Florida's Water Resources:
Where We've Been, Where We're Going

A while ago I read a magazine article with an interesting concept: what if the stereotypical middle class family of the 1950s, Ozzie and Harriet, were to go 50 years in the future to 2000 and 50 years in the past to 1900? How difficult would it be for them to adjust, and would it be more difficult for them to adjust to the future or the past?

If you had asked most anyone that question in the 1950s, the answer would probably have been that certainly it would be the future that would require a more difficult adjustment. We pictured 2000 as a time of everyone operating his own personal flying car, of colonies on the moon and Mars, of life spans much greater than a century. Or perhaps our images were on the dark side: the nuclear ashes of a post-apocalyptic earth, or a world with such an over-grown population that starvation would be the norm.

What was particularly interesting about the article was that it pointed out how relatively little change there was from 1950 to 2000 as compared to the change from 1900 to 1950. Ozzie and Harriet would find no great amount of future shock in 2000. Automobiles are a bit more streamlined, but they drive pretty much the same, and they usually stay on the ground. Telephones have push buttons instead of rotary dials, but we still call it dialing, and it wouldn't take Ozzie and Harriet more than a moment to figure out how to operate them. Television is in color, and there are a lot more channels, but it's still television. Computers are ubiquitous, but for the most part invisible to the general public. There're no colonies on the moon, and we've never even been to Mars. All in all, we don't live a lot differently in 2000 from the way we did in 1950.

But going back to 1900 would be a very different story. Indoor plumbing was not widely common for middle class homes, automobiles were rare, airplanes nonexistent, and, outside of stories by Jules Verne and H.G. Wells, space travel hadn't even been much thought about. There were no radios, much less televisions. Plagues of yellow fever, typhoid fever, and cholera were to be expected, and, partly because of them, life expectancies were not high.

Naturally, all that made me think of Florida's water resources and whether we'll see as much change in the future as we have in the past. So I decided to ask some of our esteemed colleagues who've been in Florida for a while to give us their opinions on the matter. I asked them to look at the past thirty years and the next thirty years. I chose thirty years because that's the typical length of a career for some people, because the real changes in water resources seemed to have started in the 1970s, and… well, I suppose partly because I've been in Florida 30 years this coming June.

The results are presented here in alphabetical order by author's name.

If you have any thoughts about the past, the future, or both, your letters are welcome.

— Editor

Change Is Changeless

Dave Crowson

David L. Crowson, P.E., is a 1951 civil engineering graduate of the University of Florida. His experience includes serving as city engineer and public works director for Fort Pierce, manager of Orlando's water department, and an engineer in private practice. He is a past chairman and director of FSAWWA. Readers of this publication may remember him as author of the column, "One Man's Opinion." Dave is retired and lives in Orlando with his wife of nearly 50 years.

Things change. Sometimes for the better, sometimes not. It does little good to complain about what we should have done, unless we can learn from our mistakes. We should remember the things that have been beneficial and apply them to the improvement of the relatively narrow field of water supply. To recount some changes that have occurred in the field over the past 30 years, then to presage what could occur in the ensuing 30 years, may be interesting.

Over the past three decades we've seen changes in population, communications, education, management, laboratory sophistication, materials, and conservation in Florida's water industry.

Our population has risen from 6.8 million to 15.8 million, an increase of 132%. The per capita consumption (domestic use) has changed very little and remains around 160 gallons per day, making our present demand for drinking water almost a trillion gallons per year. Even so, that is only about 3% of the total hydrological cycle (in non-drought times), which suggests an examination of some of the other 97% percent as a potential resource.

The increased sophistication of our communication capability is staggering. The benefit of developments in communications during the past 30 years are gaining impetus in the governmental sector. Remote sensing and control, using computer technology to operate equipment, chemical feeders, and even visual scanning are a given today. The benefit in information transfer for research, for education, and for a myriad of other essential functions place tools at our disposal that were undreamed of in an earlier time that many of us remember.

With these changes have come modifications in the style of management. The well-educated and self-motivated personnel in responsible charge of operating water systems today are seldom the nephew of the mayor. Loyalty and job jumping, always in an inverse ratio, are even more prevalent today, and keeping pace with service and regulatory demands requires improvement and continuing education on the part of both employer and employee.

Regulation is another area that has experienced a major shift. At one time, operating under the Division of Health, the Bureau of Geology, and the soil and water conservation districts, septic tanks and direct discharge to rivers were routine. By 1970 most major municipalities had installed central collection, treatment, and disposal systems, but those programs were accelerated by mandates of state and federal regulatory agencies, the water management districts, and other local agencies. Today there are those who could argue that the regulations are so numerous and detailed that the actual ownership of utility systems are de facto vested in regulators without their assumption of any responsibility for the systems' functions.

In the area of materials, we no longer see pipe cast in green-sand molds, nor do we see universal joints, lead goose-necks, or cement-asbestos pipe, and we're moving away from glazed clay sewer pipe, package treatment plants, chlorination of potable supplies, and elevated storage tanks.

We have also seen remarkable advances in the sophistication of laboratory equipment and processes. One of the major efforts of the industry is keeping current on standards for examination of water, and ever-improving laboratory equipment can now quantify components in terms of parts per billion.

Finally, we've seen an increased sensitivity to the essentiality and sustainability of resources, which has led to a sharpened focus on conservation. One of the pathfinder systems in wastewater reuse was at St. Petersburg under the leadership of Lloyd Dove. Many systems followed suit. It is common for agencies to encourage the use of treated wastewater for condensate cooling systems. Conservation by restrictions on lawn watering, reduced toilet bowl capacities, and other measures seem feeble and irrational when contrasted to the quantities of the hydrological cycle and the unregulated outflow to the seas.

To borrow the title of the column Hardy Croom used to write, in looking back we can see that an item we have benignly ignored is the inerrant verity of the maxim penned by Benjamin Franklin to a friend in 1746: "Do not let your chances like sunbeams pass you by, for you never miss the water till the well runs dry."

In reflecting on what could happen in Florida's water industry in the forthcoming 30 years, it is customary to extrapolate from the past. Our beloved Florida, the state of my birth, will not increase in geographical size. We will quite probably receive the same amount of rainfall. Population will double to about thirty million, and the per-capita consumption of potable water will hold steady, thus doubling demand. We will also increase our beneficial reuse of reclaimed water while, we can hope, resisting its direct reuse for potable consumption.

The lower section of Florida gets its entire supply from rainfall. Percolation to the aquifers will continue, and withdrawals will still provide 90% of our drinking water.

It is to be expected that industrial use will increase while agricultural use will hold steady. Our aquifers will continue to be mined in the major metropolitan areas, and that will give rise to numerous areas of consideration, such as dual systems, reverse osmosis treatment, resource renewal by recharging the aquifer utilizing primary pretreatment, and injection wells. Turf wars will erupt, and the sale of bottled water will zoom.

Planning in all phases of potable water and wastewater will continue to lag behind the actual community need. Central decisions will continue to be made by unelected officials who later pass into obscurity, leaving their scars for the longer term.

Although we have long since moved away from surface supplies, there will be a clamor to retap them. It could be beneficial to video catalog, for use in the future strife on the subject, all the dry lake bottoms and rivers now impassable to boat traffic because of low streamflow.

The leadership of our three associations has completely changed since I became a member in 1963. It will surely change again in the next 30 years, but many of the concerns in 2030 will be the same as they were in 1970.

Other than continued changes in science and technology, things will pretty much stay the same. If they don't, unlike our challenged wildlife, we will adapt. ■

Regulation of Water Supply Resources

Glenn Dykes

Glenn M. Dykes, P.E., graduated from the University of Florida with a bachelor of civil engineering in 1954 and a master of science in engineering in 1957. His 35-year Florida government career as an administrator of drinking water programs began at the Florida State Board of Health and culminated in 1992 with his retirement from the Florida Department of Environmental Regulation, where he was charged with the restoration/replacement of contaminated water supply facilities. Always an active member of both the American Water Works Association and the Florida Engineering Society, he served in many positions. Retirement from the United States Army Reserve with the rank of colonel came after 33 years of service. He and his wife live in Tallahassee.

