

# CHASTAIN-SKILLMAN, INC.

ENGINEERS • ARCHITECTS • SCIENTISTS • SURVEYORS

## CONSULTANT'S UPDATE

ISSUE 27

JANUARY—MARCH 2008

### ENGINEERS AND COMPUTERS

By Paul H. Racette, PE



A “subject of interest” currently being discussed throughout the Structural Engineering profession, and engineering community in general, is the use of computers. More specifically, the question arises, “is there an over-reliance by engineers on the use of computers, and is this reliance fostering the inability among these engineers to sense when a computer answer is likely incorrect?”

“Older generation engineers” were trained in the use of slide rules and estimations. This knowledge inherently prepared these students to have an excellent intuitive feel for what made sense, relative to the correctness of an answer. Making rough approximations and rounding of numbers were the norm, and

the thought process that accompanied such calculations led to a general understanding of what we should expect in answer to a calculation. Combining this training with the speed of the computer provides greater efficiency. Personnel, trained in this manner, carried into the computer age a strong understanding of the principles surrounding the calculations, and thus a well-earned knack for “getting it right”. With that said, in today’s environment, engineers could not remain competitive (time management-wise) if they continued to design structures using hand calculations.

As recently as just 10 or 15 years ago, Structural Engineers used “back-of-the-envelope” methods to determine starting sizes for use in project analyses. A series of calculations

*(Computers—Continued on page 5)*



*The staff at Chastain-Skillman would like to wish you a very Happy New Year!*



### ACID RAIN REVISITED

By Noreen D. Poor, PhD, PE



In the 1970s, acid rain was implicated in the dramatic decline of lake and stream fish stocks and of forest trees in the eastern United States. Plumes from fossil fuel combustion contain hydrochloric, sulfuric, sulfurous, nitric, nitrous, and organic acids. Acids within plumes can be scavenged by water inside or below clouds, and reach the ground in precipitation. “Acid rain” is a term coined to describe the wet deposition of acids in rain, sleet, snow, or ice to the earth’s sur-

face. In clean air, rain droplets equilibrate with atmospheric carbon dioxide and absorb carbonic acid. The resulting natural acidity of rainfall is between pH 5.0 and pH 5.6 but, in open arid regions, suspended alkaline minerals can neutralize this natural acidity.

In urbanized and industrial regions, however, acids are present in the atmosphere as by-products from fossil fuel combustion and can greatly increase the acidity of rainfall. A pH 4.6 rainfall is 10-fold more acidic than a pH 5.6 rainfall. Acid deposition is the

*(Acid Rain—Continued on page 6)*

#### Inside this issue:

|   |   |
|---|---|
| Engineers and Computers                           | 1 |
| Acid Rain Revisited                               | 1 |
| Water, Water Everywhere, and Not a Drop to Drink! | 2 |
| Supporting Engineering Students                   | 7 |

# WATER, WATER EVERYWHERE, AND NOT A DROP TO DRINK!

By L. Michael Saltzman, PE



Those familiar with “The Rime of the Ancient Mariner” recognize its reference to being far out to sea with no fresh water. In many ways, this quote also applies to development in central Florida today. With a multitude of lakes, rivers and streams throughout the region, it is hard to believe there is a shortage of water. Most people are aware of the water restrictions associated with irrigation (i.e., lawn/landscape watering), but may not be aware of water supply restrictions as they relate to land development.

One of the most frequent hurdles to development within Polk County and its 17 municipalities is the availability of potable water in sufficient quantity. Historically, the vast majority of this water has been provided through groundwater wells. These wells are drilled into the Floridan aquifer system - the primary source of water for public supply, agricultural and industrial uses in Central Florida. While this has been a relatively inexpensive and easy source, this supply of water is not endless. The development of new well fields, and increased pumpage of existing wells, has created a tremendous stress on the aquifer. The resultant reduction of water pressure within the aquifer has led to increased saltwater intrusion in some areas, and also reduced or eliminated flow from many of our natural springs and seeps that feed rivers, creeks, lakes and wetlands. A good example of reduced flows is evident in the upper Peace River (south of Bartow) which has experienced portions of dry streambed during the drier times of the year.

