

Greening the Campus: Water Audit

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INTRODUCTION

Water loss is globally acknowledged as an urgent issue to be addressed. Water use in societies has changed through the years following population growth and developmental advancements. Despite the urgency of the issue, people's perception remains limited leading to more water loss and perpetuating the problem. Thus, the answer to the problem lies on change in people's habits and attitudes. College campuses are depiction of societies in small scale. Considering the facilities and services offered by most colleges in developed countries, water use on campuses is usually high. Hence, water conservation is important both for environmental and financial reasons. This essay aims to conduct research on the issue of water scarcity and on sustainable colleges, analyze the situation at Deree regarding the issue and provide suggestions for improvement.

LITERATURE REVIEW

In our effort to understand water waste and common misconceptions regarding water use we conducted research across the board, focusing especially on sustainable campuses that have conducted campaigns and have taken measures limiting the average water waste.

WATER SCARCITY RESEARCH

The issue of limited water resources has been discussed by several scientists. The sustainable Goals are of great importance and there is a need for interconnectedness amongst nations which will guarantee water security for the future (Ait-Kadi, 2015). Water could be characterized as a "total social fact", a theory developed by Mauss, which means that water is a phenomenon that cuts "across virtually all domains of society" (Orlove, Caton, 2010, 402). Nowadays, the large amount of water wasted could be attributed to a fundamental lack of understanding of water scarcity across the globe, what they call "deep social delusion" (Madrid, Cabello and Giampietro 2013, 14). This lack of understanding relates to the public perception of wasteful habits. As shown in a recent survey, when participants were asked to mention water saving methods, most of them mentioned curtailment methods rather than efficiency actions or the participants suggested efficiency actions for others and curtailment methods for themselves. Therefore, participants showed they generally avoid efficiency actions due to the high cost sometimes related to the replacement of taps, pipes, toilets etc. (Attari, 2014). The belief of public opinion that all problems related to water issues have already been resolved is listed as one of the four major challenges of dealing with water management in the 21st century (Daigger, 2006). Therefore, most scientists highlight as one of the most important aspects of dealing with water waste the element of public perception. Notifying the public regarding the areas where

water measures are pivotal is presented as a key part of promoting water saving methods and making sure that some of these methods will be adopted as long-term solutions.

IMPORTANCE OF UNIVERSITIES IN PERCEPTION ISSUES REGARDING SUSTAINABILITY

Perception is of outmost importance when it comes to the public adopting water conservation measures. Several scientists have highlighted the importance of adopting sustainable habits in the university when the consumption of energy and water is quite high. Adopting such habits at the young age and understanding the water loss amounting the discontinuation of such techniques and methods seems to be a key element to achieving a change in the public opinion regarding water scarcity. Universities are recognized as responsible for setting the example and promoting the mentality of sustainable practices (Weenen, 2000). Research on the importance of changing consumer behavior relating to water use and energy waste concludes that universities are important in terms of water loss because they are responsible for the vast majority of energy use and water consumption. The new generation has the greatest difficulty in shifting to "more sustainable patterns of resource consumption" (Petersen, 2015, 38). Researchers support that college students need to adopt water-saving habits in order to make certain that sustainable policies will be adopted in the future (Uhl and Anderson, 2001).

SUSTAINABLE UNIVERSITIES AND MEASURES FOR PROMOTING WATER SUSTAINABILITY METHODS TO THE PUBLIC

In our research, we started from finding universities that had already succeeded in adopting water saving techniques was pivotal in order to make sure that we could propose similar methods to be implemented at the ACG Community. After an initial search we examined Deree's previous Water Audit, which happened in 2012, as a tool to map the situation and outline the main water issues in order to discover whether Deree has applied effective or ineffective policies since then and whether the perception regarding water waste has changed. Cornell University has started a successful campaign named "Take Back the Tap" concerning the reduction of the cost of bottled water and energy use and GHG emissions. Cornerstones of the campaign seem to be the information session relating to water awareness during orientation and providing reusable water bottles to all incoming students (Cornell University, n.d.). Boston University follows a similar approach to Cornell It launched a campaign called "It's What You Do", thus, placing agency on the individual students regarding water consumption. Boston University suggests measures such as to take shorter showers, bring a reusable thermos and washing clothes with cold water to save on energy use. In fact, Boston has enforced deals with coffee shops situated in and close to the university campus to provide a 25c discount for students

who arrive with their own mug (Boston University, n.d.). Stanford University has similarly been encouraging water conservation. On their site, they list “Water Wars” as a water-saving activity, where students residences compete on who can cut water consumption the most compared to the previous semester (Stanford University, n.d.). Raising awareness and informing the students and the staff about possible water-conserving measures seems a deciding factor in the success of water sustainability campaigns.

METHODOLOGY

Our survey is part of a follow-up of the 2012 water audit. In our attempt to have an in depth understanding of the present situation in Deree about the existing policies and the attitudes of students and members of the ACG towards water consumption, we conducted two methodological approaches. We used quantitative and qualitative research in order to understand the perception of people regarding water use. Quantitative research allows generalization of data of a sample to an entire population, and gathers data in numerical forms that can be measured. It searches for structural explanations, not individual explanations and it allows researchers to collect, analyze and report the results of the study. Moreover, quantitative research uses graphs and tables of raw data to present the results, it tests a hypothesis, and it is considered a controlled method of research. Qualitative research provides an in depth understanding of a problem, and involves analysis of text, pictures, gathering of open ended data and personal clarification of the findings (Landrum & Garza, 2015).

During our research, we conducted interviews and surveys regarding college and student attitudes towards water use. The interviewees were people that had knowledge of the processes concerning water, such as the gardening, cleaning, athletic, and technical services. The purpose of the interviews was to help us understand the mentality of Deree faculty regarding water use, to trace the wasteful behaviors, to become aware of any policies regarding water consumption and receive information regarding Deree’s campaigns concerning water use. With the interviews, we managed to understand the processes repeated on campus and the attitudes of faculty members regarding water use in everyday activities. The questions on the interview schedules were mostly grouped around common malfunctions, the cost of water leakages, the differences regarding the consumption of water throughout the years and per seasons, the use of chemicals and the input of the interviewees concerning the need of water waste awareness campaigns. Furthermore, we created a questionnaire together with the Storm Water Perception Group. The goal of the questionnaire was to understand the perception of water loss amongst Deree faculty and students. The questions were mostly focused on the daily habits of the individuals at home and on campus aiming to map out any differences and trace wasteful behaviours. The questionnaire has been shared to the whole Deree community via

email and the results reflect 158 respondents, out of which 57,3% are Deree students and 72,6% are female. 57,3% of the respondents spend 4-5 days per week on campus, excluding special circumstances; 22.9% spend 3 days/week and 19,7% spend 1-2 days/week. 39,5% work or study at Deree for more than 6 years, 25,5% for 3-5 years and 35% are associated with the college for maximum 2 years. The sample of our survey occurs to spend a large part of their life on campus, thus their attitudes have a great impact on college, which adds to the significance of that sample and to the value of our research.

