THE RESPONSE OF MANAGEMENT AT TWO TERTIARY EDUCATION INSTITUTIONS IN SOUTH AFRICA TO WATER CONSERVATION RECOMMENDATIONS

Prepared by Mark van Druten

A research paper submitted to the Department of Environmental and Geographical Science, University of Cape Town, in partial fulfilment of the requirements for the Master of Philosophy degree

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LIST OF ACRONYMS

CMA	Cape Metropolitan Area
CMC	Cape Metropolitan Council
EEU	Environmental Evaluation Unit
UCT	University of Cape Town
US	University of Stellenbosch

GLOSSARY

Water Meter	An instrument for measuring and recording the volume of water passing a given point.
Retrofit	The replacement of parts in an existing plumbing fixture or water-using appliance in order to improve its operational efficiency.
Water-use Audit	A systematic accounting of water uses by end users (residential, commercial or industrial), often used to identify potential areas for water reduction, conservation, or efficiency improvement.
Water Demand Management	Measures, practices or incentives deployed by water utilities to permanently reduce the level or change the pattern of demand for a utility service.
Water fixtures	Appliances or devices that require water for their operation.

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Osman A. Sankoh (Editor-in-Chief)
Department of Statistics
Environmental and Ecological Statistics
University of Dortmund
PO Box 500 500
D-44221 Dortmund
Germany

E-mail: sankoh@statistik.uni-dortmund.de

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Mark van Druten
2nd year Masters student
Department of Environmental and Geographical Science
University of Cape Town
South Africa

ABSTRACT

This paper presents the results of an investigation of two case studies at tertiary education institutions in the Western Cape of South Africa, in which water audits were implemented. The two institutions are the University of Cape Town and the University of Stellenbosch. The study was initiated following the poor response of one institution to water conservation recommendations.

This study emanates from the findings of a more comprehensive Baseline Report, which highlighted the fact that many public organisations and institutions posses the potential for water and cost savings which could be realised by implementing viable water-use audit recommendations. Furthermore, there is growing support and need for improving water-use efficiency due to the ever-increasing demand and limited supplies of water in the Western Cape and South Africa in general.

The University of Cape Town was found to be 'unsuccessful' in implementing a set of water conservation recommendations, which resulted from a comprehensive water-use audit on the premises. Finance was not provided for the full implementation and although some devices have been retrofitted, it continues on an ad-hoc basis. Conversely, the University of Stellenbosch has 'successfully' implemented recommendations that were made as a result of a small-scale water-use audit. The University of Stellenbosch study was far less comprehensive and aimed at retrofitting the toilets with more water efficient devices. Despite initial scepticism, a successful trial run was sufficient to convince the management to retrofit all of the toilets in the student residences.

Important factors that are likely to result in the implementation of water conservation recommendations include:
(1) Appropriate and accurate recommendations from a professional perspective; and
(2) Management support and the associated provision of finance.

These factors underpin the relative 'success' at the University of Stellenbosch.

Finally, based on discussions with water-use auditing experts, it was concluded that the problems experienced at the University of Cape Town are not unique to the field of water conservation. Water conservation is not a priority of many institutions despite the impending shortages. Furthermore, pure financial savings are not always sufficient to encourage a change to more efficient practices. This can be attributed to the relatively small amounts involved and the associated low price of water.

1. INTRODUCTION

1.1 REASON FOR THIS STUDY

This study emanates from the findings of a more comprehensive Baseline Report entitled "*An Assessment of Water Demand Management and the Attitudes, Perceptions and Practices of Large Potable Water Consumers within the Cape Metropolitan Area*" (Allison *et al*, 2000). The Report concludes that many organisations within the Cape Metropolitan Area (CMA), particularly some of the public institutions, posses the potential for water and financial savings. The Report suggested that many of these savings would be possible following a water-use audit at the premises and the implementation of viable recommendations. Furthermore, increasing demand for water and diminishing supplies as mentioned in the Baseline Report, make water savings a crucial practice for the region and South Africa.

It is within this context of a growing support and need for improving water-use efficiency that two local water-use auditing case studies are investigated. These two institutions were chosen for the investigation due to the fact that they responded differently to water conservation recommendations that were made as a result of a water-use audit. The first case study is the University of Cape Town (UCT) and the second, the University of Stellenbosch (US). Both are tertiary education institutions operating in the Western Cape of South Africa and they are in close proximity to one another. UCT falls within the boundaries of the CMA whilst US is just outside of this boundary. A map showing their geographic position with respect to the CMA is shown in Figure 1.1.

UCT undertook a water-use survey on its premises in 1996/ 97. This was a comprehensive water survey focussing on a number of objectives pertaining to UCT's water use. The Environmental Evaluation Unit (EEU), from the Department of Environmental and Geographical Science at UCT, was primarily responsible for conducting this survey.

