WHY SHOULD I CONSERVE WATER WHEN OTHERS GET TO USE SO MUCH? A WATER CONSERVATION PANEL DISCUSSION

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Abstract. The purpose of this paper is to show that, regarding water conservation in Georgia, all water use sectors are involved. This panel has representatives from the green industry, state government – institutional, state government – agriculture, private industry, and municipal government. Each panel representative will give an example of water conservation from their perspective and experience. Coordination of all of these efforts is needed, which is the main objective of the newly formed Department of Natural Resources (DNR) Water Conservation Program.

THE GREEN INDUSTRY[1]

Georgia's Urban Agriculture Industry is comprised of over 6600 small businesses, which employ over 60,000 employees and generate over $5.6 billion in annual revenue. The value of this industry, both in products and services, is currently perceived for its positive effects on aesthetics and the value of real estate. The urban landscape is an integral part of Georgia's quality of life and economy. In fact, scientific research documents that landscapes can be one of the most influential factors in mitigating the environmental impact of urbanization. It has become apparent that the Georgia Urban Agriculture Industry, with the support of the University System of Georgia, has an unprecedented opportunity to develop improved Best Management Practices (BMPs) thereby supporting the implementation of functional landscape systems that would effectively reduce:

- Stormwater and non-stormwater runoff;
- Non-point source pollutants;
- Erosion and sedimentation;
- The need for irrigation water;
- The need for synthetic fertilizers and pesticides;
- Thermal stress from impervious surfaces; and
- Urban heat zones through the combination of soils and plants.

The Georgia Urban Agriculture Industry's directives include:

1) To continue the establishment of an open dialog with state government agencies for the purpose of providing expertise and support towards Georgia's government agencies water-related goals and objectives.

2) To play an integral role in Georgia's Comprehensive Statewide Water Management Plan through the activity of the Stake Holder Advisory Group.

3) To remain pro-active in all state-sanctioned water task forces and/or committees thereby assisting them in the development of specific urban agricultural processes such as:

   - Outdoor watering guidelines that are scientifically based and that achieve a substantial reduction of water consumption.

   - Landscape irrigation design and performance guidelines that are scientifically based. To detail the differences between established landscape irrigation requirements and newly installed landscape irrigation needs.

   - Research other methods such as water budgeting for landscapes and promoting new technology that automates water usage through the use of computerized irrigation controllers (such as ET controllers).

4) To support the development of a centralized research and development center for water quality and quantity.

5) To support the statewide standardization of the water rate structure.

6) To encourage and assist in the development of statewide consumer based landscape and water conservation education initiatives.

7) To create a statewide landscape certification program, which will focus on technical expertise, including water management techniques

STATE GOVERNMENT – INSTITUTIONAL[2]

The Georgia Department of Corrections (GDC) operates two prisons in Reidsville, Georgia : Rogers State Prison and Georgia State Prison. Georgia State Prison houses approximately 1,260 inmates in a maximum-security setting. Rogers State Prison houses 1,227 adult male felons in a medium to minimum-security setting. Between the two prisons, there are 1,100 correctional officers and staff. Approximately 160 single-family homes are available for staff housing. Additionally this facility is the home to a 10,000-acre farm where inmates produce and process meat and vegetables.

The Department operates a water and wastewater treatment plant at the Rogers/GSP facilities. This water and wastewater treatment plants serve Rogers State Prison, Georgia State Prison, State housing, the canning plant, dairy operations and an abattoir. Water is provided from three wells in the Upper Floridan aquifer. Disinfection is the only treatment step for the drinking water. The wastewater treatment plant treats 850,000 gallons per day of wastewater before it is discharged into the Ohoopee River.

The canning plant, operated by the department, processes most of the vegetables consumed by Georgia inmates. The farm and abattoir produce and process most of the meat consumed by the inmates. The cannery produces approximately 144,000 cases per year of greens, potatoes, carrots, peas and squash. The abattoir processes several hundred head of cattle and hogs per week.

A team of engineers from Georgia Environmental Partnership (GEP) was called in to assist the Department of Corrections (Department) with identifying water and energy conservation opportunities. The primary purpose of the GEP study was to reduce peak flows to the treatment plant. When the cannery is operating three shifts per day, peak flow to the treatment plant can exceed 1.2 million gallons per day. However, because of flow equalization, the treatment plant is able to stay within permit limits even during peak flows.

