

**The development of an environmental education programme
for water conservation in the Steelpoort area.**

by

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DECLARATION

“I, Katishi Lehumo Silas MATHIPA, declare that *the development of an environmental education programme for water conservation in the Steelpoort area* is my own and that all that sources that I have used and or quoted have been indicated and acknowledged by means of complete references.”

SIGNATURE
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DATE

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SUMMARY

The purpose of this study was to determine what activities and practices prejudice water conservation in the Steelpoort area. Using this information, context specific environmental education programmes were designed for various sectors of the community.

A qualitative research approach was used. Respondents who provided information through interviews and questionnaires included school principals and educators, non-teaching staff members, learners and adult community members.

The theory developed from the literature review facilitated the development of qualitative research for the study.

The research identified certain activities and practices that contribute to the unsustainable use of water in the area. The respondents suggested that consumers generally need to acquire knowledge and skills that will enable them to effectively conserve and utilise water. Specific programmes intended to meet the needs of the various categories of consumers that will facilitate water conservation and its sustainable use were designed as an outcome and recommendation of the research.

Key words:

Water conservation
Water Management
Water Usage
Water
Conservation
Education
Environmental Programmes
Sustainability
Water scarcity/resources

LIST OF ACRONYMS

C2005	Curriculum 2005
DWAF	Department of Water Affairs and Forestry
EE	Environmental Education
GTM	Greater Tubatse Municipality
NWA	National Water Act
NWP	National Water Policy
NWRS	National Water Resource Strategy
OBE	Outcomes Based Education
WCA	Water conservation Awareness
WC	Water conservation
WCC	Water Consumption and Conservation
WCED	World Commission on Environment and Development
WDM	Water Demand Management
WESSA	Wildlife Environment Society of South Africa
WFW	Working for Water Programmes
WPMC	Water Provisioning Management and Conservation
WSMC	Water Source Management and Conservation
SAYWP	South African Youth Water Prize
SWAP	School Water Action Project

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CHAPTER 1

An orientation to the study

1.1 Background

Access to safe water is a fundamental need and a basic human right (WHO 2000: 1). However globally 1.1 billion people are without access to a safe water supply and of this number, 28% is found on the African continent. During the period 1990 to 2000, the global human population expanded by 15% to reach an estimated 6.06 billion people. Africa's population growth is almost double the global average (WHO 2000: 7). This rise in population escalates water demand and usage (Archimedes 2002(a):17; Archimedes 2002(b):16; Pillay 2002:43) and it is reasonable to deduce that this pressure cannot be withstood unless steps to ensure effective water management and consumption are instituted.

It is also found that even in rural areas where there is plenty of fresh water, there are still sometimes shortages. The World Resource Institute has reported that of all the ecosystems on the earth the fresh water system has suffered the most damage. The quality of our water is decreasing because of pollution and destruction of rivers and wetlands by human interference (Enviro Teach 2001:13). It has been predicted that by 2015, half the world's population could be facing serious water shortages and could also run out of safe drinking water due to the unprecedented rise in the population and the associated degradation of the sources (Archimedes 2002(b):16); Barker 1997:110; DWA 2001:13).

1.1.1 A brief overview of the supply and availability of water

At least 70% of the earth's surface is covered by water. Despite this vast mass of water, in many parts of the world water is a scarce resource. Most of the available water is salt water located largely in the oceans and seas. Only 3% of all the water is fresh water, safe for drinking and most of this is unavailable for human use. This is because fresh water that is available for human consumption is either part of the frozen and largely uninhabited ice caps and glaciers or found underground (contained in soil and rocks below the surface). What remains for our use is about 1% of the total (Barker 1997:111; Dowling 2001: 24; Icehower 2006; Smith 2002:32).

The hydrological cycle is responsible for the replenishment of water through rain, snow and other forms. However the distribution is unequal. This can be attributed to the extremely complex ocean currents and temperature, latitudes and their relationship to the sun's distance, atmospheric jet streams, and variations in the earth's atmospheric temperature. These physical conditions have been significantly altered by man through his abuse of the earth over the past number of years and consequently have contributed to a deterioration of water quality and availability (Icehower 2006).

South Africa is a dry country with unreliable rainfall. Our average rainfall is less than 50mm a year with the driest part of the country receiving less than 20mm per year and the wettest receiving more than 2500mm per year. Rain does not always fall where it is most needed, and some areas of high demand receive less water than they need. Most rain falls in the narrow belt along the eastern and the southern coasts. The rest of the country receives only 27% of South Africa's total rainfall. In addition hot, dry conditions which are prevalent through much of the country results in a high evaporation rate (Umgeni Water 2006).

Water is thus a very scarce resource in South Africa and to complicate matters, there are no major rivers of globally comparative scale (Archimedes 2002 (b):16; Barker 1997:110). The largest river in the country is the Orange River while most of the other significant rivers flowing through the country are shared by the neighbouring states and have been dammed or modified. During times of drought when rain is below average for a number of years, water supply can become dangerously low (Rebelo 2004:26).

Water shortages and water pollution are also major problems throughout the majority of the country's rural areas. Rural water requirements are expected to increase because the constant rise in the number of people who live in the areas around streams and other water sources has put increasing pressure on this scarce resource. The continuing deforestation to make way for new settlements negatively affects water catchments and quality. Because people take water for granted and do not oversee its management and use, the sustainability of a sustainable water supply is put at risk.

Water shortages are jeopardizing economic development and quality of life for people living in these regions. Given these circumstances, it is reasonable to assume that many rural South Africans will lack access to clean water and sanitation in the near future. The residents of Steelpoort village (Winterveld) are no exception.

1.1.2 An overview of the supply and availability of water in the research area

Steelpoort village is located approximately 154km from Polokwane and 198 km from Nelspruit and situated around Steelpoort, south west of Burgersfort as part of Samancor Eastern Chrome Mine’s premises. This serviced area provides housing to three peri-urban villages namely Mangabane village (blacks only), Top village (blacks and whites) and Bottom village (blacks and whites) which are all serviced with both internal water supply and water-borne sewage from the local Samancor ferrochrome mine. A further large number of squatter camps or shacks located in a remote rural village (an informal settlement) within the perimeters of Mangabane called Makgemeng receive water by means of communal standpipes from the local Greater Tubatse Municipality (GTM).

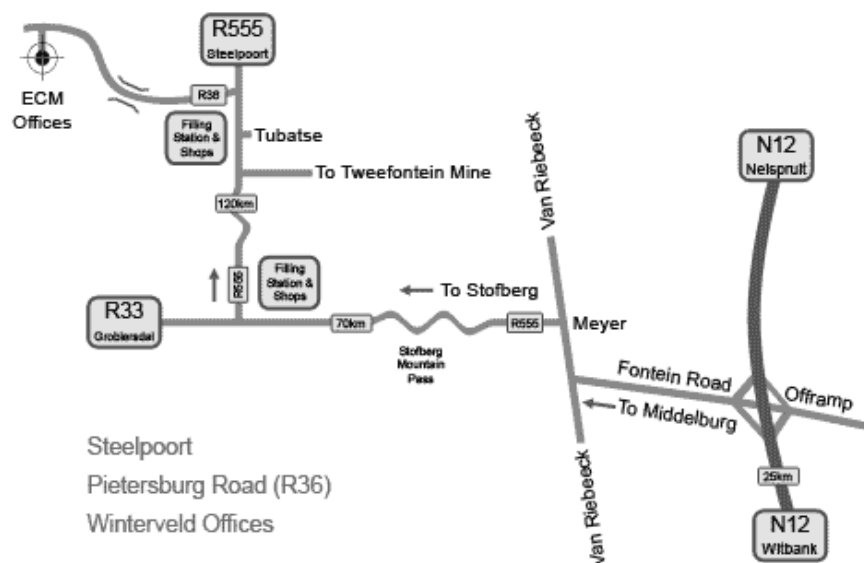


Figure 1: Location of Steelpoort and associated areas

Source: http://www.samancorc.com/content_sub.asp?ssID=39

Despite the fact that all these residential areas are supplied with water, the standard and the effectiveness of the service differs considerably. The communities of Steelpoort in particular experience a significant disparity in water supply. Winterveld is supplied with potable water from the Tubatse River which feeds the large Doornbosch Dam. This dam supplies the households in the three villages, but inadequately – especially in Mangabane. Steelpoort has been expanding since the late 70's when the first houses were built. At that time, the basic water distribution infrastructure was modern, in good condition and under proper management. The water at Steelpoort villages is currently unevenly distributed and some areas have less than others. For instance, in a section of Mangabane village where there are many residents the level of consumption is high. This area has no proper basic water provisioning service and water supply is very poor or irregular. Over the years, the section of the community has experienced a high level of population growth and a growing number of informal settlements such as Makgemeng village have been established. These sections of the community are poverty stricken, do not have access to an adequate supply of potable water and have no means to improve their circumstances. At Makgemeng municipal legislation requires the residents to have water storage tanks fed by run-off rain water in addition to the available running water system with which they have been provided. However, regulations of both Samancor and the Municipality are too lenient – or not followed – as they are not resolving this rural area's water shortage. For example, garden and watering restrictions were to be followed strictly as stipulated by management, for instance watering on a daily basis between 16h00 to 18h00 only. According to the regulations, failure to follow these rules would result in the suspension of the supply of water to the houses concerned without notice and disciplinary action would be taken. However, this does not happen (Kruger, H & Maimane, E.L 2005).

Both Mangabane and Makgemeng residents live under hazardous health conditions as a result of the continued shortage of access to water in the region. As in many regions in South Africa, a high rate of unemployment forces many people into informal settlement areas where the community has no option but to utilize polluted river water for cooking, washing and drinking purposes (Tlhabanelo 2004:2).

On the other hand Bottom and Top village residents enjoy a higher standard of living, have better access to potable water and have all the necessary means to take care of themselves and their environment. Both Top and Bottom residential areas have fewer residents and lower consumption needs compared to Mangabane. There is proper basic service provision with adequate water supply. The water is not only used for basic necessities, it is also used to maintain gardens, swimming pools and other luxuries. The unequal distribution of water with regard to quantity and quality is clear evidence of the gap between the rich and poor.

The above discussion points to two of the environmental issues that are faced by Mangabane: water scarcity and inadequate management of water provisioning and consumption.

1.2 Motivation for and contribution of the study

Because of the enormities of the emerging global water crisis, there has been great concern for the conservation of water not only in South Africa, but throughout the world. Over the past decades, the issue of water shortage has stimulated the interest of many individuals and organisations to hold international conferences and to put forward declarations and reports on how to use water sustainably. Water consumption was a key point of discussion at various international environmental conferences and featured prominently in documents that emerged from these deliberations. The *Tbilisi Declaration* (1997), the *World Conservation Strategy* (1980), the *Brundtland Report* (1987), the *Rio De Janeiro Earth Summit* (Agenda 21) held in 1992 and the *World Summit on Sustainable Development* held in Johannesburg 2002 all gave attention to the issue of sustainable water use.

Key to these conferences and international declarations were that education and training are important instruments in empowering communities so that they become “agents of social and sustainable development” (Huckle in Fien 1993; Enviro Teach 2002(A):5).

These international principles and policies have to be upheld and implemented by the local communities if the intent is to become reality. Crucial stakeholders in ensuring compliance with the principles and policies are governments and the departments that are role players in environmental and natural resource management issues such as departments of environment,

water affairs, education and others; local regional authorities; district municipalities, and individual community members.

Recognition of this fact in relation to the community that the researcher is familiar with, motivated an investigation into ways in which management of the supply and use of water in the Mangabane community could be improved to ensure the sustainability of the resource.

1.3 The research problem, aims and objectives of the study

The preceding discussion has pointed to the importance of articulating and implementing effective water management procedures if communities are to be empowered to use water in a sustainable manner.

1.3.1 The problem statement

The research problem that needed to be examined was to establish how to design, develop and implement environmental education (EE) programmes to effectively manage water consumption and conservation (WCC) in the Mangabane rural community. The following sub-problems were identified as being part of the key research problem.

1.3.2 Research sub-problem statements

To find answers to the above problem, it was necessary to establish

- what criteria underpin the effective design and development of environmental programmes
- what the demographic features, water supply and consumption patterns in the rural villages of Mangabane are
- which policies and regulations are currently applied to manage the conservation and consumption of water in Mangabane rural villages
- whether there are existing community development initiatives in relation to water consumption and conservation
- what the consumption and conservation of water issue are that need to be addressed by EE programmes.

1.3.3 The aims of the research

This general aim of the study was to – through data acquired from field research – design and develop a contextually relevant EE programme for the Steelpoort community that would support the sustainable consumption and conservation of water. By implication the achievement of this aim would entail educating all members of the community irrespective of age or academic level about effective water management procedures to stimulate positive behaviour and attitude towards the consumption and conservation of water.

1.3.4 The objectives of the study

The objectives of the study were to:

- identify those criteria which underpin successful EE programme design and development
- establish what policies and regulations determine water supply and use in the Steelpoort region
- determine what is currently being done in the community to support sustainable water consumption and conservation practices
- identify activities and practices that prejudice water conservation (WC)
- design and develop an EE programme relating to WCC that supports the sustainable use of the resource
- strengthen capacity within the community to respond to environmental issues especially water consumption
- positively influence the behaviour and attitudes of the community towards sustainable resource management.

1.4 Research approach

Research is defined differently in many sources (Bailey 1987:4; Struwig & Stead 2001:3). For the purpose of this study, research is defined as a systematic investigation into a problem, which in this study referred to addressing the issue of designing and developing contextually relevant EE programmes that support the sustainable use of water as a scarce natural resource in the Steelpoort rural area.

The research was undertaken as a structured inquiry that utilized conventional scientific methodology to address an identified problem and create new knowledge that is generally acceptable (Bell 1999:8-9; Charles 1995:5; Gay 1991:3; Grinell, Rothney & Thomlison in De Vos 1998:19; Leedy 1974:5; Leedy 1993:11-12).

Qualitative methods of research were applied in this study because the researcher sought to “describe, decode, translate and otherwise come to terms with the meaning not the frequency” of a naturally occurring phenomena within a community (Tlhabanelo in Neuman 1997:335). The study was exploratory because it aimed at identifying and exploring policies and activities that impact on water management and use in this rural area. The study was also descriptive because it drew on and articulated the experiences of members of the community in relation to the problem under discussion.

1.5 Chapter division

In the first chapter an orientation of the study was provided. Chapter two focuses on a review of the literature on the design and development of EE programmes in rural communities.

In chapter three the decisions that affected the research design, choice of research strategy and data gathering processes are elaborated on.

Chapter four focuses on a consolidation, analysis and interpretation of the collected data while chapter five looks at providing a summary of the research findings, the conclusions reached and recommendations that are proposed.

1.6 Concept clarification

1.6.1 Consumption

Using up or depleting products, goods, services or resources (Collins 2004:242). In terms of this study consumption is used in relation to using up or depleting water as an environmental resource.

1.6.2 Conservation

In terms of this study, conservation refers to the protection of the natural environment which includes the water ecosystem or the act of preventing something from being lost, wasted, damaged or destroyed. The focus is on the wise and responsible use of resources.

Conservation is seen as a primary means to ease pressure on water resources and achieve the sustainability of their development (Collins 2004:178; DEA & T 1999:v; Hornby 2001:242; Jacana Education 1998:17; Van Rooyen 1996:42).

1.6.3 Management

Management refers to the control of an organization or an institution; the act of running and controlling a business or similar organization or to administer, to be in charge of, at the head of (Collins 2004:513).

1.6.4 Sustainability

The utilization of resources wisely and in moderation (in a sustainable way) remembering that both present and future generations have interests and needs that have to be met. All resource exploitation has an impact on the environment and must occur in such a way that permanent damage is not done (DEA & T 1999:51).

1.6.5 Sustainable development

Sustainable development means providing for the need of the current generation without compromising the ability of future generations to provide for their own needs. It is also understood as development that does not use up resources more quickly than they are replaced by natural processes or new technology (Enviro Teach 2002(B):5; DEA & T 1999:16; Balance 1999:4).

