



EVERY DROP COUNTS

REPORT OF THE

AD-HOC TASK FORCE ON
WATER RESOURCES

THE UNIVERSITY OF GEORGIA
NOVEMBER 15, 2007



EXECUTIVE SUMMARY

The University of Georgia faces a significant challenge: how to maintain its core missions of teaching, research and service during an historic 100-year drought that is intensifying throughout much of the state. Water levels in many streams, lakes and reservoirs are at all-time lows, and both the state and Athens-Clarke County have mandated restrictions on water use, with the possibility of further reductions on the immediate horizon. Various factors have contributed to the current situation, including a persistent lack of rain, rapid population growth in the region and widespread inattentiveness to the importance of conservation. In order to achieve significant reductions in water use, thoughtful changes must be made in the University's operations, as well as in our own personal habits.

In October 2007, a 12-member advisory task force was charged with developing recommendations for the senior administration to consider in order to achieve more effective water conservation on campus. The charge to the Ad-Hoc Task Force on Water Resources was three-fold: (1) to develop practical recommendations to conserve significant amounts of water in the short term with the least possible impact on core missions; (2) to develop recommendations for sustained water conservation; and (3) to generate proposals for potentially increasing the University's water supply, both now and in the future.

In keeping with the task force's charge, the recommendations contained in this report represent a mix of short-term and long-term measures. They include proposals for systemic changes in UGA's construction and maintenance practices to retain water and use it more efficiently; development of an emergency management plan to identify and prioritize critical campus functions to maintain in the event of a water supply crisis; and enhancement of a public awareness campaign to increase knowledge of the issue and effect changes in behavior by individual members of the campus community. Where possible, the task force has quantified the anticipated costs and benefits of its recommendations. However, more time and analysis will be needed to assess the expense and potential savings associated with many of them.

The work of the Ad-Hoc Task Force on Water Resources should be viewed as the starting point for UGA's efforts in conservation. The recommendations cannot become "fair weather" measures to be forgotten once rains replenish the Bear Creek Reservoir and other local water sources. Instead, the University needs to set a standard for sustained conservation that will enable the campus to be better prepared when extreme drought conditions recur. Wiser stewardship of this critical natural resource may even reduce the likelihood of finding ourselves in this situation again. As UGA's Carl Vinson Institute of Government advised the Georgia Environmental Protection Division in January 2006: "The water we have is the least expensive water we can use, and if we use it more wisely and use it over again, we will reduce the demands on our water resources for increased withdrawals."¹ It is the task force's earnest hope that the recommendations contained in this report will be helpful to the senior administration in determining actions and policies that will enable the University to achieve significant water savings and avoid the need for more drastic measures in the future.

¹ Carl Vinson Institute of Government, *Water Conservation, Efficiency and Reuse: A Report to the Georgia Environmental Protection Division* (Jan. 2006) available at <http://www.cviog.uga.edu/services/policy/environmental/policyreports/waterconservation.pdf>.

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I. INTRODUCTION

In early October, Senior Vice President for Academic Affairs and Provost Arnett C. Mace, Jr. and Senior Vice President for Finance and Administration Tim Burgess created the Ad-Hoc Task Force on Water Resources for the purpose of analyzing and providing recommendations with regard to water conservation at the University of Georgia (UGA or University). Specifically, in light of the severe drought conditions present in Athens-Clarke County (ACC), as well as throughout much of the state, and the strong likelihood that these conditions will worsen, the senior administration deemed it imperative to address the University's response to this critical water shortage problem without delay.

Accordingly, the task force, consisting of two co-chairs and 10 members selected from an assortment of campus constituencies,² commenced work on October 9 with the first of numerous meetings and working sessions directed towards achieving three principal objectives: (1) developing practical recommendations for significantly reducing UGA's water consumption in the short term by as much as 25 percent, without seriously affecting the University's missions; (2) developing recommendations for sustained water conservation; and (3) generating proposals for potentially increasing the University's water supply, both now and in the future. In order to come up with meaningful, informed recommendations, the task force necessarily had to gather and study a wide array of materials from a number of sources. This report is divided into sections based on the categories into which this critical information falls.

First, it was crucial that the task force members understand the full scope of the water situation and its potential effects on the University. Part II of this report, thus, provides an overview of the drought in Georgia and ACC and discusses the legal restrictions that have been enacted as a consequence. In addition, the task force quickly realized that even prior to its formation, UGA had implemented a multitude of water-saving measures on campus. Part III of the report sets forth these efforts, as well as those that have been initiated since the beginning of October, including an extensive public awareness campaign, and elaborates upon the level of conservation success achieved. In a similar vein, to assess accurately what UGA's water-use reduction goals should be and to monitor efficiently the relative success, the task force recognized the need for a campus-wide water consumption audit. The results of this audit also are contained in Part III.

Furthermore, appreciating that a number of peer, aspirational and other comparable institutions have dealt with similar drought scenarios, the task force selected seven universities to study. Part IV of the report presents a synopsis of the task force's analysis of the water conservation initiatives at these schools and provides a foundation for many of its recommendations. Part V then delves into some of the potential alternatives for augmenting the University's water supply, and the report concludes in Part VI with the recommendations of the task force.

² A complete list of the members of the task force is contained in Appendix A.

It is important to note that in compiling and deliberating upon its recommendations, the task force benefited greatly from campus-wide input. Innumerable students, faculty and staff offered helpful and much appreciated suggestions via e-mail, through the task force's electronic suggestion box (available at http://www.uga.edu/aboutUGA/water_tips.html), and during the public forum held on October 23. The recommendations set forth in this report, therefore, reflect not only the consensus of the task force but also the collective perspectives of a broad cross-section of the University community.

II. OVERVIEW OF THE DROUGHT AND RELATED LEGAL RESTRICTIONS

Since spring 2007, Georgia has experienced a rapid escalation in the severity of its drought conditions. Pursuant to the state's Drought Management Plan enacted in 2003, there are four designated drought response levels, each requiring progressively more stringent outdoor watering restrictions. On April 18, 2007, the Georgia Environmental Protection Division (EPD) declared a Level Two drought response for the entire state. Under this level, outdoor watering was limited to three days per week (determined by street address) between the hours of midnight and 10:00 a.m., with exemptions for certain users.

As a result of continued dry conditions and excessive heat over the next two months, ACC implemented Level Three restrictions, permitting outdoor watering (with certain exemptions) only on one day per week between midnight and 10:00 a.m. With no appreciable rainfall by September 17, 2007, ACC proceeded to the most severe drought response level (at present)—Level Four (Step E)—banning all outdoor watering, with narrow exceptions. The EPD followed suit on September 28, 2007, declaring a Level Four drought response across the northern third of the state, encompassing 61 counties. At that time, EPD Director Carol A. Couch noted that the drought had reached “historic proportions.”³ It has been characterized as a 100-year drought, which means that the probability for occurrence is once in every 100 years. When combined with State Climatologist David Stooksbury's forecast for a “dry, mild winter,”⁴ the prospects for significant improvement of this exceptional drought situation seem extremely remote. Indeed, it is very likely that the state's water supply problem, if unaddressed, could become even more desperate by the spring and summer of 2008.

In the short term, predictions have been made that, without rainfall, ACC's two principal water sources—Bear Creek Reservoir and the Middle Oconee River—could be at levels too low to supply the region with potable water by the end of the year. A similar prediction has been made with regard to Atlanta's primary water source, Lake Lanier. If this dramatic, worst case scenario were realized, the state and local governments would be forced to implement drastic, emergency measures, the details of which have not yet been formulated.

In the hope of avoiding or at least substantially reducing the severity of Georgia's looming water shortage crisis, the state government has taken extraordinary measures over the past several weeks to protect Georgia's water supply. First, on October 19, a lawsuit was filed on behalf of the state seeking an injunction against the U.S. Army Corps of Engineers to restrict its release of water from Lake Lanier downstream to neighboring regions. On the following day, Governor Sonny Perdue signed an executive order declaring a State of Emergency for 85 Georgia counties and sent a letter to

³ Georgia Department of Natural Resources, *Press Release* (Sept. 28, 2007) (hereinafter “*Press Release*”).

⁴ *Press Release*, footnote 3.

President Bush requesting, among other things, a temporary exemption from the federal Endangered Species Act, which requires the release of water downstream from Georgia's federal reservoirs. The governor has since met in Washington, D.C. with federal officials, as well as the governors of Alabama and Florida, and has obtained, in principle, some relief for the state in this regard.

Apart from these efforts to halt or lessen the federal removal of water from Georgia, Governor Perdue executed two additional orders on October 23 and 24, respectively, directing water consumption reductions in North Georgia and by all agencies of the state government. The October 23 order called for a 10 percent reduction in water withdrawals (as compared to usage from December 2006 through March 31, 2007) by state permit holders in 61 North Georgia counties under the Drought Response Level Four designation. The other order called for government agencies to set an example for the state by reducing water consumption at all state-owned facilities by 10 to 15 percent and mandated certain agency-wide water conservation practices, such as optimizing the capture and utilization of condensate.