The GEP/GDC team examined all water and energy saving opportunities within both prison facilities. The cannery is the focus of this paper because it offered the best opportunity for water and energy savings.

A team of canning plant employees, GEP and GDC engineers collaborated to develop a comprehensive water efficiency program for the canning plant. The water efficiency team performed a water audit at the canning plant during pea and potato processing. The overall water usage for the canning plant was 220 and 511 gallons per minute of pea and potato processing, respectively. Most of the water is used for washing the vegetables prior to canning.

After detailed process mapping and root cause analysis, the team developed a list of 20 water efficiency measures. The team prioritized these options according to cost, feasibility and effectiveness. The combined estimated water savings for these measures is over 20 million gallons of water per year. The water efficiency measures are discussed below.

Flow meters, Totalizers and Control Valves

The team recommended installing flow meters, totalizers and control valves on the incoming water lines, brush washer and can filler. This will allow the employees to track water usage, adjust flow rate and turn off water when operations are not in use.

Pea Cooling System

English peas are currently cooled using ice. The canning built a recirculating cooling system saving 72 gallons per minute, 12 hours per day.

Alternative Plant Cleanup

Inmates currently clean the canning plant throughout the day. The hoses are left running when not in use. Eliminating the water hoses and using a dry clean-up is estimated to save over 14 million gallons of water per year.

Counter-flow Rinsing

Counter-flow rinsing involves using fresh water for final rinsing of vegetables and from this point the water is reused upstream in preceding washing steps. Water savings is estimated at 6.7 million gallons of water per year.

Total savings

As shown in table 1, approximately 22 million gallons of water can be saved per year. This will result as a savings of approximately $92,000.

Table 1. Water & Cost Savings, Capital Costs and Payback

Recom-mend.	Estimated Annual Water Savings	Estimated Annual Cost Savings	Estimat-ed Capital Cost	Estimated Simple Payback (years)
Flow meters, totalizers and control valves	N/A	N/A	$3,000	N/A
Dry Cleanup	14,232,000	$56,000	$10,000	0.17
Counter-flow Rinsing	6,732,000	$26,928	$9,000	0.33
Pea Cooling System	77,600	$7,110	$16,000	2.25
Total	**21,741,600**	**$91,638**	**$38,000**	**0.41**

STATE GOVERNMENT – AGRICULTURE[3]

Background

Agricultural water use is regulated by the Agricultural Permitting Unit of the Georgia Environmental Protection Division. EPD receives its authority to do so from The Groundwater Use Act, which governs regulation of irrigation well usage, and the Water Quality Control Act, which governs agricultural surface water withdrawals. According to both laws, any person who wishes to withdraw more than 100,000 gallons per day (gpd) on a monthly average must obtain a permit from EPD. That is only around 69 gallons per minute (gpm). A typical center pivot irrigation system uses 700 gpm, or just over one million gallons per day.

Permitting of agricultural water use did not start until 1988. Since then, EPD has issued more than 21,400 permits statewide! The vast majority of these are in south Georgia, below the Fall Line. There is an approximately equal number of permitted surface water and groundwater withdrawals statewide, but the greatest density of groundwater withdrawals can be found in southwest Georgia in the Dougherty Plain district. The Dougherty Plain is an area of very low relief surrounding the Flint River. In this area, the Floridan [limestone] aquifer is very shallow and prolific, and relatively shallow wells routinely produce 1200 gpm, or 1.7 million gallons per day (mgd). Furthermore, in normal rainfall years the Floridan aquifer, which is semi-confined and locally unconfined in the Dougherty Plain, completely recharges to previous springtime levels. The easy and cheap availability of reliable groundwater is why there are so many irrigation wells in southwest Georgia.

Response of EPD to the Problem

In order to slow the rapid growth of irrigation pumpage in southwest Georgia, EPD imposed a moratorium on the issuance of new groundwater irrigation permits in the lower Flint River Basin and new surface water permits in the entire basin. Because irrigation water is the lifeblood of agriculture, EPD's decision raised deep concern in the farming communities of the Dougherty Plain and adjacent areas. Thus, EPD agreed to release a limited number of permits for wells that had already been drilled. More than 800 permits were issued, but more than 1100 remain backlogged.

