UNIVERSITY OF PRETORIA
Department Facilities Management

Water Management Plan

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LIST OF ABBREVIATIONS

CO_2 emissions – Carbon dioxide emissions
EFTSL – Equivalent Full Time Student Load
EFTSU – Equivalent Full Time Student Unit
GFA – Gross Floor Area based on Tertiary Education Facilities Management Association (TEFMA)
KPIs – Key performance indicators
Sustainability – refer to Section 1: Defining Sustainability
The University – refer to Pretoria University
WMP - Water Management Plan

GLOSSARY OF TERMS

Potable water – Water suitable for human consumption

Unaccounted – for water - Is water that has been produced and is "lost" before it reaches the end-user. Losses can be real losses (through leaks, sometimes also referred to as physical losses) or apparent losses (for example through theft or metering inaccuracies).

1 EXECUTIVE SUMMARY

The University of Pretoria acknowledges the importance of water as an essential resource for successfully meeting its operational objectives. The University also realises the need to use this resource in a responsible manner that is sustainable and complementary to its Environmental Management Policy.

The University of Pretoria (UP) is in the process of formalising its current water management approach to be aligned with local and international policies.

In this process, the University endeavours to:

- Incorporate water efficiency measures into all new and refurbished facilities through best practice in water efficient design, the selection and sizing of equipment, systems and other water infrastructure;
- Maintain equipment and control and manage water infrastructure in order to maximise efficiency;
- Monitor and report on the University's water consumption at micro and macro levels and identify and implement opportunities for improved water efficiency;
- Promote awareness of the responsibility for water conservation to staff, students and contractors;
- Pursue the use of alternate water sources to supplement potable water use;
- Strive to meet legislative requirements and to minimise environmental impact; and
- Strive to procure, distribute and maintain water resources at the lowest cost.

The Department of Facilities Management is responsible for:

- Acquisition of water;
- Design and construction of new, and maintenance of existing facilities and their fixed water infrastructure;
- Identification, development and implementation of water awareness programs and
- Making funding available to support water conservation measures.

Water is a limited resource that is crucial to sustain life. There are several interrelated factors that contribute to the decrease in the availability of water. These factors include climate change, increasing demand, lowered water tables and environmental degradation. There is also the growing threat of international and intercommunity disputes over water supplies. It is therefore important that the University of Pretoria, as a responsible corporate citizen, manages its water resources properly.

2 INTRODUCTION

The Water Management Plan (WMP) seeks to provide a simplified overarching framework which allows different Faculties, Departments and Divisions of the University of Pretoria to work together and develop a shared understanding of the most suitable solutions to water problems on the five campuses of the University. The WMP outlines the University of Pretoria's water management strategy.

The objectives listed in the WMP plan relates directly to the Environmental Management System objectives and are measured using Key Performance Indicators (KPI's). Targets and actions documented in the WMP are measured and monitored by the Department of Facilities Management and reported to the Executive of the University.

The WMP details the importance of water management on campus, various approaches taken to date with campus metering, building, irrigation, and process systems, and methodologies for analysing water data and metrics. The plan presents a suite of strategies to attain the 5% water-use reduction goal and steps toward more comprehensive understanding, and active and adaptive management, of water use at the University of Pretoria.

The WMP is driven by the University's Environmental as well as Sustainability Policies which aims to ensure that the relevant environmental laws and regulations are complied with and that the protection of the environment is enhanced by keeping impacts to a minimum in a sustainable, financially rewarding and technically feasible manner.

The University recognises its responsibility to the community and to the environment and has allocated resources to ensure that water is managed in an efficient and sustainable manner. The University has an Environmental Policy endorsed and signed by the Vice Chancellor.

The WMP is written to ensure that water at the University of Pretoria is used in an efficient manner and that strategies are implemented to ensure a reduction in potable water consumption in accordance with the University of Pretoria Water Management Policy.

The University will;

- Ensure that all environmental legislation and regulations are met and ensure all relevant approvals are acquired;
- Regulate water use through auditing and monitoring to identify any potential problems with the network ; and
- Apply "Best Environmental Practices" in the overall management of water.