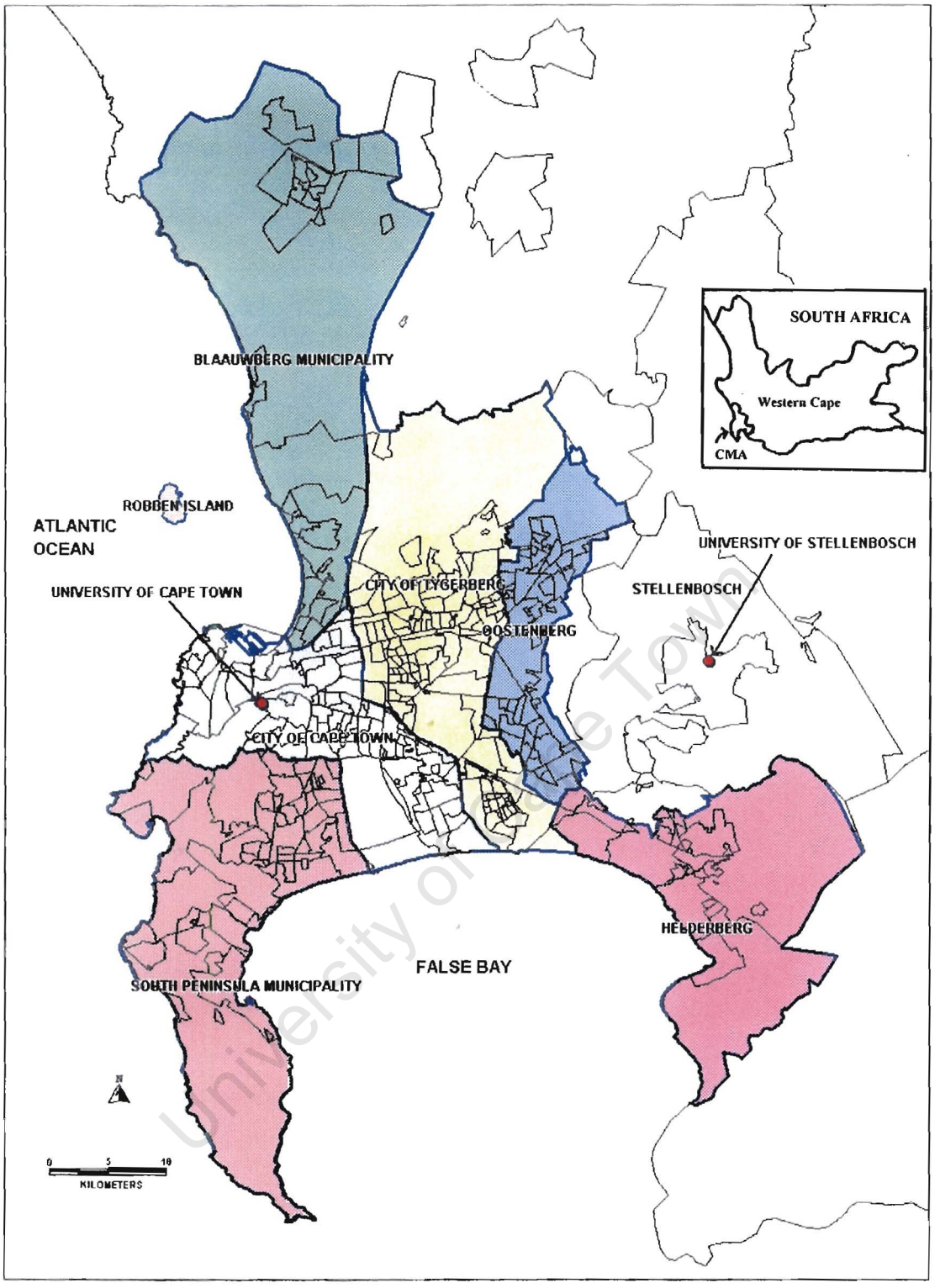

Figure 1.1: Geographic position of the University of Cape Town and the University of Stellenbosch. (*Source: GIS Department-City of Cape Town Municipality, October 2000*)

Note: The Cape Metropolitan Area is comprised of six municipalities.

As a result of the findings of this survey, recommendations were made to UCT. Calculations showed that UCT could save between R 480 000 and R 590 000 per annum with appropriate water retrofitting actions. Financial payback periods were short and ranged from 9 months to 27 months, yet little has been achieved since the report was completed.

Conversely, US investigated the suitability of retrofitting toilets and urinals in the residences on campus in 2000. This study was far less comprehensive, yet in 2000 they managed to fund a large toilet-retrofitting programme and next year they plan to continue retrofitting urinals.

So, why has there been a different and more positive response to the water conservation recommendations at US? This question is investigated further in this research paper.

1.2 OBJECTIVES OF THIS STUDY

The objectives of this research were to:

1) Investigate the implementation of the UCT and US Water-use audit recommendations taking note of the particular water-use audit that was performed in each case, the decision-making process that followed and the practical implementation of the recommendations to date;
2) Evaluate the factors which contributed to a successful implementation of the water conservation recommendations at US; and
3) Attempt to determine whether the lack of responsiveness by UCT is a common problem in the field of water-use auditing.

1.3 BACKGROUND TO THIS STUDY

The Baseline Report, referred to above, introduced the importance of water resources in general as well as the problem of water scarcity at a broad global level and within South Africa (Allison *et al*, 2000). At a national level in South Africa, a water crisis is looming. This future water crisis is clearly apparent in water supply/demand scenarios for South Africa as shown in Figure 1.2.

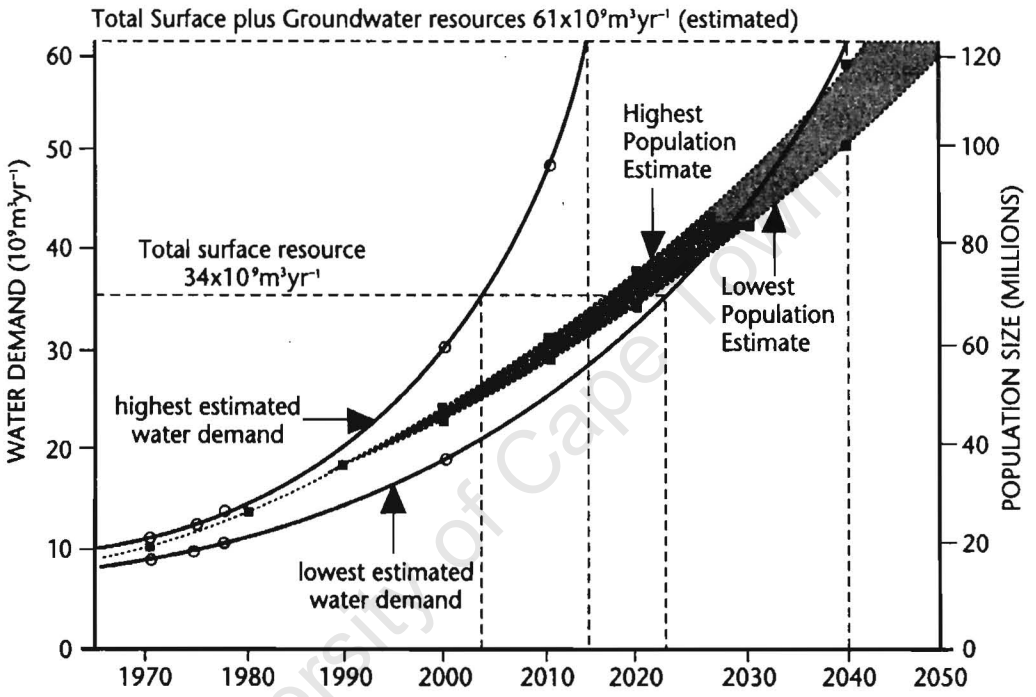

Figure 1.2: The relationship between demand for water and population of South Africa.