The latter order obviously directly affects the University, as an agency of the state, and therefore, requires the implementation of conservation measures to achieve the designated reduction level.⁵ Beyond this, UGA also must comply with any local restrictions that the ACC Commission may put into place. In particular, in order for ACC to comply with Governor Perdue's October 23 order, it will have to reduce the county's water consumption by an additional 1 million gallons per day (approximately) on top of the 28 percent reduction that the county already has achieved over the past several months. (*See Appendix B for the details of ACC's water conservation efforts through October 22 and the effect of the governor's order.*) To accomplish this, it may be necessary for ACC to move to the proposed Step F drought restrictions at some point in November, which would require the University to make reductions that range from 5 to 16 percent. (*See Appendix C for further information regarding the proposed Step F drought restrictions.*) Once Step F goes into effect, those who fail to meet the mandated reduction levels will be subject to substantial penalties. (*See Appendix D.*)

In light of the legal restrictions that have been placed upon UGA by the state and those that might be forthcoming at the local level, there is plainly a palpable need for the implementation of serious water-saving measures throughout the campus community. Fortunately, as the next section reveals, the University already has made very significant strides in terms of water conservation.

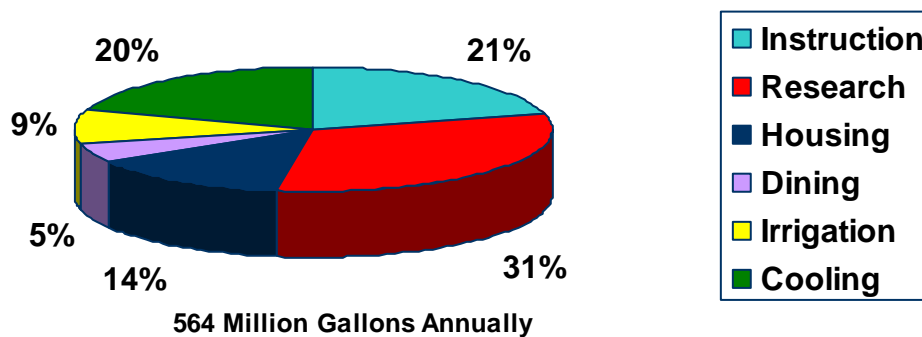
⁵ It also should be noted that the Georgia State Financing and Investment Commission has adopted its own Water Conservation Plan for all construction projects in order to implement the Executive Order of October 24.

III. UGA CONSERVATION MEASURES

As the largest user of water from the ACC municipal water supply at 564 million gallons annually, the University possesses a considerable “hydrologic footprint.” UGA is the flagship institution among the 35 colleges and universities in the University System of Georgia and is a land-grant and sea-grant institution. Therefore, it bears a responsibility not only to reduce its own water consumption but also to demonstrate to the citizens of this state through teaching, research and service how water conservation can be improved statewide. Although significant steps already are underway in these areas, the Ad-Hoc Task Force on Water Resources agrees that much more can and should be done.

Water usage at UGA currently breaks down into the following categories: 31 percent is attributed to buildings with the primary function of research; 21 percent is consumed by instructional facilities; 20 percent is used for cooling; 14 percent is used for housing; 9 percent is utilized for irrigation; and 5 percent is dedicated to dining. These usage rates are depicted by the pie chart that appears below in Figure 1.

Figure 1. Water Consumption by Category



Source: UGA Physical Plant

A. Current Measures to Reduce Consumption

Many important steps already have been implemented at the University with positive results. For example, identification and repair of leaking water pipes and fixtures have been elevated to top priorities for the Physical Plant staff. University Housing has replaced the majority of shower heads and toilets in the residence halls with low-flow devices and verified that all washing machines for student use in the residence halls are water-saving, front-loading models. Staff have identified fixtures and devices that require replacement, as well as water-saving alternatives. The Physical Plant is more than halfway through a plan to install these water-saving devices in all resident instruction buildings. The plan was developed after a 2004 audit to identify bathroom plumbing deficiencies on campus. Since that time, approximately \$50,000 to \$100,000 annually has been devoted to bathroom renovation projects. According to the audit, full realization of this retrofitting plan potentially could save 30 million gallons of water per year.

The University prides itself on the beauty of its campus landscape. Feedback from incoming students often demonstrates that the attractiveness of the grounds is a strong enticement to enroll. However, since the summer of 2007, aesthetics have been sacrificed for necessity. Brown is becoming the predominant color on campus. The grounds are not being watered, except for the reduced watering of selected athletic fields and the golf course via water from retention ponds. Wherever possible, the grounds crew is attempting to capture rainwater and use it to preserve high-priority landscaping, such as the foliage planted decades ago at the historic Founders Garden. The installation of rain gardens to reduce stormwater runoff and retain the water to irrigate plants is increasingly being employed. In addition, better mulching practices help to hold water close to plant roots. Other irrigation improvements include the use of drip irrigation and “gator bags” for newly planted trees. Fortunately, the grounds department decided several years ago to use native plants in landscaping plans; these plants are hardier and more drought-resistant. Still, in an excessive and prolonged drought, even these native varieties are suffering. Visitors to campus no longer see the impressive water fountains on campus; instead, signs inform them that these have been shut down due to the drought. No campus vehicles are being washed except sanitation vehicles (for health concerns). While some of the aforementioned measures are in direct response to the current drought, others have been in place for several years, long before the problem arose.

The conservation effort on campus encompasses all departments and units. Food Services is no longer using water to thaw frozen meats and is using paper products for its overnight service in the Snelling Dining Commons. The Georgia Center for Continuing Education also has switched to paper products in its café and buffet operations. Similarly, glasses of water are not placed at each table setting; if a customer insists upon having pre-poured drinks to achieve faster service at a special event, disposable cups are used to avoid the dual use of water, both to fill drinking glasses and later to wash them. In addition, the Georgia Center staff has stopped changing room linens on a daily basis in its hotel rooms unless specifically requested by guests. The Physical Plant has removed the automated flushing mechanisms from 144 toilets in the Student Learning Center in response to concerns that they were flushing too frequently; these devices also have been disabled on toilets at the Georgia Center.

Conservation measures are likewise being taken in research areas—identified as the primary users of water on the UGA campus. In greenhouses, plants are being consolidated and researchers are using only hand watering to further reduce water use. Research equipment has been surveyed to locate “once-through” potable water cooling, and steps are being taken to reduce these uses. In one instance, a re-circulating cooling system was added to plant growth chambers, which is expected to reduce water consumption by more than 5 million gallons per year. Researchers in the Animal and Dairy Science Department are now collecting and recycling water from their filtration systems; one floor alone saved more than 1,000 gallons of water per month through this process. In addition, Animal Care and Use is now saving 1,000 gallons of water a week by adjusting the wash cycles on the equipment used to clean animal cages. On November 7, Provost Arnett Mace and Senior Vice President Tim Burgess sent a memo to all vice

presidents, deans, directors and department heads, asking them to conduct an inventory of water-consuming equipment in their areas, with a particular focus on research equipment. The information will be compiled by engineers in the Physical Plant, who will work with those in the academic and research units to identify ways to minimize water consumption in the course of their work.

Further, the Office of University Architects for Facilities Planning takes a proactive stance on “green” measures when designing and constructing new facilities on campus. For example, the Paul D. Coverdell Center includes a cistern to capture and reuse rainwater and condensate (as does the older ROTC Building in the campus’ central precinct). The ongoing construction of the Tate Center Parking Deck is utilizing groundwater on the site in an innovative fashion. Rather than sending the groundwater to the storm sewer or creek, the water is being collected and pumped into a holding tank throughout the night; it is then used by the construction crew as needed throughout the day, thus limiting the need for the use of potable water from the municipal system. Any surplus water that is not needed each day is used by the grounds department to water vegetation. Around 600 gallons a night are usually captured by this system, and each day about 150 gallons are given to the grounds department for reuse.

B. Educational Measures

Under the auspices of the University Colleges of Agricultural and Environmental Sciences and Family and Consumer Sciences, UGA Cooperative Extension provides research-based information and resources to consumers, producers and businesses through local offices based in 157 Georgia counties. UGA Cooperative Extension already is focused on increasing public awareness of water conservation across Georgia through public service announcements, news articles and media interviews.

Several water conservation programs are in place, including a series of consumer publications entitled *Make Every Drop Count!* These publications focus on developing water-wise landscapes. UGA Extension specialists and researchers continually work on new products and resources to deliver to the public, including advances in irrigation technology.

A statewide consumer education program on household water conservation is currently under development. This multi-faceted program will deliver research-based information to the public on ways to reduce water consumption inside and outside the home. UGA Cooperative Extension entered into a memorandum of understanding with the Georgia Department of Natural Resources to use the “waterSmart” logo in conjunction with outdoor water conservation information distribution, publicity and publications. Extension agents will work with home gardeners through the Master Gardener program to further promote outdoor water conservation. Recent programs include the construction of low-cost rain barrels. The indoor water conservation working group is developing consumer handouts on how to lower water use. Because one of the most effective ways to teach adults is through their children, programs targeting young people have been

developed to educate them about the importance of conserving water. Lesson plans and training for formal and non-formal educators based on Georgia's drought are available at: http://www.conservewatergeorgia.net/Documents/tools_teachers.html.

The program will be officially launched January 2008 at the Winter School training for all of Georgia's Cooperative Extension agents. Workshops on indoor and outdoor household water conservation will be conducted, and agents will receive a packet of consumer handouts and media resources. After attending training and obtaining related support materials, county faculty will be better equipped to distribute accurate and timely information on measures that all Georgia consumers, producers and children can take to help conserve one of our most precious resources.

C. UGA Public Awareness Campaign: Every Drop Counts!

In mid-October, Provost Mace and Senior Vice President Burgess sent an e-mail message to the University community to increase awareness of the situation and encourage faculty, staff and students to change their personal habits in order to conserve water. The task force co-chairs and several members participated in numerous interviews with national, state and local television, radio and newspaper reporters to heighten awareness. UGA also established a comprehensive website, with links to various water-related sites, tips and news stories: http://www.uga.edu/aboutUGA/water_update.html. This site is continually updated and enhanced, and it can be accessed from UGA's homepage.