With the help of statistical analysis, we gathered and analyzed the data easily. In the interpretation of the results we spotted that one question was not clearly stated, so we considered the possibility of misunderstanding and thus, of false answers. The results of analyzed data however, were significant for our research.

DATA PRESENTATION AND DISCUSSION

INTRODUCTION

The main water uses on campus are for hygiene purposes in toilets and showers, for the pool, for cleaning and gardening services and for drinking purposes in the water fountains. To examine these uses we distributed a questionnaire to the Deree community and conducted interviews with key Office directors, as explained above. Following we discuss the main findings.

WATER CONSUMPTION

Contrasting the consumption of water in Pierce and Deree, the Technical Services representatives informed us that the most consumption of water happens at the Pierce facilities possibly 1/3 up in comparison to Deree's consumption. During the period between May and September the water waste is higher because of the water use in the Athletic facilities and due to the need to water the plants even two times a day. Regarding the water consumption at the Deree pool, we were informed that there are six "sand filters". The pool filters are washed 1 to 2 times per week, and with each wash 45 cm3 are used for every 3 filters. As a result, 90 m3 of water are used per week to fully clean all six filters and sanitize them (appendix 1).



Table for Deree Pool Water Consumption in m^3, 2012-2016

According to the recordings of the Athletics Department[1] concerning the 2015-16 year, the Fitness Center had more than 26,000 visits, while the swimming pool had almost 73,000. These numbers do not account for people, but for how many times users have visited those facilities. From the total 26,572 visits in the Fitness Center during 2015-16 year, the 20,255 are by students, the 4,575 by guests and only 1,662 by faculty and stuff (appendix 3). While in the pool, student activity is the lowest at 2,800 visits, guests noted 17,195 visits and 38,000 out of 72,000 visits in the pool are due to the Swim Academy activity (appendix 2). As shown in the charts (appendix 4), there is a constant increase in visits in both facilities through the years. Our interviewee explains this occurrence by the introduction of the Sports Academies. The Director of the Athletics Department also notes that the water consumption in the pool is the biggest, not only because of the more visits, but also due to the two showers requested for users before and after entering the pool. The Athletics Office directly uses water only under close cooperation with the Technical Services for the maintenance of the facilities and to fill up the pool. As explained, both departments follow specific policies to reasonably use water for such purposes and they have invested in systems for sustainability. The soccer field is considered green, because it is artificial requiring zero water consumption.

The person responsible for the Gardening Services for the last three years, described that the main practices of the gardeners are to water the grass and plants, spray the trees and deal with malfunctions. The campus of Deree takes water only from EYDAP and not from the underground drill, as they did in previous years. He could not provide us with information regarding the monthly water use, because the campus of Deree has shared water meters. Gardeners spend 5 tons of water per one

[1] The Athletics Department employees 11 people in office positions, but it also collaborates with coaches and trainers to run 75 athletic programs, such as several Sports Academies for both kids and adults. Access to water for hygiene purposes is offered to all the users of Athletic facilities; DEREE community, PIERCE students and guests.

square foot for watering the plants during summer. Deree employs two gardeners from November to February, and three gardeners from March to October. During this period, there is a need to water the plants more regularly. Moreover, the Cleaning Services[2] representative told us, when they clean, they use one bucket per classroom.

MEASURES TAKEN TO MINIMIZE WATER WASTE

In order to avoid water loss from malfunctioning taps, the Technical Services representative explained that Deree placed faucet aerators in most of the taps around the Agia Paraskevi campus as well as in the Deree Residences. Initially, the water waste when one was taking a shower would be 30lt per minute. As the representative explained, the faucet aerators minimize the water loss by 9lt per minute in the shower heads and by 2,5lt per minute in the rest of the taps placed in the bathroom sinks. Therefore, the consumption of water was cut down to 1/3 of its initial waste.

In the Athletics Department, the only measure to save water until now is the rule for three minutes-long showers for all users that is communicated through signs in all showers and in team players by their coaches. However, our interviewee explains that the main drive for that rule is to avoid delays and to have hot water for everyone, while the actual practice of that rule cannot be ensured. The Athletics Department has made a proposition to the Technical Services to launch button showers that monitor the duration of water running, in order to reduce water use. This proposition is under evaluation as we got informed during the interview with the Technical Services.

Additionally, according to both the Technical Services department and the Athletics Department, investment in fully automated operations in the pool has been done that monitors the water every hour to be within approved limits and thus save energy. For that reason, four blankets are also used every night above the pool to maintain the required temperature level in water and not waste energy. Moreover, the water of the pool gets filtered and reused up to three times and then it is dechlorinated to be appropriate for other purposes. After dichlorination the water is stored, but it has been reused only a few times in gardening and once it has been donated to a close fire station in the case of fire in Immitus, the hill where DEREE campus is located. Another investment for sustainability has been done in the indoors field, where the roof was insolated to avoid water draining and save energy from the air-conditions that is indirectly linked with water saving.

WATER LEAKS/DAMAGE CONTROL

[2] The college has a private company (ISS) to conduct the cleaning services and there are 32 people in this service. They train the cleaners depending on the needs of each building.

According to the Technical Services, the most common damages leading to water waste have to do with the heating network around campus. In order to repair the damage caused by the broken pipe, the network of pipes to which the broken pipe belongs to has to be emptied for the pipe to be repaired and then refilled with water. These are the most common damages leading to water waste, occurring at least 4-5 times a year. The piping network is old (from 1964), so if there is a damage in a radiator or a severe leak an entire level of classrooms (leading up to 47) has to be emptied and refilled. In the new classrooms, each piping network is isolated so if a damage occurs, not as much water has to be used.