(Source: Davies and Day, 1997)

Notes: The two dotted curves represent the fastest and slowest estimated rates of population growth. The two solid curves are the highest and lowest estimates of the amount of water needed to satisfy human requirements. The amount of surface water available is fairly accurately estimated whilst the amount of usable groundwater is based on guesswork.

Firstly, from the figure it is important to note that not all water is in a suitable condition for human use. Some of it is salty whilst some will be needed for maintaining aquatic ecosystems (Davies and Day, 1998). The most optimistic scenario with the slowest estimated population growth and the smallest demand for water shows that all surface water supplies will only be able to meet the demand until 2023. If all surface and ground water is used, the demand can

be met until 2040. With a worst case scenario, with the highest population growth and water demand, supplies are predicted to be exhausted between 2003 and 2015 (Davies and Day, 1998). On a local level, predictions for the CMA are also dire. Surface water resources in the Western Cape are only expected to satisfy the growing demand until 2020 (Ninham Shand, 1997).

A series of articles in local newspapers in the CMA have highlighted impending water restrictions for the year 2000 spring and summer season. In an article in *the Sunday Times Cape Metro* entitled "Water restrictions loom" (Schoonakker, 2000), it was stated that authorities are considering tough water restrictions due to water shortages in Cape Town and the Boland. The rainfall was reported to be below normal in the year 2000 and dam levels were lower than normal. In the Saturday Argus of 28/29 October 2000, a notice appeared from Mr Andrew Boraine of the City of Cape Town Municipality (CCC). It stated that water restrictions would come into effect as of 1 November 2000 and that these restrictions would apply to the City of Cape Town Municipality (CCC- Boraine, 2000). Other Municipalities are likely to follow suit.

The Baseline Report (Allison *et al*, 2000), originated from the Cape Metropolitan Council's (CMC's) study into "*Alternative Options to Meet the Demand for Water in the Cape Metropolitan Region*". This study, commissioned by the CMC, investigated alternatives to the traditional supply augmentation schemes such as dams, tunnels, reservoirs, inter-basin transfers, pipelines and weirs. Based on the future demand and supply predictions it is clear that South Africa's water resource requirements cannot be met by building new water schemes as was the case in the past. Most of the alternatives being considered in the CMC's study fall within the realm of Water Demand Management (WDM). WDM is being viewed as a viable alternative to these schemes due to the fact that substantial amounts of water can be

made available, further augmentation schemes can be delayed and water can be provided in a cost-effective manner with less impact on the environment (Allison *et al*, 2000).

During the Baseline study, selected organisations were audited by the UCT students together with Mr Roy Donovan of Tweeddale Consulting Services and Mr Heinrich Hess of ARCUS GIBB. The students also conducted audits independently on pre-determined organisations within the CMA. Pertinent findings were summarised in the Baseline Report (Allison *et al*, 2000). Some of the pertinent conclusions were:

1. Water-use auditing can determine whether an organisation has the potential to save water and money by applying WDM tools and measures;
2. The savings can be quantified in both volume and monetary terms during such an exercise; and
3. Case studies showed that once water-use auditing recommendations were implemented, substantial amounts of water were saved. WDM measures were typically cost effective and had short payback periods.

Following a number of practical water-use auditing exercises in the CMA, it can be concluded that public-owned buildings provide great opportunities for water saving. Within these buildings, improved maintenance, the retrofitting of inefficient fixtures and staff education programmes are likely to produce substantial cost effective water savings.

In summary, water-use audits were shown to be valuable tools in the field of water conservation, yet the measure of a water-use audit's real success lies in the water savings achieved at the end of the day. If organisations are not willing to implement recommendations then the process is flawed.

1.4 METHODOLOGY

Interviewing Techniques

Very little information has been written on the response of tertiary education institutions to water conservation recommendations. Most of the information obtained for this paper is first hand primary information that was gained from personal interviews with relevant people.

According to Fowler and Mangione (1990), there are two components, which are essential and common to all types of interviews. These are:

(1) The substantive part of the conversation consists of questions and answers; and

(2) The participants have defined, non-overlapping roles: One person asks the questions (the interviewer) and the other answers the questions (the respondent).

The interviews in this report are not based on a sample. They are focussed on specific individual institutions, which may or may not exhibit characteristics similar to other institutions. According to Gorden (1992), interviewing is a particular form of conversation between two people in which one person tries to direct the conversation to obtain information relevant to some specified purpose. Gorden (1992) believes that the skills required for interviewing can be learnt and has developed a Skill Learning Cycle for interviewers, which involves twelve skills. These twelve skills are shown in Figure 1.3 and fall within three phases of the interview, namely the Planning Phase, the Doing Phase and the Analysing Phase. Four of these skills, namely formulating motivating questions, evaluating the response, probing the response and coding information, were considered to be crucial for the series of interviews in this research. However, not all of the skills were strictly adhered to and they formed more of a guideline for the interviewer that a rigid set of rules.