Florida was a state under development before the depression of the 1930s, and it still continues in that mode. Water resources have always been a concern. With the continuing increase in population and land use, the need for expansion of drinking water and wastewater treatment facilities has been exacerbated. Add to this the environmental movement along with the changing political climate, and we have the real Florida.

Environmental concerns came into play in the mid 1960s when hearings were held nationwide. Anyone attending the hearings realized that the main concerns related to waste, waste treatment, and waste removal. It was easy to recognize that none of the participants had any interest in "Water in Pipes for People." The hearings did add emphasis to the need for adequate sewage treatment in contrast to the state's protracted use of septic tanks in housing developments.

The hearings also generated political concerns over the need for regulations related to air and water pollution and the enforcement of those regulations. The Florida Air and Water Pollution Control Commission was created to carry out the enforcement activities, separating the issues from Florida's health agency. Personnel from the health agency were transferred to help staff the commission. Air pollution matters went to the new agency, but review and approval of new sewage treatment and collection systems remained with the health unit. This allowed coordination between the water supply and wastewater treatment activities within one agency.

In 1970 the health agency formed a committee to address the state's rapid growth and its effect on sewage disposal. The committee represented all facets of home construction, septic tank installation, and health concerns. It was charged with developing rules to minimize long-term usage of septic tanks and to enhance sewage collection and treatment for future growth. After laboring for five years, its rule set the size of development that would require collection treatment systems. The rule was emasculated by the next session of the legislature, many members of which were developers and/or represented such constituency. The legislature's fix was so thorough that the law then allowed 16 septic tanks per acre for multiple housing. So much for trying to limit septic tank use!

With the continuing use of septic tanks, and also the onsite disposal of wastewater treatment facilities, Florida's health agency looked into the increased needs for potable water treatment. A number of areas in the state were evaluated, and it was apparent that many had potential problems. The south Florida counties of Dade, Broward, and Palm Beach seemed to be the most vulnerable because they relied on a very shallow, unconfined water resource. There were also thousands of septic tanks and onsite disposals within each county. In 1973 a memorandum was issued by the Bureau of Sanitary Engineering mandating coagulation and filtration treatment for all public water supplies in those densely populated counties.

Since it appeared that possibly 50% of the resource could be from onsite disposal, many more people became aware of Florida's potential water supply problems.

Early in the 1970s, state personnel dealing with waste collection and treatment were transferred to the pollution control agency; thus the state lost most of the coordination between water and wastewater construction. This did not last long. In 1975 the new Department of Environmental Regulation was created with water supply activities transferred to this reorganized agency. Within the new agency, engineering review and evaluation was accomplished in the district offices, with the central office providing program planning and oversight. The new agency was environment oriented and susceptible to political influence, which was considerably different from the former program.

This change coincided with the passing of the Safe Drinking Water Act (SDWA) in December 1974, necessitating new rules and mandates required by federal regulation. The SDWA offered no new drinking water standards since Florida's requirements exceeded the federal regulations. In EPA's oversight of Florida's new regulations, they would not support mandatory chlorination of public water supplies, secondary standards, and some other technical issues such as complete treatment of potentially contaminated sources. The federal money to support the program mandated time-consuming reports and oversight paperwork for both the agency and the utilities. Eventually, EPA raised the level of standards and, with time, continued to add many more rules.

There have been many pitfalls in the state's water resources planning, including the creation of water management districts. In early years, the districts were controlled and/or influenced by landowners and primarily addressed their water needs. The critical water shortage in the Tampa Bay area succinctly attests to the conflicting demands between land and water management. Development of land in Hillsborough and Pinellas counties required extensive drainage to provide building sites. In the late 1970s, lakes were ditched to lower flood potential in developing areas. All of this activity critically reduced the potential for aquifer recharge in the area, thus reducing water supply capabilities to meet the ensuing growth. Of course, the total blame for this fiasco was placed on water utilities for over pumping the area rather than the loss of recharge potential. In other areas of the state, many misuses of water resources can be found, such as large irrigation systems operating during rain or following heavy rainfall. Drainage districts exist throughout the state, as do extensive irrigation systems, yet no one has published any data indicating how those practices affect the state's water resources.

Environmentally directed efforts have the potential to create quality and/or quantity problems for water supplies. A prime example was the Conserve I project that would have injected treated waste into an aquifer serving thousands of public and private water users within that same county. Water supply authorities must be vigilant to prevent future recurrences of such actions. Also, future review of onsite waste disposal is mandated since there are approximately 60,000 septic tank permits alone being issued annually by the state.

Florida has been fortunate over the last 30 years to have been adequately supplied safe "Water in Pipes for People." Meeting the growing demands with shrinking resources is becoming an ever greater task. During this period, membrane technology has moved to the forefront and has the potential to assist utilities in meeting water supply needs. Florida has led the nation in pioneering the use of the technology, primarily because of the abundance of brackish water in its coastal areas. With all the improvements in membrane technology, it is becoming a primary water treatment process, especially considering the treatment needs required to handle the ever increasing list of chemicals being regulated. Groundwater will continue to be Florida's major water supply resource into the twenty-first century, because use of surface resources will not satisfy environmental demands. ■

One Community's Perspective

Bill Johnson

William D. Johnson's 41 years of experience includes nine years as the deputy director and operations manager for Hillsborough County and two years as manager of wastewater treatment for Tampa. He has served as director of public utilities for St. Petersburg since 1982 and taught wastewater treatment and management courses at Hillsborough Community College for eight years. He holds degrees in public administration and environmental science and management, as well as water and wastewater operator certificates.

When I was invited to write an article about Florida's water supply from the prospective of the past 30 years and the next 30 years, it brought to mind that I moved to Florida in 1971, 30 years ago. So I will be sharing some thoughts as a transplanted "Ohio Buckeye" who has had the opportunity to be involved in Florida's water issues for many years in the Tampa Bay area.

We had ample forewarnings of water supply problems, as attested by the following references:

"Florida in Deep Trouble on Water Supply," Governor Reuben Askek; *Tampa Tribune,* September 19, 1971.

"Graham Warns State on Brink of Critical Shortage of Water," Governor Bob Grahman, *Tampa Tribune*, October 30, 1981.

"Martinez Warns State's Water Crisis Must Be Addressed," Governor Bob Martinez, *Tampa Tribune*, March 6, 1990.

What happened from 1971 until 2000? If the Tampa Bay area is a barometer for the state, then apparently crisis management has been the answer.

St. Petersburg was one of the first communities in Florida to encounter severe water supply problems. In the early 1900s the municipal wells located within the city were being pumped for increasingly longer periods because of a growing population. By the mid-1920s, chloride levels in the groundwater began to increase due to saltwater intrusion. Realizing that it was facing a potential water crisis, the city entered into a contract with a private company to provide a new water supply. The company purchased land in adjacent Hillsborough County, developed a wellfield, constructed a water plant, and laid approximately thirty miles of 36-inch water main from the water plant to a water repumping station the company had constructed north of the city. It was a massive and costly project for that time.

In the early 1940s, St. Petersburg purchased the company's assets, including a second undeveloped section of land in Hillsborough County and Weeki Wachee Springs, located in Hernando County more than 60 miles north of St. Petersburg. With an average flow of 110 MGD of fresh water, the springs were bought by the water company with the intention of developing them as a water source in the future. A major tourist attraction was developed at the springs, and because of that, along with ecological concerns and strained relations with Hernando County, by the 1970s it had become apparent that obtaining a permit to develop the springs was highly improbable.

In 1963 the unused property in Hillsborough County was developed into what is now known as the Section 21 Wellfield. A second repumping station and a new 48-inch, 30-mile-long pipeline were constructed at the same time, and the water treatment plant was enlarged.

In 1973 a section of land about 40 miles north of St. Petersburg in Pasco County was purchased and developed into the South Pasco Wellfield. St. Petersburg now owned substantial tracts of land in three counties. Those counties became alarmed that they might not be able to provide adequate water for their own growing population because of St.Petersburg's water withdrawals.

When St. Petersburg joined with Pinellas County in the early 1970s to develop yet another wellfield in Pasco County, the counties of Hillsborough, Hernando, and Pasco successfully joined together to have legislation enacted to block any future water development solely for municipalities outside of their own jurisdiction. The early 1970s are known locally as the "water war years."