At least once a month, the Technical Services conduct checks searching for irregularities in water consumption. These checks, allow the tracing of external damages leading to leaks that waste almost 1m3 per day. If a student sees a damage, s/he can inform the security at the gate, and they will inform the electrician who is on call until 22:00.

As the representative of the Gardening Services explained, the gardeners use two systems for watering the plants, the first one works with electricity and the second one with batteries. We do not know the exact number of automated systems that are installed around the campus but we know that they have approximately 35 computer systems with batteries. These systems present more often malfunctions than the ones with electricity, because when the battery runs out while they work they do not stop. For that reason, the gardeners must check the automated systems every day. The automated water meter systems and automated irrigation systems may have malfunctions but it is more difficult to detect them, because they are installed underground. For such malfunction, they should check the water meters and see if they have different numbers with previous months. Every fifteen days, the gardeners should observe the automated systems from the moment they start until they finish, to see if they work correctly and check for potentials leaks. If there is a leak that they cannot fix themselves, they need to contact the technical services.

The Cleaning Services face leaks in the sink, showers and in the toilet. Cleaners must report immediately the problems, such as leaks, to the Technical Services and then they resolve the problem instantly. If they cannot fix the leak directly, they cut the water in that part of the bathroom.

CHEMICALS

The Gardening Services informed us the spring/summer period, there is a need to water the plants more regularly and spray the trees with biological chemicals for caterpillars. They have instructions not to use chemicals inside the campus because Deree has many students and faculty members and their lives would be put at risk.

Also, the Cleaning Services (ISS) provides employees with the excellence program that respects the environment, reduce the use of chemicals, and provides good equipment. All cleaning chemicals are from Johnson and Johnson. They use chlorine, Sani for the bathroom, Asset for the floor etc. They do not use chemicals irresponsibly. Nevertheless, there is no reuse of wastewater, they dispose the water only into drains.

BEHAVIORS

The only source concerning water use behavior come from the questionnaire we distributed. The first question "please, indicate how often you use/do the following every day?" (appendix 9) may be considered vague, but we provide the results below assuming respondents understood it referred in behavior on campus. For the points about "washing your hands", "washing your face" and "brushing your teeth", the answers were 67 for 2-3 times/day and for more than 4 times/day, 78 never, and 108 never respectively. Results concerning other water use on campus daily are as follow; 138 of the respondents do not use the showers at the gym at all, 8 use them once/day and 4 use them 2-3 times/day; 140 respondents do not use the showers at the pool and 10 use them once/day; 73 respondents use the campus toilets 2-3 times/day, 55 use them more than 4 times/day, 27 use them only once/day and 2 do not use them at all; 61 do not use water coolers around campus, 35 use them 2-3 times/day, 30 use them once/day and 27 more than 4 times/day.



Bar Chart of Daily Habits on Campus

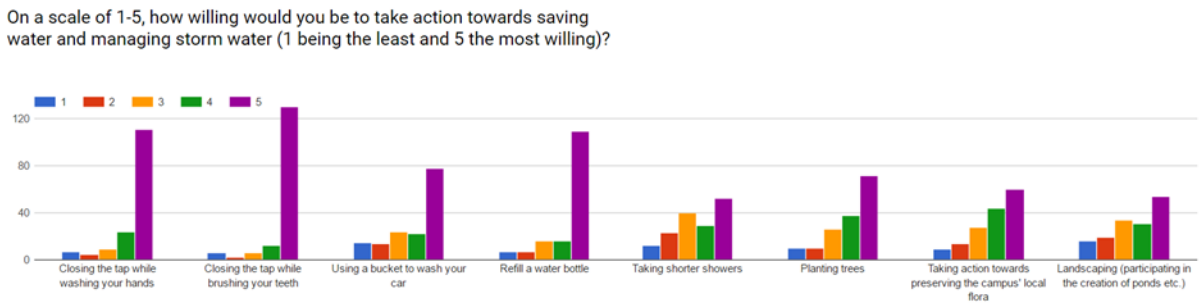
The results concerning the gym showers are contradictory to the Athletics Office data showing that students have the highest level of visits. However, our sample is too small related to Deree students' population and it is important to note that not all gym users take showers there, such those living close to campus and prefer to take their shower at home. Results regarding pool showers are in line with Athletics Office data that show high activity by Sports Academies rather than students. The high

frequency of using campus toilets prove large amounts of water waste through the flushes and taps, considering that conservation measures are not implemented in all toilets.

We have also included two questions that address regular habits off campus too. The first is "Which of the following do you do at your home?" (appendix 5). The results show that only 12 respondents occur as having it a habit taking 5 minutes-long showers; 44 do that rarely, 42 sometimes, 28 most of the times and 24 never. 60 people responded they take 10 minutes-long showers most of the time, 40 sometimes, 26 always, 17 rarely and 8 never. When washing their hands 45 always close the tap, 30 do that sometimes, another 30 most of the time, 26 rarely and 25 never. When washing their teeth 93 always close the tap, 29 most of the time, 16 sometimes, 3 rarely and 14 always leave the water running. In the question if they fill the bathtub to take a bath 2 of the respondents answered they always do, 105 never and the rest are between rarely and sometimes. When washing their car, 101 never use a hose, but it might also mean that they do not own a car, since we did not have that option. From the rest, 25 rarely use a hose, 14 sometimes, 7 always and 4 most of the time. These responses are not promising even for that small sample and prove that respondents are unaware of the water waste from taps per minute or they do not realize the importance of their small impact on world's water from these daily activities. The second question on water use habits addressed the frequency of the above (appendix 6). 57 respondents take 5 minutes-long showers once/day, 31 once/week and 21 once every three months. 74 of the respondents take 10 minutes-long showers once/day and 36 once/week. 127 respondents wash their hands twice or more/day, 24 once/day and 2 once/week. 110 respondents brush their teeth twice or more/day and 41 once/day. 100 wash their car with a hose once every three months or more, 13 once/month, 4 twice or more/month, 5 once/week and 4 once/day. 4 respondents fill the bathtub to take a bath every day, 7 once/week, 5 twice or more/month, 5 once/month and 103 once per three months or more. The answers to this question underline the significant influence individuals have on the issue of water scarcity, because we do such minor activities requiring water on a regular basis.