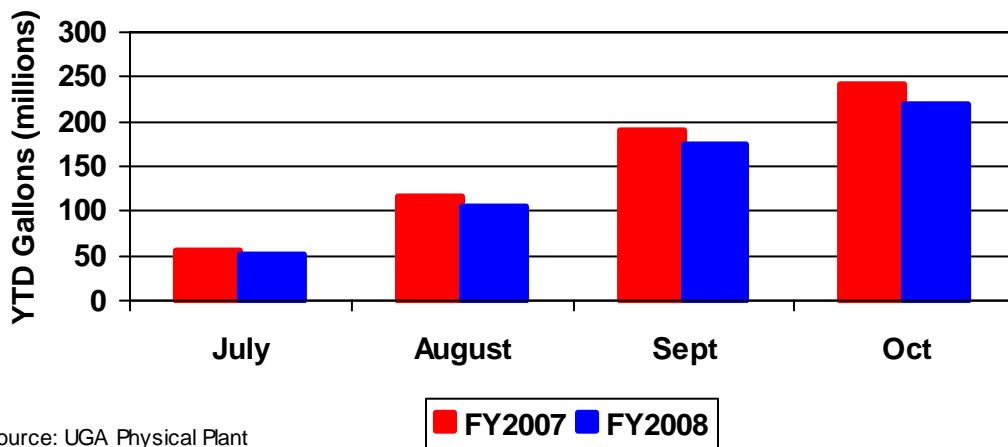
On October 23, the task force convened a public forum to heighten awareness of the need for greater water conservation on campus. In conjunction with the forum, the University's new "Every Drop Counts!" campaign was introduced. Posters featuring the number to call to report plumbing leaks were handed out to those at the meeting and to other groups over the following days; these signs were placed by custodians in all resident instruction buildings on campus. Stickers to be placed over sinks, in showers and over toilets and urinals followed in November. University Housing and the Georgia Center's hospitality operations—which are auxiliary operations not maintained by the Physical Plant—complemented the campaign by developing promotional materials tailored to their own specific needs. In addition, University Housing leaders continued to galvanize student support in the residence halls for the ongoing effort to conserve water. Executive Director Gerry Kowalski sent an e-mail message to residents in October as a way to kick off the educational and public awareness campaign.

The UGA Athletic Association coordinated with the Public Affairs Office to create water conservation messages for Sanford Stadium and all athletic venues. A series of public service announcements, scoreboard graphics and posters were developed. Signs encouraging football fans to conserve water were placed strategically across campus. Starting with the Homecoming game on November 3, signs were placed in the restrooms of Sanford Stadium, asking male fans not to flush the urinals after each use but rather to allow restroom attendants to flush them periodically, thus reducing the total number of flushes.

D. Campus Water Audit and Savings to Date

Overall, from July through October, UGA’s total water consumption was down approximately 9.6 percent—a savings of about 23 million gallons, despite the extremely high temperatures experienced during a major portion of this timeframe. It is particularly important to note that virtually all of these reductions were achieved prior to the total outdoor watering ban declared on September 17, as most of the September meters were read on or before that date. Figure 2 below demonstrates UGA’s actual water reductions from July to October when compared with usage rates from the previous year.

Figure 2. Recent Water Consumption



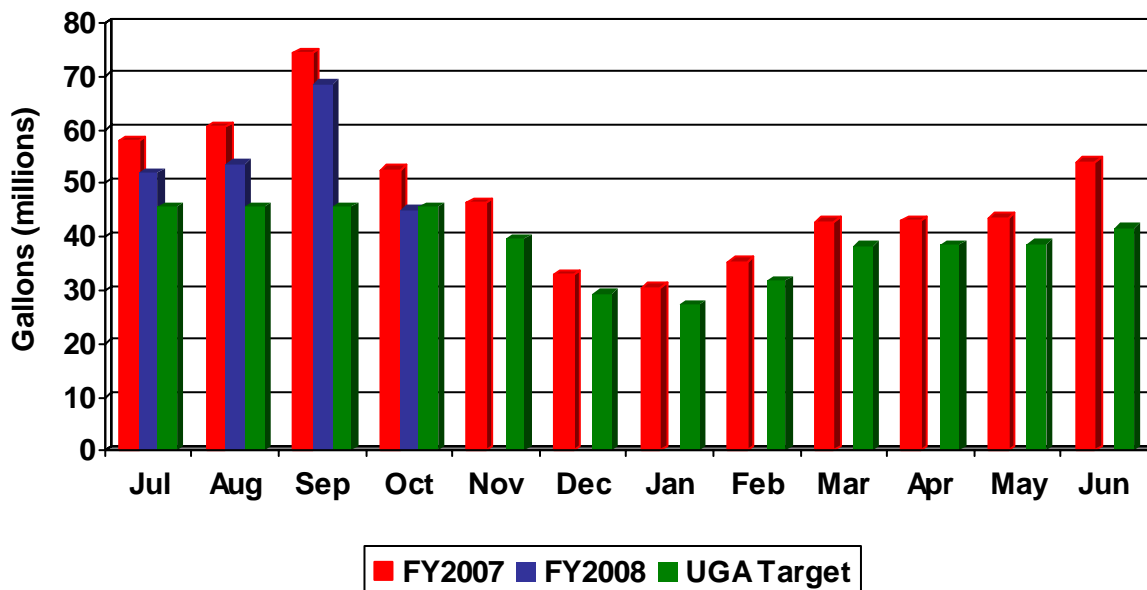
The water meters for the stadium and eight buildings which remain open to accommodate the crowds at home games were read on Friday, November 2 and again on Monday, November 5. The same process was repeated for the Auburn game the following week, and a final game-specific reading for the 2007 season will be taken the weekend of November 17. Prior to the drought, isolated meter readings for game days were not taken. This new data will enable the Athletic Association and Physical Plant to obtain a more accurate assessment of the volume of water use (restrooms, concessions, etc.) by football fans and to establish a baseline by which to monitor future game day consumption.

Under Governor Sonny Perdue’s Executive Order of October 24, 2007, UGA now is required to reduce its water usage by 10 percent. The institution’s water use during the comparable month of the previous year is to provide the baseline for this reading, with results being assessed on a cumulative basis. For example, UGA’s water reading in November 2007 will be compared to the reading for November 2006, followed by a cumulative November/December 2007 reading which will be compared to a November/December 2006 reading, and so forth. UGA’s monthly performance will be reported to the Office of the Governor through the Board of Regents.

The University also may be required to make additional reductions by Athens-Clarke County when and if the ACC Commission implements proposed Step F of ACC's Drought/Water Shortage Management Plan. Under the current version of Step F, UGA must achieve a 5 percent reduction in the majority of its research and instructional operations and a 5 percent reduction in its housing facilities. (Note: sororities and fraternities are billed separately and treated as residences.) Athens-Clarke County will measure residential use based on the winter average—the months of December 2006 through March 2007. However, the University is asking ACC officials to condense the months by which it is to be measured to January through March, given that the University is virtually shut down during much of December.

By complying with the governor's 10 percent reduction mandate, UGA also could satisfy the proposed county requirements—at least for the winter months of November to March. However, the Athletic Association is classified as a commercial venture under Step F and therefore, would be required to achieve a 16 percent reduction in water use from its annual average. The health/safety category would need to reduce consumption by 2.5 percent, measured against its annual averages. At present, no components of UGA are listed within this group, but it is unclear whether that will remain the case. As a result, it is not possible to state with precision what UGA's overall, mandated monthly reduction goal will be. It is safe to conclude, however, that the University will be called upon to meet the targets that will produce the greatest water savings. With this in mind, the task force has endeavored to calculate the University's water conservation success. This calculation is represented by the green bar in Figure 3 below. Obviously, UGA's goal is more readily within reach for the winter months than it will be during the spring and summer, when demands for cooling increase. Therefore, the greatest challenge for water conservation lies ahead.

Figure 3. Water Consumption Goals



Source: UGA Physical Plant

E. Further Potential Conservation Actions

In order to achieve the significant reductions required, UGA must take dramatic action in the short-term and long-term. The University should expedite the ongoing conservation measures it has initiated. For example, the bathroom renovation plan to retrofit campus restroom facilities in resident instruction buildings with modernized, low-flush alternatives should be implemented in its entirety during the current fiscal year. The full implementation of the plan could result in a savings of as much as 30 million gallons per year and is more than halfway complete. Consequently, it is urgent that UGA act quickly to realize these substantial annual savings. Restrooms in other facilities (athletics, auxiliaries, etc.) also should be updated as soon as practical. Similarly, all toilets with automated flushing mechanisms should be inspected; where economically feasible (*i.e.*, the mechanism is an add-on and not an integrated component of the toilet), those mechanisms should be removed or turned off, if not functioning properly. The University also should examine the use of ultra low-flow (use 0.125 per flush) and/or waterless urinals. Waterless urinals were installed previously in the Student Learning Center, but they were removed due to maintenance difficulties. The Athletic Association has suggested that the Rankin M. Smith, Sr. Student-Athlete Academic Center might be a suitable facility for trial use; this possibility should be pursued.

