to conservation rates, an outdoor water use ban, industrial water demand reductions, and consistent water conservation programming. Drought induced efficiency improvements by industrial customers and outdoor water use reductions became permanent.

The summer peaking factor decreased from 1.7 in 2007 to 1.3, where it is holding steady. As a result, outdoor water use restrictions are not as effective in reducing demand. In 2006, an outdoor water use ban could reduce water use by about 25%. Under current demand conditions, a complete outdoor water use ban would lead to only about a 13% water use reduction. This 13% water use reduction would achieve a UOBWA Drought Response Level 3.

Extended periods of extreme or exceptional drought could require demand reductions beyond Drought Response Level 3. How could ACC reduce demands even further during a more severe drought? To answer this question, ACC's water use profile was evaluated. The 13% water demand reduction from an outdoor water use ban would largely come from residential customers. Water use by all customer classes has decreased significantly since 2006, including a dramatic drop in industrial water use. Beyond the 13% outdoor use reduction, non-residential customers would bear most of the burden of water use reductions.

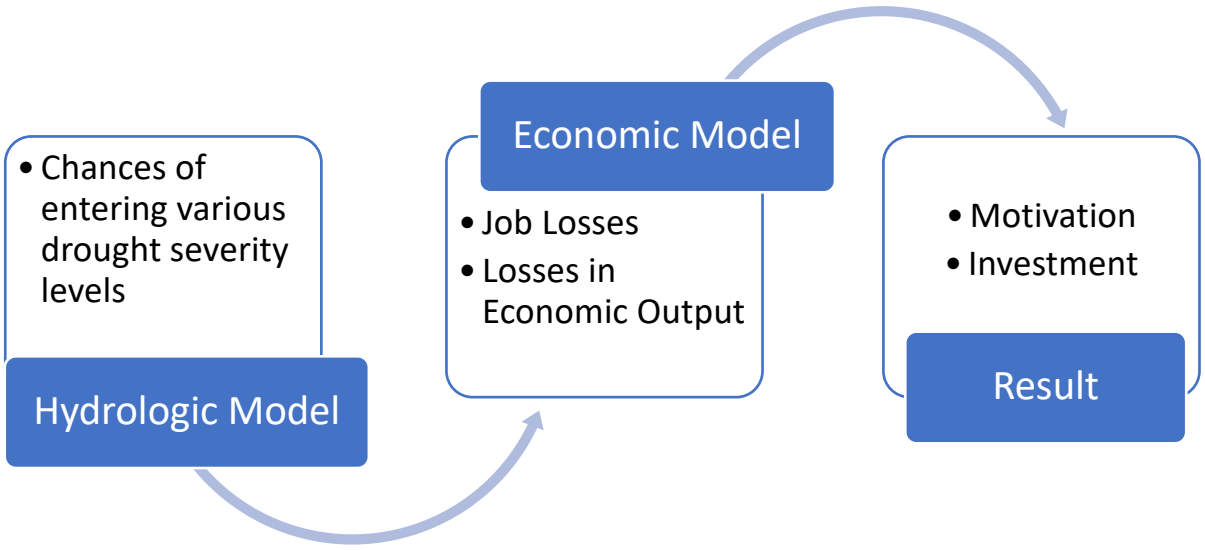

Figure 2. IMPLAN model used to assess the economic effects of water conservation.

Economic Impacts

The economic model shows the potential impacts of a 15% to 20% reduction in overall water use. We used IMPLAN, an industry standard input/output economic model. The basic concept behind IMPLAN is that the economy is made up of many sectors influencing each other by some degree. The model measures the impact of a change in a factor of production. Factors of production include things like labor, steel, land, lumber, etc. Water is a factor of production - one of many "inputs" that go into "outputs." If there is a change in the cost or quantity of an input, it will change the output.