PERCEPTION

The final part of our questionnaire addressed the perception on water waste. Interestingly, the majority of respondents did not realize any water waste on campus (appendix 7). However, the largest part of our sample stated they are truly willing to take action in saving water (appendix 8), so educative activities are more likely to have a positive impact. In contrast to the Water Audit of 2012, when "42% claimed to be definitely willing to participate in water saving practices undertaken by the College", in our 2017 survey, the percentage has gone up by almost 10%, with an average of 52,6% claiming most willing to take action towards saving water and managing stormwater (13, appendix 8).



Bar Chart on Willingness to Take Action

The Athletics Department Director clearly expressed his willingness to contribute in the process of raising awareness for water use. He explained that the Department has touched several other sensitive issues through their social media and by organizing events, speeches, friendly games and whole months dedicated to a cause, to educate, raise awareness, raise and donate money. Such efforts include relevant signs in teams' uniforms, the Relay Marathon, the activities during October that is annually dedicated to breast cancer and a friendly game with the Greek national homeless team to raise awareness on their magazine, Schedia, that helps a lot of people through its sales. Moreover, known athletes join Department's events regularly as guests, because of their influence as models. The Director explains that "athletes with ethos are chosen to convey messages especially to the younger ones that are more willing to listen". He believes that such actions are important because of the interaction of the Department with students, who are shaped now as part of the community and are willing to listen and follow directions; "it's up to us to choose the right message".

SUGGESTIONS FOR IMPROVEMENT

Keeping under consideration the results from our questionnaire and interviews we would like to share some suggestions to conserve water and raise awareness concerning water waste. Following our discussion with the Technical Services, it would be water-efficient to install faucet aerators in all the taps and showers of the Agia Paraskevi facilities because the water consumption per minute would be reduced to 1/3. In the bathrooms, installing low flow aerator valves would lead to the reduction of water consumption in the flushes. Button taps and showers should be installed all over the campus to monitor the duration of water release. The pool water that is stored after dichlorination could be used in gardening or cleaning activities such as mopping the floors on a regular basis. To avoid water waste in the case of damage in the heating pipes, the older piping network in the classrooms could be replaced by isolated piping systems per classroom. Concerning the gardening services, the watering

systems that work on batteries should be replaced by systems using electricity since when the batteries run out of power the systems are no longer monitored and keep watering until the gardeners notice.

The most important aspect that needs improvement is people's perception on water use reflected by their habits and attitudes. Our creative project is an effort to gather information about the personal and product water footprint, as well as solutions and tips to cut down on water consumption. Thus, its communication to the Deree community through social media and multimedia on campus would raise awareness regarding water waste. We do not suggest printouts of the posters since such a measure is not sustainable. Important influence on individual habits and attitudes can be achieved by departments having direct contact with people and especially the students. Following the example of Cornell and other universities, new students could be briefed about water-saving habits during orientation. Our university could also provide reusable thermoses to all incoming students and allow discounts for the students who use them to buy coffee on campus. The student life center and the athletics department could organize a week dedicated to sustainability and include activities to visualize the water waste relating to everyday habits and info sessions educating individuals how to identify and deal with potential leaks. The College could start a campaign not only to raise awareness but also help an organization in need. Deree could set a water reduction goal and donate the respective amount of money to a non-profit organization.

CONCLUSION

To conclude, the findings of our research have shown that adopting sustainable practices is of outmost importance. Specifically, at Deree, the relevant departments and services are aware of the water conservation practices, however, there is room for improvement. As shown from the questionnaire responses, water conservation is not a vibrant concept in the perception of the Deree community. Therefore, raising awareness should be a priority of the College for its own benefit and society's in general.

Words: 4,312

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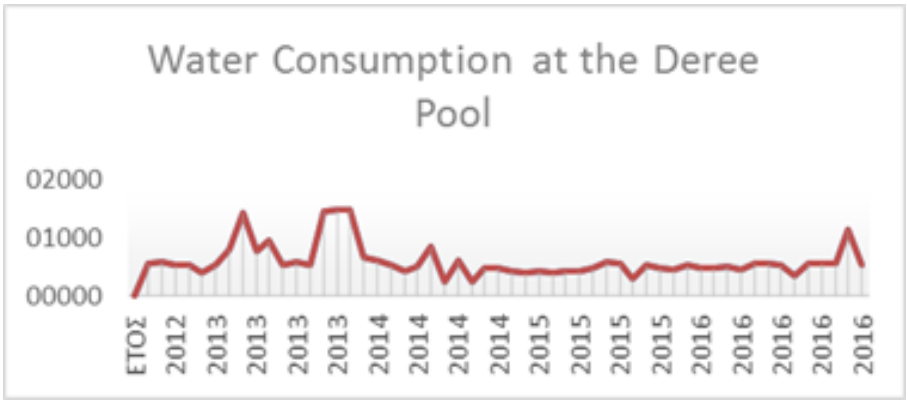
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APPENDICES