Fortunately, EPD began a series of public outreach activities that were extremely effective in building positive and constructive relationships between the regulated community, regional stakeholders, and EPD. In close cooperation with the Extension Service, the J.W. Jones Ecological Center at Ichauway, the University of Georgia National Environmentally Sound Production Agriculture Laboratory, local chambers of commerce, and a variety of smaller task forces and stakeholder groups, EPD participated in permit sign-up days throughout southwest Georgia at which farmers could sign up for permits, correct errors in their existing permits, get their wells and pumps accurately located on digital aerial photos, and get questions answered. These "County Days" had the direct benefit of upgrading EPD's digital permit database, which had numerous inconsistencies and errors regarding new addresses, permit ownership, etc. Through the efforts of the Jones Center and UGA/NESPAL, these events also generated a digital GIS database of take point locations and irrigated acreage, which has become EPD's principal mechanism for evaluating agricultural water use. An equally important but indirect benefit of County Days was the construction of an excellent relationship between EPD and the agricultural community.

Another important group with whom EPD interacted was, and continues to be, State legislators from farm-dependent districts statewide. Some of these legislators are farmers themselves, and their contacts with the farm community played an important role in shaping official policy regarding agricultural water use. The first result of this three-way relationship between EPD, lawmakers, and the farm community was the Flint River Drought Protection Act of 2000 (FRDPA). The FRDPA provided financial incentive for farmers to voluntarily suspend irrigation in severe drought years and thus conserve water in the Flint River and its tributaries. Originally, the FRDPA was to include all irrigators; however, the impact of groundwater withdrawals was not clear, so ultimately the Act only included surface water users whose impact is much more direct and demonstrable.

Surprisingly, the FRDPA was put into service for the first time in 2001, when the drought was entering its third year. The operating principle of the FRDPA is simple: after declaring a severe drought year on March 1, EPD conducts an auction soon after in which permit holders bid on an acceptable price per acre of land on which irrigation will be suspended. EPD will either accept or reject their bids based on the total amount of money available to "buy out" irrigation for one year and the total numbers of acres EPD wants removed from irrigation. The execution of the FRDPA was, in fact, enormously complicated, and required further correction of EPD's databases, accurate locating of permits, numerous public meetings, and large expenditures in equipment, personnel, and time. However, all these efforts further educated the farming community and built on the established relationships between EPD and various stakeholders.

Results

With the extensive and invaluable assistance of Georgia State' University's Andrew Young School of Economics, EPD conducted two "Irrigation auctions" according to the FRDPA. The results of each auction are summarized below.

Table 2. Irrigation Auction Summary

Acres suspended	Total cost	Average bid	Bid range	Water conserved*
(2001) 31,665	$4,478,847	$135.70	$30-$200	50 mgd
(2002) 41,145	$5,254,951	$126	$74-$145	65.2 mgd

*assumes average application rate of 10.5"/acre over 180 days

The auction of 2001 revealed problems inherent in the permit verification process, eligibility of permit holders, and other aspects of the entire agricultural water management milieu. For example, an unfortunate numbers of permit holders had not planted or irrigated in the recent past, and much money was squandered on tree farms, fallow lands, and pastures. As these fields are rarely irrigated, their impact on the Flint River system has been negligible. Also, many permit holders could not be located and verified in time for the auction. This reflected the limited amount of time and personnel EPD had to prepare for the first auction. Finally, around 150 permits were inaccurately identified as being on intermittent streams, when in fact they were on perennial streams. This was the result of using USGS topographic maps, and probably could not have been avoided. Unfortunately, EPD was sued in Federal court. The case was dismissed.

The auction of 2002 was far more successful. All of the major problems of 2001 were addressed, and only a handful of permit holders who wanted to participate were unable to do so. More acres were taken out of irrigation for less money, and a different and far more efficient auction procedure was used. We anticipate that future auctions will be even more efficient and result in greater water savings.

PRIVATE INDUSTRY[4]

Case Study – Southwire Company, Carrollton, GA

Water conservation, in the form of limiting usage and recycling, has long been a way of life at Southwire facilities, but in the summer of 2000 it became a matter of survival for Southwire's Carrollton facility. At one point, continued operation was uncertain if significant measures were not taken to conserve water and find an alternate water source.

The approach to solving the anticipated year 2000 water shortage crisis was somewhat unconventional due to the criticality of the situation. Initially, concern was focused on maintaining facility operations and, because of that focus, time didn't allow for the usual planning course. In fact, analyzing plant operations for water conservation opportunities and implementing them, where possible, were taken prior to conducting the steps outlined in Table 3.