The West Coast Regional Water Supply Authority was formed in 1974 to develop new water supplies on a regional basis for Pinellas, Hillsborough, and Pasco counties, and the cities of St. Petersburg and Tampa. St. Petersburg entered into a joint operational agreement with the authority for its wellfields. Ultimately, 11 wellfields were developed in northwest Hillsborough County and western Pasco County with a total permitted capacity of 192 MGD.

The formation of the authority should have been the resolution to the Tampa Bay area water supply issues. Unfortunately, the situation became even more volatile by the 1990s. In 1992, St. Petersburg and the authority applied for renewal of the city's three wellfield permits. No problems were anticipated since the city was simply applying for renewal of the existing permitted quantities. During the 1984-1992 permit period no permit conditions had ever been violated. In addition, St. Petersburg had an outstanding and nationally recognized water conservation program, the cornerstone being the largest urban water reclamation system in the nation. The city's wellfields pre-dated almost all other water users in the general area, and its pumpage had remained relatively stable for the previous 20 years, and had actually dropped while regional pumping had increased more than 200 percent.

Unknown to the city, the regulatory agency charged with issuing the water use permits, SWFWMD, had been studying an area in northwest Hillsborough County and western Pasco County where the eleven wellfields are located to determine the cause of declining lake and wetland levels. In 1994, after two years of responding to numerous permit-related requests for information by SWFWMD, St. Petersburg learned through a newspaper article that permitted production cutbacks of up to 75% of the municipal wellfields pumpage were being proposed by SWFWMD staff.

What followed was a $10 million, four-year legal battle, pitting governments with and against other governments, and governments with and against SWFWMD. During the most intensive period of the permit negotiation process, SWFWMD put into place a successful publicity campaign to literally discredit St. Petersburg, the Pinellas County Utilities Department, and the West Coast Regional Water Supply Authority. In turn, the utilities became very vocal critics of SWFWMD and its actions. Pinellas County and the West Coast Regional Water Supply Authority had joined in the litigation against SWFWMD. As a result, the public lost confidence in everyone involved.

It's disturbing that the regulatory agency and the regulated community could become so adversarial. SWFWMD staff was convinced that assertive action requiring a major reduction in pumping was necessary to protect the environment. Unfortunately, it became apparent that SWFWMD intended to make St. Petersburg the "test case" for the entire region.

St. Petersburg acknowledged that its groundwater withdrawals had caused some level of impact on surface features and wetlands during earlier years, prior to its permitted wellfield pumping being reduced significantly in 1984. However, another contributing factor had been the unprecedented growth and development in the vicinity of the wellfields from the 1970s through the 1990s, and the city was insistent that that factor should have been evaluated and quantified by SWFWMD. In addition, abnormally low rainfall (a 27-inch deficit from 1989 to 1994) was experienced during the period the permit applications were being reviewed. Thus, environmental conditions were stressed by a number of causes. By SWFWMD's own admission, since pumping was the only variable that could be controlled, the St. Petersburg permitted quantities would arbitrarily be reduced, although non-municipal users were not being threatened with similar quantity reduction. When the city's permits were reissued in 1984, total permitted pumpage had been reduced from 54 to 41 MGD. Permitted pumpage might now be further lowered to less than 11 MGD. Thus, St. Petersburg felt that it was being treated unfairly. It would have to literally "give-up" millions of dollars in water production infrastructure and then, in turn, develop much more expensive water supplies.

To me, the most troubling aspect of the entire event was the demonizing of the St. Petersburg and Pinellas County utilities and the West Coast Regional Water Supply Authority. The negative press was very effective. Critical letters to the editor of local and several accusatory white papers, authored by SWFWMD executive staff members at that time, were published.

Almost every one accused St. Petersburg, Pinellas County, and the West Coast Regional Water Supply Authority of "over pumping" their wellfields and wantonly damaging the environment. It was never mentioned that none of the utilities had ever violated a permit condition, permits that had been issued by SWFWMD several years earlier. Between 1984, when its permit had been renewed, and 1992, when the permit came up for renewal, St. Petersburg received no communication from SWFWMD about environmental harm. In my opinion, propaganda disguised as a public information campaign is no way to properly resolve a technical issue.

The ultimate solution was the formation of a new wholesale water supply agency, Tampa Bay Water, which was delegated ownership and complete operational authority over each of the member governments' 11 wellfields. Another important element of the agreement that formed Tampa Bay Water was that proposed new water supply projects would need only the approval of a simple majority of its board of directors, and would serve all member governments. Under the West Coast Regional Water Supply Authority, proposed projects had required voluntary subscription, and funding could be denied by any member government, which resulted in new water supply development falling further and further behind.

Under Tampa Bay Water there are currently more than $500 million of new water supply projects either in design or under construction, including the largest desalination plant in the western hemisphere. Those projects will produce new water sources to replace 100 MGD of reduced permitted groundwater quantities by 2007 and meet future growth in demand.

The Tampa Bay area is, in all probability, an indication of things to come in Florida's water future. Growth, especially in the coastal areas where potable water supplies are most limited, will pit more "water haves" against "water have nots." A repeat of St. Petersburg's situation would be a travesty of propriety. There has to be a better way of managing our water resources.

Going into the next 30 years, I would urge that a process be put into place whereby knowledgeable, unbiased experts would be available to review and make recommendations concerning sensitive permit applications. This would be outside of a courtroom setting, and early in the permit process. Because a decision concerning a water use permit is so important to a community, involvement at the highest level of state government may be required to assure an impartial and equitable outcome. For people of good will, this should be possible, and the public has a right to expect no less from its public servants. ■

Pride in the Past, Look Forward to the Future

Ed Singley

To look at the history of drinking water production in our state, we first need to look at the population increase over time. These data, from the Florida Bureau of Economic and Business Research, are shown in the accompanying graph, along with an estimate of the drinking water demand. Projections for population growth through 2030 are reasonably conservative.

J. Edward Singley, Ph.D., a native of Vero Beach, received his bachelor's and master's degrees from Georgia Tech and his doctorate from the University of Florida, where he was a student of the late A.P.Black. He was instrumental in the founding of the University of Florida's TREEO Center and served as its director for eight years. He was a professor at the University of Florida for 23 years, retiring as a professor emeritus. He is a past president of AWWA and a member of the Water Industry Hall of Fame. A teacher at operator short schools for more than 30 years, he is a certified water treatment plant operator. He currently resides in Gainesville and consults on water quality and treatment.

The demands are based on an estimate of 150 gallons per capita day with 67% of the population supplied by regulated systems (which corresponds to DEP estimates of the population served by public water supplies).

The data show that the demand for drinking water increased by almost one-half a billion gallons per day (bgd) from 1940 to 1970, a period of very rapid population growth. Although the rate of growth slowed down somewhat in the next thirty years, it still required an additional one bgd of drinking water. We have been able to meet that demand by expanding existing plants and by building some new plants. The supplies have been available, for the most part, by utilizing groundwater resources. That supply is becoming increasingly unavailable because of salt-water intrusion in the coastal areas, excessive withdrawal from wells, and agricultural or industrial contamination. The excessive withdrawal has resulted in the lowering of surrounding lakes and wetlands, along with the actual loss of some such geographic features. The static levels in some well fields have declined significantly.

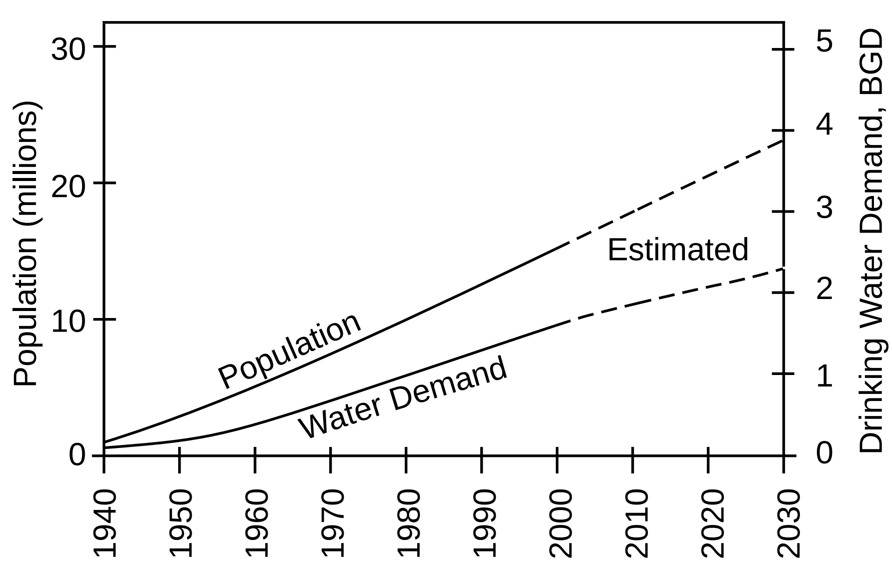
The use of the abundant surface waters has been coming under increasing pressure by "no growth" advocates. The number of environmental impact studies required to justify utilization of surface water supplies has expanded, corresponding to the growth of the population. The attempt to control growth by limiting the availability of water has obviously been ineffective, considering that the growth has been primarily in the most water-poor parts of the state.