1.6.6 Resources

Resources are those requirements that are used to meet human needs. Natural resources are requirement or the things that people use from the earth, such as water, soil, air, vegetation, animals and marine life (Enviro Teach 2001:4; Grove 2006:71).

1.6.7 Environment

The concept environment is understood to mean the natural world around us in which people, animals and plants live. More specifically, environment comprises all the physical, biological and sociological surroundings or elements of an area or the sum total of all the external conditions which may influence any organism, including humans (Collins 2004:285).

1.6.8 Environmental education

Defined by Bogan (1973:30-31), Kgatitsoe (2002:116) and Irwin (1990:4) EE is the process that helps the learner perceive and understand environmental principles and problems, and enables him to identify and evaluate the possible alternative solutions to these problems and assess their benefits and risks. EE develops in humankind the recognition of his interdependence with all life and the recognition of his responsibility to maintain the environment in a manner fit for life and fit for living.

1.7 Closing comments

The background to and context of the study were outlined in this chapter. Against this backdrop, the motivation for the need to undertake the research was outlined. The research problem statement that guided the research and determined the design of the study was put forward and the related aims and objectives of the study were identified.

In the following chapter, a report on the literature review in relation to designing and developing effective EE programmes is presented. This work was used to establish a framework on which suitable, contextually relevant programmes for the particular community and its needs relating to water resource management could be developed.

CHAPTER 2

Principles determining the design and development of environmental education programmes

2.1 Introduction

This study focused on a particular aspect of educating communities about the environment and the use of its resources, namely, how water – which is a scarce environmental resource in South Africa – should be used in a sustainable manner. In Chapter 1 the water supply and use issues unique to the Steelpoort community were outlined and it was pointed out how imperative it is to examine the current use and management of water in this community. Research of this nature would enable the researcher to analyze current trends and to provide guidelines on how to improve the community's capacity to manage its water needs in a sustainable way. The research outcome could inform the researcher on how to design, develop and implement a water management and conservation programme that meets the unique needs of the Steelpoort community in their pursuit of a sustainable lifestyle.

2.2 Status and role of environmental education

The role of education in addressing environmental problems no longer needs to be justified, it would seem. The past decades have supplied overwhelming evidence of the belief that environmental problems can be solved through education. In 1971 the *International Union for the Conservation of Nature and Natural Resources* thought it opportune to define what it understood by EE and the following definition – which has been amended and altered by numerous researchers and organizations to suit their particular perspectives, but which retains the key elements – was forthcoming.

Environment education is the process of recognizing values and clarifying concepts in order to develop skills and attitudes necessary to understand and appreciate the interrelatedness among people, their culture and their biophysical surroundings. Environmental education also entails practice in decision making and self formulation of a code of behaviour about issues concerning environmental quality (IUCN 1971).

The key strengths of this definition are that it regards as essential the

- interrelatedness of people with their biophysical surroundings

- fact that people hold values and attitudes that relate to the environment and how they behave towards and within the environment, and
- fact that skills which include decision making are part of human interaction with the environment.

In a nutshell, the purpose of EE encompasses gaining knowledge (clarifying concepts); developing skills and attitudes; and being able to make responsible decisions that will lead to action.

Looking at the current approach towards education, namely outcomes based education (OBE), it becomes clear that this definition addresses key aspects of OBE namely that knowledge, skills and attitudes are key to any process within education (White Paper 1995:164). OBE also advocates learner activity and participation – issues that are also encompassed within the parameters of this definition of EE.

2.2.1 International developments relating to environmental education

Since the publication of this definition a milestone in the development of EE on a global scale was the 1972 *United Nations Conference on the Human Environment* held in Stockholm which led to the establishment of the *United Nations Environment Programme* (UNEP) which was tasked to establish the term EE as the internationally accepted norm and the conceptual framework within which further development could take place. In 1977 the *Intergovernmental Conference on Environmental Education* was held at Tbilisi in the USSR and the guiding principles for effective EE – to become known as the *Tbilisi Principles* of EE – were adopted. In 1980 the *World Conservation Strategy* was published through sponsorship received from the IUCN/UNEP/WWF and was updated in 1991 as *Caring for the Earth: a strategy for sustainable living* (1991). EE was again strongly emphasized and the documents were used as a basis for national policy making. Other important events and reports which emphasized the role of EE in commission issues were the 1983 *Brundt Commission Report* and the *World Commission on Environment and Development* (WCED) report entitled *Our Common Future* which was also referred to as the *Bruntland Report*. The 1992 *Earth Summit* focused on the role of EE as an educational response to the environment crisis and Chapter 36 of *Agenda 21*

which emerged from the conference, emphasized the need for wide scale environmental programmes in diverse settings to respond to environmental issues. From this point onwards, EE policy was seen to build on the principles that had been established in these groundbreaking developments.

2.2.2 Recent local level developments relating to environmental education

In 1987 in South Africa, a *White Paper on Environmental Education* was developed when it became clear that education curriculum policy needed to be developed within the formal education arena. In 1994 the ANC's *Policy Framework for Education and Training* included the clause that the curriculum

will develop the understanding, values and skills necessary for sustainable development and an environment that ensures healthy living.

In 1995 the principle was further developed in the *White Paper on Education and Training* and it was stated as follows.

Environment education involving an interdisciplinary integrated and active approach to learning, must be a vital element of all levels and programmes of the education and training systems, in order to create environmentally literate and active citizens and ensure that all South Africa, present and future, enjoy a decent quality of life through the sustainable use of resources (White Paper 1995:18).

With the development of curriculum 2005 (C2005) in 1997, environment was defined as a cross-curricular phase organizer which required that in all learning areas, environment be a focus. With the revision of C2005 and the development of a *National Curriculum Statement for General Education and Training*, the phase organizers were dropped, but it was noted that EE should receive special attention. Currently EE processes are integral to all learning areas in the national curriculum with each learning area having a particular environmental focus within it.

Based on the fact that enshrined in Chapter 2 of the *Constitution of the Republic of South Africa* (Act 108 of 1996), citizens of the country are entitled to the right

2.4 Environment

- a: to an environment that is not harmful to their health or well being; and
- b: to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that
 - i: prevent pollution and ecological degradation;
 - ii: promote conservation: and
 - iii: secure ecological sustainable development and use of natural resources while promoting justifiable economic and social development.

27. Health care, food, water and social security

- 1: Everyone has the right to have access to
 - a: health care services, including reproductive health care
 - b: sufficient food and water

it becomes apparent that EE would need to be lifelong and stretch beyond the system of formal education.

Furthermore, given the context of the *White Paper on Education and Training* cited previously, the purpose of education in relation to the environment is to create a citizenry who is environmentally literate and active. It is thus implicit that this education will not be limited to formal education, but that informal, community programmes will also be used to achieve environmental literacy.

2.3 Principles governing the design and development of environmental education programmes

A concise review of what is understood by guiding principles for designing and developing EE programmes was undertaken to establish a theoretical outline or framework. This framework could be argued to be a prerequisite to any good programme planning.

2.3.1 Principles that underlie environmental education programmes

Principles that underlie EE programmes are put in place by the programme developer as an indication of what he or she believes constitutes 'good EE'. The goals of EE – which could be presumed to be the basic principles of EE – are generally perceived as the acquisition of knowledge, skills, attitudes, an awareness of and active participation in matters related to the environment (UNCED 1992).

A review of various sources (LSF; NAAEE 2007; Thomson & Hoffman 2006 : 17) regarding what is perceived to be good EE programme principles indicated that each of the points identified, relates in some way to the UNCED goals mentioned above. The principles indicated that the programme should:

- build understanding and awareness of what is meant by the concept environment ie knowledge of environmental processes and systems
- build an understanding and awareness of the attitude, values, conditions and perceptions at the heart of environmental issues
- be factually correct, promote open enquiry while allowing for presentation of different views and respect for diversity
- build lifelong thinking, decision-making and action-taking skills that enable one to address, prevent and solve environmental issues
- promote civic responsibility and action taking
- be instructionally sound and use instructional techniques that create an effective learning environment
- fit with national and local requirements – eg legislation and policy.

Similarly, Blakeley (s.a.:1-8) comments that an effective EE programme should be

- focused on learning to improve and sustain the environment
- relevant to the community
- developed in partnership with the community and stakeholders
- implemented using learning approaches that are participatory and which develop critical thinking skills
- used to promote environmentally responsible actions within the community.

These principles or criteria tie in with the tenets of the 21 *Tbilisi Principles* and also link to the IUCN goals of EE: acquisition of knowledge, skills, attitudes, awareness and active participation. These five goals could be seen to encapsulate the principles towards which good EE programmes should strive.

2.3.2 Developing and designing environmental education programmes

NAAEE (2002:10-11) emphasizes ten criteria that need to be considered when developing EE programs. EE programmes

- are credible, reputable, and based on solid facts, traditional knowledge, or on science
- create knowledge and understanding about ecological, social, economic, and political concepts, and demonstrate the interdependence between a healthy environment, human well-being, and a sound economy
- involve a cycle of continual improvement that includes the processes of design, delivery, evaluation, and redesign
- are grounded in a real-world context that is specific to age, curriculum, and place, and encourage a personal affinity with the earth through practical experiences out-of-doors and through the practice of an ethic of care. Like the environment itself, programs transcend curricular boundaries, striving to integrate traditional subject areas and disciplines.
- provide creative learning experiences that are hands-on and learner-centered, where students teach each other and educators are mentors and facilitators. These experiences promote higher order thinking and provide a cooperative context for learning and evaluation.
- create exciting and enjoyable learning situations that teach to all learning styles, promote life-long learning, and celebrate the beauty of nature
- examine environmental problems and issues in an all-inclusive manner that includes social, moral, and ethical dimensions, promotes values clarification, and is respectful of the diversity of values that exist in our society
- motivate and empower students through the provision of specific action skills, allowing students to develop strategies for responsible citizenship through the application of their knowledge and skills as they work cooperatively toward the resolution of an environmental problem or issue
- engage the learner in a long-term mentoring relationship, transforming them as they examine their personal values, attitudes, feelings and behaviours.

- promote an understanding of the past, a sense of the present, and a positive vision for the future, developing a sense of commitment in the learner to help create a healthier environment and a sustainable home, community, and planet.

NAAEE (2002) also sets out six key characteristics of high quality EE programmes in the non-formal sector. Such programmes

- support their parent organizations' mission, purpose, and goals
- are designed to fill specific needs and produce tangible benefits
- function within a well-defined scope and structure
- require careful planning and well-trained staff
- are built on a foundation of quality instructional materials and thorough planning
- define and measure results in order to improve current programs, ensure accountability, and maximize the effects of future efforts.

These criteria give more specific insight into the nature or character of proposed intervention programmes. For example the aims and types of learning experiences that should be accommodated are set out in these criteria. By using these development criteria, programmes that are appropriate to and relevant for specific groups can be put together. But when curricula for EE programmes are designed, specific key issues need to be taken into consideration.

These include:

- a *needs analysis* which is conducted to identify a broad range of problems within a community and to identify which need the programme will address
- a *situation analysis* which provides an overview of the general conditions of the target group and the location in which the programme is going to be implemented and includes issues such as social, political, economic and ecological elements
- a *target group analysis* which seeks to answer the questions relating to the characteristics of the people who will benefit from and be involved in the programme, directly or indirectly (CEDPA 2000).

Curriculum development (programme development) is generally considered to be a continuous process that starts with a situation analysis moving through various stages and then

progressing to the evaluation of the programme. On the basis of the outcomes of the needs, situation and target group analysis, the following aspects need to be decided:

- intended goals, objectives and outcomes of the programme
- content and activities that will be included in the programme
- procedures of presentation
- materials (media, resources) required for presentation
- evaluation of the programme.

Other logistical issues that impact on the design of the programme could include

- management and administration of the programme
- time frame of the programme
- transportation of participants to and from the venue if necessary
- costs and who will be carrying the costs of materials, resources and other items (UNEP 2007:5).

The characteristics and criteria listed above indicate that due to the nature of EE, the programme activities that are selected should be based on and make provision for exploration, examination, discovery, enquiry learning and hands-on experiences that actively engage participants. This view is in line with the principles of EE as outlined at Tbilisi.

2.4 Effective environmental education programmes

To develop EE programs effectively, the complex, holistic and multifaceted nature of EE should be recognized and it should also be understood that programme presenters need to have clear, effective and concise programme objectives, outlines, procedures and development strategies in place. Developers need to present programs that are built on a sound understanding of the community the programme is aimed at (see the programme development principles discussed under 2.3.1) and the pressing needs which they are experiencing and which need to be addressed. Effective EE programs should lead to a greater awareness and empowerment of community members, help sustain and improve the environment and solve the problems at a local level.

Developing EE programmes involves communication, education, informing and marketing the actuality of EE. It means involving people for participation at all levels of the society. From a review of readings (UNEP 2003:3-4) on how to successfully promote and develop EE programmes, it would seem that one should attempt to:

- raise public awareness of the programme through various means
- build capacity amongst facilitators (and consequently the participants) that will enable them to take responsibility and sustain the programme
- attend to communication and facilitation skills
- follow collaborative and partnership approaches
- coordinate activities and manage time efficiently
- ensure ongoing support and follow-up activities to ensure the sustainability of the programme
- evaluate the impact of the programme and review it as required.

The selection of instructional methods should take into account the programme learning objectives, participant characteristics and needs, time constraints, community dynamics, available resources and the instructional setting.

2.5 Water management and conservation programmes

EE focuses on the development of skills and attitudes necessary to understand and appreciate the interrelatedness among people, their culture and their biophysical surroundings and natural resources and as such, water management and conservation (WMC) programmes are an element of EE programmes.

Water is a scarce resource in South Africa and needs to be protected. The water crisis in South African rural areas requires the implementation of WMC programmes to minimize this escalating problem. WMC programmes can be best explained as raising awareness and active participation in relation to water management and conservation on all levels – formal education as well as at community level – in all settings including rural areas.

2.5.1 Water management and conservation: an outline of the legal framework

According to the *Constitution of South Africa*, management of water resources should occur in a sustainable, equitable and efficient manner. South Africa is obliged by national policy and legislation as well as international agreements to protect and conserve water resources.

The *National Water Policy* (NWP) was adopted by Cabinet in 1997. The NWP was preceded by the development of 28 *Fundamental Principles and Objectives for a New South African Water Law*. Principle 7 is particularly relevant and states that

The objective of managing the quantity, quality and reliability of the Nation's water resources is to achieve optimum, long-term, environmentally sustainable social and economic benefit for society from their use.

Three fundamental objectives for managing South Africa's water resources, which are firmly grounded in the provisions of the *Bill of Rights* of the *Constitution of South Africa*, arise from the principles. These are

- to achieve equitable access to water, that is, equity of access to water services, to the use of water resources, and to the benefits from the use of water resources
- to achieve sustainable use of water by making progressive adjustments to water use with the objective of striking a balance between water availability and legitimate water requirements, and by implementing measures to protect water resources
- to achieve efficient and effective water use for optimum social and economic benefits (DWAf 2004:7).

The *National Water Act* (NWA) passed in 1998 (Act 36 of 1998) derives directly from the *Fundamental Principles and Objectives for a New South African Water Law* and the NWP's proposals for managing water resources. The Act is the principal legal instrument relating to water resource management in South Africa and contains comprehensive provisions for the protection, use, development, conservation, management and control of South Africa's water resources.

Since water is essential for all life and human endeavours, various other policies and laws administered by a number of government departments also regulate activities dependent on

water or which affect water resources. For example, the *Strategic Framework for Water Services* (2003), and the *Water Services Act, 1997* (No. 108 of 1997), the *National Environmental Management Act, 1998* (Act 107 of 1998), and parts of the *Environment Conservation Act, 1989* (Act. 73 of 1989) also apply to WMC.