In the late 1980s, the Southwest Florida Water Management District (SWFWMD, or the District) initiated a program to con-

duct Water Resource Assessment Projects (WRAPs) to assess water availability in several regions. There are five areas of the District for which WRAPs have been initiated. The first three WRAPs were for North Tampa Bay (NTB), Eastern Tampa Bay (ETB) and Highlands Ridge (HR). Realizing that certain interim resource management initiatives could be implemented to help prevent worsening of existing problems in the WRAP areas, the District established Water Use Caution Areas

the Southern Water Use Caution Area (SWUCA) (Fig. 1). After a lengthy court challenge to the original 1994 plan, the SWUCA management plan was implemented in 2003 with both regulatory and non-regulatory recommendations. One recommendation of the original management plan was the establishment of a “minimum Floridan aquifer level” in some areas of the SWUCA.

Understanding that development was inevitable and important to the local economies, the District conducted several studies to establish future water demands. In order to address the projected water demands and potential sources of water to meet these demands, the legislation amended Chapter 373, Florida Statutes (F.S.), in 1997. This amendment brought about the requirement for regional water supply planning and resulted in the preparation of a District-wide Water Supply Assessment (WSA).

The District’s WSA was completed and accepted by the Governing Board in June 1998. Four water supply planning regions (northern, west-central, east-central and southern) were identified for purposes of preparing the WSA. Three of the four planning regions generally correspond to the jurisdictional areas of Regional Water Supply Authorities (RWSA), (Withlacoochee RWSA for the northern region; Tampa Bay Water, previously West Coast RWSA, for the west-central re-

gion; and Peace River/Manasota RWSA, PR/MRWSA, for the southern region). The fourth planning region includes portions of Polk, Highlands and Hardee counties, where the District recently co-funded a feasibility study for the establishment of a new RWSA.

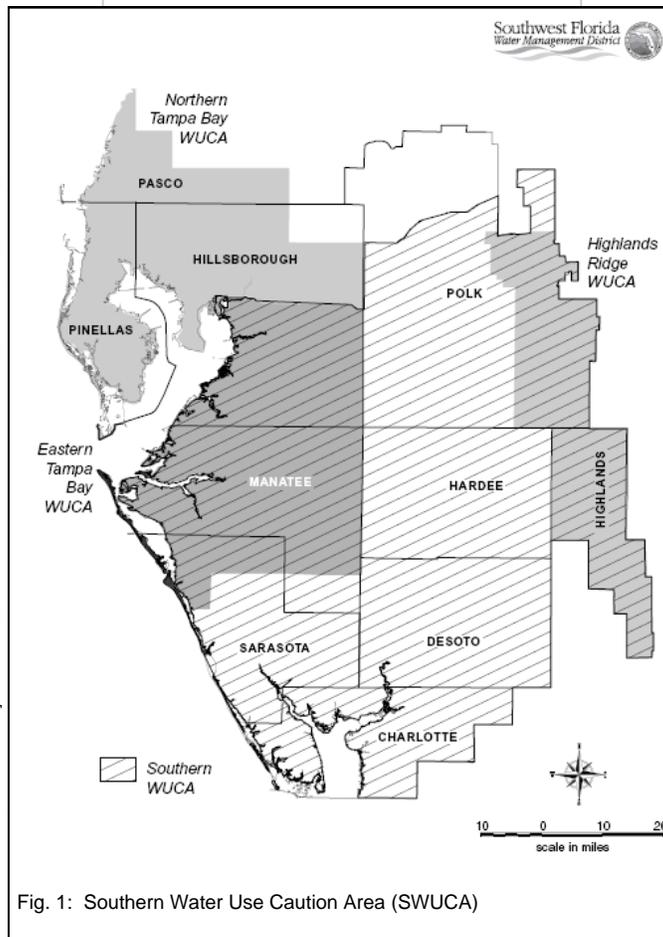


Fig. 1: Southern Water Use Caution Area (SWUCA)

(WUCAs). These were incorporated by reference into Chapter 62-40 of the Florida Administrative Code (F.A.C.) in 1989.