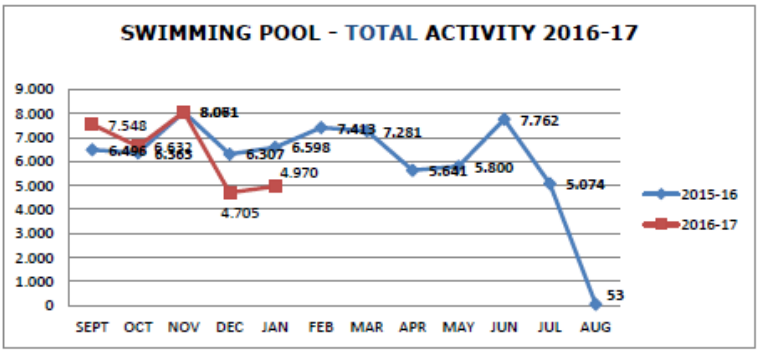
Appendix 1



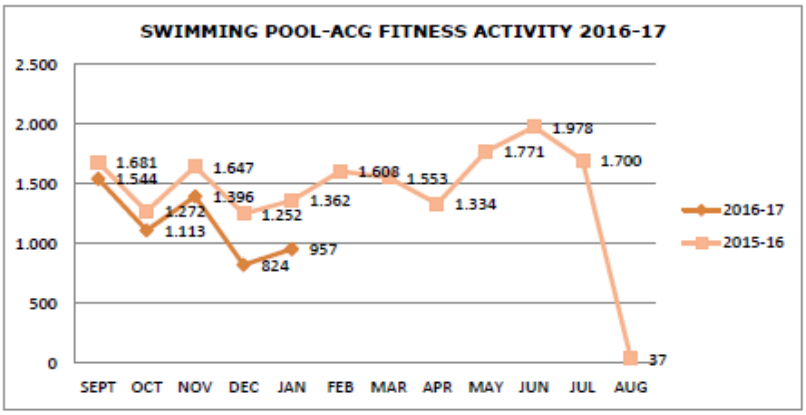
Appendix 2

SWIMMING POOL - ACTIVITY 2016-17

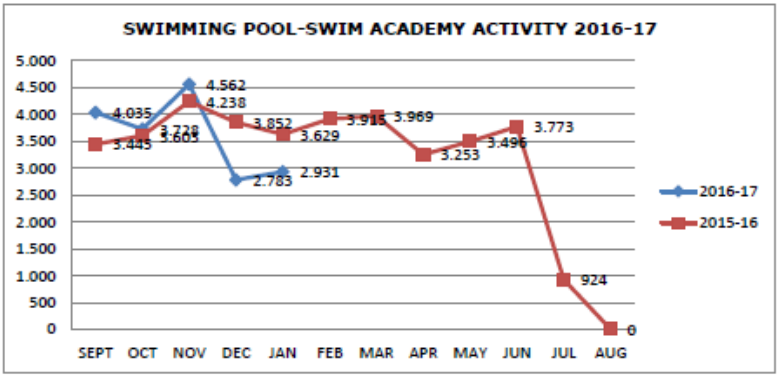
2015-16	TOTAL	2016-17
6.496	SEPT	**7.548**
6.363	OCT	**6.632**
8.061	NOV	**8.071**
6.307	DEC	**4.705**
6.598	JAN	**4.970**
7.413	FEB	
7.281	MAR	
5.641	APR	
5.800	MAY	
7.762	JUN	
5.074	JUL	
53	AUG	
72.849		



2015-16	ACG FITNESS	2016-17
1.681	SEPT	**1.544**
1.272	OCT	**1.113**
1.647	NOV	**1.396**
1.252	DEC	**824**
1.362	JAN	**957**
1.608	FEB	
1.553	MAR	
1.334	APR	
1.771	MAY	
1.978	JUN	
1.700	JUL	
37	AUG	
17.195		**5.834**

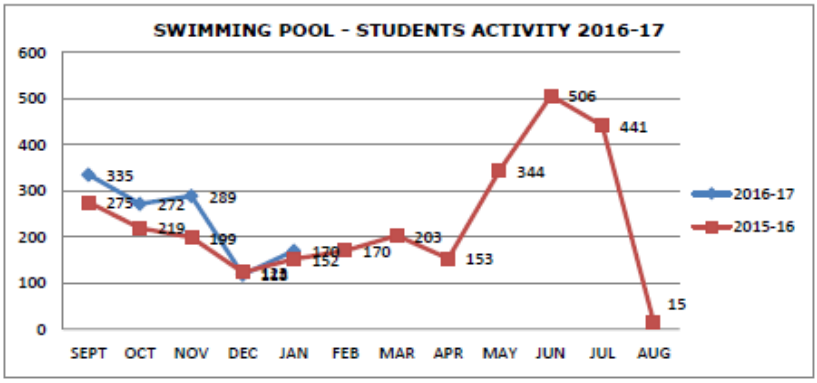


2015-16	SWIM ACADEMY	2016-17
3.445	SEPT	**4.035**
3.603	OCT	**3.728**
4.238	NOV	**4.562**
3.852	DEC	**2.783**
3.629	JAN	**2.931**
3.915	FEB	
3.969	MAR	
3.253	APR	
3.496	MAY	
3.773	JUN	
924	JUL	
0	AUG	
38.097		**18.039**



Theodore Priskomatis
Director of Athletics

2015-16	STUDENTS	2016-17
275	SEPT	**335**
219	OCT	**272**
199	NOV	**289**
123	DEC	**118**
152	JAN	**170**
170	FEB	
203	MAR	
153	APR	
344	MAY	
506	JUN	
441	JUL	
15	AUG	
2.800		**1.184**