Successful water resource management depends on co-operation among various spheres of government and the active involvement of consumers and authorities. As from July 2001, the policy of *Free Basic Water* was introduced to ensure that all households have access to a basic supply of water (DWAF 2004:8). Yet to come is the *National Water Resources Strategy* (NWRS) which will provide the framework within which water resources will be managed throughout the country. Section 5(3) of the Act states that South Africa's water resources must be protected, used, developed, conserved, managed and controlled in accordance with the NWRS and explains the implementation of the *National Water Act* (Act 36 of 1998) (DWAF 2002:42). The *Department of Water Affairs and Forestry* (DWAF) is currently responsible for water resources management at national level (DWAF 2004:9; 11).

2.5.2 Understanding the concept of water management and conservation

Most cities, towns and villages are facing water stress as their reserve of water is diminishing while the demand for water is increasing. Maintaining an adequate supply of potable water is increasingly becoming a challenge. The mean daily demand for water has consistently outstripped the mean flow of available water (Srinivas 2006:1). It is therefore essential to understand that the cycle of water in this context is that for water to be made available for use, it first needs to be collected, stored, relayed or provided. During each of these stages, the water has to be sustainably managed and conserved.

According to the *Environmental Management Framework*, (DWAF 2002:9) the historical focus of water resources management was the development of systems to store and transport water. This included the construction and operation of large dams, tunnels and pipelines, and the local construction of systems of weirs, pump stations and irrigation canals. More recently, the focus has changed from constructing major structures to alleviating water shortages and to a more balanced approach of equity in access to water, as well as to WC and demand

management. The *Water Resources Management Branch* of DWAF is mandated by the NWA to ensure that South Africa's water resources are protected, used, developed, conserved and controlled in an integrated, sustainable, equitable, efficient and optimal manner, to the benefit of all persons.

From a broad environmental perspective, the *Water Resources Management Branch's* functions can be divided into those that impact on the environment and those related to managing the environment. Impacting functions include water resource infrastructure planning, development and operation, while managing functions include policy and strategy development, water resource protection and regulating water use (DWAF 2004:9).

WC and water demand management (WDM) relate to the efficient and effective use of water and to the minimisation of loss and wastage of water, and are important elements of the approach to the care and protection of water resources (DWAF 2004:78)

According to the *National Water Research Strategy*, the core objective is to create a culture of WC and WDM amongst service authorities, providers and consumers. Underlying WC and WDM is the encouragement and support of consumers to increase the efficiency of their water use and reduce their demand for water. The premise is that many water users can maintain their quality of life, and achieve the desired outcomes or products from their water use, whilst using less water. Significant reductions in water use can be achieved by minimising wastage and increasing the efficiency of water use by changes in behaviour and adopting water-saving technologies (DWAF 2004:78).

An essential component of the National WC/WDM Strategy is a programme of communication, education, awareness creation and promotion, and the development of supportive networks.

An analysis of the terms WDM and WC indicates that

- water source management and conservation (WSMC) means an efficient management, storage, allocation and transfer of raw water from its source. It is also the management

which involves the monitoring of water quality and quantity of local rivers, streams and vleis through rehabilitation activities, river clean ups and similar initiatives (Herbertson 2001:111; Imiesa 2002:31).

- water provisioning management and conservation (WPMC) refers to the distribution of water with minimal losses and consumption without wastage. It is also an improvement of the operation and maintenance for public supply, distribution and more efficient provisioning of water for consumption (Du Plessis 2004:11).
- water conservation awareness (WCA) refers to an understanding of the need to use water more wisely and efficiently at all stages from capture to consumption in order to promote changes in attitudes and behaviour with regard to water management and use (Herbertson 2001:1).

In allocating water in public interest, national Government must consider the planning and development of water resources in a manner which ensures the efficient, equitable and sustainable use of the resources. To make water available as planned, it is essential that the principles of conservation and demand management are understood and applied.

2.5.3 Key principles of water management and conservation programmes

Principles underlying water management and conservation reflect the fundamental beliefs and attitudes to conserve and provide water efficiently to those who need it. The National WC/WDM Strategy as discussed in the *National Water Resource Strategy* (DWAF 2004:79) is based on three fundamental principles, namely

- water institutions should strive to supply water efficiently and effectively, minimise water losses and promote WC/WDM among their consumers. Water institutions responsible for supplying water to users should take steps to reduce leakage in their systems, and develop and implement measures to promote WC/WDM.
- users should not waste water and should strive to use it efficiently. Wasted water is water used without any direct benefit being derived. Inefficient use of water is water use that exceeds the accepted benchmark for the particular purpose, or water used where the derived benefit is sub-optimal.

- WC/WDM should be an integral part of the planning processes for water resources management, water supply and the provision of water services.

It is stated in the NWA that sustainability and equity are central guiding principles in the protection, use, development, conservation, management and control of water resources. These guiding principles recognize the basic human needs of present and future generations, the need to protect water resources, and the need to promote social and economic development through the use of water (Enviro Teach 2002(A):23, White Paper 2006:1).

Actions needed to reverse the present trends of over-consumption and irresponsible use of water resources could be said to be guided by four principles encapsulated in the *Dublin Statement* forthcoming from the international conference on water and environment held in 1992.

Principle No. 1

Fresh water is a finite and vulnerable resource, essential to sustain life, development and the environment.

Since water sustains life, effective management of water resources demands a holistic approach, linking social and economic development with protection of natural ecosystems. Effective management links land and water uses across the whole of a catchments area or groundwater aquifer.

Principle No. 2

Water development and management should be based on a participatory approach, involving users, planners and policy-makers at all levels.

The participatory approach involves raising awareness of the importance of water among policy-makers and the general public. It means that decisions are taken at the lowest appropriate level, with full public consultation and involvement of users in the planning and implementation of water projects.

Principle No. 3

Women play a central part in the provision, management and safeguarding of water.

This pivotal role of women as providers and users of water and guardians of the living environment has seldom been reflected in institutional arrangements for the development and management of water resources. Acceptance and implementation of this principle requires positive policies to address women's specific needs and to equip and empower women to participate at all levels in water resources programmes, including decision-making and implementation, in ways defined by them.

Principle No. 4

Water has an economic value in all its competing uses and should be recognized as an economic good.

Within this principle, it is vital to recognize first the basic right of all human beings to have access to clean water and sanitation at an affordable price. Past failure to recognize the economic value of water has led to wasteful and environmentally damaging uses of the resource. Managing water as an economic good is an important way of achieving efficient and equitable use, and of encouraging conservation and protection of water resources.

Up to this point, the discussion above – apart from a cursory mention in Principle 1 – has focused on principles of WC and management for human use: to provide people with enough to meet their basic needs – to drink, grow their food and support their industries. An interesting thought is to consider that people cannot live by water alone and that they require the services of environment's life support system, which itself needs water to function. Consequently, sound water management should focus on the global ecosystem and not as a conflict against nature to supply water for people (Acreman 1998). Principles for the management and conservation of water must consequently take into account human *and* environmental needs and should be managed through an ecosystems approach. An ecosystem approach is a strategy for the integrated management of resources that promotes conservation and sustainable use of those resources – plant, animal, micro-organism communities and their non-living environment interacting as a functional unit – in an equitable way. In terms of water management, an ecosystems approach is an integrated approach that supports improved

water governance, democratisation of water management and economic development while conserving and restoring rivers, lakes, wetlands and groundwater reserves (IUCN 2003).

In 2000 the IUCN identified principles relating to water management. These principles are:

- Equity - water management activities equitably distribute the costs and benefits from water resource use and management and explicitly aim to alleviate poverty and create gender balance.
- Efficiency - management promotes the most efficient use and reflects the full value of the resource, including market, ecosystem and socio-cultural values.
- Sustainability - the water management regime is self-sustaining and readily adapts to changing conditions.
- Legitimacy - water management institutions have a sound legal basis and their decisions and actions are seen as legitimate and fair by all stakeholders.
- Accountability - policies and practice, and roles and responsibilities lead to efficient, fair and legitimate uses of water resources and the different stakeholders are accountable for their actions.
- Subsidiary - decision-making authority is devolved to the lowest appropriate level along with the power and resources to make and implement these decisions.
- Participatory - all stakeholders are given the opportunity to participate in water resources planning and management decision-making and to become involved in reducing water conflicts.

Water supply depends first on the ecosystems that capture, filter, store and distribute water such as forests, wetlands and soils. When WC and management programmes are undertaken, it is significant that these important principles should also be noted.

2.5.4 An overview of existing programmes in rural areas of South Africa

WC programmes are basically aimed at preparing the youth and older community members to participate and become responsibly involved in water related issues for example, consumption, conservation and management. Currently there are several existing programmes in rural areas in South Africa. A brief review of some of these programmes is provided.

2.5.4.1 Department of Water Affairs and Forestry (DWAf) programmes

- **The 20/20 Vision for Water Education Programmes**

This WMC programme provides guidance on strategies to prevent water wastage in rural communities. It also helps to raise the youth's level of awareness to use water efficiently, conserve natural resources, participate in water resource management, make informed decisions and then transfer the knowledge to their parents. Youth are able to play a key role in changing the mindset of communities. They are taught to conduct water audits at school and homes, to form enviro-clubs and water committees, and to celebrate environmental commemorative days such as Water Week, Wetland Day and others as part of public awareness campaigns in South Africa. The project also develops materials for the different phases of the curriculum and provides teachers with training support (Enviro-Teach 2000:31; Enviro-Teach 2001:18-23; DWAf 2001:9; Lotz-Sisitka 2005:3).

- **The Working for Water Programmes (WFW)**

The key intention of this programme is to control invading alien plant species that drain water from the environment. Strategies to use water wisely have been promoted in the rural community of Mangabane (Earthyyear 2001:104, Barker 1997:110, Enviro Teach 2001:23, Enviro-Teach 2002:35). These programmes also promote the celebration of environmental days such as Water Week and Wetland Day.



Photo1: Learners from Mangabane Primary School involved in the ‘Working for Water programmes’.

- **Enviro-clubs / Eco Clubs**

DWAF was instrumental in encouraging local schools to form enviro-clubs. The purpose of enviro-clubs is to coordinate EE initiatives at school. These clubs can also play a role in WC issues by identifying water waste areas such as leaks and dripping taps for repair in order to save water and money.

- **Celebration of environmental days**

As mentioned above, the commemoration of Water Week, Wetland Day and others are supported by DWAF to raise awareness of their importance in the water sector annually. During Arbor Day celebrations, trees are supplied to the community to encourage the prevention of soil erosion in order to enhance water supply in the rural communities.



Photo 2: Learners from Mangabane Primary School involved in the ‘Celebration of Environmental days’.



Photo 3: Learners from Magakantshe Primary school involved in the ‘Celebration of Environmental days’.

2.5.4.2 The Mvula Trust

The mission of Mvula Trust is to alleviate poverty in rural areas by increasing their access to safe and sustainable water and sanitation services. It supports the development of good practice in the water sectors by advocating sustainable programmes. The local black women are empowered to run and manage their village water committees on their own (Earthyear 2001:103).

2.5.4.3 School Water Action Project (SWAP)

This project helps with water awareness activities which involve audits and water rehabilitation programmes such as greening the environment. This includes tree planting and the planting of flowers, grass and shrubs to prevent soil erosion. The activities of SWAP are supported by the Delta Environmental Centre and the Eco-schools project coordinated by the Wildlife and Environment Society of South Africa (WESSA).

2.5.4.4 Rain Water Harvesting Programme

The International Rainwater Harvesting Alliance was founded after the *World Summit for Sustainable Development* in Johannesburg (DWAF 2002) as a response to the ever-increasing water management crisis. Rain water is collected from the roofs of buildings via gutters and is stored in tanks for later use (DWAF 2001:68; Lang 2003:2-3; Snyman 1998:10-11).

2.5.4.5 Drought Emergency Programmes

This type of project is essential to sustain South Africa's water economy as well as to meet social needs particularly in the rural areas. It was initiated by DWAF in order to ensure investment in water security (DWAF 2001:28; Rebelo 2004:26).

2.5.4.6 Water-wise Gardening Project

The project promotes gardening with plants suitable to a particular area and conditions. People are taught to plant drought resistant crops and flowers which use little water (DWAF 2001:72).

2.6 Closing Comments

The principles determining the design, development and implementation of EE programmes in general were highlighted. The concepts underlying water management and conservation were defined and analyzed, and the guiding principles for WMC were identified.

In the following chapter, the decisions that affected the research design, choice of research strategy and data gathering process are discussed.

CHAPTER 3

Research methodology and design

3.1 Introduction

Chapter three highlights the research design, methodology and research process that was followed in the actual study. The reasons for the decisions that guided the research are also outlined.

In essence, the study was approached as a qualitative case study. Data that is grounded in context was obtained through qualitative research data collection strategies. Throughout the study, measures were taken to ensure trustworthiness of the data and that ethical research principles were applied. These issues are discussed in this chapter.

3.2 Research approach and method

The methods, techniques and procedures – ie the research methodology – used in the research are to a large extent determined by the nature of the research problem and the type of data required to investigate that problem. Research methodologies are broadly categorized as “qualitative” and “quantitative” (Leedy & Ormrod 2001:100). In order to motivate the selection of the specific research methodology for the purpose of this study, a brief discussion of certain distinguishing characteristics of both qualitative and quantitative approaches follows.

3.2.1 Distinguishing characteristics of qualitative research

The purpose of a qualitative study is to understand and describe actions, events and processes within the actual circumstances in which they occur. Qualitative studies are thus descriptive and exploratory in nature (Babbie & Mouton 2001:270-271; Leedy & Ormrod 2001:102).

In qualitative research multiple realities exist pertaining to the phenomenon being studied, namely that of the reader, the research population and the researcher. It is the responsibility of the qualitative researcher to report accurately on the realities of both the participants and researcher (Babbie & Mouton 2001:270-271; Creswell 1994:4&6). The qualitative research

design is flexible and develops as the research progresses (Leedy & Ormrod 2001:15). The researcher interacts with participants in the study and tries to minimize the distance between him / her and those being studied (Creswell 1994:6).

The data in a qualitative study are in the form of words or pictures and are analysed through the identification of emerging categories and themes. Qualitative research reports are more of a personal nature and are written in a literary style (Borg & Gall 1996:30; Leedy & Ormrod 2001:103).

3.2.2 Distinguishing characteristics of quantitative research

In quantitative research the research design is fixed and controlled by carefully designed guidelines. Reality is seen as objective and meaning is determined by the researcher who attempts to remain distant from that which is being researched in order to remain unbiased (Creswell 1994:6; Leedy & Ormrod 2001:102; University of South Africa 2001(a):15).

Concepts, variables, hypothesis and methods of measurements are defined before the study begins and remain the same for the duration thereof (Leedy & Ormrod 2001:102). In qualitative research the tendency is to select a few participants who would best be able to shed light on the process, actions or events being investigated, whereas with quantitative research, data are normally collected from large samples which would represent a population. For the purpose of quantitative research, data are normally in numerical form and are analysed statistically (Unisa 2001(a):15). Quantitative reports are impersonal and objective (Gall, Borg & Gall 1996:30; Leedy & Ormrod 2001:103)

3.2.3 Justification for the choice of research approach

It appeared that most of the assumptions of a qualitative research approach were relevant to this research study. Consequently this research which explored and described how selected respondents from the Steelpoort area perceive and experience the issue of WCC was guided by a qualitative approach.

Within the qualitative approach further options are available to the researcher. Apart from the characteristics already mentioned, a further characteristic of the study that qualified it as

qualitative research was that the research was value-bound (Borg & Gall 1989:385). The values of the researcher and those of the researched orientated the process of inquiry. The choice of the research methods employed and the values and opinions of the researched were integral to the research process and its outcomes and its interpretation.

In assuming to derive meaning from data, the researcher assumed an inductive stance (Merriam 2001:17). He began reflecting on the data from the very first day of fieldwork (Woods 1992:387) assimilating the elements he uncovered to understand how they interact in the life world of the participants.

3.3 Types of qualitative research

Case studies, ethnographies, phenomenological studies, grounded theory studies and content analysis, represent kinds of qualitative studies (Gall, Borg & Gall 1996:544, Leedy & Ormrod 2001:147-148). In this research, a case study approach was followed.