Recognizing that the Southern Groundwater Basin (as defined, in part, by the WRAPs noted above) should be managed in a comprehensive fashion, the District consolidated the HR-WUCA, much of the ETB-WUCA, and the area in between, into

(Water—Continued on page 3)

(Water—Continued from page 2)

The most widely recognized RWSA, due to the population density it contains, is Tampa Bay Water. An agreement between SWFWMD and Tampa Bay Water ended the region's "water wars" and created a new alliance between six governments in west-central Florida: Hillsborough County, Pasco County, Pinellas County, New Port Richey, St. Petersburg and Tampa. Since October 1998, Tampa Bay Water has been the sole and exclusive water provider to the six governments it serves. The main goals of the agency's creation were to reduce groundwater pumping from eleven long-producing well fields, develop new water supply sources, end litigation and obtain funding from SWFWMD. Tampa Bay Water has successfully met those goals.

Recognizing that continued growth within Polk County would require increased water supply, the Polk County Commission decided to move forward and address water issues themselves. In 2001, the Commission created the "Water Policy Advisory Committee". This committee joined forces with adjacent inland counties, Hardee, Highlands and DeSoto, and formed the Heartland Water Alliance (HWA). The HWA obtained funding from SWFWMD through the Peace River Basin Board in order to develop a Water Supply Plan that would be best suited for the region's needs.

The HWA Water Supply Plan was completed in 2006, and contained several recommendations for new sources of water. To date, Polk County continues to coordinate with the other counties involved, and has included several of the municipalities contained within. Although there have been considerable coordination and planning efforts for available water supply, the local governments in Polk County still operate under individual Water Use Permits (WUPs) issued by the District, and maintain separate well, treatment and delivery systems. There is now an Interlocal Agree-

ment, between Polk County and the 17 municipalities contained therein, to cooperate on a more regional basis.

In addition to the SWUCA management plan, SWFWMD has established a coordinated effort with the neighboring Water Management Districts - South Florida (SFWMD) and St. Johns River (SJRWMD) - to develop an Action Plan on water supply planning and resource regulation. As a result, the Central Florida Coordination Area (CFCA) was developed (Fig. 2). The districts have each concluded, through detailed water supply planning and individual permit actions, that the growth in public water supply over the next 20 years within the

Most of the relatively small municipalities simply do not have the resources to construct some of the projects identified within the HWA report, so cooperation with other local governments and SWFWMD co-funding of regional-scale projects is essential to meet the growing demand for water. As a result, regionalization of water supplies is likely the next logical step to support the development of large-scale regional water supply projects. Water conservation, maximized reuse of reclaimed water, and protection of prime recharge areas are also key elements to meeting this demand.

Land development will become increasingly difficult until sufficient new water sources are brought online through regional water supply funding. Comprehensive Plan amendments will require demonstrating that sufficient water supply capacity is available. We will all benefit from a proactive approach to meeting water supply challenges.

Listed below are some useful web links you can visit for more information on this subject.

<http://www.swfwmd.state.fl.us/documents/plans/RWSP/rwsp.pdf>

[http://www.swfwmd.state.fl.us/documents/plans/swuca\\_recovery\\_strategy.pdf](http://www.swfwmd.state.fl.us/documents/plans/swuca_recovery_strategy.pdf)

[http://www.polk-county.net/country\\_offices/Water\\_Resources/index.aspx](http://www.polk-county.net/country_offices/Water_Resources/index.aspx)

[http://www.swfwmd.state.fl.us/projects/cfca/cfca\\_drafrules.pdf](http://www.swfwmd.state.fl.us/projects/cfca/cfca_drafrules.pdf)

<http://www.swfwmd.state.fl.us/projects/cfca/>

*Mike Saltzman is a Senior Project Manager in the Civil Department in Chastain-Skillman's Lakeland office. Mike specializes in civil engineering design for commercial and residential Site Development. Mike graduated with a Bachelor of Science degree in Civil/Environmental Engineering from the University of South Florida. He can be reached at (863) 646-1402 or [msaltzman@chastainkillman.com](mailto:msaltzman@chastainkillman.com).*