The University of Pretoria strives to sustain its local and global environment, organisational health and ability to create a positive, viable future. The University of Pretoria endeavours to include environmental sustainability principles and targets in all aspects of its decision-making.

Through its research, teaching and learning, operations and community engagement, The University of Pretoria aims to:

- Minimise the environmental impact of its operations and move towards restoring environmental integrity;
- Promote social justice, equity and diversity;
- Contribute to human health and well-being; and
- Maintain its financial viability.

This plan sets out a path towards sustainable water use at the University of Pretoria. In doing so it aims to reduce institutional water costs and consumption, integrate sustainable water management practices into curricula, improve the quality of storm water runoff and raise awareness of water management and waste water conservation amongst the University of Pretoria's community, including staff, students, contractors and visitors.

The legislative requirements regarding accessibility to potable water, has prompted the University to update its water management strategy by looking into the temporary water storage facilities, handling water at its point of origin, collecting or harvesting water from buildings on the five campuses and temporarily storing water until required.

3 THE IMPORTANCE OF WATER MANAGEMENT

South Africa is one of the driest countries on earth. Water resources in South African cities and towns are under increasing pressure from population growth, climate change, extreme drought and waterway degradation. Per capita water consumption has increased to unsustainable levels and increasing amounts of technology and energy are used to provide water for human need.

Rather than the traditional approach of managing urban water supply, storm water and wastewater separately, the University of Pretoria is moving to a more integrated approach and treating all three as a single resource by creating a closed loop system where all water is used as effectively as possible. This approach includes water demand management, where the demand for water is reduced, and water recycling and reuse (where appropriate).

Water is a critical utility for the University of Pretoria, accounting for approximately 15% of UP's annual utility budget. In addition to serving the daily domestic needs of more than 66 000 people, water is used for energy production, laboratory and research processes, dining services, in restrooms and grounds maintenance for campuses consisting of more than 1 238 524 m² net floor area.

3.1 Legislative Requirements

Water usage in South Africa is currently governed by laws and regulations, including *inter alia*:

- The South African Constitution (Act 108 of 1996);
- National Water Policy White Paper of 1997;
- National Water Act (Act 36 of 1998)[NWA] and the
- National Water Services Act (Act 108 of 1997).

The Acts are complementary and provide a framework for sustainable water resource management while enabling improved and broadened service delivery.

The NWA is founded on the principle that all water forms part of a unitary, interdependent water cycle, and should thus be governed under consistent rules. It contains comprehensive provisions for the protection, use, development, conservation, management and control of South African water resources. The strategic objectives are stipulated in the National Water Resource Strategy (NWRS; DWAF 2004).

At present, two references to national standards for quality of potable water exist in South Africa. The first is the Water Services Act (Act 108 of 1997) in which clause 4 (in terms of section 9(1)(b) of Water Services Act), refers to a compulsory national standard. The regulations relating to compulsory national standards for the quality of potable water are described in Clause 5 of the "Regulations Relating to Compulsory National Standards and Measures to Conserve Water" as gazetted on 8 June 2001 (Government Gazette 22355, 2001). The second is the Strategic Framework for Water Services (RSA, 2003a), in which Clause 6.3.2 thereof makes reference to drinking-water quality.

3.1.1 Water Services Act (Act 108 of 1997)

The Compulsory National Standards for the Quality of Potable Water, as published in Government Gazette No 22355 of 8 June 2001, reads as follows:

Quality of potable water:

(1) Within two years of the promulgation of these Regulations, a water services authority must include a suitable programme for sampling the quality of potable water provided to consumers in its water services development plan.

(2) The water quality sampling programme contemplated in sub regulation (1) must specify the points at which potable water provided to consumers will be sampled, the frequency of sampling and for which substances and determinants the water will be tested.

(3) A water services institution must compare the results obtained from the testing of samples with SANS 241: Specifications for Drinking Water; or the South African Water Quality Guidelines published by the Department of Water Affairs and Forestry.

(4) Should the comparison of the results as contemplated in sub regulation (3) indicate that the water supplied poses a health risk, the water services institution must inform the Director-General of the Department of Water Affairs and Forestry and the head of the Provincial Department of Health and it must take steps to inform its consumers-

(a) that the quality of the water that it supplies poses a health risk;

(b) of the reasons for the health risk;

(c) of any precautions to be taken by the consumers; and

(d) of the time frame, if any, within which it may be expected that water of a safe quality will be provided.