3.3.1 Case studies as research method

The case study method provides the opportunity for the investigation and analysis of a selected group of primary respondents who comprised mainly adult members of the community, youth and the teachers at the two local primary schools. It also enables the researchers to discover the uniqueness of the people's experiences within a particular context (Huysamen 1994:168). It is a study that occurs within a bounded system (Merriam 2001: 20) - in this case, from Steelpoort community who generally lack basic education regarding water management and conservation ethics.

The direct linkage between context and the experiences cannot be separated in a case study (Yin 1993:31). Context offers numerous and rich variables and consequently experimental design, which isolates one or two variables and controls the remainder is unsuitable to this type of research (Ibid). The case study undertaken considered the interpretations and descriptions of participants regarding multiple views in the outcomes of the research (Stake 1995:64).

As in case study research, the researcher tried to avoid exerting any influence, control or manipulation of the attitude of the community consumers being studied to ensure that the responses elicited were reflective of context, honest and reliable (Borg & Gall 1989:382). A further precaution to ensure validity and reliability of findings was to carry out the research in its natural context. Several forms of inquiry were employed to help the researcher understand how the members of the community being researched viewed and constructed their reality, and felt and responded to their experiences (Merriam 2001:5-6). Consideration of all contextual factors enabled the researcher to gather rich data to create reliable interpretations of the findings (Bassegy 1999:65). A phenomenological approach that holds that description of an object or occurrence as it exists precedes explanation by means of causes, purposes or grounds (CARP 1997-2002), guided the researcher in deriving accurate data and interpretations.

3.3.2 Measures to ensure research accuracy

Phenomenology features prominently in qualitative research. Huysamen (1994:167) explains:

Phenomenologists are concerned with understanding social and psychological phenomena from the perspectives of the persons involved. The phenomenologist is primarily concerned with the participant's experience of the phenomena.

During the inquiry process, the researcher develops the perspectives of the community consumers and adopts an insider's viewpoint (Borg & Gall 1989:289). However, the researcher had to acknowledge his preconstruction / presumptions and suspend them so that the collected data is not distorted or misconstrued by underlying personal assumptions.

Janse van Rensburg (2001:8) is of the opinion that researchers have an ethical responsibility to society to ensure that they produce trustworthy research outcomes. Her concern is that research outcomes affect the world – they inform policy, programmes and projects. Thus measures have been put in place as a safeguard against deception. She identifies four criteria used to judge research integrity in qualitative research namely, credibility (truth value), transferability (applicability), dependability (consistency) and confirmability (neutrality).

Credibility is an attempt to provide authentic accounts of events (Gall & Borg 1989:406). To meet this criterion, the researcher was sensitive to any personal biases that might distort data collection, analysis and interpretation.

The following measures were in place to reduce subjective distortions: reflexivity, prolonged and varied field experience, member checking and triangulation (Janse van Rensburg 2001:9). Triangulation involves the use of at least three approaches to collect the data. In this research data was collected through observation, interviews, document analysis, photos and video recording (see Mouton 1996:156). Woods (1992:394) supports the use of multiple techniques because each has its own strengths and limitations. This enables the researcher to note counter patterns and convergence in the data (Lather 1986:270). Triangulation also supports and confirms collected data.

Applicability refers to the extent to which research outcomes can be extended to other similar cases (Maxwell 1992:293). In this study theories and hypotheses were developed that can be applied to situations similar to the one studied. Purposeful sampling was done to enable the researcher to gain an in-depth understanding of sustainability issues at the community level, from which generalizations were made (see Yin 1993:40). Purposeful sampling entails the selection of respondents who, in the researcher's opinion are in a position to provide perceptive and meaningful data.

Dependability is the extent to which the same research accounts can be obtained given the same context and population at different times (Bassegy 1999:75). To increase the dependability of the data, the researcher asked the interviewees to study the interview transcripts and reports to ensure that whatever was included in the report was supported by the interviewees (Ibid:69).

To ensure conformability, the researcher applied triangulation and flexibility as advised by Janse van Rensburg (2001:9).

3.4 Research design and process

The research was conducted in the Steelpoort area among adults and youth who are regular users of water in the Mangabane community in Mpumalanga. The process of collecting data relied mainly on the human qualities of interaction, observation and interpretation to gather and document holistic information (Borg & Gall 1989:379). The person as the instrument for data collection and analysis (Merriam 2001:7) was the most appropriate for this particular study. The intention was to gain an in-depth understanding of the whole setting where the community consumers' activities were taking place (Ibid). The collection of data through personal interaction was supplemented by video recordings and photography.

Fieldwork dominated the inquiry and the data collection process as it enabled the researcher to get to understand the social and biophysical aspects of the researched unfolding in a natural setting (Ibid). The research activity is summarised below.

Activity: Literature review

Date: 03-01-2006 to 07-10-2006

Data sources: Textbooks, journal articles and online sources.

Research questions:

- 1 What are the principles that affect the design and development of EE programmes?
- 2 What theories, policies and actions underpin the practice of water conservation?

Research objective:

Reviewing literature on theories and principles that underpin the practice of EE programmes and WC.

Activity: Fieldwork – observation

Date: Every other Monday from 28-05-2006 to 29-09-2006

Data sources: Community members, school members and the biophysical environment.

Data collection methods: Photography and observation

Research questions:

- 1 Which of the incidences of wasteful water activities were manifested?

- 2 What water related issues are experienced in the community that affect the life situations of community members?

Research objectives:

- 1 Observing the participants to discover which incidences of wasteful water activities were manifested.
- 2 Conducting a WC audit to record water related issues that affect the life situations of Steelpoort rural community.

Activity: Document analysis

Date: 11-01-2007 and 28-02-2007

Data sources: School's environmental policy and educator's notes.

Research question: What WC skills were the participants exposed to during the research process?

Research objective: Reviewing the documents related to the water auditing activities dealt with during the programme and relating them to causes of water shortage or problems experienced in the community and schools.

Activity: Questionnaires

Date: 30-01-2007 to 28-02-2007

Data sources: Copies of the questionnaire

Research question: What is currently being done in the community to support sustainable water usage?

Research objective: Finding out which issues need to be provided for when designing EE programmes can be designed to influence the behaviour and attitudes of the community towards sustainable resource management.

Activity: Interviews

Date: 29-01-2007 to 07-01-2008

Data sources: Documents, articles and interview schedule.

Research question: What has been done to strengthen the capacity within the community to respond to environmental issues?

Research objective: Finding out the capacity building applied currently to help the community to respond to environmental issues.

Date	Activity
July – Dec 2005	Determining the research topic and refining the research problem Administering the questionnaire and conducting the interviews
Jan – Feb 2006	Conducting the questionnaire and evaluation of the interview schedule
March – May 2007	Conducting interviews and carrying out observations, transcribing the interview responses, verifying the interview responses with the interviewees
Sept – Oct 2007	Analysing and interpreting data
Oct – Dec 2007	Writing the research report

Table 3.1 Synopsis of research schedule

3.4.1 The role of the researcher

In qualitative research the researcher is regarded as “an instrument” for data gathering purposes (Borg & Gall 1989:385) in much the same way as an intelligence test is considered “an instrument” (Leedy & Ormrod 2001:147) in determining IQ. It would seem to be essential that a qualitative researcher prepares him / herself for this role of “research instrument.” The preparation appears to include self-examination, the development of data analysis skills and the studying of relevant literature on research processes and the topic being studied (Schurink 1998:257-258).

According to Schurink (1998:256-266) fieldwork in which the qualitative researcher would get involved would not be “straight forward” nor “unproblematic”, and gaining access to the respondents could also prove to be hard work.

3.4.1.1 Gaining access into the setting

Gaining legitimate access to a setting, as well as building and maintaining good relationships with gatekeepers (principals and community leaders in the context of this study), is a prerequisite for successful fieldwork. In order to enhance the possibility of gaining access, the aim and purpose of the research should be explained to the gatekeeper. It is also necessary to explain what the research process at the specific setting would entail as well as the researcher's intention to collect and analyse the data as objectively as possible (Schurink 1998:258-259).

The researcher had made contact during 2005 with the management of Samancor in order to obtain permission to do research at Steelpoort community (see Appendix 1). At that stage, the meeting was exploratory and aimed to discuss research problems pertinent to the research community's "real world" which could possibly be used as a topic for the researcher's M.Ed studies. The researcher was referred to the Samancor Household Manager who organised a general meeting with the community members regarding the water problems experienced in the community and suggestions to address the problem with the help of the researcher. The response from community members to participate in the study was very supportive and cooperative.

During the process of doing research, ethical principles, which are briefly referred to in the following paragraph, guided the researcher's conduct.

3.4.1.2 Ethical considerations

Ethical guidelines serve as standards and form the basis upon which a researcher evaluates his / her own conduct pertaining to the research undertaken (Strydom 1998:24). These guidelines / principles relate to considerations of fairness, honesty, openness of intent, disclosure of methods, explaining the purpose for which the research is being done, respect for the integrity of the individual, guaranteeing individual privacy and a willingness on the part of the participant to voluntarily participate in the research activity (Leedy 1997:116). It would seem that ethical aspects need the utmost consideration when human beings are the object of study (Borg & Gall 1989; Leedy 1997:116; Strydom 1998:23).

The researcher adhered to ethical considerations by assuring and guaranteeing respect for privacy and confidentiality. The researcher attempted to report the findings of the study as accurately and objectively as possible. The researcher gave the respondents a letter (see Appendix 3) requesting their participation in the study and also explaining the purpose of the study.

3.4.1.3 Personal values and biases

In view of the fact that interpretation of data by the researcher is a distinctive characteristic of qualitative research (Stake 1995:8-9) the biases, values and subjective opinions of the researcher that could influence data interpretation consequently need to be kept in check. The researcher needed to identify and state these biases and opinions in the research report (see Creswell 1994:147 & 163-164) as it is argued that this openness would encourage greater objectivity on the side of the researcher and may also assist a reader with further understanding and interpretation of the reported findings.

The researcher who conducted this study is an employee of the Department of Education in Limpopo Province (Nakgwadi Secondary School). The researcher is not a member of the community selected for the case study investigation and consequently did not have personal gain – eg gain in status or recognition within the community – at heart when he undertook the research. His field of work does not in any way relate to EE, however, as fulfilment of the requirement to undertake a research project as part of his masters' studies in EE with Unisa, he chose to investigate the question of water management and conservation (WMC) in an attempt to gain an in-depth understanding of water usage in the community. The findings of the research would be used to develop an environmentally focused programme that would enable Steelpoort community consumers to utilise water in a responsible and conservative manner.

The researcher was aware that the community is generally environmentally illiterate especially with regard to wise resource usage. The researcher, as a student in EE, has a desire to work towards informing others about the importance of developing positive and responsible

environmental attitudes and behaviour. In other words, it is the researchers desire to build environmental literacy within communities.

3.5 The participants

3.5.1 Selection of respondents

Mangabane Primary School situated at Mangabane village (1 Principal, 5 educators, 1 non-teaching staff member, 6 learners and 8 community members) and Magakantshe Primary School situated at Makgemeng rural area (1 principal, 1 educator, 1 non-teaching staff member, 6 learners and 4 community members) were identified for research purposes because of their proximity to the researcher's residence. Another factor that was taken into account when selecting the sample was that this is a representative sample which consists of an advantaged school, namely, Mangabane Primary School situated at a peri-urban area and a disadvantaged school, namely Magakantshe Primary School situated at a remote rural area that consists largely of informal buildings (shacks and mud houses). The sample was also a fair representation of the socio-economic status of the population of Mangabane village since it included the employed, unemployed and single housewives.

Thirty four people were identified and selected for the purpose of completing questionnaires. They were regarded as an adequate sample for giving in-depth responses for the purpose of the study. The sample consisted of two school principals; six educators from grades 5, 6 & 7; two non-staff members; twelve learners selected from grades 5, 6 & 7 in both schools and twelve community members of which eight were from Mangabane peri-urban area while four were from Makgemeng remote area.

The following criteria were used to select school principals:

- they are the heads of the institutions
- they are in a managerial position
- they (helped by deputy principals and heads of the departments as well as educators under them) are responsible for determining the needs of the school such as curriculum needs, curriculum extension, EE policy, integration and implementation of EE into the existing school curriculum.

The following criteria were used to select educators:

- they are facilitating teaching and learning programs for grades 5, 6 & 7
- they had been trained in C2005 which supports a cross-curricular approach (integration within single learning areas and across several learning areas). They were therefore in a better position to answer the curriculum related questions as compared to educators in the lower grades.
- although EE is not a learning area, environment is integral to individual learning outcomes in each of the eight learning areas of the C2005 and they should have knowledge of the concept.

The following criteria were used to select non-teaching staff members:

- they are working in the environment outside / around the school grounds.
- their work requires them to interact with the natural environment and water resources (gardeners and cleaners).
- they should be familiar with WC and management issues as they will take over those responsibilities after the research has been completed.

The following criteria were used to select learners:

- they are the senior learners of the primary school children (in grades 5, 6 & 7)
- they were able to read, write, speak and understand English which was the language used during the research process
- they were able to demonstrate and to act in a play or drama, to draw posters and become actively involved in some activities selected specifically for the study.

The following criteria were used to select the community members (mostly women):

- they are the water managers of their households.
- they (women) are the housewives as they are not working away from home – particularly those respondents in the rural areas – and therefore are more likely to be consumers of water than men (who are employed and work outside the community).

- women have a great responsibility in relation to using and managing water (see 2.5.3) so it was imperative to include them as research participants; and a few men (business owners, hostel dwellers and unemployed) were also involved.

3.5.2 Gaining access to respondents

The researcher requested permission to conduct research in Mangabane rural communities from Samancor management (see Appendix 1). Permission was granted as outlined in the letter (see Appendix 2).

The researcher stays in Mangabane village during the week and therefore was able to personally interact with the residents. As such the researcher had opportunity and access to request prospective respondents to participate in the study. The researcher introduced himself and supplied the respondents with a letter of permission was granted as outlined in their response by the Samancor (Winterveld) management to conduct research at Mangabane village. The researcher also supplied the respondents with a letter (see Appendix 3) requesting them to participate in the study and also explained the purpose of the study to them to ensure that they were informed of what would be required from them (see par 3.4.1.2).

The researcher obtained permission to conduct the research in the schools of Steelpoort area from the Samancor management (see appendix 2).

3.5.3 Data collection tools

The researcher used observation, interviews, questionnaires, photographing, video recording and document analysis to collect data pertinent to the study.

3.5.3.1 Observation

Observation provided data on the physical setting, the participants, activities and their verbal and non-verbal interactions (Merriam 2001:97). The researcher adhered to the following ethical procedures or requirements regarding observations. He ...

- obtained permission from the management of Samancor to enter the community. The community leaders introduced the researcher to the adult members of the community, members from both Mangabane and Makgemeng villages.
- provided participants with honest information about the research and about the researcher's qualifications and experience
- explained that the purpose of the research was to work towards developing positive attitudes and action in relation to the use and management of water.

Observing the above-mentioned ethical requirements enabled the researcher to establish rapport and put participants at ease. The researcher's presence was consequently construed as unobtrusive and acceptable (Merriam 2001:99). The researcher's role as an investigator was known and group members selected to use the researcher as a resource person as well.

Observations were made on an ongoing basis throughout the study and were recorded in a field notebook. From the field observations records were developed. These were used to build up a database which formed the basis for critical analysis, reflection and interpretation (Merriam 2001:111). In these records the researcher described the setting of the people and their activities. Direct quotations and the core ideas of conversations were also noted while the researcher's comments and observations were put in the margins (see Woods 1992:387). Strict measures were applied to check against unreliable data (Bassey 1999:74).

The researcher visited the research site (the schools and the community) continuously till the end of the research process. This assured prolonged field experience, catered for repeated data collection sessions that allowed trends and regularities of the setting to unveil naturally (Yin 1993:46). The researcher also took account of his personal conceptions towards the research through reflection to identify views and feelings that could pose a potential threat and influence data analysis and interpretation (Woods 1992:373).