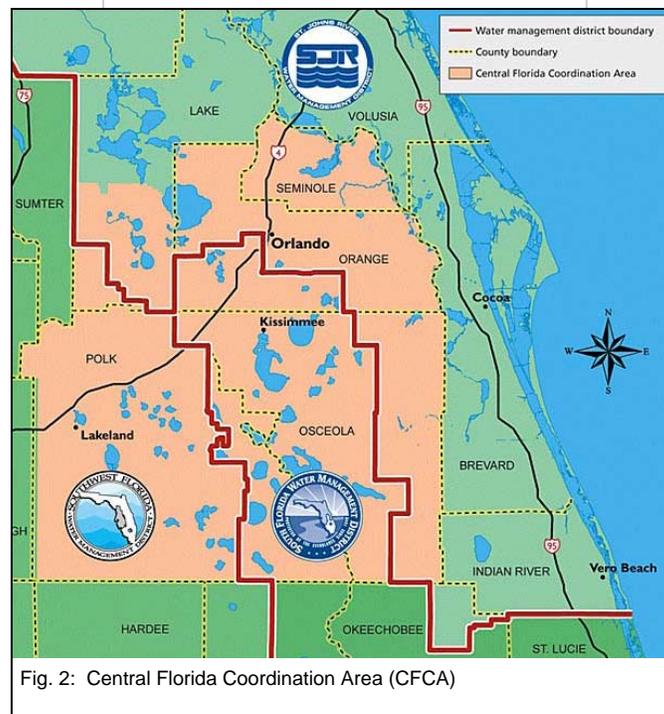


Fig. 2: Central Florida Coordination Area (CFCA)

area from traditional groundwater sources is not sustainable. Recent water supply plan updates and permitting experience confirms that, if traditional groundwater sources continue to be developed to meet growing public water supply demands in the area, harm to the water resources (rivers, streams, lakes, wetlands and aquifer quality) will occur. New CFCA rules amending Chapter 40D-2, F.A.C. will restrict permitted groundwater quantities to the demonstrated need in year 2013. Development of alternative water supply sources will be necessary to meet additional demand.

## Project Spotlight

*Chastain-Skillman recently provided design and construction management services to the City of Lakeland for their Glendale Water Reclamation Facility.*

*The design goal was to produce Class A biosolids, suitable for reuse, as plant capacity increased to 13.7 MGD.*

*The result? An innovative two-phase anaerobic digestion process, enhanced with an egg-shaped digester (shown at right).*

*The improved biosolids treatment will serve as a national demonstration model of a "process for reducing pathogens".*



## PLEASE JOIN US AS WE WELCOME OUR NEW ASSOCIATES

### In Lakeland

Our Lakeland Civil group has added Lance Michael "Mike" Saltzman, PE as Senior Project Manager. Mike graduated with a Bachelor of Science degree in Civil/Environmental Engineering from the University of South Florida. Mike comes to us with 15 years of construction experience and 10 years of engineering experience.

### In Tampa

Our Corporate Administration group has added Karla Gibson, filling the new role of Corporate Recruiter. Although based out of the Tampa office, Karla will recruit professionals for all of Chastain-Skillman's office locations. Karla has more than 15 years experience in professional recruiting and staffing. She earned her Bachelor of Arts degree from Loyola College in Baltimore, Maryland.

### In Sebring

Our Sebring Civil group has added Bruce Dorey. Bruce will be filling the role of Senior Drafter.

### In Orlando

Correction: In last quarter's newsletter, we announced **David Breitrick**, PE but misstated his title. David is a Senior Project Manager.

(Computers—Continued from page 1)

were subsequently initiated which would either confirm or disprove initial assumptions. If the initial estimated “size” was not adequate, it would be altered based on previous experience and then recalculated. Since the time penalty for poor initial assumptions and the ensuing recalculations could be considerable, engineers developed good intuition for what the answer should be, prior to making their initial assumptions and beginning their calculations.

As products of the era of total computerization, it is a concern that perhaps recent engineering graduates have missed out on the development of a finely-tuned sense of intuition which was naturally gleaned by engineers of the “long-hand calculations” era. Without this sense of intuition, a data input error, or a bug in the software, might easily lead to miscalculations which could go completely unrecognized. With no pre-calculation thought process to provide a range in which the answer is likely to fall, one might easily accept an answer that was truly the result of the old adage “garbage in - garbage out” and the result could be a design that just won't work, even though the calculator told us it would.