The University needs to audit research laboratories more aggressively. With 31 percent of UGA's water use attributed to buildings dedicated to research, room for improvement exists. These measures should in no way impede the University's core research mission. Rather, the Physical Plant should work cooperatively with the Office of the Vice President for Research (OVPR) and other academic units to identify all instances of potable water usage at laboratory experiment stations. The Complex Carbohydrate Research Center has made good use of diaphragm vacuum pumps to replace water aspirators, which use potable water to draw a vacuum during experiment processes. While expensive—approximately \$1,000 per unit—the University should seek to achieve savings for purchasing in bulk and work with researchers, OVPR and the Budget Office to develop a cost-effective and equitable way to increase the use of alternative vacuum pumping methods in research labs.

The campus public awareness plan needs to be launched more aggressively. While the involvement of all members of the University community is essential, the student body can play a particularly integral role in this effort. It would be most helpful if the Student Government Association, Residence Hall Association and other student groups, especially those with an environmental focus, became actively involved. Water competitions between residence halls could heighten awareness in a visible, yet fun and good-spirited way. Engagement of student energy and creativity through enlistment of public relations/marketing students at the Grady College could be invaluable.

In connection with public awareness efforts, the University must keep in mind that only 20 percent of its students live in on-campus housing. Therefore, UGA's educational campaign must extend to those who live in off-campus fraternity and sorority houses, as well as the vast majority who live in other types of off-campus residences. Although the water use of these students is monitored and billed separately by ACC and does not

contribute to the total assessed to the University, a direct link to UGA obviously exists. As a result, UGA's public awareness campaign should strive to reduce consumption by these students as well. A list of water conservation tips should be provided to off-campus students to enable them to identify water-saving opportunities. This message also could be beneficial to faculty and staff members in assessing the water efficiencies of their homes. The "Every Drop Counts!" message should be conveyed to all who attend special events at UGA, be they concerts, conferences or athletic competitions. In addition, faculty members should consider incorporating discussions of the drought and conservation into their instruction, where appropriate.

The task force's recommendations provided at the end of this report succinctly restate some of the potential activities detailed in this section and enumerate many other ideas for achieving significant savings and water supply enhancements in the short-term and long-term. A number of these recommendations were obtained from research into the best practices of peer, aspirational and other comparable institutions across the country: University of North Carolina-Chapel Hill; North Carolina State University; University of Virginia; University of Connecticut; Colorado State University; Stanford University; and University of California, Berkeley. These universities have persevered through similar droughts and have effectively planned for sustained water conservation in the long-term.

IV. WATER CONSERVATION AT OTHER INSTITUTIONS

A. University of North Carolina at Chapel Hill⁶

In 2002, North Carolina endured a severe drought that resulted in the need for enhanced water conservation throughout the state. The University of North Carolina at Chapel Hill (UNC) and North Carolina State University (NC State) emerged as leaders in response to this statewide crisis and have notably made a sustained commitment to conservation that is worthy of emulation. UNC, with approximately 38,000 water users at present, embarked upon an ambitious public information campaign in 2002, centered around the same slogan as UGA—"Every Drop Counts." The goal of the campaign, which persists to this day, was to reduce campus water consumption by 25 percent. It utilized a variety of approaches to raise awareness, including: a dedicated water conservation website; informational posters, stickers and bus placards; numerous articles in employee and student newsletters; a university-sponsored "drought forum" to educate the campus community about the severity of the drought and the ongoing efforts to address the problem; and "water wars" competitions between residence halls that rewarded those most successful in lessening their water consumption.

In addition to these awareness-based efforts, UNC also has made substantial investments in water-saving equipment. Initially, it allocated \$307,000 from its emergency budget to accelerate the installation of planned water-related building enhancements, and it has continued to fund an assortment of innovative water conservation projects. Among other things, the university has: (1) installed 160 waterless urinals since 2002 (saving 2.1 million gallons and \$17,300 per year); (2) renovated the toilets in many buildings with dual-flush valves, reducing the water used per flush by as much as 31 percent; (3) incorporated vegetated/green roofs (consisting of extensive trees and plants) and storage areas (to capture and store rainwater for reuse) into several new construction projects in order to utilize rainwater and reduce runoff; (4) made it standard practice to pave all new roads, parking lots and sidewalks with special porous pavement over infiltration beds—the beds replenish groundwater and enhance stream flow during dry conditions; (5) incorporated storage/infiltration beds into athletic and intramural fields; (6) constructed an underground cistern and gravel storage field, which capture significant amounts of rainwater (up to 500,000 gallons) from the roofs of the School of Government and indoor track; and (7) upgraded its once-through research lab cooling mechanisms to water-saving, closed-loop systems.

Besides the foregoing, UNC, in partnership with the local water and sewer authority, is in the process of developing a reclaimed water system that will divert highly treated water

⁶ The principal sources for this section were: (i) the "Water" section of UNC's "Sustainability" website (<http://sustainability.unc.edu/Water/tabid/65/Default.aspx>) and its related links; (ii) UNC's 2005 Campus Sustainability Report (<http://sustainability.unc.edu/Portals/0/Documents/2005%20Sustainability%20Report.pdf>); (iii) UNC's 2007 Campus Sustainability Report (http://sustainability.unc.edu/Portals/0/Documents/2007%20Sustainability%20Report_web.pdf); and (iv) conversations with the Sustainability Office.

from one of the area's sewage treatment plants for reuse by the university for certain purposes. The project is scheduled to be in operation by 2009 and is expected to reduce UNC's total potable water consumption by 22 percent, benefiting both the university and surrounding communities. Overseeing all of UNC's water and other sustained conservation efforts is its Sustainability Office, formally created in 2003 and led by the associate vice chancellor for campus services and the director for sustainability.

North Carolina State University⁷

Like UNC, NC State has undertaken significant water and other energy conservation initiatives since 2002. Its total campus population is about 41,000 with a consumption level of 1.1 million gallons of water per day. Through its water-saving efforts in 2001-2002, NC State was able to achieve a 29 percent reduction in water usage per square foot, and the institution has worked diligently to cultivate a conservationist mentality on campus. In addition to its public awareness-related efforts (similar to those utilized at UNC), NC State has established an active Campus Environmental Sustainability Team, which recently completed a university-wide assessment that included recommendations for future environmentally-conscious improvements.

In terms of water-related conservation measures, NC State formed a Conservation Awareness Team that developed a strategic water plan for the university and continues to monitor existing conservation efforts. The university also has upgraded its irrigation equipment with ground moisture sensors that automatically suspend watering when moisture is detected. In addition, it has installed low-flow shower heads and faucets and is experimenting with the use of waterless urinals and rain capture systems. NC State also utilizes front-loading washers in all residence halls.

The university's adoption of water conservation protocols that correspond to its county's conservation stages seems to have been a very wise and practical strategy. When the county moves to Stage 2, for example, NC State has predetermined Stage 2 actions that it will implement throughout the campus. (Appendix E is a copy of NC State's Stage 2 protocols.) These required actions are channeled through and led by building liaisons who operate as point persons for safety, security, information and other building-related issues. In addition to leading the implementation of the requisite conservation measures, the building liaisons also are tasked with the responsibility of posting and distributing conservation-related materials throughout their buildings.

Perhaps the most important facet of NC State's water conservation efforts is its investment in installing operational water meters in every building on campus. This allows for efficient monitoring of water consumption, as well as the timely detection of leaks or other possible system inefficiencies.

⁷ The principal sources for this section were: (i) NC State University, *Campus Environmental Sustainability Assessment* (April 21, 2006); and (ii) conversations with NC State energy and grounds officials.

University of Virginia⁸

As in North Carolina, Virginia experienced a severe drought in 2002 that required the implementation of significant water-saving efforts. The University of Virginia (UVA) has been quite successful in dramatically reducing its campus water consumption. Between 2001 and 2005, UVA cut its water usage by almost 40 percent. A relatively modest jump over the past two years is attributed to an increase in square footage and university population.

When drought conditions present themselves in the Charlottesville area, UVA convenes a task force comprising various senior officials representing a number of constituencies from throughout the university, including athletics, facilities and business operations. The task force formulates the university's response to the area's water shortage, which is dictated by the relative severity of the situation, similar to NC State's approach.

UVA has implemented many of the same measures as UNC and NC State in terms of conservation initiatives, including the deployment of a comprehensive public awareness campaign, the utilization of low-flow fixtures and faucet aerators, and the curtailment of outdoor irrigation (which every institution appears to have done under severe conditions). Apart from these actions, however, UVA also installed water-conserving washing machines in its residence halls, conducted an ultrasonic survey of underground pipes for the purpose of detecting and repairing leaks, and closely monitored the daily use of water in the university's closed-loop heating and cooling systems to ensure the prompt detection and repair of leaks.

University of Connecticut⁹

The University of Connecticut's (U. Conn.) perspective on water conservation and supply issues is somewhat unique insofar as it is actually the owner and operator of the public water system that serves the campus and surrounding community. Given this, U. Conn. has been very proactive as an institution in terms of water management. Notably, in 2002 it created the Office of Environmental Policy (OEP), which focuses on the university's environmental performance, with an emphasis on sustainability in all contexts, including water resources. Among numerous other things, OEP maintains an extensive and informative website devoted to water conservation (<http://www.ecohusky.uconn.edu/waterconservation.html>). Its director reports to U. Conn.'s chief operating officer and works closely with the university's Environmental Policy Advisory Council, a 25-member senior advisory group appointed by the president and provost. The creation and

⁸ The information for this section was obtained through the University of Virginia's homepage (<http://www.virginia.edu>) and its specific water conservation site and related links—Water Conservation at the University of Virginia, <http://www.virginia.edu/drought/> and <http://www.virginia.edu/drought/uvaconservation.html>.