Table 3. Steps for a Successful Water Efficiency Program

Step 1 -	Establish commitment and goals
Step 2 -	Develop support and resources
Step 3 -	Survey water use and develop a facility water balance
Step 4 -	Identify water efficiency opportunities
Step 5 -	Develop and implement water management plan
Step 6 -	Track results and publicize success
Step 7 -	Update water management plan

Initial water conservation successes were achieved through brainstorming sessions with plant personnel familiar with piping and water usage patterns. Of course, lawn sprinkling and landscape applications were some of the first things to be discontinued. Additionally, many inefficient water uses were identified by simply tracing visible water piping as far as possible and then shutting a valve to see what happened. Admittedly not very scientific, but it worked to achieve fairly immediate reductions in water use. Some of the greatest water savings were from reduced filter backwash and system blowdowns (wasting of water to reduce mineral build-up). Concurrent with these reduction activities, two deep wells were drilled to provide an alternate water source. Once adequate water to supply the facility was secured, then a more reasoned approach was taken to search out inefficient water usage, and significant additional gains were made through the more structured and traditional planning approach.

Southwire was spurred by the following directive from Chief Executive Officer, Roy Richards, Jr.,:

I want every Southwire facility to develop and implement a long-term action plan for water management with annual targets for improvement. My expectation is that you will build water management into your management systems so that we make measurable progress every year and show dramatic improvements over the next five years.

Southwire facilities have developed and implemented formal water management plans based on the following key elements:

1. Measuring baselines for use and discharge;
2. Identifying major users at the facility;
3. Establishing long-term and annual improvement goals;
4. Measuring results;
5. Making adjustments to ensure continuous improvement.

To start the analytical process, teams of personnel were formed from a breadth of operational areas and given the charge to measure baseline water use and identify major water uses. One of the team members was Mr. Bill Vondersmith, of P2AD, who offered valuable input to the process. Plant drawings, city water bills, run hour meter readings for pumps, and engineering intuition served as the basis for analysis. Data was organized, tabulated and, in many cases, graphed to reveal trends. Water meters were added as necessary to quantify water use. Every process utilizing water was examined for losses and water use efficiency. Once the best water saving opportunities had been identified the next step was establishing reduction goals and developing and implementing the opportunities. The schedule for implementation was prioritized based on potential water savings and ease of implementation.

Fortunately, implementation of most of the identified water saving opportunities was straightforward and could be accomplished without major disruption of facility operations. After implementation, it was time to measure and evaluate the results. Results were gratifying with an annualized

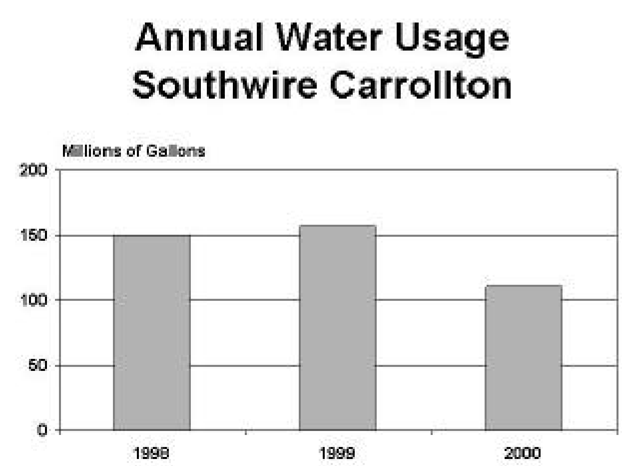

Figure 1. Annual Water Usage.

reduction of approximately 40,000,000 gallons for the year 2000, as compared to 1999 (Figure 1).

MUNICIPAL GOVERNMENT[5]

Conservation rate structures

Many water purveyors in the Atlanta metropolitan area use either tiered or seasonal water rate structures. In Gwinnett County, for example, the rate structure has several conservation elements.

First, the *base charge* is relatively small compared to the total bill, and it includes no usage allowance. A high base bill relative to the volumetric charge tends to levelize the customer's water bill across the seasons. A small base bill and higher volumetric charge makes the monthly bill more variable according to usage, thus giving the consumer a stronger signal on the costs of his/her behavior.

Secondly, all Gwinnett water customers get a 25% *summer surcharge* on usage over 125% of that individual account's winter average usage if the peak season usage exceeds 10,000 gallons per month. This recent rate change drew significant newspaper and television attention.

The summer surcharge applies to all water used by irrigation-only accounts.