Currently, the norm is for educational facilities to provide computer laboratories in engineering schools. Students are routinely required to use sophisticated computer programs to work on a project/assignment, often without the benefit of knowing how these programs were developed, or what the limitations of the software might be. The result is a system that develops students who could have absolute blind faith in computer-generated results.

I concur with my colleagues who have recommended that the industry develop and conduct seminars that address methods by which computer-generated results could be generally

confirmed. These methods would naturally include the presentation of classical analysis methods as well as more up-to-date techniques. We believe it would likely be beneficial for the industry to re-visit the benefits of the old “back-of-the-envelope” approaches and make them relevant for today's practice. Engineers need to generally understand whether (and why) a calculation is correct and dependable.

Consider the Apollo 13 astronauts and the predicament they, and the NASA engineers, faced in achieving their safe return to earth following their spacecraft's major, life-threatening malfunctions. They were thrust into a set of circumstances toward which there were no existing software programs to turn. However, their understanding of the principles that were driving the problems they faced allowed them to analyze the situation, craft intuitive solutions, hand-calculate the probability of success of those solutions and, ultimately, facilitate the safe return of the spacecraft. Total dependence on a computer and non-existing software at that juncture would most likely have produced dire results. Reason, intuition, and slide rules saved the day!

Certainly the world and all disciplines of engineering have progressed and advanced in wondrous and exponential ways as the result of the amazing power of computers. Let's be sure we keep human intuition and reasoning as an important part of the problem-solving formula in order to catch those instances of “garbage in – garbage out” before they take on a flawed, built form.

*Paul Racette is a Department Head/Senior Project Engineer for Chastain-Skillman's Structural Department in Lakeland. Paul received a Bachelor of Civil Engineering degree from the University of South Florida in 1977. He can be reached at (863) 646-1402 or [pracette@chastainskillman.com](mailto:pracette@chastainskillman.com).*

## RECENT PROJECTS AND CONTRACTS OF INTEREST

- Chastain-Skillman has been authorized by Polk County Utilities to proceed with the implementation of standby power improvements at over 25 water treatment facility sites around the County. In conjunction with these improvements, Chastain-Skillman will also prepare Spill Prevention Control and Countermeasure (SPCC) plans for the Southwest Regional Wastewater Treatment Plant and the Oak Hills Water Treatment Facility.
- In Orlando, Chastain-Skillman is designing a new truck trailer staging area for Publix at their Orlando Distribution Center on Sand Lake Road near the Florida Mall.
- Between Lakeland and Bartow, preliminary construction has begun on the widening of CR 540-A. Chastain-Skillman is providing engineering design for the utility relocation efforts.
- Chastain-Skillman was recently selected as part of a team led by Kimley-Horn, Inc., to provide engineering and surveying services on a continuing contract basis to Osceola County. Chastain-Skillman will provide the land surveying services for work awarded out of this contract.

(Acid Rain—Continued from page 1)

greatest where precipitation is acidic and precipitation rates are high, for example, in central Florida, or where acidic clouds intercept mountain ridges, for example, along the Appalachian Mountains.

Research during the 1980s revealed that sulfuric acid generated from the combustion of sulfur-bearing coal was a major constituent of acid rain. Air pollution modeling showed a roughly proportional relationship between sulfur dioxide (SO<sub>2</sub>) emissions and sulfuric acid deposition. The Clean Air Act Amendments of 1990 (CAAA) mandated that coal-fired power plants significantly reduce SO<sub>2</sub> emissions from 1990 levels and a national market for trading emission credits provided incentive and flexibility for early reductions. Broader legislative drivers included provisions within the CAAA to reduce human health risks from exposure to hazardous air pollutants and to improve visibility in national parks.