The direct change in output based on a change in water supply will vary from industry to industry and sector to sector. To determine the impact of a reduction in water use, each sector's sensitivity to water availability was estimated. Elasticity coefficients from empirical literature were used to estimate how output in the respective economic sectors respond to changes in the water availability[i]. These elasticity coefficients were estimated for broad sectors and show annual reductions in output corresponding to prolonged water use limits. The elasticities were applied to current output to calculate the value of output reductions.

Additional assumptions in the model led to a conservative underestimation of overall economic impacts. These assumptions included that agricultural and livestock producers are not subject to reductions, results do not include economic losses due to residential water use reduction, and economic impact due to reductions by the University of Georgia are not taken into account.

The IMPLAN model used 2014 data from Athens-Clarke County and included 536 sectors of the economy. Data included employment, output, employee compensation, proprietor income, and taxes. The model showed economic impacts in terms of reductions in employment and losses in Gross Regional Product (GRP). The GRP reduction includes direct losses by sectors experiencing water reductions, indirect losses from other sectors that supply the direct loss sectors, and induced losses from reduced spending by households previously employed by the direct loss sectors.

Saying No to the Cost of Apathy

The economic model shows the potential cost of apathy to be a reduction in the GRP of $244,000,000 and the loss of 4,171 jobs (Table 3). The hydrologic model shows that every year there is a 5% chance of entering a drought that could require demand reductions and create such an impact. While the risk of imposed reductions may be small, the economic impacts to the community are large.

ACC's Mayor and Commission didn't want to gamble with the future of the county and decided that virtually no level of risk is acceptable given the high stakes. To find strategies that would mitigate the risks associated with future drought, the Assessment was run using a variety of scenarios. The ACC Mayor and Commission approved a scenario that minimized economic impacts by diversifying the water supply portfolio with additional conservation, water reuse, and storage.

Table 3. Estimated economic impacts

Category	Water Use Reduction			
	15-20%	20-25%	25-30%	>30%
Institutional	3.7%	5.3%	11.1%	16.0%
Commercial + Industrial	11.8%	16.8%	35.3%	50.0%
Job Losses (annual)	4,171	10,280	22,932	23,417
GDP Losses (annual, millions, 2014 dollars)	$244	$566	$1,287	$1,214

The first recommendation for diversification was the development of additional efficiency and conservation programs to reduce per capita demands an additional 10%. To accomplish this goal, the county is creating a customer portal to strengthen the ability of customers to monitor their own water use and has begun active leak detection in its distribution system. ACC will also consider improving cooling tower efficiency and auditing high water users.

In May 2018, ACC completed its Water Reuse Master Plan, saying no to the cost of apathy. The Plan establishes the path forward for implementing a non-potable reuse system with the flexibility for future expansion to an indirect potable reuse system. The non-potable system distributes reclaimed water that is treated to an extent appropriate for use in irrigation, industrial, cooling, and other non-drinking purposes.

A non-potable reuse system and improved efficiency will significantly improve water supply reliability and help reduce the impacts of smaller droughts. However, the Economic Risked-Based Assessment showed that this system will not be enough protect the county from the impacts of a prolonged severe drought. The addition of indirect potable reuse and additional storage nearly eliminates the impacts of drought through the foreseeable planning horizon. Indirect potable reuse will involve deliberate augmentation of a drinking water source with treated reclaimed water in a storage facility that will serve as an environmental buffer.

Special Thanks: Athens-Clarke County Public Utilities would like to thank CH2M for its assistance and expertise on helping create and implement the Economic Risk-Based Assessment and Reuse Master Plan.

[i] Spectrum Economics. 1991. “Cost of Industrial Water Shortages: Preliminary Observations.” April 11, 199 as cited in S.D. Norvell and S.D. Shaw. 2010. Socioeconomic Impacts of Water Shortages for the South Central Texas Regional Water Planning Area (Region L), Prepared in Support of the 2011 South Central Texas Regional Water Plan. Texas Water Development Board. June, 2010.