Thirdly, Gwinnett charges for sewer on the full volume of metered water, regardless of whether that water went to sewer or on the lawn. Some jurisdictions levelize the sewer bill based on winter usage, thus they avoid arguments with irate customers. In contrast, *charging sewer on the full volume of water usage* can double the summer water and sewer bill over winter billings. This billing method has much more conservation incentive than the summer surcharge.

When the three rate elements are combined, water and sewer customers pay a substantial premium for discretionary outdoor usage. Even relatively low usage during the summer can generate unit charges that are 225% of winter rates.

Lastly, Gwinnett does not encourage irrigation taps. Irrigation taps pay the same system development charge as a regular water tap, with no offsetting credits.

Along with the benefits of sustaining supplies and habitat, there are good fiscal reasons for reducing peak demand. Production capacity to meet peak demand is the most expensive investment a utility makes because the extra capacity only generates revenue a few month of the year. This peak capacity is *idle capital* during the off-peak season. Simplistically speaking, if that peak capacity is dormant half the year, then the water it produces during the peak season should be priced at two-times the embedded capital cost as base-demand capacity. A cost-of-service study can ascertain what the extra-capacity charge should be; however, the industry's push for social and environmental agendas has in some jurisdictions left cost-of-service rationale behind in their quest for conservation incentives.

Several studies in water-scarce states conclude that the annual average price *elasticity* of water is -0.10, meaning that for a doubling of water rates there is a 10% reduction in annual water usage. This relative inelasticity may be indicative of the fact that public water is inexpensive in the first place. Doubling the price of a commodity that is cheap may not make much difference in consumer behavior. However, those same studies indicate that summertime elasticity is -0.20. This suggests that there is hope in modulating peak demand through conservation rate structures.

Drought proofing

Part of the motivation for water conservation is to sustain limited supplies during a protracted drought. Water purveyors should always plan as though the thousand-year drought cycle will begin next year. This means that from a supply perspective fresh water supplies should be retained as high in the watershed for as long as feasible. This is often compatible with recreational uses and for sustaining headwaters habitat flows below impoundments when that thousand-year drought eventually occurs.

Drought proofing generally entails preemptive measures which conserve available upstream water supplies even in wet weather periods. Ideally, one keeps reservoirs full up until the last possible moment.

Conservation measures which become convention and habit can keep supplies whole for longer duration at the onset of a multiyear drought even when we do not know that we have entered such a drought. And, routine conservation practices can sustain dwindling volume over a longer period without resorting to emergency responses. Conservation practices in the good times makes a community less vulnerable in dry times. It is for this reason that many local communities also resist squandering stored water on low priority releases for which alternatives are available.

Per capita usage

Two metrics for conservation are per capita usage on an annual average and over a peak period. When contrasting the effects of water conservation programs around the nation, be cognizant of absolute values and not just percentage reductions. A reduction in usage in a western city from 385 gpcd to 200 gpcd is a dramatic percentage reduction. But in the metropolitan area of Atlanta per capita usage is under 200 gpcd. For example, in Gwinnett per capita usage is closer to 130 gpcd.

Because Gwinnett County recognizes its headwaters situation, its government has resisted water-intense industries from locating there. This has not proven detrimental to the county's economy, which is supported by 330,000 jobs. Areas of low-water yield such as the Piedmont region of Georgia, are not ideal locations for multi-mgd industries. Discouraging water intense industries in water-scarce areas makes good conservation sense. For this reason total per capita usage is a better metric of water usage in north Georgia than usage per customer category.

Impact of outdoor use restrictions

From 1999 through 2002 Gwinnett's average annual water withdrawals have gradually declined. This is probably more attributable to outdoor use restrictions more than any other factor. What is remarkable is that since January 1, 1999, through December 31, 2002, Gwinnett County's water service population grew by approximately 120,000.

SUMMARY

This paper has shown that all water use sectors are involved in water conservation in Georgia. It is time to stop pointing the finger and to begin to work together, collectively, so that we can accomplish significant water use efficiency. Our precious water resources, and all 8.2 million citizens, are depending on it.

The mission of the Georgia Department of Natural Resources Water Conservation Program is to promote the long-term efficient use of Georgia’s water resources throughout the state. This will be accomplished by coordinating and strengthening existing water conservation efforts; coordinating and strengthening existing water conservation plans and programs; creating and implementing a statewide water conservation plan; creating new and supporting existing statewide public education and outreach opportunities; strengthening the regulatory role of the Environmental Protection Division in water conservation planning; and acquiring stable funding sources at the federal, state and local levels to execute all of items above.