Power utilities responded by switching fuels to low sulfur coal or natural gas, installing exhaust gas scrubbers, retiring older plants, or building clean coal technology plants. By 2006, power sector SO<sub>2</sub> emissions had dropped from 17.3 to 9.4 million tons per year and modest reductions in acid deposition have been observed within National Atmospheric Deposition Program (NADP) National Trends Network (NTN). At a local level, changes in power plant configurations have, within the last decade, lowered SO<sub>2</sub> emissions by more than 70%; and during this time, ambient air concentrations of SO<sub>2</sub> fell by almost 50% (Fig. 1). A trend toward fewer sulfates and a higher pH (or less acidity) in rainfall was just discernible in precipitation data from the nearest NADP/NTN site in Sarasota County (Fig. 2).

We can expect further improvements in both air and rainwater quality and acid deposition as power plants, industries, and motor vehicles modernize to technologies that are lower in acid and acidic gas emissions.

*Noreen Poor is a Senior Consultant in the Environmental Engineering department of Chastain-Skillman's Lakeland office. Noreen earned her engineering degrees from the University of Texas at Austin and Virginia Polytechnic Institute and has over 10 years of experience in air pollution-related research and modeling. She can be reached at (863) 646-1402 or npoor@chastainskillman.com.*

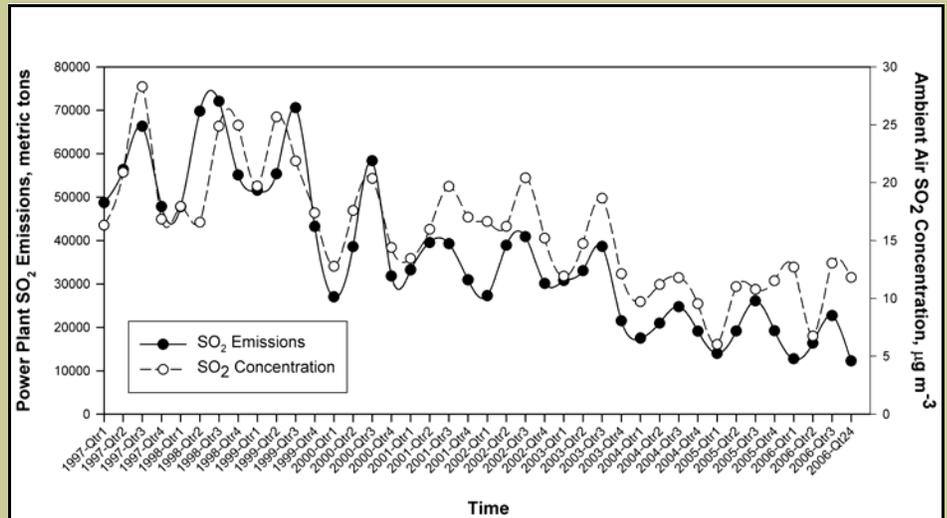


Fig. 1. Quarterly emissions of power plant sulfur dioxide (SO<sub>2</sub>) for power plants within 60 miles of Tampa Bay, Florida; and quarterly average ambient air SO<sub>2</sub> concentrations measured in urban Tampa.