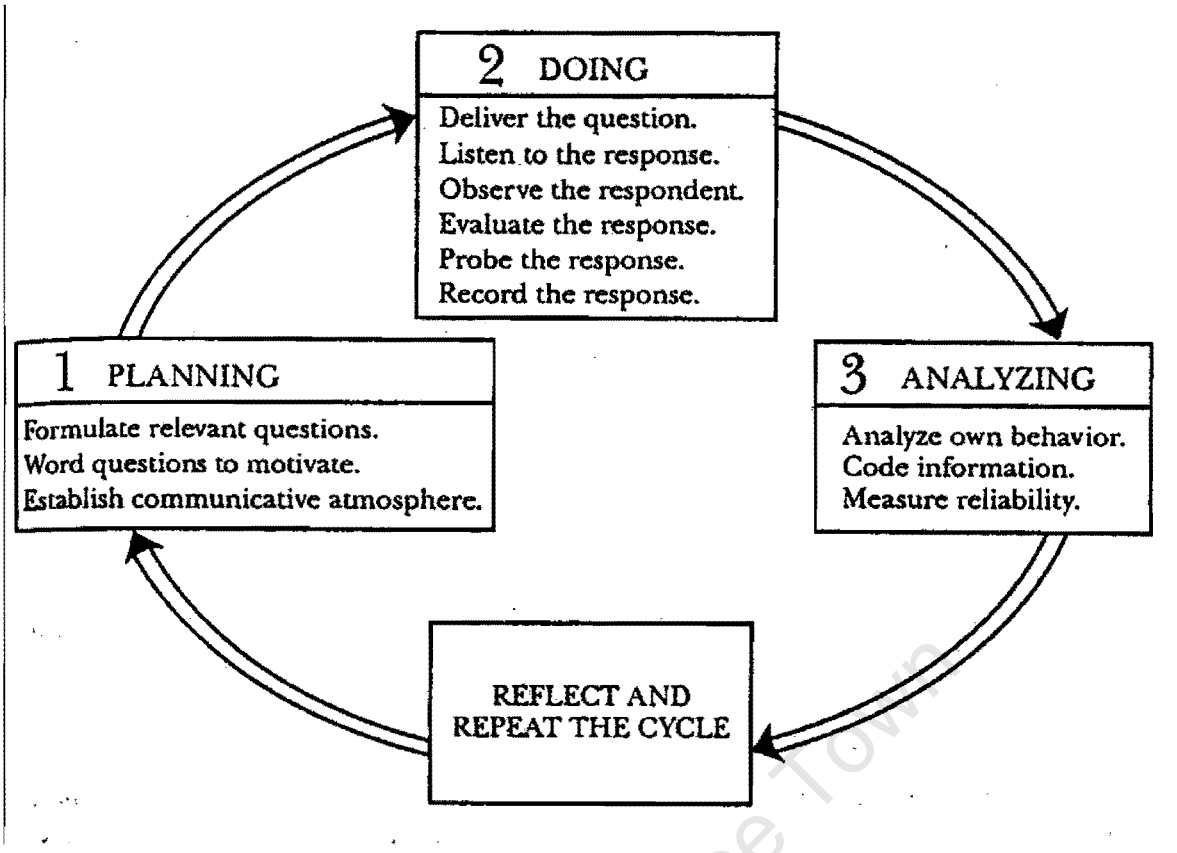

Figure 1.3: The Skill Learning Cycle showing the twelve interviewing skills

(*Source: Gorden, 1992*)

The skill learning cycle was particularly easy to understand and follow and formed the basis for the interviewing that was to take place in this study.

Methodology for Comparison of Case Studies

The two case studies differ slightly from one another, although they are similar in one major aspect; both water-use audits resulted in retrofitting recommendations pertaining to plumbing fixtures for which financial payback periods were calculated. In both studies the financial payback periods were short and financially viable. In comparing the two studies, the focus will be on these retrofitting recommendations. The associated indicators of successful implementation of these recommendations will be:

- Whether or not the management structures approved the recommendations and provided finance for the implementation phase. If the recommendations were not implemented, the reasons for the decision will be presented and discussed.
- The extent to which the recommendations were implemented.

1.5 LIMITATIONS

A major limitation is the lack of theory and research in this field of work.

1.6 PLAN OF DEVELOPMENT

The paper begins with a presentation of the results of the investigation of the two case studies. Each study is described, the relevant decision making process elaborated on and finally the progress to date is noted. The discussion section which follows, focuses on the response to the recommendations as well as the differences between the two case studies.

This paper is aimed at assisting future water conservation initiatives in the field of water-use auditing in South Africa. Although the research is focussed on two public higher education institutions in close geographic proximity to each other, it is likely that many of the lessons learnt will be generic to this field of work particularly with similar public sector organisations.

2. THE RESPONSE OF MANAGEMENT AT UCT TO WATER CONSERVATIONS RECOMMENDATIONS

A summary of the findings and recommendations of the 1996/97 Water-use survey conducted at the University of Cape Town is presented in this chapter. This is followed by a discussion on the relevant decision making process with respect to these recommendations as well as the actual recommendations that have been implemented to date.

2.1 UCT WATER-USE SURVEY

Between March 1996 and February 1997 the Environmental Evaluation Unit (EEU), of the Department of Environmental and Geographical Science at UCT, conducted a water-use survey at UCT. The EEU was tasked by the UCT Environmental Conservation Committee and the report was presented to the Environmental Planning Sub-Committee of UCT (Environmental Evaluation Unit, 1997). The study area included Upper, Middle and Lower Campuses; all university residences; the Baxter Theatre; the Medical School Campus; the Hiddingh Campus and the Graduate School of Business (Environmental Evaluation Unit, 1997). The EEU was required to:

(1) Determine how much water is being used at UCT;

(2) Determine where and how it is used;

(3) Gain a preliminary understanding of attitudes and behaviour patterns at UCT, to water use;

(4) Make a critical appraisal of the horticultural and irrigation practices and policies at UCT;

(5) Make recommendations as to how and where UCT can conserve water; and

(6) Provide the conceptual basis for, and suggested timeframe, for future annual water audits at UCT.

Point number 5 is most applicable to this report as it refers directly to water conservation opportunities at UCT. These recommendations will form the focus of this chapter.