For the past 30 years the industry has been under increasing regulatory pressure, beginning with the passage of the Federal Safe Drinking Water Act (SDWA) in 1974 when the federal government began regulating the quality of drinking water, a responsibility previously controlled by the state. Prior to that time the only federal involvement was in the area of interstate water use regulated under public health standards. The 1962 "Standards" formed the basis for the first "Interim Primary Drinking Water Standards" in 1975, which required acceptance by the states and compliance by water suppliers. Amendments to that act added many contaminants to the list, until the list contains almost anything that has ever been detected in water. The amendments to the SDWA have been almost continuous since it's promulgation by EPA.

The original "primary" regulations didn't seriously impact utilities in Florida because the 1962 USPHS "Standards" had been adopted as Florida "Standards prior to the passage of the SDWA. There were only a few modifications, including the requirement of disinfection with chlorine, the establishment of a chloride maximum of 250 mg/L, and the setting of mandatory compliance with the Secondary Standards. As federal regulations expanded, Florida regulations similarly expanded over the next thirty years.

The first major impact on Florida systems was the promulgation of the Trihalomethane (THM) Rule (unscientifically called the "Total TrihaloMethane Rule, although only four of the sixteen trihalomethanes are regulated).

A report by Joop Rook of the water works in Rotterdam, Netherlands, showing the formation of THMs from the reaction of free chlorine with natural organic matter led to changes in the disinfection process from free chlorine to chloramines by the addition of ammonia. Chloramines do not form THMs. When free chlorine is used as the primary disinfectant, the high organic content of many of Florida's waters resulted in the production of high THMs, with seven-day THM formation potentials (THMFP) greater than 3000 being observed. The maximum contaminant level (MCL) of the four "regulated"



THMs was established as 0.100 ug/L in the in the 1979 THM Rule. The MCL was reduced to 0.080 mg/L in the next step and will probably be reduced further.

The Stage I Disinfection/Disinfection By-Product Rule also included a number of other disinfection by-products, including some of the haloacetic acids, for which MCL was set at 0.60 mg/L. This additional requirement proved to be a major problem for some utilities, since the haloacids are the favored by-product at a lower pH.

The change to chloramines has introduced other problems, the principal one being the necessity to provide much greater detention time and storage capacity for the reduced disinfecting capacity of the chloramines (primarily monochloramine) to react.

In Florida there are currently 24 water treatment plants serving populations of 100,000 or more, and 6,500 plants serving populations under 1000. The major plants are consistently in compliance with the regulations, but occasional problems are encountered in all systems. Between 80 and 90% of drinking water in Florida is from groundwater; there are only 18 surface water treatment plants in the state, but that includes several of the larger plants. Surface water plants are usually of the conventional coagulation/settling/filtration type, although lime softening is practiced. Groundwater plants vary in process from simple aeration/settling/disinfection to lime or membrane softening and demineralization. There are many variations to the processes currently used, including ozonation, ion exchange, caustic soda addition, and blending of waters from different processes and/or sources.

Although any guess about the future is risky, there is little doubt that the continuing population growth will be accompanied by an increase in the demand for water. Over the next 30 years the demand will increased by over 700 million gallons per day. That means we will need the equivalent of 14 plants of 50 MGD capacity each. That will not include the extensive infrastructure replacement demands for the industry. Some of our systems are approaching 100 years of use. In addition, we can expect increased regulatory overview and regulations.

Over the next thirty years there will be few lime softening plants and probably fewer surface water treatment plants. The availability of supplies will be a major impediment to be considered. The use of more highly mineralized water will require new treatment processes or the increased use of one of the membrane processes. Hopefully, new disinfection processes will gain acceptance. An example of a process of promise is UV light, which has an advantage of no known by-products. Other developments can be anticipated because of the activity of research groups, such as the AWWA Research Foundation. The very strong support by the utilities themselves assures implementation of any significant advances.

We should all take pride in the accomplishments of the past and look forward to even more in the future. ■

News Briefs *from Page 36*

On the Brink of Crisis

Governor Jeb Bush stated in February that Florida stands on the brink of a water crisis as debilitating as California's power crisis and warned that the worst drought in 200 years could affect every facet of life, from rivers running dry to wildfires. He called for a state-wide effort to conserve water and better manage it in the future. The governor issued a draft of a drought action plan that suggested a number of steps, including increased conservation and public education.

The director of Tampa's water department, Dave Tippin, disclosed that Tampa had issued 4,000 citations for illegal water use during January and February as compared to 3,000 in all of last year.

A proposed legistative act would create a Water Supply 2020 Study Commission to determine what the state's water supply needs will be in 20 years and how best those needs can be developed to provide an adequate water supply. Part of the commission's role would be the siting of new water supplies, an evaluation of the need for a statutory siting act, and a review of the water management districts. It provides for appointment of technical advisory committees and an executive director.

The commission would consist of 23 voting members, 19 appointed by the governor, two appointed by the president of the senate, and two by the speaker of the house. They would include the commissioner of agriculture, the secretary of DEP, a representative from a governmentally-owned water supply serving 200,000 or more and a representative from one serving less than 200,000, and representatives from a privately-owned utility, a regional water supply authority, and from various other facets of water use interests.

FWEA Focus *from Page 34*

FWEA leader or two at the annual WEF Leadership Workshop in Washington, D.C.

I would like to thank a few committee chairs that I've seen perform especially well in support of our goals this year. They've used the knowledge and techniques taught at the annual Leadership Workshop to build successful committees staffed with dedicated volunteers. First and most obvious are Mike Gregory of the Stormwater Committee and Chris Ferraro of the Reuse Committee. Not only have their committees hosted successful seminars, they've significantly improved their committees' page on our Web site, contributed to the FWRC technical program, and helped to recognize outstanding achievements through the association's awards program. I would also like to thank Christina Garcia-Marquez for her leadership of the International Committee. Although her committee has received relatively limited financial support from the board, Cristina has assembled a great group of engaged volunteers who work hard to assist our sister association in Argentina, APAMA. Her enthusiasm for her committee's work is obvious to all who meet her. These FWEA leaders have been model committee chairs, and I urge any of our new committee chairs to call any them if you want to know what it takes to build an effective FWEA committee.

Last but certainly not least is membership growth. As you all should know by now, we set a goal to reach the level of 2000 members by the end of the year 2000. Unfortunately, but not entirely unexpectedly, we didn't reach our goal in the time frame set. For most of the year our membership remained level at about 1710. However, we recently recruited 64 new members with our new policy of including the cost of a WEF annual membership in the registration fee for non-members that attend our seminars. This, along with a flurry of recruiting activity at the end of the year, should bring us over the 1800 member level very soon. And I'm sure Mike Cliburn will soon tell you about all the great plans that he has for next year to accelerate the growth of our membership towards that lofty goal of 2000.

In summary, I'm pleased and proud to report that FWEA continues to grow and to make progress towards achieving our strategic vision and mission. I am humbled that you have trusted me with the honor of being the president of this wonderful association of water quality professionals, and I will always be grateful to you for the support that you have given me during my term as your president. ■

A Comparison Of Public and Private Utility Service Mechanisms

Frederick Bloetscher, William Lynch, and Tom Boyd

In evaluating the delivery of water and sewer service, there are a number of factors that must be considered. Some concern the general operation of the utility system, while others are financial or political.