3.1.2 Strategic Framework for Water Services

Clause 6.3.2 of the Strategic Framework for Water Services (RSA, 2003a) refers to the need to consider drinking-water quality as follows:

Potable water quality - Water supplied by water service providers that is intended to be used for drinking or domestic purposes (potable water) must be of a quality consistent with SANS 241 (Specifications for Drinking Water) as may be amended from time to time.

It is clear, that the Compulsory National Standards for the Quality of Potable Water are the more prescriptive and more demanding, and the ruling legal requirement for consideration with regards to the provision of drinking-water and the quality thereof. The commonality is the reference to the use of SANS 241 (Specifications for Drinking Water) as the guideline for drinking-water quality.

3.1.3 SANS 241: Specifications for Drinking Water

It is worth noting that the present governing version of SANS 241 - Specifications for Drinking Water, differs in a not inconsiderable manner from its long standing predecessors, SABS 241-2001 and SABS 241-1984, and is more closely aligned to the philosophy first introduced by the South African Water Quality Guidelines as published by DWAF (RSA, 1998e). SANS 241, specifies various classes of water in terms of physical, microbiological and chemical quality.

The South African Water Quality Guidelines are used as a basis to inform water users about the physical, chemical, biological and aesthetic properties of water. It consists of the water quality criteria, the Target Water Quality Range (TWQR), and support information, such as the occurrence of the constituent in the aquatic environment, its effects on water uses, how these effects can be mitigated and possible treatment options.

The Target Water Quality Range (TWQR) for a particular water use is defined as the range of concentrations or levels at which the presence of the constituent would have no known adverse or anticipated effects on the fitness on the water assuming long-term continuous use, and for safeguarding the health of aquatic ecosystems. All the different Target Water Quality Range (TWQR) for all the different water use sectors is dealt with in South African Water Quality Guidelines volumes one to seven.

These include the guidelines for:

- Domestic Water Use (Volume 1),
- Recreational Water Use (Volume 2),
- Industrial Water Use (Volume 3),
- Irrigation Water Use (Volume 4),
- Livestock Watering (Volume 5),
- Aquacultural Water Use (Volume 6),
- Aquatic Ecosystem (Volume 7).

3.1.4 Volume 1: South African Water Quality Guidelines - Domestic Water Use

Domestic water refers to water that is used in a domestic environment and also refers to all uses water can be put to in this environment. These include water for drinking, food and beverage preparation, hot water systems, bathing and personal hygiene, laundry and gardening.

Domestic water users can experience a range of impacts like health, aesthetic and economic impacts as a result of changes in water quality. Water quality problems are associated with the presence of constituents and the interactions between them. The constituents like cadmium, chromium (VI), lead, mercury and vanadium can have either acute and/or irreversible effects on human health, even at low concentrations. As a precautionary measure, it is advisable not to use, for potable purpose, water containing these constituents, at concentrations above the Target Water Quality Range (TWQR).

UP has a responsibility as a reasonable corporate citizen to ensure that water management is in line with the requirements of national legislation and regulations. If the general duty of a water user is to be met, UP as significant water user within the City of Tshwane Metropolitan Municipality, should ensure that the quality of the water provided to water users on its campuses comply with standards and specifications.

3.2 Benefits of Water Management

The benefits of water management for the University include:

- Improved operational efficiency.
- Lowered water system operational costs.
- Reduced potential for contamination.

- Extended life of facilities.
- Reduced potential property damage and water system liability.
- Reduced water outage events.

The environmental benefits of using reclaimed water at the University of Pretoria campuses include:

- Increased water quantity:
    - Decreased diversion of fresh water from other ecosystems.
    - Reduced use of potable water by industrial, housing, and recreational development projects that use reclaimed water.
    - A reduction in the amount of groundwater withdrawal, which impacts base flow in many rivers and streams.
- Increased water quality:
    - A reduction in the amount of nutrients entering the water bodies.