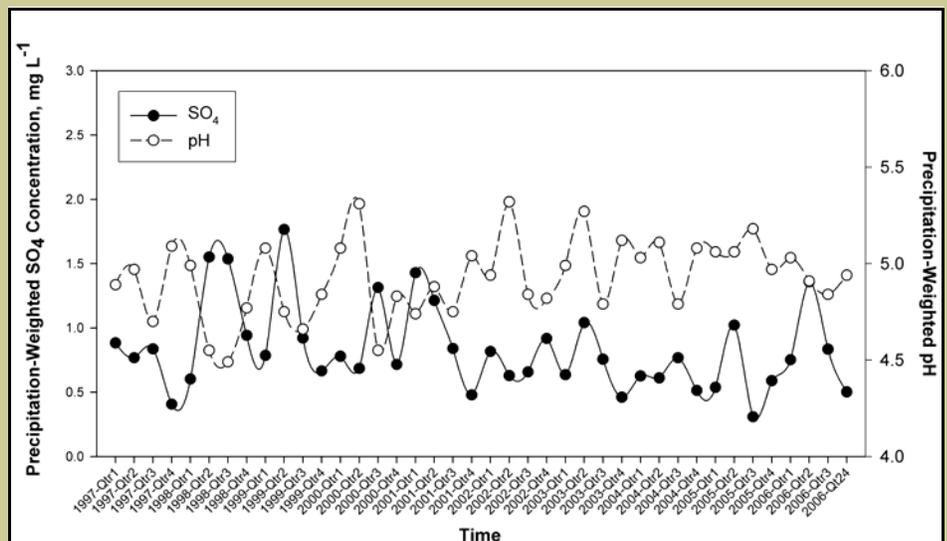


Fig. 2. Quarterly precipitation-weighted mean sulfate (SO<sub>4</sub>) concentration and pH in rainfall as measured at a NADP/NTN site in Sarasota County, Florida.

## SUPPORTING ENGINEERING STUDENTS

Chastain-Skillman's Karen Karvazy recently donated her time to assist the Tampa Bay Area Society of Women Engineers (SWE) in their efforts to introduce young women to the career opportunities of engineering. During an event called "Wow! That's Engineering!" Karen assisted 70 middle school girls with an engineering project in which they created a Thumb Piano, explaining the engineering principles to them as they proceeded.