In 1996, UCT used 501 465.4 kilolitres of water costing R 1028 004. Automatic flushing urinals and Cooling Towers were found to use large proportions of water at UCT (Environmental Evaluation Unit, 1997). The greatest immediate water saving potential at UCT was presented in replacing water-wasting devices with more efficient alternatives. In this regard, the following recommendations were presented:

- Replace regular flush toilets with Dual-flush toilets

  Dual-flush toilets allow for both low volume flushes and large volume flushes and can use up to 67% less than traditional 11 litre full flush cisterns. Calculations were done based on 20 000 people using a toilet twice a day for nine months of the year (excluding weekends, public holidays and student holidays). It was calculated that a 60% saving in water would save UCT approximately 64 800 kilolitres and R 130 248 per year. The cost of the retrofit would be approximately R 293 550 with a payback time of 2.25 years.

- Retrofit automatic flush urinals with manual push-button flush valves

  This represents the greatest single water saving opportunity at UCT. Automatic flush urinals use an estimated 40% of the total amount of water used at UCT. The retrofit was calculated to cost approximately R346 500. Based on an experimental retrofit in a building at UCT, potential savings range from R 348 947 (170 218 kilolitres) to R462 936 (225 823 kilolitres) per year. Payback time ranges from 4 months to 17 months.

- Fitting flow restrictors/ aerators on taps and showerheads

  These relatively inexpensive devices effectively reduce the output capacity of a tap or showerhead.

- Retrofitting large water cooling devices

  Recycling systems can be fitted to autoclaves and air-conditioning units to save substantial amounts of water.

In terms of the use of and demand for water by the natural components of the study, the following recommendations were made:

- The UCT landscape plan must be re-assessed and water conservation should be one of the major objectives of the plan;
- The current irrigation system at UCT needs to be investigated, and standardised to prevent water wastage;
- Water efficiency should be the main objective of the planting programme;
- The retention of runoff for irrigation use could be improved on Campus. It was recommended that the option of dredging the reservoir be looked at to improve storage volume. It was also recommended that the possibility of building retention ponds be looked at;
- Stormwater canals on upper campus need to be cleared of obstructions; and
- Exotic vegetation needs to be removed to increase runoff from the mountain.

The EEU also recommended that an ongoing multifaceted education campaign be embarked on in 1997. Building supervisors were also targeted as being able to play a vital role in water conservation efforts. Some of their tasks would be to fix small leaks, knowing where to turn the buildings water mains off in the event of a leak, educating staff and students about saving water, to place conservation posters and stickers in appropriate places and to make suggestions to university administration.

Additional water saving recommendations included:

- Setting up a water-waste hotline which would reach a responsible maintenance person or office that can act immediately on calls;
- Improvement in accountability of water use at UCT. This could be achieved via an effective awareness campaign; and
- UCT should have a stated aim of being the "best environmentally managed" campus in Africa.

A list of guidelines for new buildings at UCT was also provided, pertaining to water savings. The EEU also called for the appointment of an Environmental Manager at UCT. The EEU believed this to be absolutely vital to the successful implementation of conservation initiatives. Lastly the EEU recommended that UCT make a commitment to reduce its water consumption by 50% by the end of the year 2000.

2.2 DECISION MAKING PROCESS WITH RESPECT TO THESE RECOMMENDATIONS

Properties and Services at UCT have limited access to funds for this sort of work. This is coupled with fact that Properties and Services have limited management time available for the implementation of the recommendations provided in the report (B. Duncan-Smith *pers. comm.*). However, Mr Geoff de Wet who is Head of the Physical Planning Unit at UCT says that the extra work required to implement the recommendations could be built into job descriptions of relevant personal (G. de Wet *pers. comm.*). According to Mr Basil Duncan-Smith there is also no authority from the 'upper echelons' to do this sort of work. Mr Chris Briers, Facilities Project Engineer at UCT, agrees with this and says that there is limited access to funds and there are no in-house people to do the work (C. Briers *pers. comm.*).

Funding has not been granted by the UCT Finance Committee from the UCT Budget for this sort of work according to Mr Alex Hurter (A. Hurter *pers. comm.*), former member of Environmental Planning Sub-Committee of UCT. Mr Geoff de Wet says that the Physical Planning Unit made an initial proposal to access funding from the General Operating Budget of UCT. The proposal failed and UCT Finance Committee was not interested in the idea of paying out large amounts of capital. He said that it is short sighted of the university not to invest in retrofitting programmes due to the increasing cost of water. The Finance Committee has a major influence in the 'shape' of the budget including which proposals are able to access funds from the General Operating Budget (G. de Wet *pers. comm.*).

Mr Peter Grant, former Acting Deputy Finance Director of UCT, was contacted in this regard. He says that it is the responsibility of Properties and Services to allow for money from their own budget allocation for this sort of work. Properties and Services has to establish their own list of priorities and work out whether the water-use survey recommendations are important enough to receive an allocation from their budget. In other words the decision would be an internal one from Properties and Services (P. Grant *pers. comm.*). Mr Chris Briers does not agree with this and says that Properties and Services do not get a lump sum budget to do as they please with. They have to submit a budget request to the Finance Committee. This budget would include a water consumption budget as well as capital requests for improvements such as water saving ideas. Finance for the retrofitting has not been approved (C. Briers *pers. comm.[2]*).

When asked whether the UCT Finance Committee would ever consider borrowing money for this sort of work where the payback periods are financially viable, Mr Grant said that the university would not borrow money from a lending institution unless the figures were significant, in other words in the millions of Rands (P. Grant *pers. comm.*).

An important change that has occurred since the report was written is the fact that Building Supervisors are no longer present at UCT (G. de Wet *pers. comm.*). Each building now has a curator. The curator's duties are presently being discussed at meetings at UCT. It is expected that one of the curator's duties will be to monitor the water wastage status of their building (G. de Wet *pers. comm.*).