In addition to providing a dependable, locally-controlled water supply, water recycling provides tremendous environmental benefits. By providing an additional source of water, water recycling decreases the diversion of water from sensitive ecosystems. Other benefits include decreasing waste water discharges and reducing and preventing pollution.

4 VISION FOR WATER MANAGEMENT

The University of Pretoria envisions that water is actively and adaptively managed as a valuable and reliable resource on all its campuses and other properties. While the Sustainability Management Plan lays out concrete three-year goals toward this vision, the University of Pretoria anticipates that these activities serve as the foundation for more comprehensive, longer-term initiatives that are fully coordinated with energy, storm water, and risk management planning. Such coordination will result in:

1. Energy: The relationship between energy and water, also known as the energy water nexus, is evident on campus. Water reductions lead to energy savings in pumping.

2. Storm water: Effective management of storm water will reduce potable water used for irrigation. Infrastructure put in place to manage storm water present opportunities for storing water to be used in lieu of potable water.

3. Risk Management: Reduced water use alleviates stress on utility infrastructure, making the University campuses less vulnerable to unforeseen events and more resilient in the long term.

Future efforts in water management planning shall be further guided by a set of shared principles. Like the Sustainability Planning Principles, these principles capture the strength of short-term activities, provide direction for future development, and should be taken collectively to motivate and focus work:

- Collecting and analysing water-use data creates educational and research opportunities for students and faculty here and beyond the university.

- The University of Pretoria shall encourage university-wide participation and stewardship of water management.

5 APPROACH TO WATER MANAGEMENT

The Water Management Plan will amongst others address the following:

- The design of new buildings or refurbishment of existing buildings to include building systems that will reduce water usage such as high-efficiency plumbing fixtures.
- Measures to stop water flow into buildings after hours and holidays and thus prevent water loss through leakage.
- Leakage detection and repairs as well as preventative maintenance.
- The implementation of water wise gardening.
- The use of water efficient irrigation systems.
- The use of reclaimed water.
- Rain water harvesting and storage.
- The use of storage tanks and reservoirs to store borehole water.
- Water use monitoring.

5.1 The design of new buildings or refurbishment of existing buildings

The International Code Council (ICC) has published provisions devoted to sustainable building practices, many of which focus on water efficiency. The International Green Construction Code™ (IgCC™) includes comprehensive provisions for water efficiency covering virtually every water conservation related area of construction.

The University of Pretoria needs to continuously update existing design standards and planning documents to reflect the most current requirements for water metering, water efficiency, and reclaimed water strategies. The University of Pretoria has piloted a number of systems over the past several years, particularly within the LEED-certified buildings, and has reviewed the performance of many of these pilots to intentionally inform future direction on campus. Over the past few years, the University has installed a variety of high-efficiency plumbing systems that reduces consumption of potable water in new and renovated buildings. Installations include low-flow and dual-flush water closets, low-flow and waterless urinals, low-flow lavatory faucets, low-flow laboratory faucets, and low-flow showerheads. Many of these installations contributed to earning Water Efficiency (WE) and Innovation in Design (ID) credits toward Leadership in Energy and Environmental Design (LEED) certification.

Future projects, including those designated as Comprehensive, Small Scope, and Limited Scope, will be executed in accordance with design standards and planning documents updated and aligned with water management goals. This strategy will focus on the following two tactics:

- Update sections of the University of Pretoria Design Standards for Capital Projects to reflect requirements for water-efficient plumbing fixtures, water metering, and water sub-metering within buildings.

- Prepare internal resources and guidelines to inform the design, installation, and operation of reclaimed water systems and irrigation systems on campus. The University of Pretoria has committed staff, time and resources to these tactics. Considerable progress has been made to date toward internal reclaimed water and irrigation system guidelines.

5.2 Leakage detection and repairs as well as preventative maintenance.

Detecting and repairing leaks is one of the main components of water conservation. Old or poorly constructed pipelines, inadequate corrosion protection, poorly maintained valves and mechanical damage are some of the factors contributing to leakage. Leak detection has historically assumed that leaks rise to the surface and are visible. In fact, many leaks continue below the surface for long periods of time and remain undetected. With an aggressive leak detection program previously undetected leaks can be detected.