⁹ The sources for this section were U. Conn.'s "Eco-Husky" Office of Environmental Policy website and a number of its incorporated links. See <http://www.ecohusky.uconn.edu/index.html>.

maintenance of these bodies demonstrate a strong commitment to environmental matters at U. Conn.

In addition to its impressive administrative structure, the university has embarked upon a number of significant initiatives in terms of water conservation. Many are along the same lines as those already discussed in this section and include: (1) installation of water-efficient washing machines and dishwashers; (2) incorporation of water-saving fixtures and devices in new construction and upgrades of existing equipment in older structures; (3) installation of water-efficient research equipment; (4) utilization of a broad and effective campus public awareness campaign—"Stop the Drop"; and (5) employment of "Eco-Madness" residence hall competitions. U. Conn. also has developed an elaborate Water Supply Emergency Contingency Plan (similar to NC State's conservation protocols) that mandates the water-conserving actions that must be taken, depending upon the severity of the drought conditions.¹⁰

Colorado State University¹¹

Unlike the institutions discussed thus far, Colorado State University (CSU) and other institutions in the more arid western regions of the country have contended for some time with significant water supply concerns. By necessity, since the late 1960s, CSU, its surrounding community and the entire state have made water conservation a fundamental component of their culture. CSU's successful, far-sighted and sustained conservation efforts are highly impressive and set a standard that we in the Southeast should strive to replicate.

The university has a resident student body of 24,700, and like UGA, is the largest user of water in its city (Fort Collins). Potable water use at CSU has decreased by 22 percent since 1990, despite an increase in student population (5,000) and gross building square footage (1.4 million sq. ft.). Such sustained conservation seems directly attributable to an assortment of measures that the university has undertaken over the years, including: (1) an annual "Green is Gold" (school colors) conservation awareness campaign; (2) the retrofitting of cooling equipment in campus residence halls (saving an estimated 10 million gallons per year); (3) utilization of a computerized meter and control system for campus irrigation; (4) installation of a process-cooling loop for three laser-based and seven environmental laboratories (these eliminate the need for continuously running cold

¹⁰ It is not clear whether this plan has been implemented yet. A draft is *available at* <http://www.ecohusky.uconn.edu/documents/wateremergencycontingencyplan.pdf>. It also should be noted that U. Conn. released a very extensive Water and Wastewater Master Plan in June 2007. This plan can be viewed at [http://fo.uconn.edu/UCONN%20Water%20and%20Wastewater%20Master%20Plan%20\(June%202007\).pdf](http://fo.uconn.edu/UCONN%20Water%20and%20Wastewater%20Master%20Plan%20(June%202007).pdf).

¹¹ The sources for this section were the following: (i) http://newsinfo.colostate.edu/index.asp?url+csu_quick_facts; (ii) <http://www.fm.colostate.edu/sustain/webreport.pdf>; (iii) http://www.fm.colostate.edu/sustain/Enviro_Report/FY06Water.pdf; (iv) http://newsinfo.colostate.edu/index.asp?page=news_item_display&news_item_id=1057902451 (Sept. 29, 2006); (v) http://newsinfo.colostate.edu/index.asp?page=news_item_display&news_item_id=143409791 (Oct. 9, 2006); and (vi) http://www.fm.colostate.edu/sustain/Water_Consv/water.htm.

water as part of the cooling system); (5) the retrofitting of toilets, shower heads and faucets with low-flow fixtures; and (6) implementation of a sub-metering system for both water and energy in all campus buildings, allowing for efficient and effective monitoring of consumption.

It also is important to highlight the leadership role that CSU has played in its surrounding community and throughout the state. From an educational standpoint, it is visibly committed to spreading its conservation and sustainability messages to the public. As already noted, UGA has undertaken similar efforts within the state, but the institution should further enhance its leadership role in this regard.

Stanford University¹²

Like Colorado, California has been forced to address drought-related issues for an extended period of time. From 1986 to 1992, Northern California experienced a severe drought. Since that time, institutions such as Stanford University have adopted and sustained significant conservation programs.

With over 14,000 students, a huge percentage of whom live on campus, Stanford is a major consumer of water—2.22 million gallons per day of potable water in 2005-2006. To reduce its consumption, the university has: (1) maintained several different public awareness campaigns—“Save Water Now,” “You Can Make a Difference,” “Conservation and You!”—and sponsors the ongoing “Sustainable Stanford” initiative; (2) replaced once-through laboratory cooling systems with re-circulating systems; (3) upgraded over 90 percent of its toilets to the low-flow variety; (4) replaced all campus washing machines with water-efficient, horizontal axis models, which utilize half as much water as standard machines; (5) installed low-flow shower heads and faucet aerators in all residence halls; (6) upgraded the campus irrigation by installing a highly sophisticated, automated system (*Maxicom*); and (7) installed Water-Mizer® for use in connection with the medical school and hospital’s sterilization process (instead of running water constantly, the device senses when water is needed and shuts it off when not in use).

In addition, Stanford makes available extensive web-based resources and information to assist in elevating and sustaining public awareness with regard to water and energy conservation. The Student Housing website, for example, maintains an “Energy and Water Conservation Checklist.”

¹² The sources for this section were the following: (i) 2006 Annual Water Quality Report—Stanford University Utilities Division (May 2007), available at <http://facilities.stanford.edu/environment/StanfordCCR2006.pdf>; (ii) Maddaus Water Management & Stanford University, *Water Conservation, Reuse and Recycling Master Plan* (Oct. 2003), available at http://facilities.stanford.edu/conservation/FINALStanfordConservation_Recommended_Plan10_16_033.pdf; (iii) Stanford University News Service, at <http://news-service.stanford.edu/pr/91/910729Arc1244.html>; and (iv) Sustainable Stanford, at <http://ssu.stanford.edu/overview.html>.

University of California, Berkeley¹³

Like Stanford, the University of California, Berkeley (Berkeley) had to endure Northern California's severe drought conditions between 1986 and 1992. Furthermore, the region's outlook going forward seems quite discouraging. For example, Berkeley's municipal utility authority has predicted drought-related water shortages of 62.5 million gallons per day by the year 2020.

In light of California's historic water supply problem and the rather grim prospects for the future, Berkeley has acknowledged its "responsibility to be a model for efficient and responsible water use, not only through exceptional research, but also by demonstrating how to incorporate sustainable water use and planning into all areas of [its] operations."¹⁴ To effectuate this commitment, the university conducted a campus-wide water sustainability assessment, identifying its successes in terms of water management and making recommendations for the implementation of further water-saving measures. This assessment was led by the Chancellor's Advisory Committee on Sustainability—a standing committee that focuses upon all sustainability-related issues, not just water.

Some of the more significant efforts that Berkeley has undertaken or plans to commence are: (1) reduce water use in new construction by 30 percent; (2) eliminate once-through cooling systems in connection with major laboratory renovations and new construction; (3) install and upgrade low-flow or no-flow plumbing fixtures throughout the campus, including waterless urinals and dual flush toilets, among others; (4) include cisterns as components of new construction; (5) pilot a gray water/wastewater project in new or renovated construction; (6) extend efforts directed towards raising public awareness, including the utilization of residential sustainability education coordinators in residence halls—live-in student volunteers who educate residents on environmental issues and the importance of conserving natural resources; (7) provide monthly water consumption figures to building occupants and post general water use/savings data on the university website; and (8) automate the campus irrigation system.

An extensive follow-up report to the university's sustainability assessment nicely encapsulated the important role that public institutions, consistent with their teaching, research and service missions, can and should play in terms of preserving our natural resources: "UC Berkeley could be the perfect example of how communities can live sustainability on the earth, not only by teaching about sustainability but by incorporating sustainability practices into its everyday operations."¹⁵

¹³ The principal source for the information contained in this section was UC Berkeley Chancellor's Advisory Committee on Sustainability, *UC Berkeley Campus Sustainability Assessment—Water* (2005), [hereinafter "*Berkeley Sustainability Assessment*"], available at http://sustainability.berkeley.edu/assessment/pdf/CACS_UCB_Assessment_3_Water.pdf and a subsequent report prepared by a Berkeley graduate student that expanded upon the university's initial assessment, Jubilee Daniels, *A Sustainable Water Plan for the University of California, Berkeley—A Professional Report for the Chancellor's Advisory Committee on Sustainability* (May 2005) [hereinafter "*Sustainable Water Plan*"], available at http://sustainability.berkeley.edu/water_plan/A_Sustainable_Water_Plan_for_UCB.pdf.

¹⁴ *Berkeley Sustainability Assessment*, footnote 13.

¹⁵ *Sustainable Water Plan*, footnote 13.

UGA must be equally willing to take up this mantle, by teaching about, researching and implementing significant water conservation measures and by creatively exploring opportunities for alternative water sources for our campus and community, such as those discussed in the next section.

V. WATER SUPPLY

Consistent with a culture of sustained conservation is an appreciation for measures to enhance the existing water supply. By maximizing the amount of water from alternative sources that can be used for irrigation and other purposes, UGA can reduce its consumption of potable water from the ACC municipal water system. The benefits are two-fold: the University becomes more self-sufficient, and the community retains more water in its local drinking supply, enabling it to weather drought conditions for a longer period of time before resorting to extreme measures, such as purchasing water from other systems or private suppliers. Several potential and innovative ways to maximize UGA's water supply exist.

A. Groundwater

Water in the subsurface can be used for many purposes without treatment, such as for irrigation, cooling water, etc. Groundwater is water found in voids or pores within the subsurface. These voids are small and are usually invisible in soil. In rock, the voids are generally in fractures or in weathered zones between rock layers. The porosity is the term used to describe the volume of water per unit volume of geologic material. The permeability is the term used to describe the rate at which water can move through the geologic material.