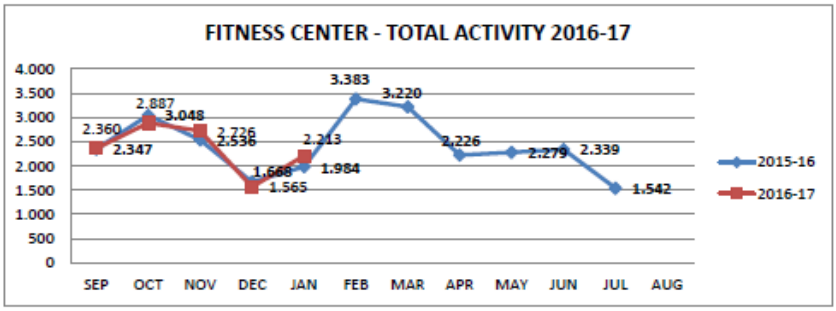


Theodore Priskomatis
Director of Athletics

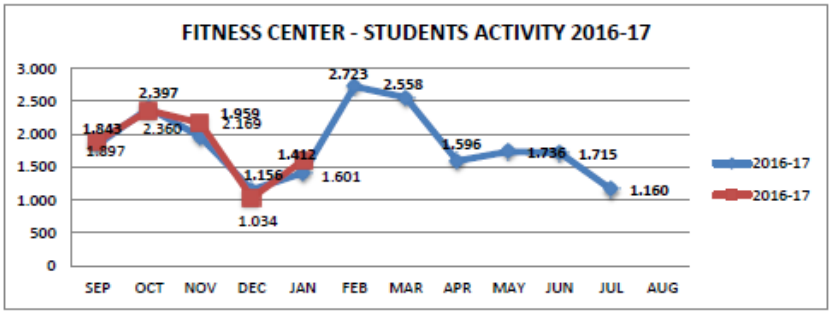
Appendix 3

FITNESS CENTER - ACTIVITY 2016-17

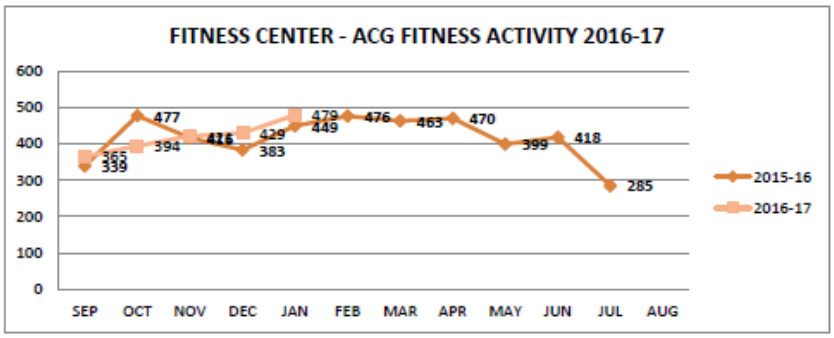
2015-16	TOTAL	2016-17
2.347	SEP	**2.360**
3.048	OCT	**2.887**
2.536	NOV	**2.726**
1.668	DEC	**1.565**
1.984	JAN	**2.213**
3.383	FEB	
3.220	MAR	
2.226	APR	
2.279	MAY	
2.339	JUN	
1.542	JUL	
	AUG	
26.572		**11.751**



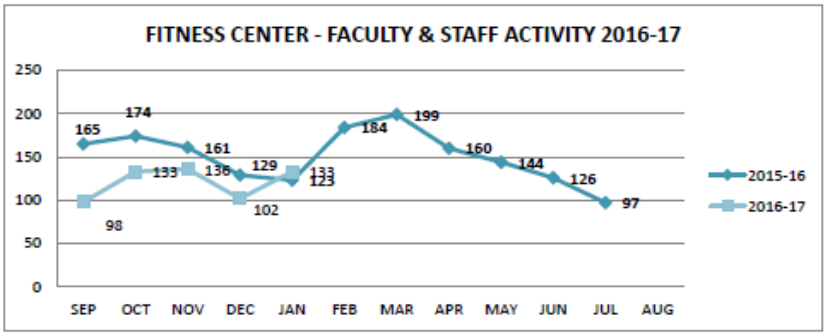
2015-16	STUDENTS	2016-17
1.843	SEP	**1.897**
2.397	OCT	**2.360**
1.959	NOV	**2.169**
1.156	DEC	**1.034**
1.412	JAN	**1.601**
2.723	FEB	
2.558	MAR	
1.596	APR	
1.736	MAY	
1.715	JUN	
1.160	JUL	
	AUG	
20.255		**9.061**



2015-16	ACG FITNESS	2016-17
339	SEP	**365**
477	OCT	**394**
416	NOV	**421**
383	DEC	**429**
449	JAN	**479**
476	FEB	
463	MAR	
470	APR	
399	MAY	
418	JUN	
285	JUL	
	AUG	
4.575		**2.088**



2015-16	FACULTY & STAFF	2016-17
165	SEP	**98**
174	OCT	**133**
161	NOV	**136**
129	DEC	**102**
123	JAN	**133**
184	FEB	
199	MAR	
160	APR	
144	MAY	
126	JUN	
97	JUL	
	AUG	
1.662		**602**



Appendix 4

Deree-The American College of Greece - SWIMMING POOL ACTIVITY (6-year comparison)

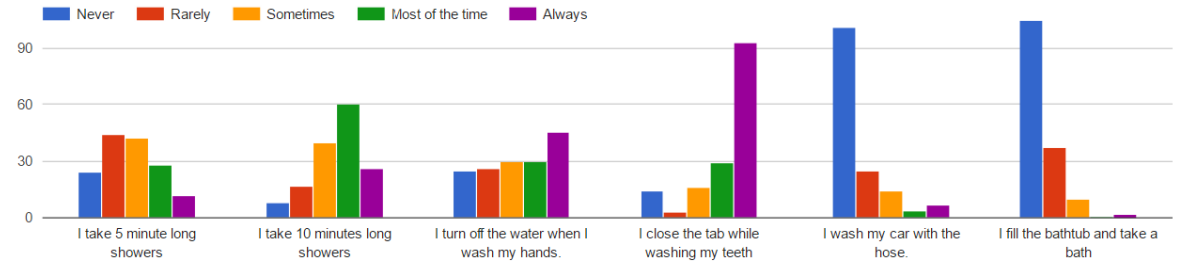
	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	**2016-17**	2016/17-2015/16 (%)
SEP	1.667	2.406	4.703	6.747	6.093	6.496	**7.548**	16,19%
OCT	1.422	2.622	5.287	5.796	5.589	6.363	**6.632**	4,23%
NOV	1.642	3.462	5.853	7.114	6.376	8.061	**8.071**	0,12%
DEC	1.219	2.698	3.989	4.874	5.418	6.307	**4.705**	-25,40%
JAN	1.389	2.699	4.649	6.969	5.551	6.598	**4.970**	-24,67%
FEB	1.484	2.521	4.909	6.449	5.682	7.413		-100,00%
MAR	1.329	3.666	4.778	6.395	6.609	7.281		-100,00%
APR	760	2.229	4.751	4.111	5.034	5.641		-100,00%
MAY	1.329	2.354	4.233	6.434	5.941	5.800		-100,00%
JUN	1.586	4.373	5.519	6.664	7.373	7.762		-100,00%
JUL	1.302	3.549	3.396	4.326	4.507	5.074		-100,00%
AUG	0	0	0	135	166	53		-100,00%
	15.129	32.579	52.067	66.014	64.339	**72.849**	**31.926**	-56,18%

Deree-The American College of Greece FITNESS CENTER ACTIVITY (6 years - comparison)

	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	**2016-17**	2016/17-2015/16 (%)
SEP	1.148	1.479	1.707	1.842	2.254	2.347	**2.360**	0,6%
OCT	1.327	1.829	2.430	2.184	3.103	3.048	**2.887**	-5,3%
NOV	1.084	1.641	1.985	2.143	2.271	2.596	**2.726**	5,0%
DEC	509	938	1.126	1.200	1.555	1.668	**1.565**	-6,2%
JAN	850	1.298	1.922	2.134	2.085	1.984	**2.213**	11,5%
FEB	1.084	1.204	2.226	2.228	3.186	3.383		-100,0%
MAR	1.623	2.743	2.036	2.189	3.411	3.220		-100,0%
APR	868	1.345	1.861	1.508	2.139	2.226		-100,0%
MAY	1.242	2.231	1.561	2.137	2.088	2.279		-100,0%
JUN	675	1.205	1.407	1.822	2.407	2.339		-100,0%
JUL	490	937	1084	1406	1595	1542		-100,0%
AUG	0	0	0	45	142	92		-100,0%
	10.900	16.850	19.345	20.838	26.236	26.724	**11.751**	-56,0%