Active leak control will reduce expensive emergency overtime repairs and the associated liability costs.

The most important element in a leak detection and repair program is accurate and detailed water use records that are consistent over time and easy to analyse. Generally, the leak detection system should keep three sets of records:

- Monthly reports on unaccounted – for water;
- Leak repair reports; and
- Updated maps of the distribution system showing the location, type, and class of leaks.

The following actions are proposed at the University:

- Inspection of the irrigation systems for obvious above ground leaks. Extremely wet areas above an underground pipe would possibly indicate a broken pipe or joint.
- Examine equipment routinely and look at exposed pipes to see if any leaking water can be detected.
- Comparison of records with the same month of previous years. While the amount of water used will vary due to weather and processes, sharp increases in water consumption could indicate a leak.
- A weekly or monthly visual inspection of water equipment.

The leak detection programme should include documented evidence that:

- A leak detection survey using best available technologies has been completed on the system within the past three years;
- All leaks found have been repaired;
- The leak detection system is unable to locate additional leaks; and,
- On-going efforts to minimise leakage are included as part of the system's water-use efficiency program.

Maintenance of current metering infrastructure and quarterly data collection processes are important for any leak detection undertaken on campus. Data at building level should be analysed and published on an annual basis. Access to accurate and detailed water data is a critical component in identifying opportunities to save water and setting appropriate goals. As described above, the University of Pretoria has made a significant investment in water meters and collection processes over the past several years. This strategy will focus on the following three tactics:

- Maintain existing meters and install new meters as required for new construction. Commit resources as needed to ensure sub-meters are operational.

- Maintain existing quarterly data collection and quality control processes. Establish and maintain review with municipal meter readings to ensure that the most accurate numbers possible are provided on monthly bills.

- Analyse and publish data at the building level on an annual basis.

5.3 The implementation of water wise gardening.

The University of Pretoria has always been very proud of the beautiful gardens and landscapes on all campuses. It is seldom realised what impact this has on the surrounding environment, especially on dwindling water resources. In South Africa about 35% of water use is used for irrigating gardens.

With water wise gardening one can create a peaceful environment that will provide shade, perfume and even colour throughout the year. With careful planning, appropriate plant choices and proficient maintenance a water wise garden can survive with minimal water during the dry season.

Water wise gardening is about using plants that are appropriate to the local climate. It is becoming increasingly popular. A water wise garden includes indigenous plants, ornamental grasses, succulents; drought-resistant vegetation and hard landscaping materials like bark chips, mulch, rocks and gravel.

For hot, dry areas plants are chosen that need only minimal watering. Plants with high and low watering needs should not be planted in the same area. Trees help to reduce evaporation by blocking wind and shading the soil. The University of Pretoria is implementing the following:

- Adding organic matter to the soil.

All soil is not created equal. Soil is essentially a collection of mineral particles of different sizes. If most of the particles are large (sand), water passes through rapidly. If most of the particles are small (clay), water will penetrate the soil much slower. The solution to either problem is the same: add organic matter. Organic matter, in the form of compost, chopped up leaves or composted manure will improve the texture and water-holding capacity of the soil. Add at least an inch of compost each year.

- Watering.

Deliver water to the root-zone.
Soaker hoses ensure that up to 90% of the water applied to the garden is actually available to your plants. Sprinklers are only 40 to 50% efficient. Drip irrigation and soaker hoses minimize evaporation loss and keep the areas between plants dry, which also helps limit weed growth. Aqua Cones are an economic and effective way to get water directly to the roots of individual plants. The Flat Soaker Hose delivers water slowly and evenly in garden or landscape beds.

- Use mulch to retain water.

A 6 to 8 inch layer of organic mulch can cut water needs in half by blocking thirsty weeds and reducing evaporation. Organic mulches retain some water themselves and increase the humidity level around plants. Organic mulches include chopped or shredded leaves, straw, compost,shredded newspaper, grass clippings and rotted hay.
Just my opinion: Salt hay is native to America and may become invasive if planted for mulching purposes.

- Use free water.

Rainwater is the best choice for plants. It is clear, unchlorinated and free. Use rain barrels or a cistern to collect water from downspouts. A 12 square meter roof surface will yield 111.8 litre of water from 1 mm rain.