Pumping water from the subsurface causes water to flow toward the well. The water drains from pores in the immediate vicinity of the well. This means that wells located in zones of higher permeability and near larger volumes of stored water will yield greater quantities of water. Wells near permanent water sources, such as lakes and streams, or in zones where there is greater depth to bedrock also yield more dependable water yields.

There are several areas on or near the University campus that would likely provide adequate water yields (*i.e.*, wells that could provide at least 50 gallons per minute). Wells along the North Oconee River, Tanyard Branch or Lilly Branch would be likely areas to investigate; however, concerns about water quality may need to be addressed. Wells next to Lake Herrick or on South Milledge and at Whitehall Forest also could be installed or refurbished. Ongoing petroleum and sewage leaks from urban sources may require additional treatment if the water is to be used in situations where human contact is possible.

B. Stormwater

Routing of stormwater directly to streams has adverse consequences, in that these discharges often contain unacceptable sediments and pollutants. Instead, the campus should emphasize the infiltration and recharge of these flows, especially in the vicinity of wells that can use these flows during drought periods. The collection and reuse of these storm flows using rain barrels, cisterns and other water storage facilities also should be pursued.

Collecting stormwater runoff from impervious surfaces has multiple benefits: (1) it decreases adverse ecologic impacts on receiving streams; (2) it can be used to augment soil moisture during times of drought; (3) it can be used to recharge groundwater pumped by wells; and (4) it prevents flooding of streets and streams. Many communities impose a stormwater fee based on the impervious surface area of a property. These fees are used to offset the adverse effects of stormwater. Thus, financial benefits associated with minimizing impervious surfaces also exist.

Much of the UGA landscape is contoured to route stormwater to drainage structures, including roads, roofs, lawns and planting beds. Historically this was done to prevent ponding of stagnant water, with the associated fear of pathogens carried by mosquitoes that breed in these ponds. However, infiltration rates can be increased to allow the rapid percolation of water into the soil, thus preventing the formation of stagnant pools on the landscape.

Additional above-ground and below-ground storage structures, such as cisterns and rain barrels, also provide means for intercepting stormwater and saving it for periods when rainfall is insufficient to meet irrigation demands. Green/vegetated roof opportunities exist on campus, where soil media is used on roofs to store water for subsequent evapotranspiration by plants. Demonstration gardens already are established on campus, and these have proven to be cost-effective mechanisms for reducing stormwater as well as the urban heat-island effect.

C. Pond Water

There are several lakes on or near the University campus, including those at the UGA Golf Course, Whitehall Forest and Lake Herrick. These lakes could be tapped for irrigation and for fire-fighting purposes, and even for potable supplies if appropriately treated. They could be used to harvest stormwater, as well as to enhance groundwater recharge.

Lake Herrick has a normal surface area of 15 acres and stores approximately 50 acre-feet of water (about 16 million gallons), with a total capacity of perhaps 100 acre-feet at maximum stage. The other lakes at the UGA Golf Course and Whitehall Forest are significantly smaller and farther from campus.

The natural inflow to the lakes is small (or non-existent) during droughts and cannot be depended upon to offset uses. In addition, evaporation from the lake surface will reduce water levels over time. The total volume of water stored in these lakes is not sufficient to provide a continuous supply of water, but it could be used as a back-up for intermittent, emergency uses.

Given the proximity of Lake Herrick to the outfall of the ACC Bailey Road (#1) wastewater treatment facility, a possible source of water to supplement the reservoir might be the effluent from the treatment plant. This wastewater could be stored in the pond and accessed for emergency needs. Pumping from the discharge point would be relatively straightforward, given their proximity.

D. Gray Water

Gray water reuse is currently restricted by the Georgia Environmental Protection Division due to public health concerns. In some jurisdictions, gray water is permitted after treatment. There may be a time when Georgia allows appropriate gray water systems. Indeed, a working group has been formed in partnership between UGA and the Georgia Department of Community Affairs to evaluate the current regulatory guidelines.

The prime use for gray water, if allowed by code, is for irrigation, especially for landscaping and recreational fields. While xeric (drought-tolerant) plantings would be an alternative for landscaping, there always will be some need for recreational fields that require supplemental irrigation. Another potential use of gray water is for toilet and urinal flushing.

A significant public health concern related to gray water, because it is untreated, is that pathogens dangerous to humans and animals may be present, especially if the gray water contains fecal matter, blood or uncooked meat products. This resource should not be used if public health concerns cannot be mitigated.

E. Purple Water

Purple water refers to treated (or reclaimed) wastewater that has been processed to meet specific water quality safety requirements. This water is referred to as purple water because it is distributed in pipe that is colored purple to distinguish it from potable water.

The use of reclaimed wastewater is allowed in Georgia, and the new ACC wastewater treatment plants will be plumbed to provide this resource. Costs associated with developing the infrastructure to utilize this resource include the requisite pumping, treatment and distribution systems.

In addition to purple water utilization opportunities from wastewater treatment plants, localized treatment systems also are available that could be installed in residential, classroom and research facilities. These would capture water onsite where it would be filtered and disinfected. However, some laboratory facilities may discharge chemicals that make the water not suitable for subsequent reuse. Care should be taken in determining the types and sources of water considered for reuse.

F. Purchased Water

Obtaining water from public and private sources, other than ACC, may be an option. Private lakes and wells, as well as other regional water sources, might have sufficient excess capacity to provide water.

Oconee County is currently contracting with private well owners to supply water that augments its distribution system. Tying into privately operated wells is a possibility and may provide additional sources in areas where UGA does not currently have the required infrastructure.

VI. TASK FORCE RECOMMENDATIONS

Where possible, the Ad-Hoc Task Force on Water Resources has quantified the anticipated costs and benefits of its proposals. However, more time will be needed to assess the costs of many items: for example, while the list price of a water-saving device might be known, buying in bulk on a bid should lead to considerable monetary savings. Other recommendations, such as the possible use of paper products in dining facilities, will have environmental trade-offs which must be considered. In addition, while most of the recommendations have proven track records of success at other institutions, attempting to project the precise water savings specific to UGA at this point would be a guessing game at best. The optimal time to make those projections will be when pilot units are installed, and accurate readings can be obtained.

The task force's recommendations for the senior administration's consideration are listed below, in no particular order of priority.

A. Short-Term Water Conservation

- Continue with and expand the campus public awareness campaign. Among other things, enlist Grady College marketing and public relations students to develop strategies for enhancing and maximizing the impact of the University's "Every Drop Counts!" campaign.
- Adjust and maintain all building thermostats at a level that optimally conserves water and energy.
- Partner with a supplier or distributor of water-saving devices (such as low-flow shower heads, faucet aerators, etc.) and give coupons to UGA employees and students so they can purchase such items. This benefit should be provided not only to employees and students in Athens, but also to those who are based at the University's other campus locations.
- Initiate efforts to harvest and utilize rainwater to the maximum extent possible.
- Retrofit all campus facilities with low-flow toilets, and consider the addition of dual-flush valves (use a maximum of 1.1 gallons of water per flush for liquid waste and 1.6 gallons for solids). Along the same lines, eliminate all inefficient automatic-flushing toilets and urinals and replace them with more efficient alternatives. [Estimated cost: \$450,000. Estimated water savings: 60,000–70,000 gallons per day for an approximate annual monetary savings of \$115,000.]
- In buildings that have meters, monthly and year-to-date water usage totals should be posted in a visible location, along with an indication of the previous year's totals for the same time period. This information also should be e-mailed to all building occupants. Doing so will help to engage the broader campus community in the University's conservation efforts.

- Conduct water conservation competitions between the various residence halls, as well as between other entities (*e.g.*, sororities and fraternities) and buildings on campus. Awards/incentives should be offered at the end of each month to encourage participation.
- Conduct water education forums and update sessions in the residence halls and at other venues on campus.
- Reduce the frequency of campus maintenance that requires water, consistent with applicable health and safety standards (*e.g.*, mopping, etc.).
- Require patrons of the Ramsey Center to provide their own towels for workout and showering purposes, relieving the facility of a significant amount of daily laundry.
- Encourage faculty, staff and students to bring their own water to campus for personal consumption.
- Conduct water audits to ensure that water pressure levels are correct for all buildings to maximize the efficient provision of water.
- Investigate the benefits of installing hand sanitizer dispensers as an alternative to water use in campus restrooms.

B. Sustained Water Conservation

1. Educational

- Maintain the University's public awareness campaign and strive to make water and energy conservation an integral part of the campus culture.
- Incorporate water conservation education into orientation programs for all students, faculty and staff. The students' message should be reinforced through programming for incoming students in the residence halls.

2. Research/Laboratory

- The Office of the Vice President for Research, in concert with the Physical Plant, should closely monitor research-related water consumption and develop methods to ensure that water conservation measures are incorporated into institutional research efforts, where practical.
- Continue to audit water-using research equipment, and maximize the use of recycled water for cooling purposes. If cooling equipment is required for research, then it should be mandated that the equipment ties into closed-loop cooling systems, wherever practical. In addition, other water-saving measures should be incorporated into laboratory

activities, where practical, such as the use of diaphragm pumps in place of water aspirators.