Operational and financial issues are generally straightforward in their evaluation. Information on revenues, expenditures, budgets, customer costs, and debt obligations can be gathered and compared for the alternative delivery mechanisms. Similar comparisons can be done with operating factors; reliability, system expansion, maintenance needs, and economies-of-scale are common factors regardless of the delivery mechanism.

Political factors are harder to predict and evaluate because there is no quantification available. In many cases the political landscape of the underlying local governments drive the issues. As a result, focus is generally on the resource allocation and operational issues associated with each.

There are two sectors responsible for water delivery and sewer infrastructure: private, consisting of developers and private systems; and public, composed of local governments and regional authorities. The operating environments of the two sectors are markedly different, and the different capitalization policies of the two sectors distort the picture.

Comparisions of Public Sector Systems

A comparative analysis of the operation of all southeast Broward County utilities, all but two of which were public systems, was undertaken in the summer of 1997. The study's goal was the review of the argument for economies-of-scale by large, more regional service providers. South Broward County was used because all of the utilities there are similarly situated. Most report to underlying local governments with full responsibility of water and sewer provision, and all have similar social, environmental, and business climates. None of the systems has received many complaints about services or encountered significant problems with regulatory agencies over the previous four years. It was therefore assumed that the delivered services met the needs of the residents. No financial comparison has previously been conducted in any depth for these systems.

Based on significant investigation and study of the statistical parameters, the following information was evident:

- The average daily water flows versus average daily sewer flows demonstrated that the customers were relatively consistent, so that any comparison made between the utilities does not have a significant distinguishing factor due to affluence or relative lack thereof.
- The comparative statistic that provided the best picture of the impact to the customer was the cost per thousand gallons for water treatment, water distribution, sewer collection, and wastewater treatment. It clearly demonstrated the economy-of-scale of the larger utility operations versus small scale operations.
- The economy-of-scale arguments for utility operations were realized. The data support the long-held contention of EPA and other regulatory agencies that smaller utilities simply do not have the cash flow to operate systems efficiently. This leads to the very controversial conclusion that, from a purely operational cost basis, regionalization might be of benefit. Since operating costs for all utilities will increase with time, it is clear that if the rates remain similar, only the larger systems will have the ability to invest in the system on a routine basis without creating rate shock.
- Newer systems have a lower cost than older systems as measured in the expenses to maintain miles of pipe, but this does not translate to plant operations costs.
- Rate structures are generally similar; there is an availability charge and a volumetric charge. Given this fact, the economies-of-scale of the larger systems will allow funding of more capital projects (or provide higher general fund subsidies) and will permit more debt funding.
- Smaller utilities generally are accumulating enough money to handle their operating requirements but insufficient funds for reinvestment in the system.
- Larger systems raise significant revenues for the construction of improvements on the system (via RRI and bond funds), which is more than the smaller utilities generally do.
- Debt service appears to drive rates for most of the utilities regardless of the disparity between the size of the system and the cost per thousand gallons to produce, collect, and distribute or treat.

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Comparative Statistics and Conclusions

Based on the 1997 evaluation, the next step was to compare a series of public and private utility systems of varying size to discern if there were any differences in how service is delivered. Data were gathered from 34 utility systems throughout Florida, twenty of which were public. One of the public systems was a regional authority.

The data were expected to show not only economies-of-scale in the larger systems but insight on public versus private sector costs for service delivery. Similar statistics were developed based on the prior analysis.

The comparative statistics that provide the best picture of the impact to the customer — the cost per thousand gallons for water treatment, water distribution, sewer collection and wastewater treatment — clearly demonstrate the economy-of-scale of the larger utility operations versus small-scale operations. Administrative costs versus total budget parameters also demonstrates the economy-of-scale argument that larger utilities can perform tasks at a lesser cost per unit than the smaller utilities.

The following analyses result from plotting the above information for all systems, and then plotting the same statistics for public and private systems individually. Those data points lying below the curve represent systems that appear to perform better than others of the same size. Those close to the curve are the expected results as estimated by the authors. Further analysis will explain why some of these systems appear to be better performers.

Water treatment costs per thousand gallons, when plotted against the average daily flows, show the expected economy-of-scale as found in the earlier analysis (see Figure 1). The dashed line on Figure 1 shows the delineation between the public and private systems: a rather stark occurrence. The reasons for this differential lie in the following:

1. The private systems tend to be very

small compared to their public counterparts,

2. The regulations concerning the operation of small water plants do not require full-time operator coverage as is typically provided in larger public systems. Public sector systems take minimal risks in staffing and insuring that their system will continue to operate, while private sector systems are willing to minimize staffing and take chances on the interruption of service.
3. Maintenance expenditures are generally minimal in the private systems because maintenance costs are capitalized, so they appear in a different expenditure code.
4. Several of the small private systems only treat with disinfection as opposed to a full treatment process.

Wastewater treatment costs per thousand gallons, when plotted against the average daily flows show the expected economy-of-scale as found previously (see Figure 2). The dashed line in Figure 2 shows the delineation between the public and private systems: a similarly stark difference as found with water treatment. The reasons for this differential lie in the same set of circumstances as listed in 1 - 3 above for water treatment costs.

Water Distribution costs per thousand gallons, when plotted against the average daily flows, show the expected economy-of-scale as found previously (see Figure 3), but a series of data points huddled around the axes indicates that these systems have no significant costs for their water distribution systems. In looking at the actual operation of a water distribution system, nearly all expenses are associated with maintenance of pipes and valves. A review of the private systems indicates that all of these near-zero data points are private systems. The public systems track the economy-of-scale plot. A dashed line on Figure 3 shows the delineation between the public and private systems. The reasons are that maintenance expenditures are generally minimal in the private systems because they are capitalized. Even personnel costs associated with pipeline repairs are capitalized. Public sector systems take minimal risks, so they keep personnel on staff to address pipeline maintenance and emergencies and charge them as operating costs

Sewer collection costs per thousand gallons, when plotted against average daily flows, show the expected economy-of-scale as found previously (see Figure 4). This analysis shows the same trends as water distribution.