Observation provided first hand information of the context studied, but because an individual cannot observe everything and information on environmental issues cannot be obtained

through observation only, interviews were carried out to gain information on what others had observed and on the events of the past (Stake 1995:64).

3.5.3.2 Interviews with participants

Interviews do not only provide data that cannot be obtained through observation but also compliment observation data (Merriam 2001:91). Noting that interviews offer the perceptions of the informant, the researcher employed measures to respect the interviewees as persons and the truth-value of the information provided (Bassey 1999:74). To elicit credible and dependable responses from the interviewees and respecting them as persons and information sources, the interviewer was careful to:

- be sensitive and empathetic to their health state, physical well-being and mood (Merriam 2001:91)
- be non-threatening, avoiding an atmosphere of interrogation, and to create a relaxed conversational mode of interaction (Borg & Gall 1989:397)
- pose questions using the vernacular, so that questions were clear and meaningful to the respondents (Ibid:401)
- seek the consent of the respondents prior to recording interview data on video and on paper
- be non-judgemental, maintaining a neutral stance to the information provided (Merriam 2001:84)
- listen actively showing respondents that he followed by reacting both verbally their comments, by infilling where responses were unclear, and nonverbally by nodding and using paralinguistic (Woods 1992:372)
- talk less than the respondents (Borg & Gall 1989:401)
- reflect on the impact of the interview on both the interviewer and the interviewees (Woods 1992:373)
- account for any biases, predispositions, attitudes and physical state of both the interviewer and the interviewees that could distort the data collected (Merriam 2001:87)
- ask local teachers to act as research assistants

- take note of non-verbal responses such as body movements, intonation and paralinguistic, because they punctuate verbal communication and give emphasis to meaning while expressing an emotive overtone.

In qualitative research, a prime requirement of an interviewer is for him or her to be sociable and to develop friendly interactions with the participants. Both at the start of the research and at the end of the research the interviewer opted for unstructured interviews which further enabled him to explore and gain an insight into the respondents' experiences.

3.5.3.2.1 Interviews with the principals and teachers

The researcher conducted interviews with principals and teachers. The questions that guided the interview were:

- Are you familiar with the concept of WC?
- Have you taught / are you teaching EE at your school?
- Does the school have EE programmes or activities?
- Have you had any formal training in WC or water saving skills at your school?
- Are there some activities at the school that could be contributing to excessive water use or loss?
- Do you have a water policy at your school?

These questions sparked opportunities to further probe and discussed related issues that enabled teachers to elaborate on water saving skills at the school and within the community.

3.5.3.2.2 Interviews with non-teaching staff

The researcher conducted interviews with the non-teaching staff members. The questions that guided the interview were:

- Who is taking care of your school's garden, the nursery and orchard and cleaning?
- What time of the day do you water the garden?
- Do you remove/control weeds from the garden?
- Do you regularly check for leaks around the school?
- Do you know how much water is used per day at your school?

3.5.3.2.3 Interviews with the community members

The interview with the community members featured a mix of open-ended and structured questions. The list of the questions posed is given below:

- How is water supplied to your community?
- Where do you report leaking / broken taps / pipes?
- What time of the day do you irrigate / water your garden?
- Can you estimate how much water do you use per day at home?
- What can you say about WC?

The community members were keen respondents and gave detailed responses to each of the questions. The researcher also used photography for data collection. This method further served to increase the trustworthiness and to add a visual record of the data collected.

3.5.3.2.4 Interviews with the learners

The researcher conducted interviews with the learners. The questions that guided the interview were:

- Do you inform your family members the importance of WC?
- Can the vegetation (flowers) become green without water?
- Do you plant trees on Arbor Day at your school?
- Do you celebrate the Environmental Commemorative Days i.e. Wetland Day at your school?

3.5.3.4 Photographing

With the help of some residents, the researcher took photographs of instances where water is being wasted in areas at the schools and in the community to help complement observation data. Photographic evidence was taken at the time of the interviews, when observations were being recorded and during research to increase the dependability of the data. The researcher sought permission before taking the photographs. In all instances, the participants supported this data collection process and as an expression of his appreciation he gave participants copies of all the photographs.

3.5.3.5 Video Recording

With the help of some residents, the researcher video recorded most of the water waste practices as they occurred at school and community sites to help complement observation data. This was also done during observation and interviews to increase the dependability of the data.

3.5.3.6 Questionnaires

The researcher distributed copies of the questionnaires to the principals, teachers, non-teaching staff, and children and to the adult community consumers to help complement observation data obtained during the initial stages of the research process. The researcher collected the completed questionnaires from the participants before the end of research for analysis and integration. The questionnaires provided to each category of respondents differed. By doing it this way, the researcher ensured that the information received from each group took their unique situation into account and that the questions were of particular relevance to their circumstances and role in the community. Below is a list of the questions that were included in the questionnaires (also see appendixes 4.5.1; 4.5.2; 4.5.3; 4.5.4 & 4.5.5).

Principals and teachers

- Six questions that were asked in the interview were repeated.
- Do you think that EE can be integrated into the various learning areas?
 - * If yes, say how?
 - * If no, say why?

Non-teaching staff members

Five questions that were asked in the interview were repeated.

- Are you familiar with the concept WC?
- How do you water the school garden? Provide information on the way in which you water the garden.
- Do you plant trees and shrubs to prevent soil erosion around the school yard?
- Please give an indication of how water is used in the ablution facilities.
- Please comment on the general use of water at the school.

School children

- Do you know where the water in your school taps comes from?
- Did you know that South Africa is a dry country?
- Do you report leaking taps and pipes at school / home?
- Do you understand the process of the water cycle?
- When should gardens be irrigated?
- Are you familiar with the process of water auditing?
- What would you be able to learn from a water audit?
- Can you estimate how much water you use per day at your school / home?
- Is there an enviro-club at your school?
- Are you a member of the club?

Mangabane community consumers

- At what time of the day do you irrigate your garden?
- Do you bath using a basin, bath or shower?
- How do you wash your cars?
- Do you rinse your clothes directly in a basin or in the laundry machine?
- Do you report leaking pipes / taps in the community?
- Do you attempt to repair leaking taps or pipes yourself?
- What are the actual activities and practices that prejudice WC in your area?
- Estimate how much water you use per day at home.
- Do you think your village will have enough water in 20years to come? Motivate your answer.

Makgemeng community consumers

- How is the water supplied to your area?
- Do you rinse your clothes or bath in the river / stream / basin?
- At what time of the day do you irrigate your gardens?
- Where do you report leaking / broken taps / pipes?
- What are some activities and practices that contribute to water wastage in the community?
- Please estimate how much water you use per day at home.

- For what purposes is this water used? Please try to estimate a percentage for each purpose.
- Are you concerned about the supply of water to your community? Please explain your answer.

3.5.3.7 Document analysis

The researcher used several policy documents relating to water auditing activities and WC skills dealt with during the research process. These WC audit activities such as checking for leaks or drippings from the taps, pipes or pumps and record them were noted inside the researchers notebook. Further on that, skills for WC such as planting drought resistant vegetation, watering gardens at appropriate times, washing cars using buckets, water recycling and others were also well noted.

3.6 Data analysis

Data analysis was done on a continuous basis after every observation and interview session. The outcome of the analysis in turn guided further investigation (Woods 1992:374). The cycle of data gathering and data analysis continued until the researcher was satisfied that there was no new data to be gathered. The data collected using the different methods were constantly compared with the purpose of identifying trends and categories. Similar data were grouped into categories and patterns emerged from the data which the researcher used to build grounded theory (Merriam 2001:18).

3.7 Closing comments

This chapter explained the qualitative nature of the research undertaken with a particular focus on the case study approach. The research design and schedule were explained. Information pertaining to the data collection methods applied and their relevance to the study were outlined. The chapter further indicated the influence of theoretical data analysis.

Chapter four provides the results of the research by presenting an analysis and synopsis of the data that was collected.

CHAPTER 4

Principles determining the design and development of environmental education programmes in the Steelpoort area.

4.1 Introduction

Chapter four focuses on an analysis and interpretation of the data collected through interviews and questionnaires. Observations and photographs were also analysed and interpreted for the study and the findings are provided in this chapter.

4.2 Research findings relating to interviews with participants

Interviews were conducted with thirty two participants. The answers came from

- two principals of whom one was a deputy principal who responded on behalf of the principal
- six educators
- two non-teaching staff members
- twelve learners
- twelve community members

Six questions were set for principals and educators, five questions for non-teaching staff members, five questions for community members and four questions were put to the learners (see 3.5.3.2). The responses were analysed and interpreted and are reported in this chapter.

Where verbal reports are included in the report back, the language has not been edited. The responses are verbatim to ensure that they are a true reflection of the views of the participants. The researcher did not edit the transcripts for fear of altering the views which were expressed by the participants / interviewees.

4.2.1 Interviews with principals and educators

- **Have you had any formal training on WC or water saving skills at your school?**

Of the eight (100%) participants, only three (37.5%) participants, members of the water team at Mangabane Primary School, had had formal training in WC or water saving skills.

- **Are you familiar with the concept of WC?**

Three (37.5%) participants (100%) were familiar with the concept of WC. They were all representatives of the water team from Mangabane Primary School.

- **Have you taught / are you teaching EE at your school?**

Of the eight participants, none have taught or have started teaching EE at their respective schools.

“No, we are not teaching EE because we do not understand anything about it. We have not been trained about it so far, we just read about it in the papers.”

- **Does the school have EE programmes or activities**

Out of two (100%) schools, none of them have had EE programmes or activities.

“No, we do not have EE activities because our school employs the general workers (cleaners) and a gardener to take care of some activities related to EE activities.”

- **Are there any activities at the school that could lead to excessive water use or loss?**

Six (75%) of the eight (100%) participants who all comes from Mangabane Primary School agreed / confirmed that there are some activities / practices mainly perpetrated by school children and the gardener that seriously contributed to an excessive loss / use of water at their school. The activities that came to mind included drinking water from cupped hands under running tap, not closing taps tightly, flushing the toilets heavily after urinating and the gardener who irrigates the garden during the hot midday's.

- **Do you have the water policy at your school?**

Of eight (100%) participants, none has a water policy or water regulations at their schools.

4.2.2 Interview with the non-teaching staff members

- **Who is taking care of your school's garden, the nursery and orchard and the cleaning?**

One respondent (50%) indicated that he is responsible for gardening. The other interviewee (50%) indicated that she is responsible for cleaning only as they don't have water for a garden.

- **What time of the day do you water the garden?**

One interviewee (50%) a gardener from Mangabane Primary School indicated that he waters the garden in the morning and in the afternoon. The other interviewee (50%) from Mangabane Primary School indicated that she does not have water for a garden.

- **Do you remove / control weeds from the school?**

Both interviewees (100%) indicated that they do not remove weeds from the garden at their respective schools.

- **Do you know how much water is used per day at your school?**

Both (100%) interviewees indicated that they did not know how much water they use per day at their respective schools.

- **Do you regularly plant trees and shrubs to prevent soil erosion around the school yard?**

The gardener (50%) from Mangabane Primary School indicated that they planted trees / vegetation annually in order to prevent soil erosion. The other interviewee (50%) indicated that the school does not have water nor a garden.

4.2.3 Interviews with community members

- **How is water supplied to your community?**

Only one (8.3%) of the twelve (100%) participants / interviewees, who is a water community leader at Makgemeng remote village, could identify the source of water supply to her area. Participants of Mangabane seemed not to know how water is supplied to their area.

- **Where do you report broken / leaking taps / pipes?**

All the participants indicated that they report broken / leaking taps / pipes to the Samancor household manager and to the water committee leader in their respective areas (Mangabane & Makgemeng).

- **What time of the day do you irrigate / or water your garden?**

Six participants (50%) from Mangabane indicated different times to irrigate their gardens. Six other participants (50%) from Makgemeng indicated that they do not have gardens since there is not enough water in their area to support a garden. Among the views expressed by the participants verbally on this question, the following are highlighted:

“I irrigate my garden during the day while I am free to do any job because I like flowers.”

“I water the garden in the morning to save water.”

“I irrigate my flowers during winter because there is no rainfall.”

“I irrigate my garden with a hosepipe during the night because it is not hot and more water will drain down the soil.”

“I irrigate the garden in the morning and in the afternoon everyday.”

“I water the garden using a hosepipe in the summer night.”

- **What can you say about WC?**

None of the participants responded to the question as they seemed not to understand the concept of WC at all.

4.2.4 Interviews with the learners

- **Do you inform your family members the importance of WC?**

None of the participants / interviewees (100%) indicated that they inform their family members about WC because they do not understand what it is all about.

- **Can the vegetation (flowers) become green without water?**

All the participants / interviewees indicated that no vegetation on earth can flourish without water because water is a life giving source to all the living organisms.

- **Do you plant trees during Arbor Day at your school?**

All the participants / interviewees indicated that most of the times they are not supplied with trees by the local Municipality at their schools because the Municipality officials seem not to understand EE and the importance of trees to life. Among other reasons is that the learners believe that the people employed at the Municipality whose function would be to supply trees do not have the relevant qualifications or are under qualified.

- **Do you celebrate the Environmental Commemorative Days ie Wetland Days at your school?**

All the participants / interviewees indicated that they do not celebrate those days at all because their teachers / educators seem not to understand anything with regard to EE and environmental commemorative days.

4.3 Research findings with regard to visual records

The researcher used field observations and photographs to obtain data relating to the research questions that were also addressed through interviews and questionnaires. The purpose of this

process was to establish whether the verbal and written responses were supported by concrete evidence and is part of the process of triangulation. In relation to testing the accuracy of the analysis of the photographs, the researcher interviewed people who were linked to the events being recorded for their opinions and input.

4.3.1 Field observations

The researcher analysed and interpreted data of the observed physical settings, the participants' activities and their verbal and non-verbal interactions on an ongoing basis (see 3.5.3.1). During data analysis, observed reactions were interpreted both verbally and non-verbally. The non-verbal responses such as body movements and expressions were analysed. They served as punctuation for verbal communication and give expression of an emotive overtone.

4.3.1.1 Physical setting

- **Mangabane peri-urban**
 - Well structured houses, hostel, schools, community hall and shopping complex with streets within the village.
 - Old, poor and dusty infrastructure used at schools, houses, hostel, community hall and shopping complex.
 - Leaking and dripping taps, pipes and pumps.
 - Very dry and poor gardens everywhere.

- **Makgemeng remote rural area**
 - Unstructured shacks and muddy houses at the foot of the mountain with green bushes and one school.
 - Many communal standpipes which are ineffective and only one communal standpipe which is effective that has to supply the whole community.
 - One perennial river and a stream in which effluent is present from Mangabane area.
 - Open storage tanks for drinking water.
 - No gardens and only pit toilets at the residential site.

4.3.1.2 The participants and activities

- Women used water for cleaning, rinsing clothes, cooking and flushing.
- Women watered gardens during hot midday's daily.
- People washed cars using hosepipes.
- Cleaners were neglectful of using water sparingly when washing floors and cooking.
- Gardens irrigated on hot days.
- Educators watched learners wasting water at the taps and toilets.
- Educators were aware of and saw leaking taps and pipes throughout the day.
- People bathed in the river / stream.
- Women rinsed clothes, and bathed in a river / stream.
- Animals shared water with people in a stream / river.
- Women pushed wheelbarrows with 20L containers queuing for water at a single communal standpipe.
- Theft of water using bakkies to sell for profit.
- The tap was left running while washing dishes, brushing teeth, shaving and other everyday activities.

4.3.2 Photographing

The researcher took photographs of most of the water wastage practices at both schools and in the community (see 3.5.3.4). Examples of the analysed and interpreted photographs of the most prominent water waste issues are listed below.

4.3.2.1 Irrigation with a hosepipe during the hot midday

This photograph complements observation data and data obtained through the interviews with school staff. It indicates that a substantial amount of water is wasted through the irrigation practices used by the gardener.