- Reduce lawn

Turf grass is one of the most thirsty and labour-intensive types of "gardens" that’s around. Consideration should be given to planting groundcovers or low-maintenance perennials instead.

- Plan before planting.

By planning the University gardens before it is planted, the division Landscaping can take advantage of the characteristics of the site, such as sun, shade, wind and soil. It is planned that plants with similar water needs will be grouped together. Furthermore the division Landscaping is also considering how the plants will get the water they need.

- Choose plants carefully.

A plant that's satisfied getting most of the water it needs from natural rainfall will require a lot less maintenance and care. For drought-tolerant perennials, choose varieties that are native to the area (or a region with a similar climate). These plants will have adapted to the climate and soils.

- Take care of the plants.

Healthy plants need less water, fertilizer and pest controls than stressed plants. By keeping on top of tasks — such as weeding, thinning, pruning and monitoring pests — water will be needed less frequently.

5.4 The use of water efficient irrigation systems.

Water-efficient irrigation and landscaping are ways to save water by choosing different irrigation equipment, different plants, and siting plants differently. They can also be combined with water reuse.

Water efficiency must be considered from the initial irrigation system design phase through to installation to ensure optimal performance. Consistent management and maintenance is also essential. Failure to do so can result in significant losses in system efficiency from poor management, improper system design, installation, or maintenance.

In addition to following simple steps to watering wisely, using water-efficient technologies can make a big difference in the volume water used on the University campuses. Water saving technologies includes:

- Soil moisture sensors

Soil moisture based control technologies water plants based on their needs by measuring the amount of moisture in the soil and tailoring the irrigation schedule accordingly.

- Rainfall shutoff devices

Rainfall shutoff devices turn off the irrigation system in rainy weather and help compensate for natural rainfall. This inexpensive device can be retrofitted to almost any system. Rain sensors can help decrease water wasted in the landscape by turning off the irrigation system when it is raining.

- Sprinkler heads

Certain types of sprinkler heads apply water more efficiently than others. Rotary spray heads deliver water in a thicker stream than mist spray heads, ensuring more water reaches plants and less is lost to evaporation and wind.

- Micro-irrigation

Micro–irrigation or drip systems are generally more efficient than conventional sprinklers, because they deliver low volumes of water directly to plants' roots, minimising losses to wind, runoff, evaporation, or overspray. Drip irrigations systems use 20 to 50% less water than conventional pop-up sprinkler systems and can save up to 115 000 litres per year.

Avoiding evaporation can be done by delivering water more directly to the soil, or by delivering larger water droplets so they will not evaporate as easily, or by timing irrigation to avoid hot sunny times of the day that causes more evaporation.

Delivering water to the soil can be done by "micro-irrigation" or drip irrigation. Micro-irrigation is where irrigation nozzles are very near to the ground, but more numerous to make up for the lack of range of each nozzle. Drip irrigation does not spray water, but drips it from holes in a pipe that lies on the ground or underground, to avoid evaporation entirely.

5.5 The use of reclaimed water.

The demand for fresh water in South Africa, and Gauteng specifically, is growing as the population increases. This demand can potentially exceed supply during times of even moderate drought. In recent years, the normal seasonal droughts that have occurred in South Africa have caused government to enact water conservation ordinances. These ordinances limit the use of potable water for activities such as washing of cars and landscape irrigation. Conservation measures, such as irrigating with reclaimed water, help to ensure that existing water supplies are utilized as efficiently as possible.

Grey water is reusable wastewater from residential, commercial and industrial bathroom sinks, bath tub shower drains, and clothes washing equipment drains. Grey water is reused onsite, typically for landscape irrigation. Reclaimed water systems collect a proportion of the reusable water from around the campuses. This water is usually filtered and fed into a tank from where it is used in sanitary fittings, typically water closets and urinals.

> ***Reclaimed water systems***: A reclaimed water system is a general term to describe a system that retains non-potable water to be used for non-potable demand, such as sewage conveyance, and irrigation. Recently the University of Pretoria has commenced with the installation of reclaimed water systems on the various campuses, with various design and operational approaches and a range of performance outcomes.