2.3 PRACTICAL IMPLEMENTATION OF RECOMMENDATIONS TO DATE

Very little has happened since the results of the UCT water-use survey were handed to the Head of the Physical Planning Unit, Mr Geoff de Wet. Retrofitting does take place on a small scale but typically on an ad-hoc basis where problems arise in a system (B. Duncan-Smith *pers. comm.*). Mr de Wet says that fixtures are only replaced if they break down (G. de Wet *pers. comm.*). For example, an automatic flushing urinal will be replaced with a manual water efficient design only if the particular building is being renovated or the urinal is faulty. In other words the retrofitting is not initiated by the potential to save water. Mr de Wet agrees with Mr Duncan-Smith and says that the overall retrofitting programme has not progressed well.

According to Mr Duncan-Smith, the cooling towers in the Robert Leslie Building are currently being retrofitted with more water efficient devices. A Total Dissolved Solids control is being installed which has been shown to be highly water efficient (B. Duncan-Smith *pers. comm.*). However, Mr Briers says that there is no funding to retrofit all of the water cooling towers with water efficient units even if the retrofitting will prolong the life of the equipment and be financially viable (C. Briers *pers. comm.*).

In terms of dredging the reservoir, there is a grid of drainage pipes at the bottom of the reservoir, which would be damaged if dredging was to take place. UCT is however presently

considering the possibility of removing the sludge to increase capacity in another way (C. Briers *pers. comm.*).

An Environmental Manager has not been appointed at UCT (C. Briers *pers. comm.*) and no 'driver' has been appointed for the water conservation programme (B. Duncan-Smith *pers. comm.*).

It was later established that the toilet retrofitting costs were much higher than previously estimated (C. Briers *pers. comm.*). Even though the cost estimates were inaccurate the payback periods are still financially favourable and the replacement would make financial sense (C. Briers *pers. comm.*). The Flush Saver 2000 is currently being checked for suitability at the university (B. Duncan-Smith *pers. comm.[2]*).

Approximately 10% of the automatic flushing urinals have been retrofitted to date (B. Duncan-Smith *pers. comm.[2].*). In terms of the recommendation to install low flow devices and flow restrictors, Mr Chris Briers says that these devices are not practical in public places due to vandalism. He has found that the devices have even been unscrewed once welded in place (C. Briers *pers. comm.*).

The set of water efficient recommendations is being incorporated into all new building designs at UCT. All new buildings are also being connected to separate water meters. This improves accountability for both water use and possible wastage (G. de Wet *pers. comm.*).

A new grass species is being used at UCT, which uses less water (G. de Wet *pers. comm.*). Watering is also more strictly controlled. Watering does not take place while it is raining and over-watering is avoided (B. Duncan-Smith *pers. comm.[2]*). However, nothing has been

done about the clearing of exotic vegetation. Stormwater canals have been cleared in the past but this has not been done recently (G. de Wet *pers. comm.*). A call desk phone number is available for any maintenance or other problems (B. Duncan-Smith *pers. comm.[2]*).

Finally, with reference to the two indicators of successful implementation of recommendations, it can be stated that UCT has been unsuccessful in implementing the water conservation recommendations, due to the fact that:

(1) The management structures have 'partially' approved the recommendations. Finance has not been provided although Properties and Services is retrofitting on an ad-hoc basis; and

(2) Only a fraction of the recommendations have been implemented to date.

The greatest water saving potential at UCT lies in replacing water-wasting devices with more efficient alternatives. Payback periods were calculated for toilet and urinal retrofitting. These payback periods were short and financially favourable despite the inaccuracies discovered later. More than three and a half years after the report was completed, approximately 10% of the automatic flushing urinals have been retrofitted and the toilet retrofit option is still being investigated. Devices are replaced or retrofitted once they break down and not due to their excessive water wastage.

University management cannot agree on the steps required to raise the necessary capital although the majority of respondents believe that the problem is out of their hands and is the responsibility of the UCT Finance Committee. It is for these reasons that the case study has been deemed unsuccessful.

3. THE RESPONSE OF MANAGEMENT AT US TO WATER CONSERVATION RECOMMENDATIONS

A description of the US retrofitting study is presented below. This is followed by the decision making process that took place with respect to recommendations that emerged from this study and the retrofitting actions that have been implemented to date.

3.1 US STUDY

This project, which involved the installation of Multi-flush toilet units, was initiated by Mr Deon Stone of a private company called Aqua Smart Water Management (D. Stone *pers. comm.*). Mr Stone approached the Chief Administrative Officer at US who then referred him to Mr Eric Cornish, Maintenance Foreman in the Maintenance Department. Mr Cornish had already been approached by others who wanted to install similar such devices on the university premises without much success. Consequently, he was sceptical about the effectiveness of any water efficient devices. Mr Stone and Mr Cornish agreed that a test run would be the most appropriate option at that stage.

A test run was conducted in a student area on campus where the Maintenance Department had experienced the most breakages of toilets in the past. The Maintenance Department wanted to know how much water they could save and whether the toilets would stand up to the rigorous student use. In Lydia Residence, 4 toilets were retrofitted with the Multi-flush units. This toilet flushing mechanism is operated by a single lever, which flushes for as long as the person holds the handle down or until the cistern is empty. This enables the user to independently control the amount of flush volume required. A separate water meter was installed which recorded the water use for 14 days prior to retrofit and 14 days after retrofit. For the 14 days prior to the retrofit the toilets used 24 093 litres of water and for the 14 days after the retrofit the toilets used 9 807 litres of water. Consequently, this retrofit produced a

water saving of 59%. These savings were achieved despite the fact that no education programme was embarked on. The change in toilet operation was merely accompanied by small signs on the wall above the toilet. There were no comments or complaints from the students or the Maintenance Department. A similar trial was conducted at one of the mens residences with similar results. Irene Hostel, which houses between 150 and 200 students, was then completely retrofitted with the Multi-flush toilet units. The retrofit resulted in an annual saving of 4,2 million litres and the retrofit was paid off from the resultant savings in less than 6 months (D. Stone *pers. comm.*).