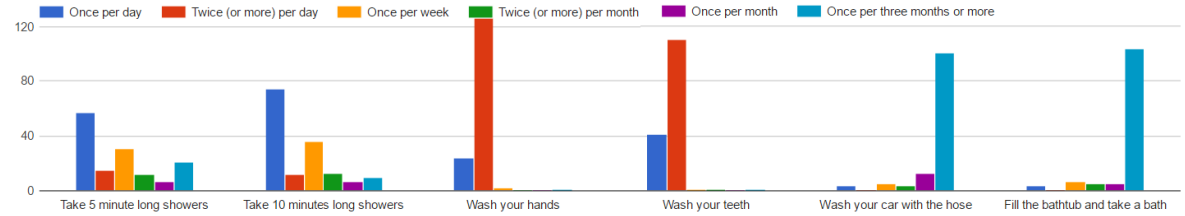
Appendix 5

Which of the following do you do at your home?



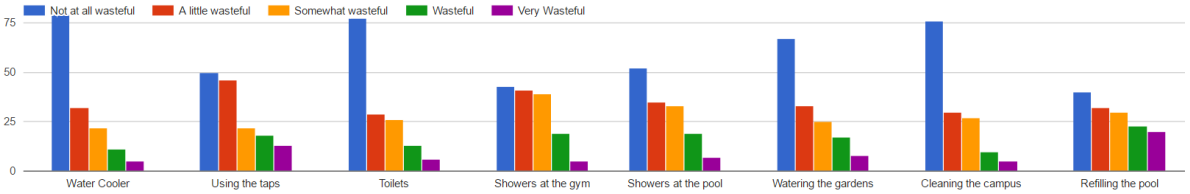
Appendix 6

How often do you do the following at home?



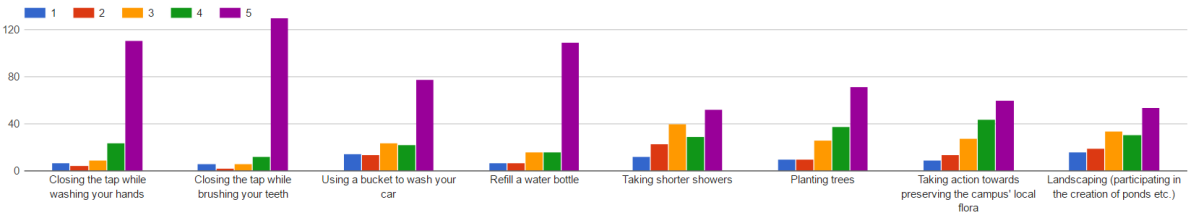
Appendix 7

Please indicate in your opinion how wasteful is each of the following water uses, as they apply to the whole College. Check the appropriate box.



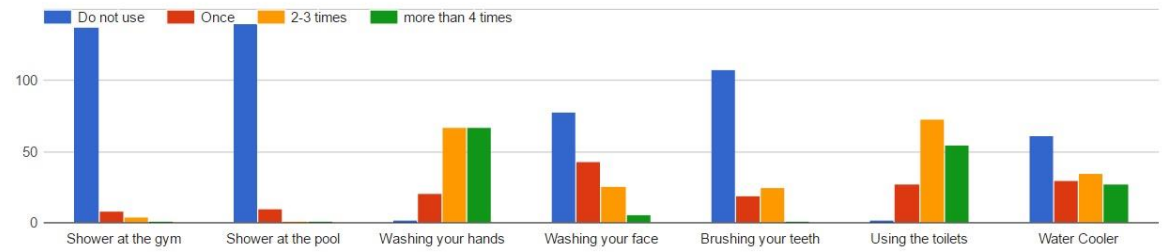
Appendix 8

On a scale of 1-5, how willing would you be to take action towards saving water and managing storm water (1 being the least and 5 the most willing)?



Appendix 9

Please indicate how often you use/do the following every day.



Appendix 10

Technical Services, Interview Schedule

Name of Unit	Technical Services
Responsible person	
Interviewee	
Contact information	
Number of employees at unit	
Date of interview	
Duration of interview	
Location of interview	
Interviewers	Maria Bouchli – Konstantinos Koutsaftis
Questionnaire code	

PRE-INTERVIEW QUESTIONS

1. Are there any available measurements and data before and after the flood?
2. How frequently does ACG take measurements when dealing with rainwater?
3. Has ACG conducted a monthly or yearly comparison with the numbers collected from the measurements?
4. How much quantity of water is being stored weekly/monthly/yearly?
5. What is the cost of maintaining the water management system?
6. What is the cost of the water supply?
7. How much energy is consumed in water acquisition?
8. How much energy is consumed in water distribution?

9. What is the volume of total rainfall runoff?
10. What is the peak outflow rate for the present storm design?
11. What is the volume of the combined sewer flows in the campus area?

12. What is the estimated amount of flood protection benefits (Euros/year) of the current campus infrastructure?
13. What is the cost of the water supply?
14. What is the volume of total rainfall runoff?
15. What is the peak outflow rate for the present storm design?
16. What is the volume of the combined sewer flows in the campus area?

17. What is the estimated amount of flood protection benefits (Euros/year) of the current campus infrastructure?

18. What quantities of stored rainwater are used for gardening purposes?
19. How much water have you used for irrigation in the past from the drill?

STORMWATER MANAGEMENT

MEASURES IN PLACE

1. What were the measures before the flood (we will explain in which flood we are referring to – probably we will need a date). Have there been any corrective measures/new infrastructure after the flood?

Measure	**Description**	**Study**	**Effectiveness on a scale of 1 – 5**	**Cost in €**

1. Has ACG experienced another flood or leaks of a big magnitude since then? If so, have the measures taken by ACG been successful?