Recycled water can satisfy most water demands, as long as it is adequately treated to ensure water quality appropriate for the use. In uses where there is a greater chance of human exposure to the water, more treatment is required. As for any water source that is not properly treated, health problems could arise from drinking or being exposed to recycled water if it contains disease-causing organisms or other contaminants.

5.6 Rain water harvesting and storage.

Rainwater harvesting refers to the concentration and entrapment of rainwater runoff from a catchment. A catchment is any discrete area draining into a common system and thus can be a roof, a threshing floor or a mountain watershed. Similarly, the means of rainwater storage can range from a bucket to a large dam. Rainwater harvesting can provide a reliable, cheap and good quality alternative water source. Rainwater harvesting also complements groundwater.

Rainwater harvesting systems can be implemented and effectively maintained if the following simple guidelines are taken into consideration:

- The catchment

The key elements to consider with respect to both water quality and quantity are the material that the catchment is made of and possible routes of contamination of the catchment surface.

i. Routes of contamination

The risk of contamination should be minimised. This includes cleaning the catchment and storage tank if no rain has fallen for a long time, and discouraging birds from perching and animals from wandering on, or over, the catchment surface.

ii. The guttering system and down pipes for roof water harvesters

Guttering is often the weak link in the performance of a rainwater harvesting system. Problems range from gutter maintenance to gutter design. The most appropriate and affordable guttering and down pipe system should therefore be used to harvest all available water. The selection of a more expensive (but durable) guttering (e.g. fibre cement or aluminium) will depend on the purchaser’s preparedness to spend more on the initial installation to avoid long-term maintenance issues.

- Optimising the design

The following design elements optimise water quality:

  - Include a coarse screen between the guttering and the delivery pipe in order to prevent the ingress of large foreign bodies, such as leaves;
  - A fine screen between the delivery pipe and the tank and at all openings to the tank will prevent access by insects and rodents;
  - A lid on top of the tank keeps out dust;
  - A system to intercept and dispose of the first flush from the catchment; and
  - The use of a suitable catchment surface material.

The RDP Rural Water Supply Design Criteria Guidelines published by Department: Water Affairs and Forestry (1997), state that:

- Animals and people should be prevented from contaminating rainwater collection surfaces. House roofs are generally preferred collection surfaces.
- Rainwater collection surfaces should be constructed from inert materials, should be well maintained and cleaned (particularly at the end of the dry season) to prevent contamination.
- A ‘first flush’ system should be incorporated into the rainwater collection system, to remove as much contamination as possible before the storage tank starts to fill.

5.7 The use of storage tanks and reservoirs to store borehole water.

Clean storm water is collected from the boreholes on the various campuses and temporarily stored in water tanks and reservoirs. There are a total of 23 reservoirs and dams on the five campuses of the University of Pretoria. These reservoirs and dams have a combined storage capacity of 1 162 000 Litres.

The various campuses fall in different water catchment areas. Each catchment area has legislation regulating the extraction and storage of borehole water. These regulations are released as General Authorizations.

The National Water Act (Act 36 of 1998)[NWA] provides in section 22(1)(a) thereof that a person may only use water without a licence if that water use is permissible in terms of schedule 1 of the NWA, or if it is permissible as a continuation of an existing lawful water use, or if the water use is permissible in terms of a general authorisation issued under section 39. Section 22(1)(b) further allows water use that is authorised by a licence issued in terms of the NWA and section 22(1)(c) allows for water use if the responsible authority, which in this case is the Minister of Water Affairs, has dispensed with the licence requirement.

For the purposes of this heading; the provisions of section 21 water use is defined for the purposes of the NWA as *inter alia*:

(a) taking of water from a water resource;
(b) storing of water;

The NWA also defines, in section 32, what is meant by the term existing lawful water use and it provides that an existing lawful water use is a water use which has taken place at any time during a period of two years immediately before the commencement of the NWA (which was 1998). From the deeds information (available for the University of Pretoria campuses) it is therefore evident that on the day the repealed Water Amendment Act came into operation, the University had properties which were registered in the deeds office, these properties could impound a maximum of 250 000 cubic meters of water and to abstract a maximum of 110 litres per second per property. As long as the University did not exceed impounding more than 250 000 cubic meters of water per property and abstracted less than 110 litres per second per property, it was not necessary for the University to obtain a permit to either impound or abstract water.