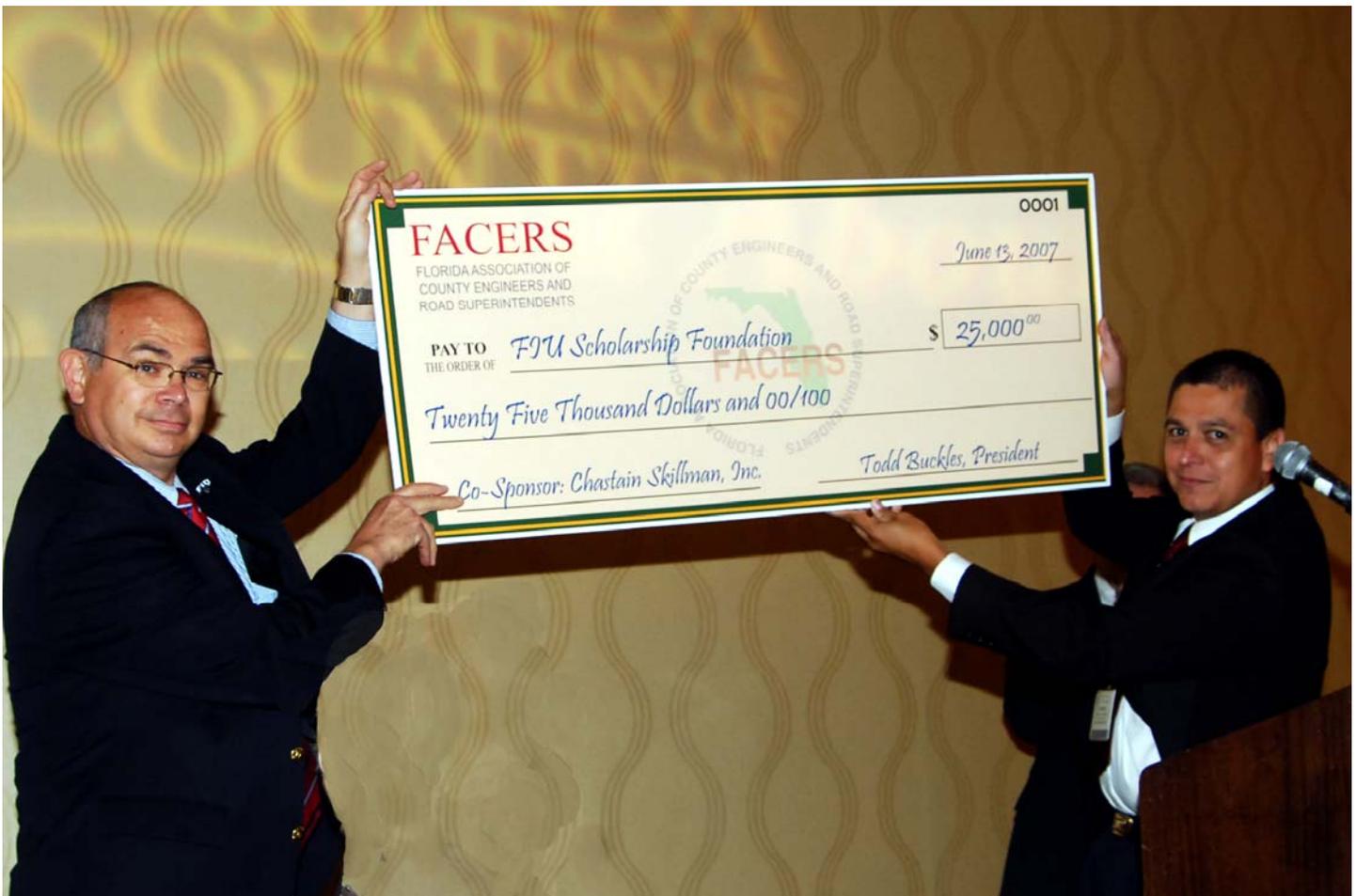


A variety of recent studies show that, over the next several years, the retirement rate of experienced engineers will far outpace the rate of new engineers entering the field, particularly in the United States. SWE hopes that events such as this one will both inform and encourage young women to pursue career opportunities in the engineering field. Response to the program was very positive, with many of the girls requesting additional information about engineering careers.

More information about the Tampa Bay Area SWE can be found at [www.swetampabay.org](http://www.swetampabay.org).



Chastain-Skillman continues its strong support of engineering students with a \$10,000 donation to the Florida Association of County Engineers and Road Superintendents (FACERS) scholarship program. As part of this program, FACERS made a \$25,000 scholarship donation to Florida International University in July of 2007. With engineers retiring at a much more rapid rate than our universities are replacing them, this is one of Chastain-Skillman's contributions to help reverse the trend.



*This newsletter is provided solely for informational purposes and presents only highly condensed summaries relating to the topics presented. Therefore, it should not be relied upon as a complete record for purposes of regulatory compliance, nor is it intended to furnish advice adequate to any particular circumstances. For additional information on any of the topics in this newsletter, please contact the author, or Allan Duhm, (863) 646-1402, or e-mail us.*

|  |  |
|--|--|
| General Information                        | <a href="mailto:Info@chastainskillman.com">Info@chastainskillman.com</a>                   |
| Architecture                               | <a href="mailto:Architecture@chastainskillman.com">Architecture@chastainskillman.com</a>   |
| Civil Engineering                          | <a href="mailto:Civil@chastainskillman.com">Civil@chastainskillman.com</a>                 |
| Environmental Engineering                  | <a href="mailto:Environmental@chastainskillman.com">Environmental@chastainskillman.com</a> |
| Structural Engineering                     | <a href="mailto:Structural@chastainskillman.com">Structural@chastainskillman.com</a>       |
| Environmental/Occupational Health & Safety | <a href="mailto:EOH@chastainskillman.com">EOH@chastainskillman.com</a>                     |
| Hydrogeology                               | <a href="mailto:Hydrogeology@chastainskillman.com">Hydrogeology@chastainskillman.com</a>   |
| Survey                                     | <a href="mailto:Survey@chastainskillman.com">Survey@chastainskillman.com</a>               |

Atlanta, Georgia  
Phone (770) 980-9880  
Fax (770) 980-9810

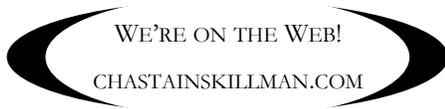
Lakeland, Florida  
Phone (863) 646-1402  
Fax (863) 647-3806

Orlando, Florida  
Phone (407) 851-7177  
Fax (407) 851-7123

Sebring, Florida  
Phone (863) 382-4160  
Fax (863) 382-3760

Tallahassee, Florida  
Phone (850) 942-9883  
Fax (850) 878-0945

Tampa, Florida  
Phone (813) 621-9229  
Fax (813) 626-9698



*If you would like to receive this publication electronically rather than hard copy, please take just a moment to e-mail us at [newsletter@chastainskillman.com](mailto:newsletter@chastainskillman.com) with the comment "Electronic format please" as your message.*

engineers • scientists • surveyors



4705 Old Highway 37  
Lakeland, FL 33813-2031