3.2 DECISION MAKING PROCESS WITH RESPECT TO THESE RECOMMENDATIONS

A survey was done by Mr Stone to assess the number of toilets that could be retrofitted across the entire campus for the student areas only. The Maintenance Department, who were impressed with the outcome of the trials, drew up a proposal for the University Finance Department. According to Mr John Villet, Head of the Maintenance Department at Stellenbosch University, they were able to show on paper that a significant amount of money and water could be saved if the retrofitting was to take place (J. Villet *pers. comm.*). After six months, the Finance Department approved the proposal because they found the payback periods attractive. Initial calculations by Mr Villet indicated a two-year payback period (J. Villet *pers. comm.*[2]).

Funds were made available from the water account budget because that is the fund, which would benefit from the savings. A separate budget was provided from this water budget allocation, which the Maintenance Department could and still can use, for similar work. R160 000 was made available for the year 2000 and this amount increases by 10% per annum (J. Villet *pers. comm.*). Mr Cornish says that the University of Stellenbosch was and is still

concerned about their excessive use of water because of increasing water tariffs and the fact that future legislation is likely to ban automatic flushing urinals.

In summary, Mr Stone says that the successful trial runs were very persuasive and helpful in convincing the client to consider an alternative. What was important in this retrofit is the fact that the devices are highly water efficient as well as extremely low maintenance. Mr Cornish also says that the trial run in which 59% of the water was saved in a toilet retrofit was the most convincing factor, which led to the full-scale implementation of a campus wide retrofit. If it was not for the trial run it is unlikely that the university would have made the changes (E. Cornish *pers. comm.*).

3.3 PRACTICAL IMPLEMENTATION OF RECOMMENDATIONS TO DATE

The work was focussed on retrofitting toilets and nothing else. To date 673 Multi-flush units have been installed in residences at US at a cost of approximately R117 000. All mens and womens residences have been retrofitted (E. Cornish *pers. comm.*). A monitoring programme has been started to measure the water savings over a one-year period. To date the response has been very positive from the Maintenance Department who have said that the toilets are far more reliable than the older systems. The Maintenance Department has experienced fewer toilet blockages, easy installation and they have had no problems at all (E. Cornish *pers. comm.*).

The Maintenance Department has also replaced all of the shower roses with more efficient designs. This replacement programme was completed a few years ago and did not form part of the present study. An interesting finding is that they also experienced similar problems to UCT regarding the vandalism of showerheads. Mr Stone, who has been experimenting with showerhead designs over a number of years, says that showerhead vandalism seems to be a

problem when the users do not like the performance of the showerheads. Many of the water efficient showerheads do not offer an enjoyable shower and as a result they are often removed.

Mr Cornish says that they sampled 24 water efficient showerheads at US in Wilgenhof Residence. The students did not like them. Another type of showerhead manufactured by Walcro has found favour at US. These showerheads are not the most highly water efficient although they do use approximately a third less water than the conventional older shower rose designs (D. Stone *pers. comm.*). The students do not remove these showerheads.

The Maintenance Department is currently busy with a trial run of basin tap restrictors (eight litres per minute) at one of the residences at the university. Before any large retrofitting takes place they prefer to do a trial run of the device (E. Cornish *pers. comm.*).

Mr Cornish states that US is taking the water conservation measures step by step. In this way, US does not have to be committed to one large capital investment but instead a series of smaller investments in which the savings can be used for further work. He believes that it would have been unlikely for the university to back the retrofitting programme if they had tried to do all of the work in one year instead of working at it step by step. The Finance Department may not have been able to make very large sums of money available and there may not have been enough manpower to manage and implement the programmes effectively (E. Cornish *pers. comm.*).

The Academic Departments and Administrative Buildings have not yet been retrofitted. In 2001, the Maintenance Department plans to retrofit the toilets in the Administration blocks as well as all automatic flushing urinals on campus.

Finally, with reference to the two indicators of successful implementation of recommendations, it can be stated that US have been successful in implementing the water conservation recommendations due to the fact that:

(1) The management structures at US approved the recommendations and finance was provided; and

(2) The recommendations were completely implemented.

US management based their decision on the practical results obtained from the trial runs on their premises. The Maintenance Department's willingness to experiment with new devices shows a pro-active and less conservative approach to water conservation. Even when a set a showerheads was unsuccessfully tested in one of the residences, the management were still willing to try another brand of showerhead which they later found acceptable.

4. FACTORS AFFECTING MANAGEMENT RESPONSE TO WATER CONSERVATION RECOMMENDATIONS

4.1 APPROPRIATE AND ACCURATE RECOMMENDATIONS

The first aspect that is apparent from the investigation into the two case studies is that the actual water-use audit procedures varied significantly. The UCT case study consisted of a far more comprehensive audit covering a wide range of water related topics. Conversely, the US study was far more focussed and purposeful. It was aimed specifically at toilet retrofitting for which viable financial payback periods were calculated. A possible benefit of the more focussed US study, is that focus is drawn upon the financially viable recommendations. In addition, the university management does not have to commit to a full university-wide water management initiative at first.

Another important difference with the US study is the fact that the water-use audit was completed by the company, which was eventually involved in the actual retrofitting. The recommendations are thus practical and based on years of experience. Some of the recommendations that were made in the UCT study, pertaining to toilet retrofitting costs, have been found to be inaccurate (C. Briers *pers. comm.*). This inaccuracy influences the university management's confidence in the study and other recommendations.

It is also interesting to note that Dual-flush toilet systems were recommended in the UCT study. In this current investigation, it has been found that Dual-flush mechanisms are not popular retrofitting options due to poor performance. The Dual-flush toilet operates with two handles next to one another. The smaller handle is typically for small flushes and the larger handle is for large volume flushes. At Rhodes University the Maintenance Department sampled the Dual-flush toilet mechanism. The devices broke and did not save any water. Mr Deon Stone says that these toilets are often not fitted properly and the two handles confuse

users. Similar negative reports have also been received from Somerset College regarding the Dual-flush mechanism. Mr Stone says that he has never seen a report, which documents water savings as a result of a successful practical trial run of the Dual-flush mechanism (D. Stone *pers. comm.)*.