Photo 4: Irrigation during hot midday at Mangabane Primary School.

4.3.2.2 Learners play fun games with water and also drinking water with cupped hands

This complements observation data and it is evidence that learners waste water in front of the teachers.

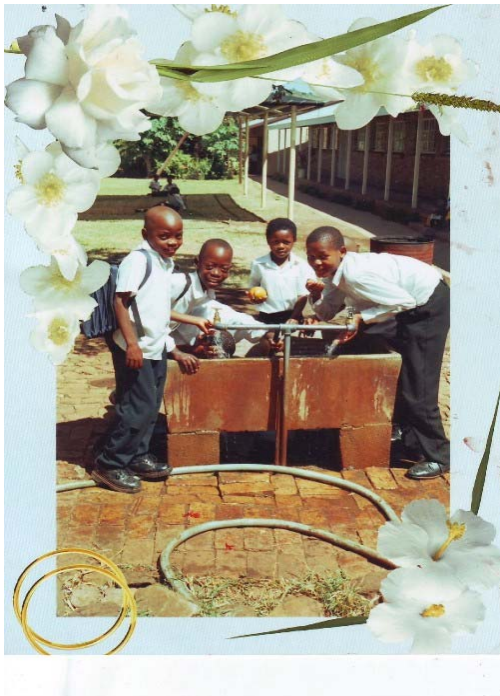


Photo 5: Children playing with water at Mangabane Primary School.

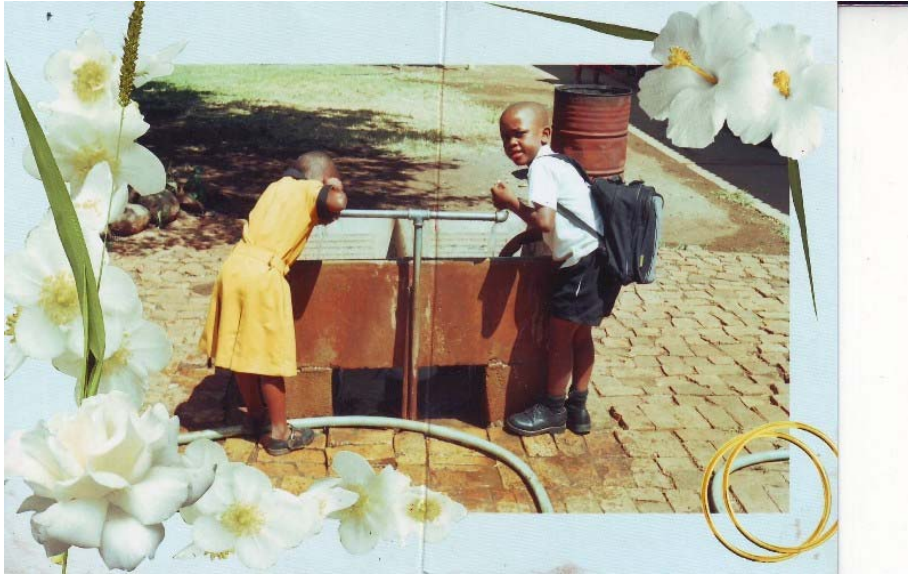


Photo 6: Children drinking from cupped hands at Mangabane Primary School.

4.3.2.3 Waterlogged lawn at the Mangabane Primary School

This photograph complements observation data and interviews. It is also evidence that school grounds are irrigated with more water than required and this even occurs during the hot midday's. It is noticeable that a sprinkler is used.



Photo 7: Waterlogged lawn at Mangabane Primary School.

4.3.2.4 Polluted dammed sewage water in a stream from Mangabane area

This photograph complements observation and interview data which serves as evidence that this contaminated water is used for domestic purpose at the remote rural area.

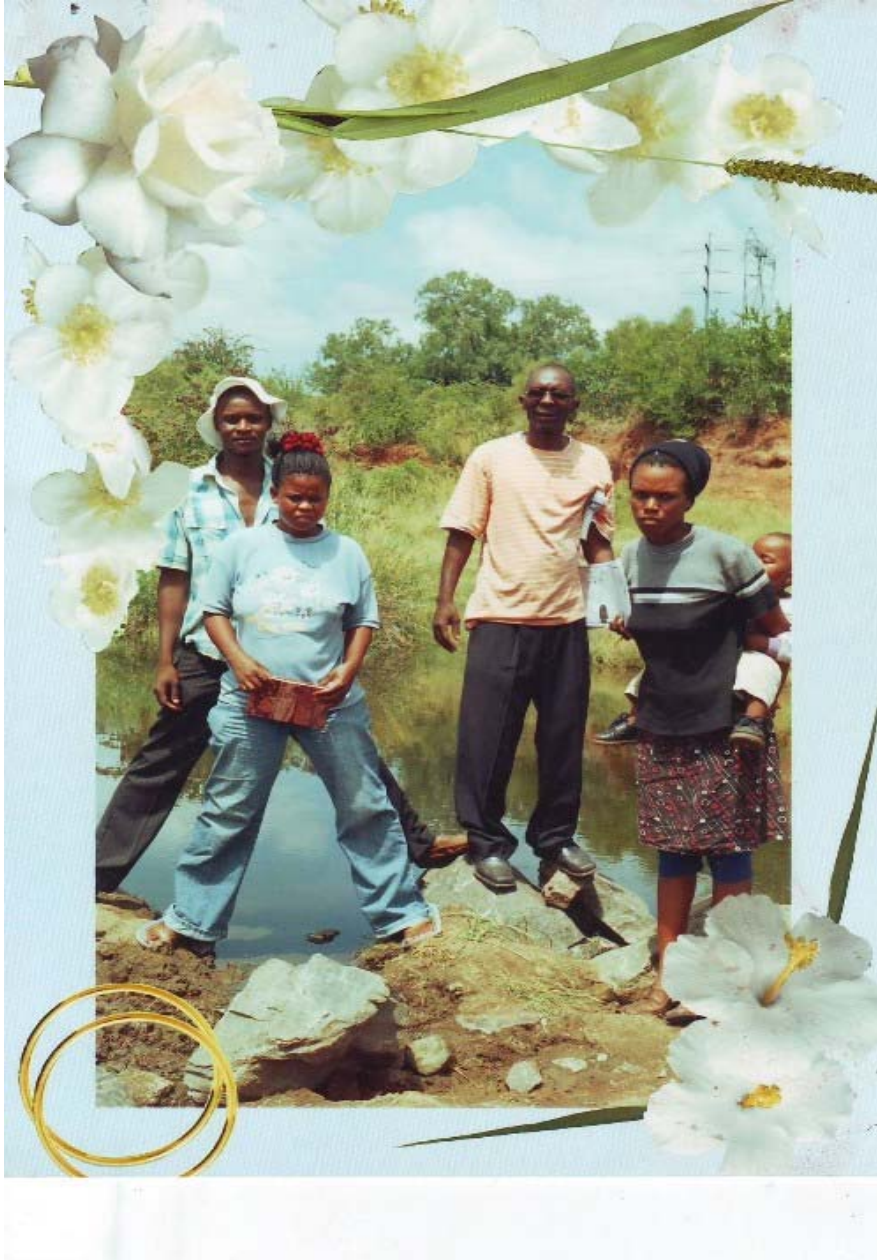


Photo 8: Sewage polluted water at Makgemeng rural area.

4.3.2.5 Wetland in the river

This photograph complements observation and interview data which serves as proof that the wetland is not being taken care of. Community members do not know its significance and the responsibility they have to protect the area.



Photo 9: Wetland at Makgemeng rural area.

4.4 Video recording

The researcher video recorded most of the water waste areas and practices at both schools and in the community sites. This was also done during observation and interviews.

4.5 Research findings relating to the questionnaires

4.5.1 Principals and educators

- **Are you familiar with the concept of WC?**

Three (37,5%) respondents of the eight respondents (100%) were familiar with the concept of WC. They were all the water team members from the same school namely, Mangabane Primary School.

- **Have you taught / are you teaching EE at your school?**

Out of eight (100%) respondents, all of them (100%) have not taught or started teaching EE at their respective schools.

- **Does the school have EE programmes or activities?**

Out of the two (100%) schools, all of them (100%) have not had EE programmes or activities. Among other reasons, is that both schools employ the general workers (cleaners) and (gardener) at their respective schools.

- **Have you had any formal training in (WC) water saving skills at your school?**

Out of the eight (100%) respondents, one (12,5%) respondent, namely, one water “team member” had had formal training in (WC) water saving skills at her school namely, Mangabane Primary School in 2002 by an Environmental officer from Lydenburg in Mpumalanga.

- **Are there some activities at the school that could be in to excessive water use or loss?**

Six (75%) respondents from the same school namely, Mangabane Primary School of the eight (100%) respondents agreed / confirmed that there are some activities / practices mainly by school children and the gardener that seriously contribute to an excessive water loss / use at their schools such as drinking by hands, leaving taps not tightly closed and the gardener who irrigates during the hot midday’s.

- **Do you have a water policy at your school?**

Out of eight (100%) respondents, none (100%) have a water policy and regulations at their schools.

- **Do you think that EE can be integrated into your learning areas?**

If yes, say how?

If no, say why?

All the two principals, one, a deputy principal who responded on behalf of the principal and six educators, that is (100%) of all the respondents (100%) agreed EE can be integrated into their learning areas.

Below are some examples of the views expressed by the respondents in elaborating on this question below:

“EE can be integrated into our learning areas such as Mathematics and Life Skills”

How?

On Maths water is used on measurement about litres.

Life skills, on how water is used, water purification.

“EE can be integrated into our learning areas”

How?

Teaching caring for plants

Uses of water in Natural Science measurement of liquids and converting ml – l

Target environmental special days e.g. Water week, Arbor Day etc. to help learners to understand EE better.

“It can be integrated in learning areas like Natural Science, Life Orientation and social science.”

How?

To workshop teachers so that they can teach their learners.

“It can be integrated in learning areas like NS, Life Skills, Maths, EMS”

How?

We teach learners life skills which embrace lot of Enviro-Education Competition.

Programmes like celebration of Arbor week, water week, DWAF projects.

Water policy is available for all learners to adhere to.

The Environmental officer from Water Affairs in Mpumalanga taught us about WC from taps & toilet in 2002.

“EE should be integrated in all levels.”

How?

Because water is life and every living creature on earth needs water to survive.

We need to use water as sparingly as we can.

The responses of five respondents were YES to the above question although the other three respondents did not respond to either YES or NO because they did not mention any reason for not responding to one of the two questions above.

4.5.2 The non-teaching staff members

- **Are you familiar with the concept WC?**

Neither of the two respondents (100%) indicated that they are familiar with the concept WC. The respondents were a gardener (man) and a cleaner (woman) who are both responsible for using water on daily basis from each school.

- **Who is taking care of your school's garden nursery and orchard and cleaning?**

Both respondents indicated that they are responsible for gardening and cleaning respectively.

- **How do you water the school garden? Provide information on the way in which you water the garden.**

The gardener indicated that he uses a sprinkler and chitter for irrigation while the other respondent (the cleaner) indicated that they don't have water or a garden at their school.

- **What time of the day do you water the garden?**

The gardener from Mangabane Primary School noted that the right time for watering is in the morning and in the afternoon. The other respondent (50%) from Magakantshe Primary School indicated that they do not have water nor a garden.

- **Do you remove / control weeds from the garden?**

Both respondents (100%) indicated that they do not remove weeds from the garden at their respective schools.

- **Do you regularly check for leaks around the school?**

Both respondents confirmed that they do not check for leaks at their schools.

- **Do you know how much water is used per day at your school?**

Both (100%) respondents indicated that they did not know how much water they use per day at their schools.

- **Do you annually plant trees and shrubs to prevent soil erosion around the school yard?**

The gardener from Mangabane Primary School confirmed that he planted vegetation annually in order to prevent soil erosion.

- **Please give an indication of how water is used in the ablution facilities.**

Neither of the respondents knew how much water is used in the ablution facilities at their schools respectively.

- **Please comment on the general use of water at the school.**

The gardener at Mangabane Primary School commented on the general use of water at the school. He commented that

“I was not aware of the water saving methods because I just irrigate even during the hot days. And I believe that we are using too much water for cleaning, gardening and cooking.”

The other respondent from Magakantshe Primary School indicated that they do not have water at their school.

4.5.3 School children

- **Do you know where water from your school taps comes from?**

Five (47.7%) respondents of the twelve (100%) respondents confirmed that they know the source of water supply at their respective areas (Mangabane & Makgemeng).

- **Did you know that South Africa is a dry country?**

Ten (83.3%) respondents of the twelve (100%) respondents confirmed that they know that South Africa is a dry / water stressed country.

- **Do you report leaking taps and pipes at school / home?**

Nine (75%) respondents of the twelve (100%) respondents indicated that they report the leaking taps and pipes at school / home.

- **Do you understand the process of water cycle?**

Twelve (100%) respondents of the twelve (100%) respondents indicated that they know the process of “water cycle”.

- **When should gardens be irrigated?**

Eight (66.7%) respondents out of the twelve (100%) respondents agreed that they irrigate the gardens at the right time (such as in the morning / afternoon).

- **Are you familiar with process of water auditing?**

One (8.3%) respondent out of twelve (100%) respondents indicated that he / she understands what water auditing is all about.

- **What would you be able to learn from a water audit?**

One (8.3%) respondent out of twelve (100%) respondents indicated that he / she would learn water saving skills from water audit; eleven (91.7%) respondents indicated that they do not have knowledge about a water audit and do not know what they would be able to learn from water auditing.

- **Can you estimate how much water you use per day at school / home.**

Two (16.7%) respondents of the twelve (100%) respondents confirmed to know the amount of water they use per day at school / home.

- **Is there an enviro-club at your school?**

Twelve (100%) respondents of the twelve (100%) respondents indicated that there is no enviro-club at their school respectively.

- **Are you a member of the club?**

None of the respondents is a member of the club.

4.5.4 Mangabane Community Consumers

- **At what time of the day do you irrigate your garden?**

All eight (100%) respondents indicated that they irrigate their gardens at the right times (mornings / afternoons). These respondents included five household owners in different streets, one Bar Lounge owner, one General Dealer and one hostel dweller.

- **Do you bath using a basin, bath or shower?**

Six (75%) respondents of eight (100%) respondents indicated that they shower while the two (25%) respondents indicated that they prefer to take a bath.

- **How do you wash your car?**

Seven (87.5%) respondents of the eight (100%) respondents indicated that they use buckets to wash their cars while two (25%) respondents indicated that he / she use hose pipes.

- **Do you rinse your clothes directly in the basin or in the laundry machine?**

Seven (87.5%) respondents of the eight (100%) respondents indicated that they rinse clothes directly into the basin while one (12.5%) respondent indicated that he / she rinses her clothes in the laundry machine.

- **Do you report leaking pipes / taps in the community?**

Seven (87.5%) respondents of the eight (100%) respondents indicated that they report the leaking taps / pipes but not attempting to repair it themselves. Only one (12.5%) respondent responded that she / he did nothing at all.

- **Do you attempt to repair leaking taps or pipes yourself?**

Out of eight (100%) respondents, all of them (100%) respondents indicated that they do not attempt to repair leaking taps or pipes themselves but they report to the Samancor household manager.

- **What are the actual activities and practices that prejudice WC in your area?**

Two (25%) respondent of the eight (100%) respondents indicated some activities and practice such as leakage and drips, poor service, poor, old & rusty infrastructure, negligence and others as among other examples that influence water problems in the area of research (Mangabane).

- **Estimate how much water you use per day at home.**

Of the eight (100%) respondents, all of them were able to estimate the amount of water used. These eight different estimations differed indicating that water usage depends on a combination of factors.

- **Do you think your village will have enough water in 20 years to come? Motivate your answer.**

Five (62.5%) respondents stressed that unless something significant is done urgently to ensure the sustainable use of water and consumers change their attitude and behaviour to minimize wastage, they will run out of water in 20 years to come.