Figure 5 shows the billing costs for public systems, private systems, and both

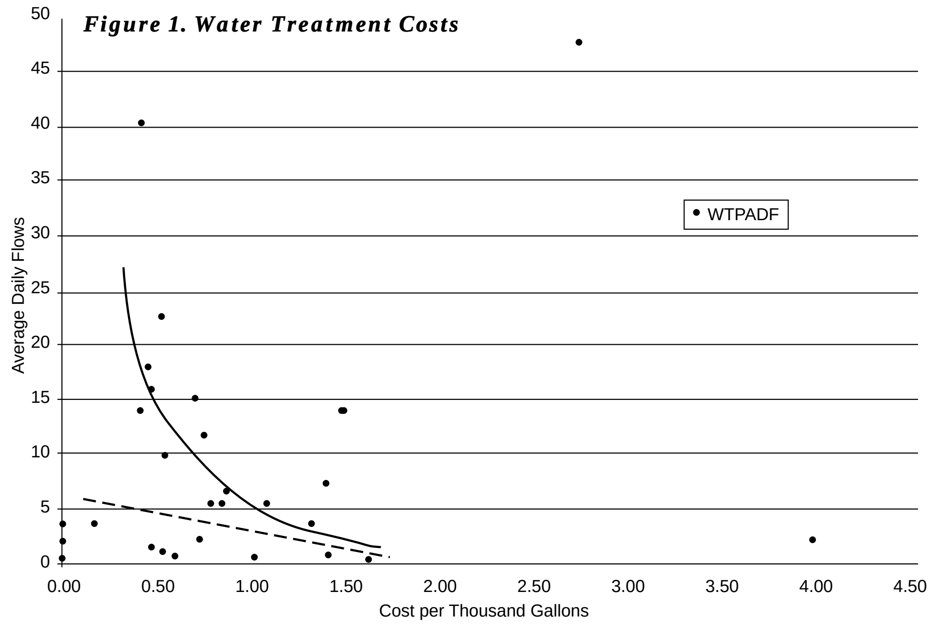

Figure 1. Water Treatment Costs

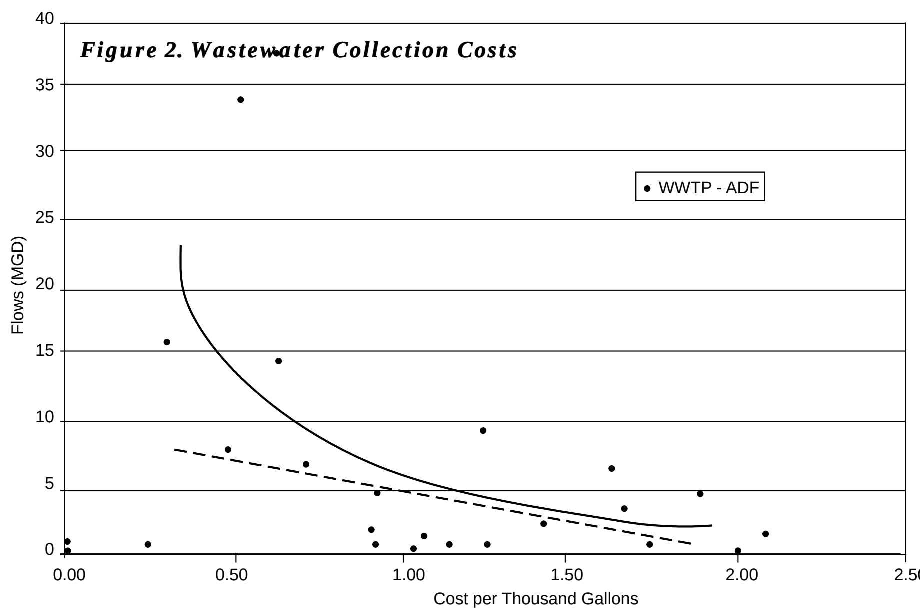

Figure 2. Wastewater Collection Costs

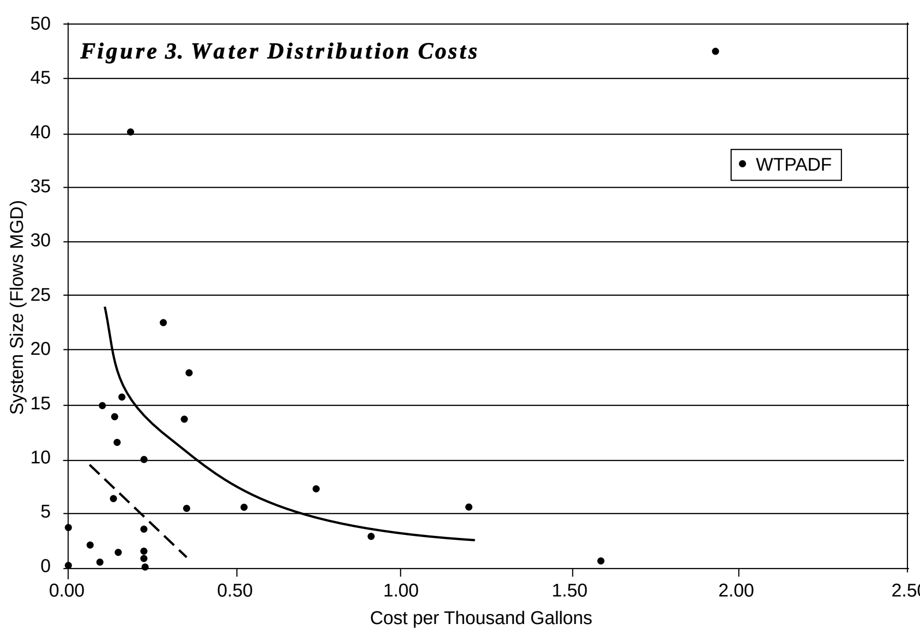

Figure 3. Water Distribution Costs

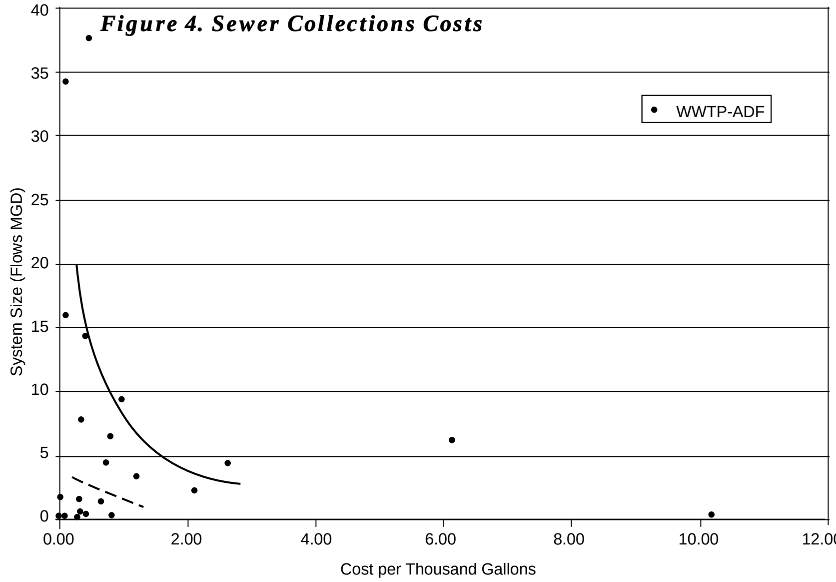

Figure 4. Sewer Collections Costs

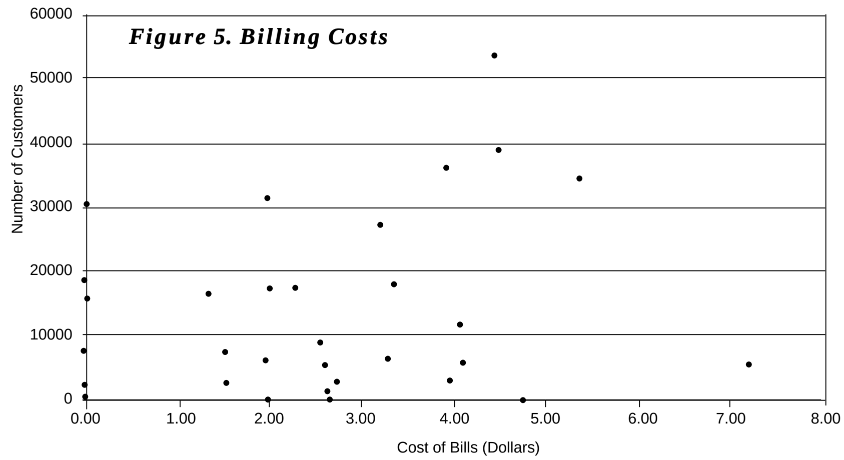

Figure 5. Billing Costs

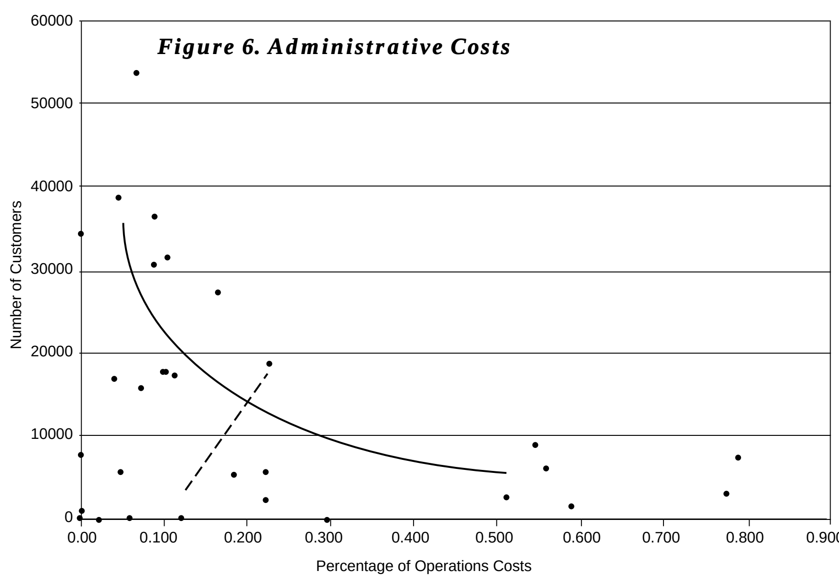

Figure 6. Administrative Costs

systems. There is no discernable pattern in any of the plots, probably because of the allocation of administrative, computer, or customer service costs to different sections of the budget. For instance, Hollywood, reflecting one of the higher costs, contracts with a private provider for a portion of the services, retains some in house, and scatters responsibility among multiple departments. The full cost is shown for this system, but it is unclear whether it is for the other public systems.