Therefore, the University of Pretoria may use its reservoirs and dams to impound a maximum of 250 000 cubic meters of water per campus.

5.8 Implement water conservation projects and activities

The University of Pretoria has committed to an assertive water conservation goal within the Sustainability Management Plan 2013–2016. The University of Pretoria recognises that achieving this goal will rely on successful implementation of multiple projects and activities over the next three years.

Each tactic below represents a category of projects that are under consideration.
Final results of approved projects shall be critically reviewed and published in future Water Management Plans.

- Develop and implement projects to increase the water efficiency of existing campus fixtures and systems in order to conserve approximately 76 million liter of potable water.
    - Retrofit existing showerheads within residential and athletic facilities with high performance, low-flow showerheads.
    - Decommission underutilised washing equipment serving critical research areas.
    - Install equipment and improved water treatment and chemical control processes within power plants for makeup demand.
    - Retrofit existing irrigation systems with high-performance systems at select high volume locations.

- Develop and implement projects to provide non-potable water demands with alternative sources of water in order to conserve approximately 115 000 litres of potable water.
    - Investigate strategies to develop campus-level reclaimed water infrastructure.

- Coordinate educational initiatives with the University of Pretoria office of Sustainability, Sustainability Service Corps, and other relevant groups on campus to raise awareness about water use and influence behaviour toward water conservation.

- Formulate longer-term projects for future development and implementation focusing on both water conservation and storm water runoff reduction.

The University of Pretoria has formulated projects and activities within each tactic, and committed staff, time and resources at various levels. Progress has been made to date within each tactic.

Through a combination of all tactics, the University of Pretoria intends to save approximately 106 million litres of water over the next three years.

5.9 Adapt management plan goals

The WMP is presented to support an adaptive and iterative process to promote water conservation at the University of Pretoria. Over the next three fiscal years, UP will have a more robust water-use data set, as well as a portfolio of projects implemented explicitly for

water conservation. It will be important to critically assess the performance of these projects and the level of activity necessary to fulfil all of the commitments outlined in this plan as part of the adaptive management process.
This will require the following two tactics:

- Establish best practice methodology for evaluating representative water use given that data quality and thermal conditions vary annually.
- Formulate preliminary costs and benefits for water conservation projects and activities prior to goal-setting, so that goals and respective tactics are appropriately defined.

6 ANALYSIS FOR WATER MANAGEMENT PLANNING

Efforts to understand and evaluate water use at the University of Pretoria have been under way for many years. Various metering technology and billing processes have been promoted. In the recent past, additional sub-meters were installed on campuses to supplement municipal utility meters. This section details the analysis of the most current metering data and establishes a representative water-use baseline for future planning.

Water metering commenced in 2007. Not all the campuses were metered at the same time. This was a phased process that was implemented as contracts were terminated and requirements changed.

There currently are the following meters on the various campuses (Figure 1: Meters, sub-meters and boreholes on the UP campuses):

Site	Council	Sub-meters	Borehole	Total	Total
OP	1	9	9	19	
Groenkloof	1	10	5	16	
Main Campus	8	40	10	58	
Ladies Res	9	12	3	24	
LC-Site	2	10	3	15	
Medical Campu	4	10	1	15	
Mamelodi	1	0	1	2	
TOTAL	**26**	**91**	**32**	**149**	149

Figure 1: Meters, sub-meters and boreholes on the UP campuses

The municipal meters' information and invoicing is received monthly. This information is carefully analysed and filed.

The total water use is monitored at the various campuses. Currently the monitoring does not make provision for the distinction between potable, heating and cooling (processing water) water. Water used for irrigation is measured and reported as a separate entity.

7 CONCLUSION

The University of Pretoria is committed to reducing its potable water usage by 5% over the next three years. With active and adaptive management, UP has the opportunity to serve as a leader in sharing water data and water conservation initiatives with the broader public. This plan presents a suite of strategies to reduce water usage, improve water use data, increase collaboration further with the City of Tshwane municipality, and to plan for the future.

8 DOCUMENT METADATA

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