4.5.5 Makgemeng Community Consumers

- **How is water supplied to your area?**

Only one (25%) of the four (100%) respondents, who is a water committee leader could identify the source of water supply to the area.

- **Do you rinse your clothes or bath in the river / streams / basin?**

Three (75%) of the respondents indicated that they rinse their clothes and bath in the river / stream. Only one (25%) respondent who stays close to the community stand pipe / pump indicated that she rinses and baths in a basin.

- **At what time of the day do you irrigate your gardens?**

None of the respondents has a garden since there is not enough water in their area to support a garden.

- **Where do you report your leaking / broken taps / pipes?**

All the respondents indicated that they report broken / leaking pumps to the water committee leader.

- **What are some activities and practices that contribute to water shortage / problems at your area?**

Two (50%) respondents – the water committee leader and a consumer – mentioned a few activities / practices that contribute to water shortage / problems at their area e.g. vandalism and theft.

- **Please estimate how much water you use per day at home.**

Three respondents (75%) were able to estimate the amount of water they use per day at their homes.

- **For what purpose is this water used? Please try to estimate a percentage to each purpose.**

Three (75%) estimated the different percentages about the purpose of the water they used.

Among other examples of the estimation of the percentages for water usage are the following:

“I use 72% of the water for rinsing clothes, 10% for cleaning, 8% for cooking and 10% for bath (100%) because I have a large family.”

“I use 50% of the water for rinsing clothes, 18% for cleaning, 15% for cooking and 17% for bath (100%) because we do not have enough water at our area.”

“I use 55% of the water for rinsing clothes, 16% for cleaning, 14% for cooking and 15% for bath (100%) because I am staying next to the stream.”

- **Are you concerned about the supply of water to your community? Please explain your answer.**

All the respondents indicated that they are concerned about the supply of water in their community.

“We are not considered as part of the Samancor community residents because we are living in the shacks and mud houses. The water committee always hold meetings with the area counsellor but nothing happens.”

“Yes, we formed the water committee so that they take our complains to the Municipality, but the infrastructure is poor and does not last.”

“Yes, we try to collect the rain water during the rainy season although it does not rain. We always collect money to buy the repair materials ourselves.”

“Yes, we bought wheelbarrows and the 20L containers to help us collect water easily from the distance as our last resort.”

4.6 Overview of the data

An overall outcome of the research was analysed by taking all the data into consideration. The data was categorised according to the findings from the analysis phase. An analysis of the data revealed that respondents generally understood the questions of both the interviews and the questionnaires since the answer were reasonable and in line with a typical answer that could be expected from the question posed.

4.6.1 Awareness of the provision and value of water

People seem to take the provision of water for granted (see 1.1.1). The learners appeared to know where water from the taps at their school comes from but only one of the other respondents could identify the source from which the water comes(see 4.5.3).

Nevertheless, although only one person had been exposed to formal training in WC issues and three were familiar with the term(see 4.5.1), all the principals and the majority of educators and non-teaching staff seemed to have understood what the questionnaire required of them and responded sensibly to the questions asked. The majority of the respondents understood the importance of WC, the importance of the resource, the irresponsibility of misusing water, the scarcity of the resource and the importance of their involvement in protecting and using water sustainably.

With regard to an analysis and interpretation of the appropriate time to irrigate and how much water is used per day at school or at home, the findings indicated that many of the respondents were unaware that irrigation should only occur at appropriate times(see 4.5.2). In general,

people did not know how much water they used per day at school or at home (see 4.5.2 & 4.5.3). An analysis of observations and photographs support the above findings(see 4.3.1 & 4.3.2).

4.6.2 Awareness of the principles of water conservation

None of the schools had a water policy nor is there an enviro-club to which learners who have an interest in the environment can belong (see 4.5.3). Learners were unfamiliar with the concept and process of environmental auditing including water auditing because EE is not taught at school nor integrated in their learning areas (see 4.5.1 & 4.5.3).

No attention is being paid to commemorating important environmental days (see 4.2.4 & 4.5.3). Furthermore, there is no local or regional support forthcoming from relevant departments or organisation to encourage learners' participation and interest in such matters. Local officials also seem to lack environmental knowledge (see 4.2.4).

4.6.3 Knowledge of water wastage issues

The majority of respondents have never reported or attempted to repair leaking and dripping taps, pipes or pumps (see 4.5.4). Although people seem to be aware of the importance of water (see 4.6.1), the lack of awareness related to water usage is linked to a lack of knowledge of water wastage issues. People were unable to estimate the amount of water they use per day at home / school (see 4.5.2 & 4.5.3). Generally they did not know that South Africa is a dry or water stressed country (see 4.3.12).

Other findings indicated that the Makgemeng consumer community is concerned about the water supply because they formed a water committee, held meetings with the area councillor in which complaints and water related issues were raised. For example, one of the main complaints to the local Municipality related to the poor infrastructure and lack of maintenance of what was in place. The findings indicate that this community relies on a single communal standpipe because the rest are ineffective. Consequently, some consumers had been obliged to purchase wheelbarrows and 20L containers to collect and transport water over long distances.

They had also collected money to buy repair materials themselves because Samancor management does not consider them as part of its residents (see 4.5.5).

4.6.4 Health related issues

The research indicated that Steelpoort rural area residents live under hazardous health conditions because they use polluted river water which is contaminated with sewage for cooking, washing and drinking purposes. Access to potable water is limited because of the unequal distribution in terms of both quantity and quality (see 1.1.2).

4.7 Closing comments

This chapter explained the results of the research by presenting a clear interpretation of data collected. Chapter five provides a summary of the conclusions reached and the recommendations that are proposed.

CHAPTER 5

Summary of the research findings, conclusions and recommendations

5.1 Introduction

This chapter summarizes the findings of the literature review discussed in Chapter 2 and the analysis and interpretation of the collected data on the activities and practices relating to the use and conservation of water in the rural communities of the Steelpoort area in Mpumalanga Province, South Africa as reported in Chapter 4. Conclusions based on the findings are then outlined and the chapter closes with recommendations on addressing the issue of WCC in the Steelpoort area.

5.2 Summary of the findings

5.2.1 Activities and practices that compromise water conservation in the Steelpoort rural communities

Empirical research was conducted to establish the experiences and perceptions of principals, educators and adult community members with regard to activities and practices that prejudice WC and management in the Steelpoort rural areas (see 4.2 & 4.3). In their responses to the interviews and the questionnaires, the respondents identified a number of actions that prejudice WC in the Steelpoort rural areas (see 4.3.12). These activities and practices include:

- Inequity in water distribution between poor and rich communities. Only the rich are supplied with adequate water and the poor have to make do with what is provided or access water from non-municipal sources (see 1.1.2 & 4.5.4).
- Lack of weed control. Weeds are not removed and use water that could be used by vegetation which was planted intentionally (see 2.5.4.6 & 2.5.4.1).
- Establishment of unplanned informal settlements that place stress on existing water resources. The increased water demand is further aggravated by the steady influx of people looking for jobs on local mines. These community members claim that their settlements are on mine property and that the mine is responsible for providing them with access to water (see 1.1.2).

- Irresponsible use of water resources by villagers with little regard for the conservation, maintenance or protection of water sources. This is evidenced by the lack of attention to leaking pipes and taps even when and if reported (see 4.5.3).
- Intermittent or irregular water supply due to illegal water connections; trespassers who cut off the water supply; depletion of the water stored in the dam since the water is also used to provide the local mining industry with its required supply of water. Generally the community members lack a sense of ownership which leads them to be indifferent towards, abuse and vandalize water resources (see 4.3.1).
- Theft of water by thieves who steal tap water that is provided to the community and use bakkies to transport the water to sell for profit in areas where water is not readily available (see 4.3).
- Generation of pollutants by local mining. As a result of the mining processes different kinds of chemicals, minerals and nutrient rich substances are discharged into the fresh water resources. These pollutants also have the potential to affect underground sources. These pollutants cannot be extracted by conventional sewage and waste water processes. This pollution of water has the potential to render the available water resources worthless for further use by the Steelpoort village communities (see 4.3).
- Irrigation at inappropriate times e.g. during the heat of the day (see 4.3 & 4.6.1).
- General water wastage as evidenced through
 - Learners who play fun games with water and also drink water from cupped hands which lead to wastage (4.3)
 - Educators' disregarding the fact that learners are wasting water at taps and toilets (see 4.3)
 - Signs of waterlogged lawns due to excessive watering during the heat of the day when evaporation is at its highest level (see 4.3)
 - Leaking and dripping of taps / pipes or pumps (see 4.6.3); and taps being left running and not tightly closed (4.3)
 - People washing cars using hosepipes (see 4.3)
 - Cleaners using excessive amounts of water for cleaning floors and cooking (see 4.3)

- Housewives using excessive quantities of water for cleaning, rinsing clothes, cooking and flushing (see 4.3).
- People bathe and rinse clothes in the river / stream which leads to contamination and pollution of the water (see 4.3 & 4.5.5).
- Community members are unaware of the demands they place on water resources. People could not estimate the amount of water they use per day at homes / schools (see 4.2, 4.3 & 4.5 & 4.6.3).
- Community members are indifferent to the importance of conserving water supplies. There are no water policy or water usage regulations in schools or in the community (see 4.2.1 & 4.5.1). There are no enviro-clubs to support WC nor are important EE days commemorated – either within the schools or the community (see 4.2.4).

The above findings were also supported by observations made in the community by the researcher. Further issues which became evident during the observation phase include:

- The local wetland which could assist in removing pollutants from water in a natural and sustainable way is not protected by the community (see 4.3).
- Water supply to the Makgemeng rural area is poor. Generally residents are obliged to rely on a single communal standpipe because the rest of the standpipes are out of order. However, an outcome of this situation was that a water committee was established on the initiative of the community to try to address the water concerns of the village (see 4.3.1.1).
- Makgemeng residents live under hazardous health conditions as they are obliged to use sewage polluted river / stream water for domestic purposes due to the inadequate potable supply (see 4.6.4, 4.3 & 4.5.5).

5.2.2 Addressing water consumption and conservation issues through environmental education programmes

The role of education in addressing environmental issues is widely accepted (2.2). The literature reviewed reflects that availability of and access to water are common problems in South Africa. It is clear that WC should be an important aspect of the way South Africans lead

their every-day lives. The conservation and management of water are learned skills which need to be provided through appropriate educational programmes (see 2.5).

In chapter 2 matters related to the design and development of educational programmes relating to environmental issues were investigated. In summary, the principles which form the foundation of any EE programme and which inform the design and development of an effective programme are (see 2.3):

- Effective and good EE programmes should lead to a greater awareness of the appropriate attitude and value system that the community should develop if it is to use water sustainably (see 2.4).
- The programme should be relevant to the community, promote civic responsibility and action taking in order to fit with national and local policy and requirements to reduce water conflicts (see 2.3.1).
- The programme should be based on a participatory approach involving users, planners and policy makers at all levels e.g. women play a central part in WCC issues (see 4.2 & 4.3).
- The programme should raise community awareness to enable them to identify and prevent activities that lead to excessive water use through capacity building and developing critical thinking skills (see 2.3.1).
- The programme should promote environmentally responsible actions within the community so as to address, prevent and solve water related issues see (2.3.1).
- The programme should be credible, reputable, and based on solid facts, traditional knowledge or on science.
- The programme should involve a cycle of continual improvement that include the processes of design, delivery, evaluation and redesign.
- The programme should create exciting and enjoyable learning experiences (see 2.3.2).

Any proposed programmes consequently need to meet the requirements as outlined above.

5.3 Research conclusion

Generally, people of the Steelpoort rural communities are oblivious to their wasteful practices as they lack education about WCC and water management issues. The conclusions drawn from the findings cited above are that all categories of consumers would benefit from attending and participating in appropriate and effective EE programmes which have water consumption, conservation and management at their core (see 2.4 & 2.5).

All the consumers including educators, non-teaching staff, learners and adult community members, should be exposed to a series of EE workshops that have been thoughtfully designed, insightfully developed and effectively presented. Participants who have attended the workshops will be in a position to inform other consumers about the importance of WC, water saving skills, water auditing and recycling (see 4.3, 2.5.4.1 & 4.6.2).

The basic elements that would need to be included in such a programme need to address the shortcomings in the knowledge, awareness and skills that came to light during the research. All the principles of WC programmes that are listed above must be taken into consideration when designing and developing programmes for WC.

In the knowledge category, consumers in all the levels of the community need to be informed about

- The scarcity of water as a resource in South Africa and the need to conserve water and use it in a sustainable manner
- The water cycle and the source of water in their community
- Water related issues that are faced in their particular community
- Practices that lead to water wastage in general and specifically in their community
- The need for proper management and maintenance for the water supply

Skills that need to be developed relate to

- Strategies to conserve water and use it in a responsible, sustainable way such as fixing dripping taps, leaking pipes and generally maintaining the water supply system
- How to protect wetlands and control weeds and alien species

Attitudes that support WC that need to be adopted by the community include

- Accepting responsibility for using water responsibly
- Appreciating the value of water as a life-giving resource
- Supporting conservation efforts
- Celebrating the environment and commemorating environmental days

5.4 Recommendations

From the research it became evident that water provisioning in the Steelpoort region is unequal both in terms of quantity (accessibility) and quality with poorer communities having to share poorly maintained sources and even having to resort to using polluted sources due to the lack of provision of potable water (see 1.1.2 & 4.6.4). The matter can be addressed through appropriate practical community based strategies and through EE programmes.

5.4.1 Provisioning of water

In order to address the activities and practices that prejudice water provisioning in the Steelpoort rural areas, the following recommendations are made:

- When supplying water to the people, the suppliers must make sure that the relevant role-players and organizational structures in that area are contacted. Different categories of consumers need to be interviewed to establish the level of supply that must be provided (see 3.5.3.2) e.g. street taps or communal standpipes, household connections and others.
- Regular meetings must be held with the community structures to create a relationship of trust and understanding between consumers and the suppliers. These meetings will for a forum for addressing issues of concern and facilitate appropriate decision-making and action-taking (see 4.5.5).
- The needs of consumers must be taken seriously and steps must be taken to ensure that these needs are met in the best possible way (see 4.5.3).
- To get maximum benefit for society all sources and consumers of water should be taken into account during planning and implementation, and preparation and maintenance. A

participatory approach should be taken in relation to participation, delegation and subsidiary water resource development and management.

- Decision-making should be at the lowest appropriate level (see 3.2) to ensure that the needs of the community are acknowledged. This type of approach will foster an attitude of ownership and personal responsibility.
- Legislation and regulations should be enforced. For instance, the Municipality and Samancor should enforce legislation that requires local industries and mining to stop discharging effluent into the streams and rivers (see 1.1.2) or to treat the effluent before discharge.
- Consumers should have access to all water laws and policies. Their input in the formulation and application of these policies should be sought in order for them to manage their own water supply scheme / system and to take ownership of their water resources (see 2.5.3).
- Gardening and watering restrictions should be followed strictly as stipulated by management (see 1.1.2).

5.4.2 Developing understanding, appreciation and skills for conserving and managing water

All sectors of consumers need to be educated about the conservation and management of water. The aim of such initiatives would be to enable consumers to (see 4.6.1):

- Understand the importance of the resource and be knowledgeable about its conservation and management.
- Be aware of the scarcity of the resource and value, appreciate and protect the resource.
- Become involved in actively managing and conserving water.

Apart from the above benefits, the value of such training to the community is that

- Temporary employment will be created
- Long-term sustainable job opportunities could be created.
- Unemployment could be addressed through the creation of training opportunities.

5.4.3 Designing and developing appropriate environmental education programmes

The following programmes are suggested for each of the categories of consumers. Specific practical aspects such as who will present the programme, where it will be presented, the content and duration are also outlined.

5.4.3.1 Programmes for principals and educators

Educators need to receive supportive training and guidance with regard to the NCS to enable them to see the links and opportunities for including the environment and conservation of natural resources such as water in learning programmes. The WMC programme outlined below provides guidance on such links which apply specifically in rural communities (see 2.5.4.1).