An analysis of administrative costs shows a more consistent economy-of-scale argument than some of the other analyses (see Figure 6). As a group, the private systems have significantly higher administrative costs as a percentage of total budget due to management fees, overhead, profit sharing, and other private sector charges made to the utility systems by their shareholding companies. However, the disparity may not be quite as stark, since many local governments take large amounts of money from the utility systems to subsidize general funds. Public systems are generally under 4%.

A comparison of the public and private systems and deferred maintenance obligations shows extremes in the public sector while the private sector is more consistent, in part because it capitalizes all maintenance costs while the public sector does not. While the prior analysis indicated that the smaller systems tend not to reinvest in the system, contributing to a generally poorer condition and higher deferred maintenance obligation than larger systems, the private sector systems are often in even poorer shape, but the deferred maintenance obligations are hidden by the manner in which maintenance is handled. This type of analysis should probably be considered as not really indicating the true condition of the system or its infrastructure.

The major issue of debt service is handled differently by public and private systems. Public sector systems were able to clearly identify debt obligations, both total and for a given fiscal year. None of the private systems reviewed could do so. This is because the PSC permits only a one-to-one return on borrowed money, which encourages internal borrowing at high interest rates. In addition, many costs are simply expended and added to the rate base. The PSC permits a 12% return on the depreciated rate base, which created a clear pattern of private utilities minimizing maintenance costs to incur capital costs that would be added to the rate base. Some utilities went so far as to capitalize all maintenance costs, regardless of size. Maintenance costs are a one-to-one reimbursement, which is a major disincentive for private sector system maintenance. In addition, the true deferred maintenance obligations are hidden because these maintenance costs create an artificial picture of system investment.

Both public systems with their political concerns and private sector systems with PSC regulation have problems with securing monies for reinvestment in their system, often leading to long-term deterioration of the utility system.

Rates were generally higher for the private systems, in part because their operating costs are shifted to capital, which earns a rate of return. Because the rates are higher and the capital allocation makes maintenance difficult to compare, the analysis does not provide a clear picture that the private sector is more efficient than the public sector, although they may be in some cases (and vice versa). ■

Development of a Cost Effective Centralized Wastewater System for Small Rural Communities

Harold E. Schmidt Jr. and Troy E. Layton

Harold E. Schmidt, Jr., P.E., DEE, and Troy E. Layton, P.E., are with Hartman & Associates, Inc., Orlando, where the former is a vice president and the latter is an associate.

Making the switch from on-site septic tank systems to a centralized wastewater system is challenging in itself. Add high groundwater tables, flooding and environmental issues, and coordination with regulatory agencies, several utility companies, two counties, and thousands of concerned citizens, and you have a truly challenging project.

The Astor-Astor Park Water Association (AAPWA) wastewater service planning area is along the St. Johns River just south of Lake George in northern Lake and Volusia counties. Within the area were seven privately owned utility systems considered as possible providers of wastewater service to the residents and businesses. However, none of the systems was capable of providing service outside of its existing certificated service areas because of limited collection, treatment, and effluent disposal capacities. Most of the systems were experiencing operational problems and permitting difficulties with regulatory agencies and could handle no additional flows. Since neither county was capable of providing wastewater service in the area, AAPWA appeared to be in the best position to provide the service, although its only experience was in providing potable water service to the area. The need to understand the requirements and demands of a wastewater system soon became evident to the AAPWA staff.

The project, which actually began in the late 1980s and early 1990s, didn't take hold until the late 1990s. The early problems with the project were twofold: the first being the development of a plan that was environmentally sensitive and acceptable to the citizens, and the second being development of a program that was financially feasible. What happened in the late 1990s that was different from the earlier attempts was that there was a greater push to obtain funds from a variety of sources.

Service Area

The AAPWA wastewater service planning area occupies a total landmass of approximately 23 square miles with a total population of about 3,700. In addition, the population density of the wastewater service area is spread out, with most of the customers located along State Road 40 west of the St. Johns River. While that figure is anticipated to increase due to the proximity of surrounding cities and direct access to the St. Johns River, an important aspect of the planning area is that the surrounding lands of the Ocala National Forest prohibit extreme growth.

Land characteristics range from a 0.5- to 1-mile wide strip of relatively level, rich soil along the St. Johns River basin to a 1.5-mile-wide upslope area with an elevation of 10 to 25 feet above mean sea level (MSL). The upslope area is followed by a relatively flat plain, about 25 to 30 feet above MSL, that extends to the Astor Park community about four miles west of the river, where sand hills begin. The sand hills slope up in a range of about 1 to 2 miles to elevations of about 60 to 70 feet above MSL. However, over 30% of the wastewater service area is located within the 100-year flood plain, which includes over 65% of the customer base of the proposed system. Furthermore, the majority of the soils that are encountered in the area are relatively poorly drained.

The area has long been noted as an environmentally sensitive area with outstanding fishing and water sports along the river and surrounding water bodies. Over time, residential and commercial development, particularly along the waterfront, had resulted in saturation of the individual septic tank drainfields and periodic overflow that reportedly has degraded water quality in the canals and portions of the river and caused potential health hazards.

System Evaluation

Because of the size and customer distribution within the proposed wastewater service area, it was decided to divide the program into three distinct phases. Phase I would encompass an area along State Road 40, involving about 550 customers, and would connect a majority of the single-family residential units and commercial customers. Phase II, connecting some of the private wastewater systems and a majority of the remaining residential customers in the central area of the planning area, would add about 750 customers. Phase III would address about 250 remote customers, primarily residential and private-utility systems in the outlying reaches of the service area. The total centralized wastewater program would connect more than 1,500 onsite septic tank/drainfield systems, and most of the private wastewater treatment systems in the area, to the AAPWA regional WWTP.

The program examined and evaluated various wastewater collection and transmission systems, including the following:

1. Conventional gravity sewers.
2. Low-pressure grinder pump systems.
3. Septic tank effluent pumping (STEP) systems.
4. Vacuum sewer systems.
5. Small diameter gravity (SDG) systems.

Preliminary routing and design for each alternative wastewater collection and transmission systems were done for each of the three phases, and O&M costs, along with the advantages and disadvantages of each system, were addressed and evaluated.. The SDG system was eliminated from further consideration during the evaluation phase because of its limited use in the U.S.

As a starting point for the evaluation, preliminary engineering and designs quantified the components of each alternative wastewater systems. Summarized in the accompanying table are the capital and O&M costs for the alternative systems that will provide service to the customers in the first five years of the program (Phases I and II).

It was determined that the grinder low-pressure wastewater system was the most cost effective alternative for collecting wastewater within the service area. Moreover, the advantages of the three alternative wastewater collection systems, when compared to the conventional system, were similar in nature and included such items as lower construction costs, negligible impacts from I/I, and lower O&M costs. Also, the topography within the service area required that the conventional system incorporate a significant number of regional lift stations to transport the wastewater to the WWTP.

Next to be evaluated was the method of effluent disposal, because WWTP design is always dictated by the method of effluent disposal and the effluent limits it imposes on the treatment process. Several methods of effluent disposal were considered, including surface water disposal and a number of land application techniques. The idea of surface water

	Estimated Construction Cost		Estimated Annual O&M Cost	
System Alternative	**Phase I**	**Phase II**	**Phase I**	**Phase II**
Conventional System	$7,857,000	$9,997,000	$100,800	$71,900
Grinder Pump System	$5,155,000	$5,935,000	$31,500	$30,900
STEP System	$5,675,000	$7,419,000	$36,000	$36,800
Vacuum System	$5,238,000	$6,825,000	$44,100	$42,300

Notes:

1.Each of the alternatives included a major wastewater transmission system to transport the wastewater to the proposed WWTP.

2.The estimated annual O&M cost for Phase II includes the additional costs only attributed to the new facilities.

disposal was quickly discarded, primarily because it would be extremely difficult to permit and would contradict the overall goal of improving water quality in the St. Johns River.