- Complete conversion of once-through water source cooling units (43) in the Biological Sciences and Miller Plant Sciences Buildings. [Estimated cost: \$75,000. Estimated water savings: 3,000 gallons per day for an approximate monetary savings of \$5,500 annually.]
- Install water conservation kits on water sterilizers used in research operations. These can reduce water use from 120 gallons to 30 gallons during a typical 20-minute cycle.
- Start-up costs for newly hired researchers should include funds for water-saving devices in the laboratory.
- Install re-circulating or more efficient greenhouse irrigation systems.

3. Construction and Equipment

- Mandate enhanced water conservation measures in connection with all new construction. These measures should be memorialized in writing and could encompass such steps as the incorporation of vegetated/green roofs, along with stormwater and condensate capture mechanisms (cisterns). The captured water can be recycled for toilet/urinal flushing, cooling and other uses.
- Install a sub-metering system throughout the campus to enable efficient monitoring of water consumption on a building-by-building basis.
- Install make-up water meters on all cooling towers to isolate the amount of water being used by each unit. [Estimated cost: \$50,000.]
- Develop plans for systematically identifying and repairing leaks (*e.g.*, install monitoring systems that notify of excessive flows or reduced pressures).
- Ensure that all campus washing machines are of the efficient variety. University Housing already has installed these types of water-saving and energy-saving washers in all residence halls.
- Investigate the installation of ultra low-flow urinals (.125 gallons of water per flush) or waterless urinals in all new construction, where practical.
- Retrofit all University faucets with low-flow aerators, and consider installing highly-efficient infrared, automatic faucets to the extent practical.
- Examine alternatives for limiting water usage in all showers on campus (*e.g.*, manually operative shut-off valves to use when lathering or shampooing; timers; and other water-use limiting devices).

- Reduce the number of buildings that remain open on game days and increase the number of port-o-lets that are available.
4. Landscaping and Irrigation
- Continue to plant more drought-resistant vegetation around campus and maximize the use of recycled or other non-potable water for irrigation purposes.
 - Install rain/moisture and leak sensor shut-off devices on irrigation systems, where necessary.
5. Water Supply
- Establish a process for refurbishing existing wells, as well as locating and installing new water supply wells. An analysis of the yield of the wells also should be performed to determine their capacity in gallons per minute.
 - Install stormwater retention/detention facilities and landscape irrigation facilities using captured stormwater. In addition, existing drainage structures should be reconfigured so that storm flows are spread across the landscape into vegetated swales and rain gardens. Cisterns, rain barrels and other structures should be required components of campus construction projects.
 - Develop a long-term water reuse and stormwater management plan.
 - Ascertain the volume of water storage within UGA's ponds, taking into account estimates of the water budget (*i.e.*, inflows, outflows, evaporation, etc.). An assessment also should be made of the potential uses and means for distributing the water to meet these uses. Finally, the possibility of augmenting pond storage using treated wastewater should be considered.
 - While gray water may become a viable source of water for irrigation and flushing purposes in the future, legal restrictions in Georgia currently preclude its use. UGA should take the lead in promoting a responsible discussion and evaluation of possible gray water use in Georgia. At the same time, it also is important for the University to put into place educational and training programs to cultivate awareness of the potential health hazards associated with handling and using gray water.
 - Explore the possibility of utilizing purple water for various purposes on campus, along the lines of the system being implemented by the University of North Carolina at Chapel Hill.
 - Develop and implement a plan to capture and reuse condensate from all campus cooling systems. Given that 20 percent of UGA's water use

is attributed to evaporative loss in the cooling process, the potential exists for significant savings. [Estimated water savings: 50,000 gallons per day during the cooling season only.]

As a pilot project for implementation, install plumbing at the Main Library to capture condensate for use as cooling tower make-up supply. [Estimated cost: \$10,000. Estimated water savings: 4,000 gallons per day during the cooling season only.]

- Consider purchasing private water. An investigation should be undertaken to identify potential water sources and to estimate the associated transaction and transportation costs. In addition, because the concept of private water purchasing is new in Georgia, an analysis of the potential legal restrictions on the development of a water market must be conducted.

6. Administrative/Operational

- Consider establishing an Office of Sustainability to coordinate and promote campus-wide efforts in water conservation, energy efficiency, recycling and other areas.
- Augment the staff in the Office of Sustainability with a standing “Committee on Sustainability and Conservation.” The committee should meet periodically throughout the year to evaluate the status of campus sustainability initiatives. Its work should include the monitoring of developments at the local and state levels; assessment of the effectiveness of UGA’s conservation measures; and the issuance of annual reports on UGA’s efforts to the campus community.
- Develop an Emergency Water Management Plan, just as the University has other plans in place for potential emergency situations (*e.g.*, avian flu pandemic). The plan should, among other things, encompass prioritization of critical functions and users to maintain in the event of an emergency water shortage.
- The senior administration should consider the possibility of shortening the length of the fall and spring semesters by one week each and, if feasible, pursue this reduction with the Board of Regents. Equivalent changes to the summer instructional periods also should be considered, as this timeframe is when campus cooling demands are at their peak. A one-week reduction would bring UGA more in line with the schedule of peer and aspirational institutions. The water and energy savings would be even greater if the reduction was achieved by starting later in the fall (lowering cooling costs) and by ending earlier in the spring (again, lowering cooling costs).

C. Worst-Case Possibilities

- Impose the restrictions required by the Emergency Water Management Plan, when developed.
- Close outdoor swimming pools.
- Investigate the possibility of a four-day work week in the summer. It may be too late to impose such a dramatic change in the class scheduling/assignment process for 2008, but there may be buildings or departments where savings could be achieved. A reduction in the number of days in the work week would reduce the number of days that people are in campus facilities.
- Move to paper products in all food service operations on campus to eliminate washing. Consideration, however, must be given to the potential collateral consequences that such a move could have on the environment.
- Close the overnight food service.
- Consider discontinuing the provision of ice with beverages at all campus food operations, including those at athletic venues. The serving of chilled or bottled beverages might have to suffice.

APPENDIX A

AD-HOC TASK FORCE ON WATER RESOURCES

MEMBERS:

Kathryn Bowers	President, Student Government Association
Lonnie Brown (Co-Chair)	Associate Professor, School of Law Administrative Fellow, Office of the Senior Vice President for Academic Affairs
Adrian Childs	Associate Professor, Hugh Hodgson School of Music
Steven Harris	Interim Director, Office of Security and Emergency Preparedness
Arthur Johnson	Associate Athletic Director, Athletic Association
Ralph Johnson	Associate Vice President, Physical Plant Division
Gerard Kowalski	Executive Director, University Housing
Denise Mewborn	Department Head, Mathematics and Science Education, College of Education
Kathy Pharr (Co-Chair)	Assistant Vice President, Office of the Senior Vice President for Finance and Administration
Todd Rasmussen	Professor, Warnell School of Forestry and Natural Resources
Shannon Scott	Assistant Editor, Institute of Continuing Legal Education
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APPENDIX B

2007 History of Drought Restrictions

Base Demand = 20 Million Gallons per Day (MGD)

Drought Level	% Reduction Goals	Reduction Goal (MGD)	Demand Goal (MGD)	Actual Demand (MGD)	Step Response/ Date of Implementation (water use allowed)
1	2.5%	0.5	-----	-----	Step A/ Year round (3 days a week; 12 midnight to 10 AM, 6 PM to 12 midnight)
2	5%	1.0	19.0	19.45	Step B/ April 18, 2007 (3 days a week; 12 midnight to 10 AM)
3	10%	2.0	18.0	17.16	Step C/ June 26, 2007 (1 day a week; 12 midnight to 10AM)
4	20%	4.0	16.0	15.16	Step E/ September 17, 2007 (outdoor water use ban)
-----	28%	-----	-----	14.46	October 22, 2007- Achieved through Public Information Campaign and community effort
5	≥ 30%	≥ 6.0	≤ 14.0	-----	Step F
10% Reduction	~ 35%	~ 6.5	~ 13.5	-----	Gov. Perdue's Declaration of 10 % Reduction for all Level 4 Counties

APPENDIX C

Step F - Drought/Water Shortage Management Plan (DWSMP) Priority Uses of Potable Water

1. Medical and Emergency Facilities, emergency purposes (Health and Safety)
2. Domestic and personal uses (Residential)
3. Institutional, Commercial, and Industrial uses
4. Refilling of ponds, hand watering
5. Spray irrigation
6. Uses that do not sustain plant, animal, or human life or health. Other....

(4,5,and 6 are uses currently prohibited under Step E)

Priority Use Categories and Examples of Sub-Categories

1- Health & Safety	2- Residential	3- Institutional	4- Commercial	5- Industrial
Clinic	Multi-Family	Assisted Living	Bar/Entertainment	Food Production
Doctor Office	Public Housing	Athens Technical College	Car Wash	Lab/Pharmaceuticals
Government: Federal/State/Local Public Safety	Single Family	Board of Education	Church	Manufacturing/Assembly
Hospital	Sorority/Fraternity	Correctional Facility	Farm	Mining
Nursing Home	UGA Housing	Day Care	Financial Institutions	
Veterinary Services		Government: Federal/State/Local Non-Public Safety	Financial Services	
		Private Schools	Food Services (Restaurants, Cafeterias, Bakeries, Caterers)	
		UGA Research & Instructional	Gas-Auto Repair	
		US Navy Supply Corps School	Gas-Convenience Stores	
			General Construction	
			Grocery Stores	
			Laundromat/Dry Cleaner	
			Motel/Hotel	
			Motor Vehicle Sales/Service/Lease	
			Office/Service/Warehouse	
			Pharmacy/Drug Store	
			Plant Nursery	
			Printing, Video & Record Production/Broadcasting/ Telecommunications	
			Recreation/Park/Fitness	
			Retail/Wholesale Sales/Service/Lease	
			Transportation	
			UGA Athletics	

Step F Recommendation

- Recommendation provides a strategy to achieve additional water use reductions in increments of 1 MGD by assigning specific reduction levels to each prioritized use category.
- Proposed recommendation is based upon:
 - Priority of uses as outlined in DWSMP
 - Staff's evaluation of community values for use of available water resources
 - Need to implement 30 days prior to reaching 25% reservoir capacity
- Recommendation follows approved DWSMP implementation process:
 - Water volume reduction to be identified by staff
 - Mayor approves recommendation and implements Step F
 - Implementation action ratified by Commission

Step F:

Recommended Reductions Required per 1 MGD

Category	% Reduction	Projected Reduction (MGD)	% Demand Goal
Health and Safety ¹	2.5%	0.01	0.1 %
Residential ²	5%	0.29	29.0 %
Institutional ¹	5%	0.06	6.0 %
Commercial ¹	16%	0.21	21.0 %
Industrial ¹	16%	0.43	43.0%
Total = 1 MGD			100 %

1 Annual Average Water Use

2 Winter Average Water Use

MGD = Million Gallons per Day

APPENDIX D

Step F – Enforcement, cont...