YES:	
NO:	

2. Has ACG focused its attention on certain, more vulnerable areas of the campus? If so, which are these areas and what has ACG done to protect those areas from flooding? (we will need the map of the campus so we know exactly which areas those are and what changes have been made)

Area	**Description**	**Measure**	**Effectiveness on a scale of 1 – 5**	**Cost in €**

RAINWATER STORAGE AND MANAGEMENT

1. Is rainwater being stored and reused? If so, how is it being collected and reused?

YES:	
NO:	

2. Are there certain policies that ACG has implemented for rainwater management?

Policy	**Department**	**Description**

3. Are the services of ACG trained and knowledgeable enough upon this subject?

YES:	
NO:	

RAINWATER TREATMENT

1. Is the stormwater being treated?

Type of treatment	**Description**	**Cost in €**

2. Do you think the annual budget would allow for other investments towards the prevention of flooding or storage and reuse of rainwater?

YES:	
NO:	

3. Are there any economical or other kind of constraints that do not allow the college from taking certain measures?

YES:	
NO:	

4. Is the municipality and the surrounding community offered any assistance in any way?

YES:	
NO:	

5. How would the faculty members (including students and others) help the college with rainwater management?

Option 1:	**Details:**
Option 2:	**Details:**

WATER AUDIT

1. Has Deree taken any measures to reduce water waste around the campus?

Measure	**Description**	**Study**	**Effectiveness on a scale of 1 – 5**	**Cost in €**

2. Did Deree conduct measurements prior and after these measures to compare the numbers regarding water waste?

YES:	
NO:	

3. Where are the two clocks that count water waste located? Are they separate for Pierce/Deree?

CLOCK 1	
CLOCK 2	

4. What is the difference between Pierce and Deree regarding water waste?

PIERCE:	
DEREE:	

5. What is the difference in water waste when comparing winter/summer months?

SUMMER:	
WINTER:	

6. Does ACG have systems in place to reduce water waste? And if so, where? Are they effective? Have they reduced the water waste significantly? How many liters per minute are saved?

Measures	Water Reduction (1-5)	Liters saved per minute per measure (app)	Effectiveness Rate (1-5)	Cost in € (app)
Faucet aerators				
Specialized pedals for the faucets				
Time sensitive water release mechanisms				
Other				

7. Have there been any recent malfunctions that led to a waste of water? Are malfunctions common? If so, how often do they occur?

Malfunctions	Frequency (1-5)	Cost in € (app)
Flooding from a broken pipe		
Running faucet		
Problematic pedal		
Watering system error		
Other		

Appendix 11

Gardening Services, Interview Schedule

WATER MANAGEMENT (USES, SOURCES, CONSUMPTION, ISSUES)

1. What quantities of water are used for gardening purposes?

QUANTITIES	

2. Does ACG have automated systems to water the plants?

YES	
NO	

3. Do those systems/system have settings for water save?

YES	
NO	

4. Have these systems presented any malfunctions that have led to the waste of water?

YES	
NO	

5. Are malfunctions common?

YES	
NO	

STORMWATER MANAGEMENT

1. What observations have you made after heavy rain-flooding?

OBSERVATIONS	

2. Which are the areas of the college that are more vulnerable to flooding according to your observations?

CN BUILDING	
DC BUILDING	
GYM	
POOL	

3. Is ACG dealing with the floods accordingly?

YES	
NO	

4. How is the rainwater being collected and stored?

COLLECTED:	**STORED:**

5. What is the capacity of the rainwater storage system?

6. Is rainwater being used for gardening purposes?

YES	
NO	

7. What quantities of stored rainwater are used for gardening purposes?

8. How much water have you used for irrigation in the past from the drill?

POLICY

1. Do you have any knowledge of the college's water and stormwater management policies?

WATER AUDIT	STORMWATER
YES	
NO	

FUTURE PLANS

1. Do you have any suggestions for the improvement of the college's dealing with issues concerning water and rainwater management?

WATER AUDIT	STORMWATER
YES	
NO	

Appendix 12
Cleaning Services, Interview Schedule

WATER (USES, SOURCES, CONSUMPTION, ISSUES)

1. Which are the source/sources from which you take the water to use it for cleaning purposes?

EYDAP	
UNDERGROUND DRILLS	

2. Where do you dispose the water?

TOILETS:	
GROUND:	
OTHER:	

3. Do you reuse the water?

YES:	
NO:	

4. What kind of chemicals do you use when cleaning? Are those chemicals biodegradable?

5. Have you observed during your work in the campus any water leaks? If yes are water leaks frequent?

YES:	
NO:	

6. Have you observed any other issues concerning ACG's water management practices, that may be problematic?

YES:	
NO:	

STORMWATER MANAGEMENT

1. What observations have you made after heavy rain-flooding?

OBSERVATIONS:	

2. Which are the areas of the college that are more vulnerable to flooding according to your observations?

OPENAIR THEATER:	
ON THE WAY TO THE GYM:	
UNDER THE POOL:	
OTHERS:	

3. Is ACG dealing with the floods accordingly?

YES:	
NO:	

POLICY

1. Do you have any knowledge of the college's water and stormwater management policies?

	WATER AUDIT	STORMWATER
YES:		
NO:		

FUTURE PLANS

1. Do you have any suggestions for the improvement of the college's dealing with issues concerning water and rainwater management?

	WATER AUDIT	STORMWATER
YES		
NO		

Appendix 13
Athletics Department, Interview Schedule

1. For what purposes and in which places on campus does the A.D. use water? Is the track and the pool included and how?

Places/purposes	UL Gym	LL Gym	Pool	Courts	Track
Showers (how many approximately)					
Toilets					
Maintenance					

2. In places under the responsibility of the A.D. who has access to use water and how?

	Personal Use	Department Use
Staff/Faculty		
Students		
Guests		
Teams		

3. Are there any rules related to water management? In which places (e.g. showers)? To whom they are addressed (e.g. teams, employees)?

	Rules	Place
Teams		
Stuff		
Guests		

4. Does the A.D. raise awareness in saving water? If yes, how and to whom?

Yes	
No	

Posts	
Campaigns	
Announcements	
Other	

5. Considering the communication of the A.D. with different, but certain groups (students, teams, guests, faculty & stuff),

a. Do you think it could affect people's perception on saving water?

Yes	
No	

b. Do you think it could bring successful results in reducing college's water use?

Yes	
No	

6. Would you be interested in taking action to raise awareness in saving water on campus? If yes, what would you do?

Yes	
No	
How	