Land application methods of effluent disposal evaluated for the AAPWA facility included the following:

1. Rapid infiltration basins.
2. Public access and restricted access spray irrigation.
3. Drip irrigation.
4. Subsurface irrigation.
5. Overland flow.
6. Natural and/or manmade wetland systems.

Capital costs for effluent disposal ranged from $340,000 to more than $890,000. Although spray irrigation was the least costly, it did not provide sufficient disposal capacity for the facility. Rapid infiltration basins were the next least costly option at approximately $510,000. It was determined that rapid infiltration basins were capable of disposing of the entire flow treated during the first two phases of the program.

The final area evaluated included the method of wastewater treatment and effluent disposal proposed. Based on the projected growth within the service area, a facility to treat 0.5 MGD was proposed for the initial phase of the program. Alternative treatment methods included the following:

1. Package WWTP.
2. Separate unit process tankage WWTP.
3. Sequential batch reactor (SBR) type WWTP.

Estimated costs for the three alternative treatment methods, inclusive of residuals management and effluent disposal facilities, ranged from $2,744,000 to $3,240,000. As expected, the package WWTP and the SBR systems were the determined to have the lowest cost and were within 5% of each other. The SBR system offered a number of advantages over the package type of facility, including a high tolerance for peak flows and shock loadings, process flexibility to control filamentous bulking, and the fact that all of the treatment is contained in one tank. Based on our experience, along with consideration of future construction issues and future expansion requirements of the facility, it was determined that the SBR was the most appropriate system.

In addition, provisions were incorporated into the design of the WWTP to treat the wastewater to a higher level and thus meet the requirements for public access reclaimed water reuse. Located adjacent to the WWTP site is a cemetery and fernery, both of which were determined to be viable options for the development of a reclaimed water reuse program as the system expands in the future.

In summary, the proposed system for the centralized wastewater system will consist of the following components:

1. Wastewater collection will be accomplished using a low-pressure grinder pump system discharging into a regional lift station that will convey the wastewater to the WWTP. The first phase will consist of more than 18 miles of low-pressure mains, the necessary number of grinder pump stations, and two regional pump stations. The second phase of the program will consist of more than 14 miles of low-pressure mains, the necessary grinder pump stations, and seven regional lift stations.
2. The wastewater generated within the service area will be treated with a sequential batch reactor process and basic disinfection process to meet secondary standards. Provisions have been incorporated into the facility to construct the necessary facilities to provide a higher degree of effluent treatment, or meet public access reclaimed water standards.
3. The effluent from the WWTP will be disposed of into three rapid infiltration basins.

The total estimated capital cost of Phase I of the AAPWA centralized wastewater system, inclusive of collection, treatment and disposal was estimated to be approximately $8,037,000.

Funding

Construction of the centralized wastewater facilities would require some type of funding assistance. Most of the individuals in this area are either retired or on limited incomes, and could not afford this service. Therefore, the goal of the development of a funding program was to maximize the grants received to develop a final average rate for wastewater service in the range of $30 to $40 per month for 5,000 gallons.

Based on preliminary investigations of the various grants available for the project, it was determined, based on average income, the area would fall within the poverty category for obtaining grants and loans through state and/or federal agencies. Moreover, during our discussions with funding agencies, it was determined that due to overall cost of the project, it would be best to divide the project into phases, which resulted in the program being divided into two primary phases.

A number of funding mechanisms was investigated, and our efforts resulted in obtaining grants in the amount of $5,000,000 for the first phase of the program. The funds (grants and loans) that were received for the first phase of the AAPWA centralized wastewater system included the following:

1. The United States Department of Agriculture Rural Development provided the AAPWA a grant in the amount of $2 million and a low interest loan in the amount of $2 million.
2. The state of Florida provided a grant in the amount of $2.5 million.
3. The Department of Commerce Economic Development Association provided a grant in the amount of $1 million for the commercial development along State Road 40.
4. Connection charges that will be paid by the customers of the system that will receive wastewater service during the first phase of the AAPWA centralized wastewater system.

The capital costs and annual O&M costs for the system, coupled with the grants and low-interest loans, resulted in an average monthly rate of approximately $35.43 for 5,000 gallons of service.

Funding is currently being pursued for the second phase of the program, primarily from the same sources that provided funds in the first phase. However, a higher grant request is being discussed from the state, and it appears promising. The total anticipated cost of the first phase of the AAPWA centralized sewer system was anticipated to be approximately $8,037,000, and the second phase approximately $5,935,000.

The project was bid in November 2000.

A total of five bids were received, ranging from $7,048,283 to $10,576,000. The breakdown of the low bid was as follows:

1. Construction of the low pressure grinder pump stations wastewater collection and transmission system: $4,165,155.
2. Construction of the SBR WWTP and effluent disposal system: $2,883,128.

Construction of the initial phase of the program began in February 2001. Final design of the second phase is anticipated to be completed in September 2001, with construction completed within 12 months, which will be concurrent with the completion of the first phase.

Conclusions

The AAPWA centralized wastewater system project was a unique application of alternative technologies from the collection of the wastewater to the treatment thereof, as well as the development of a funding program for a system that, on the surface, was not financially feasible. The program will ultimately satisfy the needs of environmental agencies in developing a centralized system to remove the on-site septic tank/drainfield systems and of homeowners, who were assisted in paying for the capital cost of the project.

The AAPWA experience illustrates that a small rural community with limited resources and funds can nevertheless work with the state, with federal officials, and with local communities to develop a cost effective centralized wastewater system. ■

Glossary of Common Terms Used in This Publication

ASR	aquifer storage and recovery
AWT	advanced water treatment
AWWT	advanced wastewater treatment
AWWA	American Water Works Association
BOD	5-day biochemical oxygen demand
BOD_x	BOD test based on other than 5 days
CBOD	5-day carbonaceous BOD
COD	chemical oxygen demand
cfm	cubic feet per minute
cfs	cubic feet per second
CWA	Clean Water Act
DEP	Florida Dept. of Environmental Protection
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
FAC	Florida Administrative Code
fps	feet per second
FSAWWA	Florida Section of AWWA
FWEA	Florida Water Environment Association
FWPCOA	Fla. Water & Pollution Control Operators Assoc.
GIS	Geographic Information System
gpcd	gallons per capita per day
gpd	gallons per day
gpm	gallons per minute
hp	horsepower
I/I	Infiltration/Inflow
MGD	million gallons per day
mg/L	milligrams per liter
MLSS	mixed liquor suspended solids
MLTSS	mixed liquor total suspended solids
NPDES	Nat. Pollutant Discharge Elimination System
NTU	nephelometric turbidity units
O&M	operation and maintenance
ORP	oxidation reduction potential
POTW	public-owned treatment works
ppm	parts per million
ppb	parts per billion
PSC	Public Service Commission
psi	pounds per square inch
PVC	polyvinyl chloride
RO	reverse osmosis
SCADA	supervisory control and data acquisition
SJRWMD	St. Johns River Water Mangement District
SFWMD	South Florida Water Management District
SRWMD	Suwannee River Water Management District
SSO	sanitary sewer overflow
SWFWMD	Southwest Florida Water Management District
TDS	total dissolved solids
TMDL	total maximum daily load
TOC	total organic carbon
TSS	total suspended solids
USGS	United States Geological Survey
WEF	Water Environment Federation
WRF	water reclamation facility
WTP	water treatment plant
WWTP	wastewater treatment plant

Editorial Calendar

January	Advanced Treatment.
February	Water Supply. Wastewater Disposal.
March	Residuals Management.
April	Annual Conference Issue.
May	Treatment Technology & Operations.
June	FSAWW /FWEA Awards. Misc. technical articles.
July	Disinfection.
August	Conservation/Reuse.
September	Industrial Wastewater. Stormwater.
October	Water Resources Management; FWPCOA Awards.
November	FSAWWA Conference; Misc. technical articles.
December	Collection & Distribution.

Technical articles are usually scheduled several months in advance and are due 60 days before the issue month (for example, May 1 for the July issue).

The closing date for display ad and directory card reservations, notices, announcements, upcoming events, and everything else except classified ads, is 30 days before the issue month (for example, June 1 for the July issue). The closing date for classified ads is 5 p.m. on the tenth of the month preceding publication (for example, June 10 for the July issue).

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