It is highly recommendable that educators be workshopped and developed.

- Pre-service environmental and water education and in-service environmental and water education should be offered to all educators.
- Educators should be empowered to become coordinators and mediators in order to integrate EE into 8 learning areas starting from primary schools to tertiary institutions.
- EE teaching should not only emphasize the knowledge, action and skills dimension of education, but also values and attitude dimensions that benefit the environment.
- Training of teachers should focus on competencies in each of the following methodologies which are essential to ensure successful EE teaching and learning:
 - The ability to integrate the study of EE (also problems) through the use of a variety of methodologies into whatever subjects or grade level programmes.
 - The ability to use effective educational methods and examine attitudes contributing toward creation of environmental problems.

<u>Proposed programme for principals and educators</u>	
Presenter	Water team members / EE official
Venue	At public places like school grounds, community halls etc.
Duration	One week
Resources	Posters, charts, magazines, pamphlets
Focus	<ul style="list-style-type: none"> ○ Encourage a positive attitude towards the environment with particular reference to water and an understanding that water is a scarce resource that must be conserved and managed

- | |
|--|
| <ul style="list-style-type: none">○ Integrate EE into the learning areas○ Develop a school environmental policy that accommodates water education○ Monitor the use of water by non-teaching staff and learners |
|--|

5.4.3.2 Programmes for non-teaching staff members and adult community consumers

Adult community consumers and non-teaching staff members need to receive supportive training with regard to environmental and in particular water education to enable them to use water sustainably.

Although the water allocation is limited in the Steelpoort areas, the importance of WC is not necessary for water resource purposes only, but it is also to ensure the sustainability, economic and financial viability of water services to the community and to ensure economic and social development.

Another important requirement of WC programmes among this category of consumers is to provide education to those who do not have easy access to water services and rely on streams and boreholes for their water supply. The focus of WC in such areas is with regard to water pollution, water purification and the preservation of water resources for health reasons. Through the programme, the threat of disease should be reduced and people should have the skills to effectively yet inexpensively treat water before it is consumed (see 2.5.4 & 4.6.4).

The practice of water harvesting should be encouraged and introduced. Gardening without access to enough or running water is still possible if alternative sources are available. What most people in rural communities do not realize is that water can be collected when it rains, even if it only rains for a short time (see 2.3.4.4). If some of this water is harvested many problems can be solved in the areas of water shortage like Steelpoort village.

This programme should help to address issues related to access to and use of water in rural areas (see 2.5.4.2) and meet the broad aims mentioned above.

It is further essential for these consumers to be workshopped in regard to the following:

- Intensive education and training of consumers is important to equip them with relevant knowledge and skills regarding the utilization of environmental resources especially water.
- Establishment of water policies and regulations to manage the conservation of water in Steelpoort rural areas.
- Identification of environmental issues that relate to the consumption and conservation of water that need to be addressed by EE programmes.
- Identify activities and practices that prejudice WC.
- Knowledge of ways in which citizens can actively participate in the reduction of environmental problems.

Proposed programme for non-teaching staff members and adult community consumers

Presenter	EE official; teacher coordinator / community water committee leaders
Venue	Public places like shopping complex and school grounds
Duration	Once a week for a month throughout the year
Resources	Books, posters, brochures, etc and gardens tools
Focus	<ul style="list-style-type: none"> ○ Understanding the environment and the scarcity of water ○ Actions that prejudice the sustainable use of water ○ Ways of conserving water relevant to their circumstances ○ Appropriate irrigation times and methods ○ Weed control / removal ○ Planting drought resistant crops and flowers which use little water ○ Bracing sloping surfaces with stones, rocks, shrubs etc. ○ Harvesting rain water ○ Protecting water resources and learning about water purification strategies

5.4.3.3 Programmes for learners

Learners need to gain skills through campaigns and projects in which they participate in order to stimulate interest in the environment and environmental resources and promote water awareness and learn how to use water sustainably.

To ensure good water management and conservation among the youth at school level it is recommended that schools be encouraged to participate in specific projects and campaigns. Involvement in these regular campaigns will promote water awareness skills among the adult

community as well as among learners. The emphasis in these projects and campaigns is on efficient and sustainable use of water resources (see 2.5.4.1). These programmes and projects which have learners as their target could influence learners as future leaders to play a key role in changing the mindset of communities to appreciate and respect environmental resources (see 2.5.4.1). In addition participation in these programmes could stimulate interest in a career in the water sector (see 2.5.4.1).

- WC Campaigns should be held at different places such as community halls, shopping complex and the schools.
- A special “Water Week” should be held annually in April to coincide with international Water Day (see 4.2.4).
- Learners should enter the National School’s poster competitions which provide prizes sponsored by industries, NGO’s and Municipalities
- The South African Youth Water Prize (SAYWP) competition for learners is an annual event to encourage learners to take an interest in issues related to water management. The aim is to encourage learners to be the corner stone of water savings and to respect the environment when they grow up (2.5.4.1).
- Enviro-clubs should be established with the input of relevant stakeholders (the learners, parents and educators at schools) and community leaders, water committee members (external) municipality officials and all the affected parties involved to help in resolving water related matters or issues (see 2.5.4.1).
- Recycling initiatives to save the loss of water in the schools and communities should be started.

However, to support these efforts, a programme that raises water awareness and provides skills to conserve and manage water as a scarce natural resource both in schools and in the community (see .2.5.4.3) needs to be provided. Such a programme is outlined below.

<u>Proposed programme for learners</u>	
Presenter	Enviro-club member (Teacher coordinator)
Venue	At school grounds
Duration	One week
Resources	Posters, books, magazines etc and garden tools
Focus	

- | |
|--|
| <ul style="list-style-type: none"> ○ The environment and environmental resources ○ Why the environment needs to be protected and how to go about this ○ The water cycle ○ How we, plants and animals depend on water ○ Conducting water audits and interpreting the findings ○ Water saving strategies that can be applied in various contexts |
|--|

5.5 Implications for further research

The research done in respect of WCC at the Steelpoort rural areas seems to indicate areas for further research. These areas include

- investigating the issue of sanitation and the link to the sustainable conservation and management of water resources
- determining the transferability of the suggested programmes to other communities where similar WCC issues are experienced
- establishing methods to strengthen the capacity within the community to respond to environmental issues
- implementing and testing the impact of the proposed EE programmes to address the issue of sustainable WCC in the Steelpoort area.

The proposed further research would appear to lead to the development of skills, knowledge and insight which could be used to assist in findings answers to problems or meeting challenges relevant to WCC in the Steelpoort rural areas (see 3.3 & 3.4).

5.6 Executive summary

Access to safe water is a fundamental need and a basic human right (see chapter 1). Most consumers are not aware of the impact of their own activities on WCC, yet in the various roles they fulfill, decisions are made daily which may affect WCC. It was believed that raising awareness, educating and training the community using water team / committee coordinators could be an effective way in which to develop sustainable water wise skills and positive lifestyles in the broader community. At school level the introduction of an enviro-club and a school environmental policy could go a long way to address the issue of sustainable water use.

This study aimed to investigate how the development of context specific EE-programmes could effectively address WCC issues in the Steelpoort rural areas. A qualitative research approach was followed to address the research question and sub-problems (see 3.1 & 3.2). The research population for the purpose of this study comprised a selection of participants from four categories of respondents, namely principals and educators, non-teaching staff members, community consumers and learners.

Most of the data was collected by means of surveys and observations (see 3.5.3). The theoretical background (see 2.3 & 5.2) formed the basis for addressing the first sub-problem (see 3.1 & 5.2.2). The data pertaining to the study were analysed and interpreted and aimed to provide answers to sub-problem 5 (see 3.4). Findings which were the outcome of the research were compared and the analysis was based (mostly) on common answers in an attempt to find solutions to the research problem that were relevant to the community under investigation.

The research findings seemed to echo the words of Rachel Carson who said that *in an age when man has forgotten his origins and is blind even to his most essential needs for survival, water along with other resources has become the victim of his indifference*. Members of the Steelpoort community – and without doubt elsewhere – are guilty of this indifference. Without doubt this lack of concern must be addressed. Wasting or using too much water, not respecting it as a scarce resource upon which our survival depends, should awaken in us a feeling of anxiety – some sort of sense of apprehension and realization that we are in some way accountable. It is hoped that when we start to feel this way, this will lead to a sense of discipline which will enable us to move away from the indifference of which Carson accuses us. Discipline and appreciating the fact that each one in the broader community can make a difference should enable us to contribute to conserving water and using this resource in a sustainable manner.

It is the researcher's sincere hope that the recommendations of the research will be implemented as he believes that these measures will make a notable difference to the way the community perceives, uses and conserves water and will contribute to the Steelpoort community's attempts to address their pressing water issues.

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APPENDIX 1

ENQ: MATHIPA K.S MR
31899218
CELL: 072 8827 062
TEL: 013 235 2593

P.O. BOX 8049
LYDENBURG
1120
15-AUGUST-2005

THE MANAGEMENT / DIRECTOR
SAMANCOR EASTERN CHROME MINES
P.O. BOX 3
STEELPOORT
1133

DEAR SIR

ATT: HANNES LUBBE & PETER LEVELLE

I am asking for a permission to conduct research at the Steelpoort (Winterveld) Villages.

I am a postgraduate student registered for Master Degree with specialisation in Environmental Education with the University of South Africa. The purpose of the research is to develop and design environmental educational programmes for water conservation at the Steelpoort Villages.

I hope my request will be considered.

Yours in Faith

MATHIPA KATISHI SILAS

APPENDIX 2


samancor

EASTERN CHROME MINES
P O Box 3 / Private Bag X505
Steelpoort 1133
Tel (013) 2307031
Fax (013) 2307003

FROM : MAINTENANCE SUPERVISOR
TO : MR KS MATHIPA
TEL : 072 8827 062
DATE : 2005 / 10 / 28
STUDENT NO : 31899218
SUBJECT : REQUEST FOR PERMISSION TO CONDUCT
RESEACH AT WINTERVELD REGION (ECM)

Your request to conduct research at winterveld region is granted, on condition that it does not disturb the normal running activities in the families (Households) and of the learning institution (Schools).

SAMANCOR LIMITED
Eastern Chrome Mines
P.O. Box 3, 1133 Steelpoort
Tel: 013 230 7000 Fax: 013 230 7003


Hannes Lubbe
Maintenance Supervisor

APPENDIX 3

K.S MATHIPA
CELL NO: 072 882 7062
TEL NO: 013 235 2593 (H)
TEL NO: 013 214 8297 (W)

P.O. BOX 8049
LYDENBURG
1120

DEAR

Your candid and honest cooperation in completing the attached questionnaire will be appreciated.

The purpose of this questionnaire is an attempt to determine which practices and activities are contributing to the water shortage or water problems at the Steelpoort rural areas (Mangabane vill, & Makgemeng).

Please attempt to answer all questions to the best of your ability and rest assured that the contents of your answered questionnaire will be handled and treated in the strictest confidentiality, except in cases where it can be rendered otherwise, but please be assured that this will only happen with consent.

I will also like to thank you in advance for the extra time you will need despite the reality that one of us have to complete this questionnaire.

Yours in trust

K.S MATHIPA

APPENDIX 4.2.1

Interviews with principals and educators at the Steelpoort rural areas about some activities and practices that prejudice water conservation.

1. Have you had any formal training in water conservation or water saving skills at your school?
2. Are you familiar with the concept of water conservation?
3. Have you taught / are you teaching EE at your school?
4. Does the school have EE programmes or activities?
5. Are there any activities at the school that could lead to excessive water use or loss?
6. Do you have a water policy at your school?

APPENDIX 4.2.2

Interviews with the non-teaching staff members at the Steelpoort rural areas about some activities and practices that prejudice water conservation.

1. Who is taking care of your school's garden, the nursery and orchard and the cleaning?
2. What time of the day do you water the gardens?
3. Do you remove/control weeds from the school?
4. Do you know how much water is used per day at your school?
5. Do you regularly plant trees and shrubs to prevent soil erosion around the school yard?

APPENDIX 4.2.3

Interviews with community members at the Steelpoort rural areas about some activities and practices that prejudice water conservation.

1. How is water supplied to your community?
2. Where do you report broken/leaking taps/pipes?
3. What time of the day do you irrigate or water your garden?
4. What can you say about water conservation?

APPENDIX 4.2.4

Interviews with the learners at the Steelpoort rural areas about some activities and practices that prejudice water conservation?

1. Do you inform your family members about the importance of water conservation?
2. Can the vegetation (flowers) become green without water?
3. Do you plant trees on Arbor Day at your school?
4. Do you celebrate the environment commemorative days i.e. Wetland Day at your school?

APPENDIX 4.5.1

Questionnaires to school principals and teachers at the Steelpoort rural areas some activities and practices that prejudice water conservation.

	Yes	No
1. Are you familiar with the concept water conservation?	<input type="checkbox"/>	<input type="checkbox"/>
2. Have you taught/are you teaching Environmental Education at your school?	<input type="checkbox"/>	<input type="checkbox"/>
3. Does the school have Environmental Education programmes or activities?	<input type="checkbox"/>	<input type="checkbox"/>
4. Have you had any formal training in (water conservation) water saving skills at your school?	<input type="checkbox"/>	<input type="checkbox"/>
5. Are there some activities at the school that could be contributing to excessive water use or loss?	<input type="checkbox"/>	<input type="checkbox"/>
6. Do you have a water policy at your school?	<input type="checkbox"/>	<input type="checkbox"/>
7. Do you think that EE can be integrated into the various learning areas?	<input type="checkbox"/>	<input type="checkbox"/>

If YES, say how?

If NO, say why?

APPENDIX 4.5.2

Questionnaires to non-teaching staff members at the Steelpoort rural areas about some activities and practices that prejudice water conservation.

1. Are you familiar with the concept water conservation?

2. Who is taking care of your school's garden, nursery and orchard and cleaning?

3. How do you water the school garden? Provide information on the way in which you water the garden?

4. What time of the day do you water your garden?

5. Do you remove/control weeds from the garden?

6. Do you regularly check for leaks around the school?

7. Do you know how much water is used per day at your school?

8. Do you usually plant trees and shrubs to prevent soil erosion around the school yard?

9. Please give an indication of how water is used in the ablution facilities?

10. Please comment on the general use of water at the school?

APPENDIX 4.5.3

Questionnaires to school children at Steelpoort rural areas about some activities and practices that prejudice water conservation.

1. Do you know where the water from your school taps come from?

2. Did you know that South Africa is a dry country?

3. Do you report leaking taps and pipes at school/home?

4. Do you understand the process of the water cycle?

5. When should gardens be irrigated?

6. Are you familiar with the process of water auditing?

7. What would you be able to learn from a water audit?

8. Can you estimate how much water you use per day at your school/home?

9. Is there an enviro-club at your school?

10. Are you a member of the club?

APPENDIX 4.5.4

Questionnaires to Mangabane community consumers at the Steelpoort rural areas about activities and practices that prejudice water conservation.

1. At what time of the day do you irrigate your garden?

2. Do you bath using a basin, bath or shower?

3. How do you wash you cars?

4. Do you rinse your clothes directly in a basin or in the laundry machine?

5. Do you report leaking pipes/taps in the community?

6. Do you attempt to repair leaking taps or pipes yourself?

7. What are the actual activities and practices that prejudice water conservation in your area?

8. Estimate how much water you use per day at home?

9. Do you think your village will have enough water in 20 years to come? Motivate your answer?

APPENDIX 4.5.5

Questionnaires to Makgemeng community consumers at Steelpoort rural areas about some activities and practices that prejudice water conservation.

1. How is the water supplied to your area?

2. Do you rinse your clothes or bath in the river/stream/basin?

3. At what time of the day do you irrigate your gardens?

4. Where do you report leaking/broken taps/pipes?

5. What are some activities and practices that contribute to water wastage in the community?

6. Please estimate how much water you use per day at home?

7. For what purpose is this water used? Please try to estimate a percentage to each purpose?

8. Are you concerned about the supply of water to your community? Please explain your answer?