The Multi-flush system is a substantial improvement over the conventional toilet designs. The old toilets were designed to flush a full cistern with every flush. As a result the cistern needs to be filled up again before the next user can flush the toilet. Due to the fact that many toilets are typically being used at the same time (lunch at school/ university), the water pressure drops and the cisterns take longer to fill. Scholars/ students often don't wait for the cistern to fill up and as soon as they are finished they flush the toilet. The reduced volume of water in the cistern may not be sufficient to flush everything away and the person may flush again and again with no success due the empty cistern. Blockages result and the toilets are often broken by the excessive forceful flushing. Similar occurrences happen when the small volume flush of the Dual-flush toilet is unable to clear the bowl (D. Stone *pers. comm.)*.

Dual-flush toilets were once tested at US. In a trial run with one toilet the mechanism broke within two weeks (E. Cornish *pers. comm.*). The design is said to be confusing and the mechanism has too many working parts. It is therefore surprising that Dual-flush toilets were recommended in the UCT water-use survey.

Some may argue that even though the UCT study was more wide ranging and some of the calculations were inaccurate, the revised financial payback periods were still financially attractive and the recommendations should have been implemented. This brings the discussion to the most important factor, which determines whether recommendations are implemented, or not: the provision of finance.

4.2 FINANCE

The lack of or provision of finance is the most important factor that determines whether a viable recommendation is implemented or not. At UCT, finance was not approved and Properties and Services were expected to access funding from within their own budget if they felt that the work was a priority according to Mr Peter Grant, former acting Deputy Finance Director of UCT. Mr Chris Briers disagrees and says that Properties and Services do not get a lump sum budget to do as they please with. They requested capital for this sort of work, as part of their budget and it was not approved.

Two final possibilities for accessing funding included applying for a loan and using funds from the water budget to make these necessary changes. The first option is not possible due to the fact that UCT Finance is not interested in borrowing money from a lending institution unless the figures are large enough to warrant the loan. Figures of less than a million are not considered (P. Grant *pers. comm.*). In terms of the final possibility, funds cannot be accessed from the water account unless they can be guaranteed to be recovered in under a year. The payback periods are apparently too long for this risk.

What can be concluded from this is that the Finance Committee of the University of Cape Town is totally inflexible in the budget allocation. Even the financially feasible possibility of borrowing money from a bank has been ruled out due to university policies.

US followed a far more simple and rational decision making process. The money they have invested has a similar payback period to the UCT recommendations yet they experienced no problems in accessing funding. They even went a step further and accessed funding from the water budget allocation, which is the account from which the savings are likely to be accrued. This proactive implementation is an example of what can be achieved. From two years time,

depending on the real payback periods, the university will be receiving the equivalent amount saved each year. This then makes further funding available for any other project financing.

4.3 TRIAL RUNS AND A PHASED IMPLEMENTATION STRATEGY

The successful trial at US provided the necessary proof to their Maintenance Department that the product worked. Trial runs at UCT also produced excellent savings of over 90% with the trial retrofit of an automatic flushing urinal. Yet this was insufficient to encourage change.

Although the US programme is being implemented step by step, the UCT implementation plan was also planned to be phased in (EEU, 1997).

It can be concluded that the successful trial of products and a phased implementation strategy were insufficient to convince the UCT Finance Committee to implement the recommendations. The US study was underpinned by the successful trial runs and this formed the focus of management attention. At UCT, the trial runs formed a small part of the overall study and they did not form the crux of the decision making process. Therefore, trial runs and a phased implementation strategy may not always result in the implementation of viable water conservation recommendations.

Finally, the need for appropriate and accurate recommendations from a professional combined with management support and finance cannot be over emphasised. It is felt that these factors are absolutely crucial in successful water conservation initiatives, particularly if they pertain to the retrofitting of fixtures.

5. GENERAL RESPONSE OF INSTITUTIONS TO WATER CONSERVATION RECOMMENDATIONS

Mr Roy Donovan believes that organisations are typically willing to act on sensible cost-effective recommendations (R. Donovan *pers. comm.*). From his experience, a common problem in water auditing of new facilities is that companies often approach the water-use auditing consultants long after the design work has been completed. The company is thus already committed to a particular brand of water fitting (R. Donovan *pers. comm.*).

However, Water-use Auditing consultant Mr Nigel Drury has experienced resistance from schools and hotels who are reluctant to lay out capital for long term financial gain. People and organisations are interested in the savings but are reluctant to part with their money according to Mr Drury. There is an idea that "*everyone wants something for nothing*" (N. Drury *pers. comm.*). He says that water conservation is not a priority and that there is no legislation, which specifically forces people to use water efficiently.

Mr Deon Stone, Water Management consultant, has found that clients are generally happy to try out a small sample of new devices especially if they do not have to pay for the sample. Many of the schools and universities he has visited are not interested in water efficient devices. School Committees and Principals are the decision-makers and they often have what they feel are more pressing issues to deal with (D. Stone *pers. comm.*). Mr Benjamin Dent, United Kingdom Department of the Environment, Transport and Regions, has found that schools are reluctant to spend money on optional retrofits rather than core functions. When the payback periods are longer, the capital budget often goes on essential maintenance rather than on what is seen as an option (B. Dent *pers. comm.*).

John Wright, Online Waterwiser Conference Manager in the United States of America (USA), says that there are a host of reasons that prevent the implementation of water

conservation measures even in the face of apparent benefits. Some of these reasons include campus politics as well as limited operational capital even with short payback periods. He says that in the USA, public sector institutions display a similar hesitancy. However, there is a Federal Energy and Policy Act (EPACT) that requires proven short-term payback opportunities to be implemented in Federal facilities. Even with this in place the process is slow in taking off (J. Wright *pers. comm.*).

Finally, it would be appropriate to say that the problems experienced in the UCT case study are not unique to the field of water conservation. Water conservation still seems to be low on the list of priorities of many organisations despite the impending shortages. In South Africa alternative means will need to be investigated and implemented to encourage large water users to use water more efficiently. It does not seem that pure financial savings are always able to encourage a change to more efficient practices. This is probably due to the small amounts involved and the low price of water.

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