Enforcement:

- Normal monthly meter readings for Residential customers
- Weekly meter readings for Industrial customers
- Bi-weekly meter readings for Health and Safety, Commercial, and Institutional customers

- The following actions shall be taken for customer non-compliance:
 - First Offense -- Written notice of violation plus 10 times existing unit charge for volumes in excess of water reduction requirements
 - Second Offense – 10 times existing unit charge for volumes in excess of water reduction requirements plus \$1000.00 surcharge
 - Third Offense – 10 times existing unit charge for volumes in excess of water reduction requirements plus \$1000.00 surcharge plus service disruption

- Appeal Process
 - Public Utilities Director
 - Water Adjustment Board
 - Administrative Hearing Officer

APPENDIX E

City of Raleigh	Stage 1 - Effective August 28, 2007
Fines	1 st Violation - \$200 2 nd Violation - \$1,000 3 rd Violation – Interruption of Service
Grounds Management	<ul style="list-style-type: none"> • Reduce watering schedule from three days a week to one day (Wednesday) for turf and ornamental irrigation (except drip irrigation). • Hand held hose watering can be done Wednesdays from 6 AM – 10 AM. • Vehicles washed only at Facilities Operations approved water reuse facility (80% water is reused). • All decorative fountains stopped and water drained for reuse. <p>** Athletic fields (safety reasons), preventative maintenance on water systems, and city-permitted watering are exempt from Stage I Restrictions per City of Raleigh. **</p>
Building Maintenance & Operations	<ul style="list-style-type: none"> • All Leaks Code 1 and should be repaired within 24 hrs. • Vehicles washed only at Facilities Operations approved water reuse facility. • Write work requests to check conductivity controllers and water control valves on cooling towers.
University Dining	<ul style="list-style-type: none"> • Water served only upon request. • Review water uses, install recycle systems where feasible. • Create and distribute a water conservation awareness flyer targeting all building users within the Dining area of operation.
University Housing	<ul style="list-style-type: none"> • All Leaks Code 1 and should be repaired within 24 hrs. • Create and distribute a water conservation awareness flyer targeting all building users within the Housing area of operation.
Housekeeping	<ul style="list-style-type: none"> • Cease washing of areas such as sidewalks, driveways, patios prohibited, except for sanitary reasons. • No window or power washing.
Athletics	<ul style="list-style-type: none"> • Water every other day, except for safety reasons on fields. • Adjust control valves in the urinals to conserve water.
Talley Student Center, Price, & Witherspoon	<ul style="list-style-type: none"> • Create and distribute a water conservation awareness flyer targeting all building users within the Talley Student Center area of operation.
Utilities & Engineering Services	<ul style="list-style-type: none"> • Write work requests to check conductivity controllers and water control valves on cooling towers. • Suspend fire hydrant flushing. • Convene NCSU Conservation Awareness Team (CAT) to update conservation strategies and educational outreach with the City of Raleigh. • Coordinate and disseminate the NCSU water conservation plan throughout campus in response to the City of Raleigh and the Governor’s mandates on water conservation. • Monitor consumption levels to measure progress.
Other	<ul style="list-style-type: none"> • Follow all rules above and those from City of Raleigh.

Updated October 17, 2007



Stage 2 Effective October 22, 2007

	Stage 2 Effective October 22, 2007	
Fines	1 st Violation - \$1,000 2 nd Violation - Interruption of Service	
Grounds Management	<ul style="list-style-type: none"> Cease all non-essential watering including drip irrigation systems. Essential plant vegetation watering to be pulled from Lake Raleigh (non-potable). Convert additional truck(s) to use non-potable Lake Raleigh water for plant material instead of City of Raleigh water. 	<ul style="list-style-type: none"> Cease all vehicle washing except for sanitary reasons. All decorative fountains campus wide stopped and water drained for reuse.
Building Maintenance & Operations	<ul style="list-style-type: none"> All leaks Code 1 should be repaired within 24 hrs. Write work requests to check conductivity controllers and water control valves on cooling towers. Convert high-flow to low-flow toilets at DH Hill Library and Harrelson Hall. Cease all vehicle washing except for sanitary reasons. 	<ul style="list-style-type: none"> Suspend fire alarm testing. Eliminate fire pump testing. Eliminate water flow in testing of sprinkler systems. Review procedures at animal washing rooms for water saving opportunities. Review process cooling applications and eliminate once through cooling.
University Dining	<ul style="list-style-type: none"> Water served only upon request. Use disposable products instead of washing wherever possible. 	<ul style="list-style-type: none"> Distribute NCSU water conservation awareness flyers targeting all building users within the Dining area of operation. Cease all vehicle washing except for sanitary reasons.
University Housing	<ul style="list-style-type: none"> All Leaks Code 1 and should be repaired within 24 hrs. Create and distribute a water conservation awareness flyer targeting all building users within the Housing area of operation. Raise building temperature and set points on air handlers if applicable. 	<ul style="list-style-type: none"> Complete conversion of all hand sinks to .5 gpm faucet aerators within 30 days. Complete conversion of all appropriate showers to 1.5 gpm shower heads within 60 days. Cease all vehicle washing except for sanitary reasons.
Housekeeping	<ul style="list-style-type: none"> Cease all washing of areas such as sidewalks, driveways, and patios except for sanitary reasons. No window or power washing. Cease all vehicle washing except for sanitary reasons. 	<ul style="list-style-type: none"> Install alcohol based hand sanitizers in restrooms. Reduce water where appropriate for cleaning and mopping operations. Turn off non-essential ice makers. Report all leaks immediately.
Athletics	<ul style="list-style-type: none"> Cease all non essential outdoor watering. Install new control valve for urinals at Carter Finley to conserve water. Complete conversion of all appropriate showers to 1.5 gpm shower heads within 60 days. Cease all vehicle washing except for sanitary reasons. 	<ul style="list-style-type: none"> Convert additional truck(s) to use non-potable Lake Raleigh water for plant material instead of City of Raleigh water. Complete conversion of all hand sinks to .5 gpm faucet aerators within 60 days.
Talley Student Center	<ul style="list-style-type: none"> Create and distribute a water conservation awareness flyer targeting all building users within the Talley Student Center area of operation. Complete conversion of all hand sinks to .5 gpm faucet aerators within 60 days. Cease all vehicle washing except for sanitary reasons. 	<ul style="list-style-type: none"> All student activities requiring water usage will be cancelled or restructured for no water usage. Perform daily checks on leaks, sensors, and operation of fixtures. Raise building temperature and set points on air handlers.
Utilities & Engineering Services	<ul style="list-style-type: none"> Write work requests to check conductivity controllers and water control valves on cooling towers. Suspend fire hydrant flushing. Convene NCSU Conservation Awareness Team (CAT) to update conservation strategies and educational outreach with the City of Raleigh. Shut down steam driven chiller at Yarbrough Building. Raise chilled water set points. Raise set points on cooling towers. Examine fines or penalty system for non-compliance with water restrictions. Investigate ultra-low flow urinal installations at Mann Hall, CVM #301, Carmichael Gymnasium, and other buildings. 	<ul style="list-style-type: none"> Coordinate and disseminate the NCSU water conservation plan throughout campus in response to the City of Raleigh and the Governor's mandates on water conservation. Monitor consumption levels to measure progress. Produce and publish daily updates of water conservation progress in the Technician and online at www.ncsu/energy Pursue permitting and digging of wells for utility plants for cooling tower make-up. Shut down any water-cooled bearing equipment that is non-essential or can be sourced elsewhere. Cease all vehicle washing except for sanitary reasons. Complete conversion of all hand sinks to .5 gpm faucet aerators in the thermal plants within 60 days.
Carmichael Gymnasium	<ul style="list-style-type: none"> Reduce backwash timing and/or frequency for Carmichael pool. Wash only full loads of laundry, and consider adjusting water temperature set point to reduce steam required to heat the water. Investigate replacing laundry equipment with more water efficient models. 	<ul style="list-style-type: none"> Install ultra-low flow urinals provided from Energy Management. Complete conversion of all hand sinks to .5 gpm faucet aerators within 30 days. Complete conversion of all appropriate showers to 1.5 gpm shower heads within 60 days. Cease watering practice fields.
Other	<ul style="list-style-type: none"> Follow all rules above and those from City of Raleigh. 	

Updated October 17, 2007

